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Article title: Are we speaking the same *language*? Finding theoretical coherence and precision in “mindfulness-based mechanisms” in chronic pain.

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Abstract

Objective: Over the past fifty years the field of chronic pain has witnessed an evolution of psychological approaches with some notable success. Some of this evolution has included “mindfulness-based interventions” (MBIs), now regarded as having encouraging partial support for their effectiveness. However, several theoretical challenges remain that may inhibit the progress of MBIs. These challenges include: lack of clarity surrounding the mindfulness construct itself; the proliferation of purported underlying mechanisms arising from different theories; and limited evidence for the mechanisms through which MBIs work. The current conceptual review provides a critique of existing theoretical models of mindfulness that have been applied to understand and treat chronic pain.

Design: A conceptual narrative review was conducted.

Setting: Treatment programmes for people with chronic pain.

Patients: Individuals with any type of chronic pain.

Interventions: MBIs for chronic pain.

Outcome Measures: Mindfulness-based mechanisms explored in relation to several domains of functioning.

Results, and Conclusions: Based on this assessment, a summary of available evidence for a particular contextual behavioral theory of “mindfulness”—psychological flexibility—is outlined. Findings show the need for further integration of existing mindfulness constructs to better guide development and evaluation of mindfulness-based treatment methods in the future.

Keywords: Mindfulness, Chronic Pain, Review, Theory, Acceptance and Commitment Therapy.

The evolution of psychological theory in chronic pain

Chronic pain is a complex multifactorial problem affecting around 20% of people worldwide (1). One in five adults suffer from pain, and one in ten are diagnosed with chronic pain every year (2). The extent of its burden is substantial, including a detrimental impact on individuals and their families, and high costs for health care systems and societies (3, 4).

It is recognized that a purely biomedical model is currently insufficient to understand the complexity of chronic pain and associated distress and disability (5). In turn, an evolution of empirically testable psychological theories spanning the last fifty years have contributed to a broader biopsychosocial understanding of chronic pain. This progression has been broadly described as a series of paradigm shifts from early “first-wave” behavioral (6), to “second-wave” cognitive-behavioral (7), and later to “third-wave”, “mindfulness” (8) and contextual-behavioral approaches (9, 10). Theories at all stages have demonstrated some clinical utility in terms of successfully translating knowledge into effective treatment approaches (for recent meta-analytic reviews of cognitive-behavioral treatments for chronic pain, including “mindfulness-based interventions” (MBIs), (see 11-13). Whilst recent reviews suggest that evidence is promising, the modest effects observed indicate there is room for improvement. Progress in cognitive-behavioral approaches to chronic pain management and, in particular, mindfulness-based interventions, may be facilitated by greater refinement of the theories underlying these treatments.

Characteristics of a ‘good’ theoretical model

Three important theoretical challenges may impede progress in the area of MBIs for chronic pain, including the lack of clarity surrounding the broader mindfulness construct itself, the expansion of purported mechanisms underlying MBIs, and how to optimise therapeutic change in mindfulness-related processes. A recent review in chronic pain (14) highlighted the importance of evaluating the utility of theoretical models

against three practical criteria, including their ability to (a) organize and *integrate* current knowledge, (b) guide and *organize* researchers, clinicians and treatment developers, and (c) create *progress*, particularly with regard to new methods and applications. Assessing existing models of mindfulness applied to chronic pain according to these criteria provides an opportunity to select elements that are best fit for purpose and may produce a more integrated unifying theory in this context.

An overview of definitions of “mindfulness”

Current definitions of mindfulness in chronic pain research have largely drawn on those in the broader mindfulness literature, which some argue lack consensus (15). A frequently quoted definition of mindfulness by Jon Kabat-Zinn includes, “Paying attention in a particular way: on purpose, in the present moment, and non-judgmentally” (p.4 16). Kabat-Zinn’s definitions of mindfulness drew mostly on teachings from Theravada and Mahayana Buddhist, and yogic, traditions (17). Langer later defined the dual concept of both mindfulness and mindlessness in the early 1990s. She defined mindfulness as “conscious awareness in which the individual is implicitly aware of the context and content of information... a state of openness to novelty in which the individual actively constructs categories and distinctions”. Mindlessness, on the other hand, she defined as “a state of mind characterized by an overreliance on categories and distinctions drawn in the past and in which the individual is context-dependent and, as such, is oblivious to novel (or simply alternative) aspects of the situation” (p. 289 18).

Subsequent operational definitions of mindfulness have included, “self-regulation of attention so that it is maintained on immediate experience,

thereby allowing for increased recognition of mental events in the present moment”, and “adopting a particular orientation towards one’s experience in the present moment, an orientation that is characterized by curiosity, openness, and acceptance” (p. 234 19). In addition, definitions of state and trait mindfulness have been proposed. State mindfulness refers to “altered sensory, cognitive, and self-referential awareness that can arise during meditation practice”, while trait mindfulness describes “lasting changes in these dimensions that persist in the meditator irrespective of being actively engaged in meditation” (p. 181 20). These definitions were followed by the development of a transdiagnostic model of mindfulness. This identified and defined further components of mindfulness based on a deconstruction of Kabat-Zinn’s early definition in combination with constructs from other “third-wave” approaches, such as “reperceiving”, “decentering”, “cognitive defusion”, “deautomatization”, “metacognitive insight” (21).

It is evident that different definitions of mindfulness used in the wider psychology literature share overlap, to a degree. However, it remains unclear whether “mindfulness” is a method, a collection of methods, a process, or a collection of processes (22). It has been suggested that the terms used to define mindfulness have the potential to create confusion because they may not be organised in a scientifically coherent way (23). This problem is also reflected in research in chronic pain, such that attempts to refine definitions of mindfulness appear to have resulted in an increasing number of nuanced independent variables, which may have limited utility (24, 25). Naturally, if the constructs one intends to measure are unclear, it becomes increasingly difficult to measure them accurately. Moreover, confusion surrounding the construct and assessment of mindfulness may limit the ability of clinicians to identify and target mindfulness through intervention, potentially limiting the impact of MBIs.

Mindfulness definitions may be confusing because they reflect a patchwork of ideas from several different traditions initially developed outside of science, and only later scrutinized scientifically (26). This makes it difficult for theorists to build on these traditions, whilst serving the requirements of science and psychology (24). A lack of precision in the concepts and words used to organize a scientific focus on mindfulness may render careful scientific evaluation of interventions targeting mindfulness a challenge. A consequence may be that policy makers and health care providers will find it increasingly challenging to make informed choices about the effectiveness of existing treatments when allocating often-scarce resources.

In light of the challenges surrounding the definition and theory of mindfulness, the current review aims to critically evaluate two existing “mindfulness” models in the context of chronic pain using McCracken & Morley’s criteria (14). We then summarise available evidence for a broadly applicable contextual behavioral theory of “mindfulness”, in an attempt to integrate existing constructs.

Examining current mindfulness models applicable to chronic pain

There are two existing models from the chronic pain literature that have been proposed to conceptualize “mindfulness” and its relationship with chronic pain outcomes (See Table 1). These models also provide guidance for examining the potential mechanisms by which interventions aimed

at increasing mindfulness, such as Mindfulness-Based Stress Reduction (MBSR), Mindfulness Based Cognitive Therapy (MBCT) (27), and other third-wave approaches (21), may improve chronic pain outcomes. It is important to note that neither of these models emerged at the same time as their respective treatment approaches: treatment methods and techniques were developed first, and theory of putative mechanisms came later. Table 1 provides a summary of the core features of these models, including an assessment of their overall utility according to McCracken and Morley's (14) criteria. It is acknowledged there are other existing models, or clinical methods, that incorporate mindfulness-based mechanisms in the wider psychology literature. However, these have not been reviewed here because they are either (a) not specific to chronic pain, (b) not transdiagnostic in nature (e.g. (28), or (c) reflect a set of treatment methods, rather than a specific theory (e.g. (29, 30).

Intention, Attention and Attitude (IAA) Model

Although not specific to chronic pain, Shapiro et al.'s (21) transdiagnostic model of mindfulness may be applied to chronic pain given its broad applicability to a range of chronic health conditions. The model identified three “axioms”, Intention, Attention and Attitude (IAA), and described their reciprocal relationships. Intention is defined as the reason(s) why an individual engages in mindfulness practice, highlighting underlying motivation for self-regulation initially. However, Shapiro et al. suggest that intention to practice may shift along a continuum from self-regulation, to self-exploration, and to self-liberation over time, whereby, for example, practice may start as a way to reduce pain or suffering, but may subsequently persist from a desire to be caring toward others. Attention refers to present moment awareness, and how one returns to it once

distracted, which includes sustained and switching attention. Finally, Attitude reflects non-striving, compassion and patience when a person is engaged in attentional practice. The IAA axioms also include four sub-mechanisms, including self-regulation, values clarification, cognitive, emotional, and behavioral flexibility, and exposure. These elements are hypothesized to fall within a “meta-mechanism” called “reperceiving”, which is likened to a “shift in perspective”, and defined as one’s ability “to dis-identify from the content of consciousness (i.e. one’s thoughts) and view his or her moment-by-moment experience with greater clarity and objectivity” (p. 377 21). The authors broadly describe key outcomes as psychological symptom reduction, wellbeing, stress management, and mindfulness sub-mechanisms in and of themselves.

The IAA model reflects a useful step forward in that it has identified potentially important processes of mindfulness consistent with common definitions, and constructs identified in other existing models (23, 31). Moreover, the IAA is comprehensive in that it describes cognitive, affective, motivational and behavioral components of mindfulness. However, the IAA model has several important limitations. First, the IAA model draws together mindfulness-based variables from several different theories, treatment approaches, and Buddhist contemplative traditions. This may be conceptually problematic because the incorporated theories make different scientific assumptions about the nature of ‘reality’, which have implications for how mindfulness is defined, and for the intended outcomes of treatment approaches targeting mindfulness. For example, it has been argued that the philosophical assumptions underlying traditional CBT (32, 33) (and appearing within some MBIs) tend to be relatively mechanistic, structuralistic, mentalistic, and reductive in character. In contrast, third-wave approaches appear to be more contextualistic, functionalistic, non-mentalistic, and non-reductive (34). Spiritual traditions typically omit explicit assumptions in these regards.

Therefore, the integration of variables across these scientific and spiritual approaches will typically lack coherent, explicit, cross-cutting philosophical underpinnings, particularly with regard to purpose, and ontological and epistemological assumptions. At the level of treatment this includes differences in focus, for example the main focus of CBT is on reducing symptoms or elimination of a disorder, whilst other third-wave approaches centre pragmatically on reaching functional goals or “workability”. These different assumptions suggest different outcomes are important (i.e. symptom reduction vs. behavioural performance), making it a challenge to define improvement when outcomes are not chosen in a philosophically and theoretically consistent way.

Second, in the IAA model it is unclear what drives the shift in the motivation to practice from self-regulation, to self-exploration, and self-liberation within the intention part of the model, and how the three axioms are linked to a clear set of behavior change principles. For instance, the IAA model may provide useful guidance on how to deal with thoughts and feelings, but it tells us less about how to build up more effective patterns of behavior. Another way to say this is that these methods focus more on “how” to do than “what” to do.

Third, the IAA model has led to a proliferation of independent variables, including: “self-regulation” (which incorporates intention, attention, connection, regulation, order and health); “cognitive, emotional, and behavioral flexibility” and “exposure”; and the overarching “reperceiving” construct. These independent variables appear no more precise or manipulable than the broader mindfulness construct. Indeed, Shapiro et al. recognize that operationalizing most of these variables is likely to be a challenging task. Finally, since the inception of the IAA model, there has

been little refinement in treatment methods or techniques, suggesting so far that the model may have limited utility for enhancing existing mindfulness-based interventions.

Day and Colleagues' Mindfulness Framework for Chronic Pain

A second theoretical model of mindfulness for chronic pain management has more recently been proposed by Day and colleagues (27). The conceptual review by Day et al. suggests there are six overarching factors that organize potential sub-processes of mindfulness, resembling a more traditional five-part cognitive behavioral framework (35). These include environmental/social variables, brain states, cognitive content, cognitive processes, behavior, and emotion/affect. Within each of these broader categories the authors propose twenty-three sub-mechanisms, such as improved social support, enhanced frontal attentional control, increased pain management self-efficacy, reduced pain catastrophizing, and improved task persistence, increased resilience, among several others. Day et al.'s framework is helpful in enumerating a number of empirically supported psychological constructs from different approaches, and highlighting their inevitable overlap. The model also attempts to disentangle mechanisms specific to MBSR or MBCT, and where they might overlap. Furthermore, it presents additional sub-processes that may be specific to either group or individual interventions. Finally, Day et al.'s model specifies a variety of testable dependent variables, including primary outcomes, such as pain intensity and interference, and secondary outcomes, including psychological functioning, quality of life, perceived disability, physical functioning, medication use, healthcare utilization, and return to work, among others.

The Day et al framework shares similar challenges with the IAA model. In terms of integration, there are a total of twenty-three variables, including “specific” (e.g. mindfulness, attentional control, decoupling), “non-specific” (e.g. self-efficacy, pain catastrophizing, pain acceptance, pain beliefs), and “common” (e.g. group coherence and therapeutic alliance) mediating mindfulness sub-mechanisms. As such, the model has added several new terms, whilst retaining all of the old ones. Consequently, it is unclear how these variables can be organized into fewer testable dimensions, and which are most important and modifiable. The intertwining of the more specific and broader level categories of analysis, such as brain states, behavior, and emotion, provide an explanatory overview of chronic pain and disability that is broad in scope that appeals to “common-sense”. However, from another perspective these categories lack precision and their distinctions may be less practical than they appear. For example, all psychological events involve brain events, thoughts are a form of behavior, and feelings too have a behavioral component. Naming all of these variables within the same set of categories obscures the fact that they actually represent different perspectives or levels of analysis, and not simply a set of variables within a single, for example, psychological level of analysis.

A second challenge is that there is little explanation for how all of variables within the Day et al model work together to improve functioning and wellbeing. Despite elucidating numerous potential processes of mindfulness in the context of chronic pain, it is unclear how each of the constructs are connected by a common set of unifying principles. The distance between specific and broader constructs also makes it challenging to appreciate how the former can be further categorized to describe broader behavioral processes and to explain how they work together to

impact functioning, such as through “experiential avoidance” or “loss of contextual sensitivity”, as examples of broader constructs.

Furthermore, the model specifies several conventionally desirable dependent variables or clinical outcomes. Some outcomes focus on improving how one *feels* in terms of pain and mood, whilst others are more about improving what one *does*, or behavioral performance. Arguably, these outcomes can contradict or mutually exclude each other, since improved behavioral performance can occur in the presence of pain, low mood or negative thinking, or even require or increase these experiences. However, the model does not make clear how the independent variables in the model are theoretically linked to inform the choice of dependent variables for research and clinical practice. As a result, the health care provider’s overarching aim to support people with chronic pain may be influenced by a number of potentially competing or conflicting goals (e.g., reducing pain *or* changing behavior), rather than one unifying goal (e.g. behavioral performance). Such confusion may result in MBIs being less targeted and impactful. When considering progress, it is not yet clear whether this model will contribute to new developments or refinement of existing MBI methods.

Different treatment approaches enhance “mindfulness”

It is important to note that while different MBIs can enhance “mindfulness” in chronic pain, the mechanisms by which MBIs work remain unclear. Since the early studies of MBSR in the 1980s (8, 17), several MBIs in chronic pain have been evaluated. Several reviews (13, 36-40)

show the most researched MBIs in chronic pain are MBSR and MBCT. However, there is also a large body of research testing other “third-wave” treatments that incorporate mindfulness components, including Acceptance and Commitment Therapy (ACT), and to a lesser extent Dialectical Behaviour Therapy (DBT) (41, 42). These reviews show overall that MBIs for chronic pain may improve mental health or emotional functioning, but show mixed findings for physical functioning, and less consistent support for reductions in pain intensity. As an aside, one limitation in the studies is that MBIs have been compared almost exclusively to treatment as usual or other inactive comparison conditions. Hence, mindfulness is better than doing nothing, but it is unclear whether it is specifically superior to any other active treatment experience in trials of patients with chronic pain. However, a systematic review including a relatively small number of MBI trials for other health conditions not specific to chronic pain show mixed support for MBSR and MBCT when compared with other active control groups on perceived mood, stress, pain, energy and quality of life outcomes (43).

The chronic pain reviews also illustrate that there has been little success in substantiating the role of proposed mediating mindfulness-based mechanisms. For example, it is unclear if MBSR or MBCT work through an awareness enhancing effect, one or more cognitive change mechanism, or more by openness and acceptance, behavioral activation, relaxation, placebo or some other non-specific treatment effect (13, 36-40). Therefore, little is known, from a perspective on mechanisms, about how these particular MBIs can be improved or optimised, and even less can be said, based on evidence, about the utility of the theoretical model on which they are based (44).

Finding greater theoretical coherence and integration: The psychological flexibility model

The identified challenges with the Shapiro et al. and Day et al models highlight the need for a model of mindfulness that integrates and unifies existing mindfulness constructs, organizes research and clinical development, and has the potential to optimize treatment impact. The psychological flexibility (PF) model, the model underlying Acceptance and Commitment Therapy (ACT), may have particular strengths for understanding mindfulness. In particular, the PF model has coherent and explicit assumptions, may hold the capacity to integrate, and to promote scientific and clinical progress.

PF was the earliest theoretical model from outside of the core mindfulness models to incorporate mindfulness-based processes in chronic pain (9). The PF model is associated with a post-Skinnerian behavioural account of language and cognition, called “Relational Frame Theory” (RFT) (45). RFT, PF and ACT are underpinned by a clear set of philosophical assumptions defined as functional contextualism, which applies a “pragmatic truth” criterion to scientific enquiry (46). Contextualism is defined as a world view, whereby any behavioral event can only be interpreted as an ongoing act that is inseparable from its current and historical context (47).. The “truth criterion” of contextualism is defined as “successful working” toward one's goals, whereby the truth and meaning of a concept lies in its function with respect to one's goals, rather than in how well it mirrors reality (48). Thus, an event is (49)“true” if it allows a person to progress toward a pre-specified goal. The functional contextual approach underlying RFT and ACT aims to provide an account of human behavior that achieves the ability to predict and influence

behaviour, with precision, scope, and depth (50). For a more comprehensive account see (34, 51, 52).

Psychological flexibility has been described as a transdiagnostic theory of “normal” human behavior, which integrates functional dimensions of analysis, and therefore incorporates “motivational” processes (14). PF is defined as the capacity to persist with, or change, behavior in a manner that includes conscious and open contact with thoughts and feelings, appreciates what the situation affords, and serve one’s goals and values (14). PF comprises six inter-related processes: Figure 1 outlines the four ‘mindfulness’ sub-processes, acceptance, defusion, self-as-context and present moment awareness, alongside two behavior, from a perspective on mechanisms, processes, values and committed action (50).

Acceptance is willing engagement in activities in a way that includes contact with unwanted experiences, such as pain, without attempts to struggle with or control them, when doing this serves one’s goals (53). Cognitive defusion is the ability to experience a distinction between thoughts and the things they describe, and to contact thoughts directly without being dominated by their potential behavioral influences (54). Self-as-context reflects the ability to experience a perspective distinct from thought content, where we are neither defined by, nor harmed, by our own thoughts and feelings (23). Present-moment awareness reflects ongoing, nonjudgmental awareness of one’s experience, and the capacity to switch focus flexibly between internal (e.g., thoughts, feelings, bodily sensations) and external (e.g., awareness of the five senses) modes of experiencing one’s environment (46, 50). Values are freely chosen, verbally constructed, qualities of purposive action that we define as important, which are ongoing and inform our goals (46). Finally, committed action is the ability to persist flexibly with a course of action guided

by values and goals, in a way that can incorporate failure and discomfort, and still continue, but can also be abandoned when unhelpful (55). The six PF processes are more extensively described elsewhere (23). The inverse of the six PF processes represents a model of behavioral problems and suffering, including experiential avoidance, cognitive fusion, an inability to take a perspective separate from thoughts and feelings, a pre-occupation with the past or future, failures in clarity or pursuit of values, and inflexible persistence or impulsive avoidance (14).

The six PF processes map directly onto a growing number of novel mindfulness, acceptance and commitment, and behaviour change treatment methods (46). Acceptance and Commitment Therapy (ACT) is the treatment approach most directly linked the PF model. In ACT, experiential exercises help clients come into contact with psychological experiences more directly. Metaphorical language, paradoxes, and stories are introduced by the therapist to help the person learn to relate to their experience in a more flexible way (50). ACT is said to be focussed on treatment process rather than technique. Thus, any method that might be used to enhance PF might be considered ACT. The processes also provide guidance on how to approach the therapeutic relationship to increase PF.

A distinctive feature of the PF model and ACT is that they actively encourage increases in behavioral qualities compatible with mindfulness (i.e., acceptance, defusion, present moment awareness, self-as-context), *and* a focus on identifying, engaging in, and persisting with values-based behavior. Another strength of the PF model and ACT is that they have clearly defined outcome variables: primary targets include physical and social role functioning, and goal performance, whilst pain intensity and emotional functioning are secondary outcomes (56). Despite their

somewhat divergent aims, the mindfulness processes and corresponding treatment methods in ACT are entirely consistent with the *de facto* emphasis within MBSR and other MBIs, where an emphasis on contextual change, or change in *how* events are experienced, not *what* is experienced, is the key focus. Unlike MBSR and MBCT, regular meditation practice is not a core component of ACT. However, it is also important to note that ACT treatment methods stemming from the PF model, such as those focused on present moment awareness, defusion and flexible perspective-taking or self-as-context experiential exercises, although not strictly prescribed as a form of daily practice, share similar qualities to those particular methods used in MBSR or MBCT that aim to enhance mindfulness.

The smaller number of constructs and treatment processes means the PF model may be more readily dismantled for the purposes of evaluation. A recent factor analytic study in people with chronic pain indicates it may even possible to condense PF with these outcomes into to three core processes, described as “open, aware and engaged” based on existing measures (57). Therefore, examining the relevance of these interrelated mechanisms in the context of MBI trials may now be more feasible, and as such may be more useful in understanding mindfulness than the term “mindfulness” itself (26).

There is growing empirical support for the validity and predictive utility of most of the PF processes in chronic pain (58). Consistent with the wider psychology literature (59, 60), component analyses of broader mindfulness measures in chronic pain suggest the PF processes may be embedded within them (25). However, the magnitude of relationships between broader mindfulness scales and PF processes and key functional

outcomes, such as emotional, physical, and psychosocial functioning, also suggests they do not entirely overlap, and PF processes have been shown to be more strongly associated with these outcomes (61-63).

[FIGURE 1 HERE]

As a mindfulness-based intervention (MBI) and an approach that promotes psychological flexibility, ACT has “strong support” as a general treatment for chronic pain (64), and four systematic reviews have summarized evidence for its efficacy (13, 56, 65, 66). Overall these reviews conclude that studies are generally small and have significant risk of bias, showing small pooled effect sizes for improvements in pain severity, anxiety, depression, and quality of life. However, more consistent with the aims of ACT and the PF model, most studies show significant small to moderate effects with regard to improving general (i.e. physical) and emotional functioning (56).

Several controlled and uncontrolled trials have shown changes in some of PF’s mindfulness-related processes, which appear to be potentially important predictors of functioning after interdisciplinary ACT treatments for chronic pain (67-72). In addition, at least three studies have conducted mediational analyses to test PF processes in the context of treatment trials. One RCT evaluating ACT in chronic whiplash-associated disorder has shown that positive changes in pain-related disability and life satisfaction were mediated by reductions in a broader measure of psychological inflexibility (73), rather than change in one of several potentially competing processes, including fear of movement and self-

efficacy. A similar effect was demonstrated in an RCT evaluating an online version of ACT, showing that pain-related psychological flexibility independently mediated changes in pain interference, psychological distress and pain intensity (74).

In contrast, one study has shown that pain acceptance did not significantly mediate pain interference (75). Changes in cognitive fusion have been shown to be inconsistent across evaluations of interdisciplinary ACT treatments for chronic pain (69, 70). Moreover, neither defusion nor self-as-context have been tested in RCTs. This is largely because measures for these constructs have only been validated in chronic pain more recently (55, 76-78), or are currently in development (79, 80). Therefore, future research is needed to test whether these components of the psychological flexibility model are empirically valid and clinically useful.

Overall, existing RCTs of ACT for chronic pain do not indicate better outcomes compared to other second- or third-wave treatments. It would require a large RCT to detect the probably small effect size likely to emerge from such comparisons. It is likely that current ACT-based treatments target a set of highly overlapping processes, and the treatment methods are not as precise or impactful in targeting the putative component processes of PF as they may one day be. Therefore, the PF model's ability to promote progress and optimize outcomes may depend on its ability to lay a path toward incrementally improving treatment delivery methods and effect sizes over time. Indeed, the recent distilling of PF processes into facets of 'open, aware, and engaged', may facilitate more efficient and successful treatment delivery in the future. Secondarily,

there may be “softer” advantages of functional contextual approaches and PF. For example, providers may prefer them and find them personally more relevant (81, 82) and patients may prefer them (83).

Summary

Invariably the functions of language mean that human beings will strive to make sense of their experience by constructing a coherent model of the world using terms that appeal to notions of “common sense”. It is easy for us to attach ourselves to convenient categories, which take on lasting effects that can be potentially helpful or unhelpful. As scientists, we cannot escape this predicament altogether, but can be guided by more functional, rather than an essentialist, coherence criteria in order to create progress.

The evidence presented in this review highlights why the different theoretical terms used to conceptualize mindfulness in the context of chronic pain may be problematic. It suggests the nature of the problem is more than just semantics, highlighting a key strategic difference between existing third-wave approaches. The goals of MBSR and MBCT, and corresponding theories of mindfulness in chronic pain outlined in this paper, reflect a preference to recognize a vast tradition of meditation methods, and attempt to understand how they work. In contrast, the PF model emerged from empirical and basic level research attempting to understand the processes of *verbal regulation of behaviour* and emotional avoidance, and only later developing treatment methods to address these. Treatment methods in ACT were built on theory rather than attempting

to derive theory from techniques (84). In order to advance our understanding of ‘mindfulness’ and improve third-wave treatment methods, it may be important to reflect on both our tendency to automatically follow existing terminology, and our natural desire as scientists to create more constructs, when to do so may inhibit our ability to work together towards more pragmatic scientific goals. Exchanging, or relinquishing, existing terminology or notions of “mindfulness” may be a necessary step to move closer to greater theoretical coherence and precision. Of course, one day this will very likely include letting go of psychological flexibility as a guiding model. In the meantime better philosophy and theory may inform the design and evaluation of more effective MBIs to further benefit people with chronic pain in the future.

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Figure Legends

Figure 1: The psychological flexibility model (reproduced from McCracken, 2011) (24)

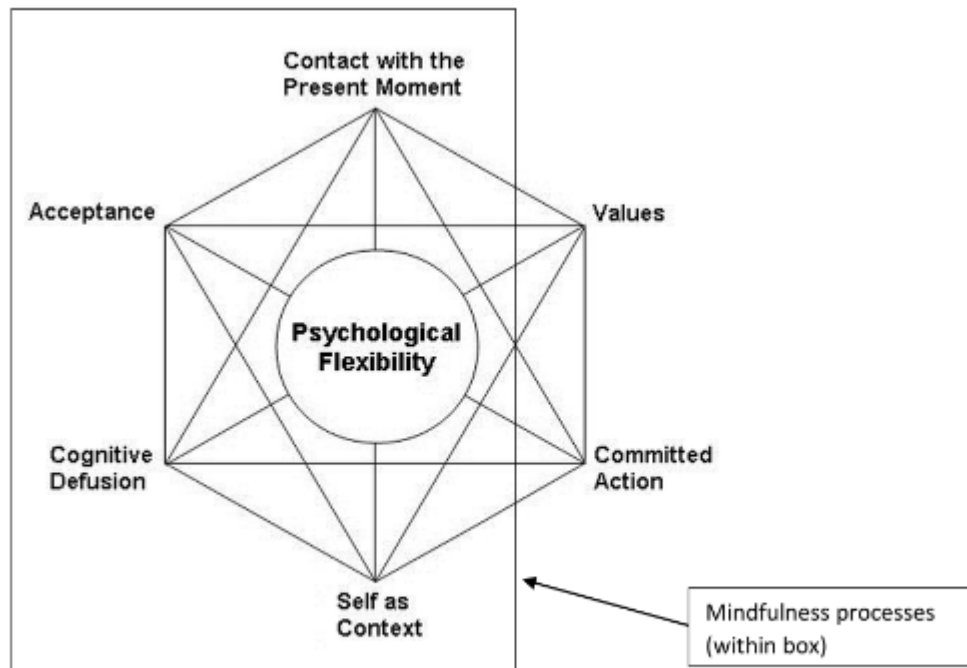


Table 1: Adapted version of McCracken and Morley's criteria (2014) as applied to mindfulness-based models

MODEL OR FRAMEWORK & REFERENCE TO KEY ACCOUNT	CORE ORGANIZING CONCEPTS	KEY OUTCOMES (DEPENDENT VARIABLES)	PRIMARY TREATMENT PROCESS VARIABLES (INDEPENDENT VARIABLES)	CHARACTERISTIC TREATMENT METHODS	CRITERIA FOR GOOD MODEL*		
					INTEGRATE	ORGANIZE	PROGRESS
IAA Model (Shapiro et al, 2006)	<p>Meta-mechanism and cyclical process of three "Axioms":</p> <p>Reperceiving / Decentring</p> <ol style="list-style-type: none"> 1. Intention 2. Attention 3. Attitude <p>Based on Jon Kabat-Zinn's earlier definition (Kabat-Zinn, 1994), combines constructs from: Wells' Self-Regulatory Executive Function model (Myers & Wells, 2005; Wells, 1999), MBCT's Differential Activation Hypothesis (Sheppard & Teasdale, 1996; Lau, Segal, & Williams, 2004; Teasdale, et al., 2002), and ACT's Psychological Flexibility Model (Hayes, 1999)</p>	Not stated, defined broadly as "Health"	<p>(1) Self-regulation (intention → attention → connection → regulation → order → health)</p> <p>(2) Values clarification</p> <p>(3) Cognitive, emotional, and behavioural flexibility</p> <p>(4) Exposure</p>	<p>Secular mindfulness meditation practice (body scan practice, seated meditations, mindful yoga / movement, and walking meditation) based on Buddhist teachings.</p> <p><i>MBSR</i>: Didactic component on stress reactivity and impact on pain.</p> <p><i>MBCT</i>: Didactic; links cognitions, stress, emotions, physical sensations (including pain), and behaviour.</p>	<p>Not clear on functional dimension of behaviour.</p> <p>Described as a "behaviourist perspective", however, derived from Jon Kabat-Zinn's (1994) earlier MBSR definition and not underpinned by basic level theory.</p>	<p>Outcomes not specified (i.e. psychological symptom reduction, wellbeing, stress, and independent variables in of themselves), some independent variables are vague (e.g. self-regulation and flexibility), scientific assumptions unclear.</p>	<p>Measures established for some (e.g. mindfulness, decentring and values) but not all factors or processes.</p> <p>Has led to few if new treatment methods developed, as yet.</p>
Organising framework for MBSR and MBCT in chronic pain (Day et al, 2014) based on a previous framework (Jensen, 2011)	Traditional CBT five-part framework based on environmental /social variables, brain states, cognitive content, cognitive coping (or cognitive processes), behaviour and emotion and affect.	<p><i>Primary</i>: Pain intensity, Pain interference / disability</p> <p><i>Secondary</i>: Psychological functioning Quality of life Perceived</p>	<p><i>Specific</i> Mindfulness mechanisms:</p> <p>Brain states:</p> <p>(1) Attentional control</p> <p>(2) Decoupling of attention from emotion</p> <p>Cognitive Process:</p> <p>(3) Mindfulness</p>	As above.	<p>Many variables (thoughts and moods), not clear how to organise into fewer testable dimensions.</p> <p>Not clear on functional or motivational dimensions. Not</p>	<p>Outcomes varied, independent variables very diverse, scientific assumptions unclear.</p>	<p>Measures established for some factors or processes, but not all.</p> <p>Has led to few if new treatment methods developed, as yet.</p>

		disability Pain medication use Pain-related health care utilization Participation Return to work Satisfaction with care Global impressions of change	Behaviour: (4) Mindfulness meditation For a full list of potential <i>non-specific</i> mindfulness mechanisms and <i>Common factors</i> see Day et al's (2014) article.		underpinned by basic level theory.		
ACT's Psychological Flexibility Model (McCracken and Morley, 2014, Hayes et al, 1999)	Functional-contextualism: Behaviour is viewed functionally and holistically as acts of the whole individual interacting with and in a context of experiences inside and outside the "mind" and skin.	Behaviour, including: Daily physical, social, and general values- and goals-based functioning.	Psychological Flexibility Mindfulness processes: (1) Acceptance (2) Cognitive defusion (3) Self-as-observer, (4) Present-focused Awareness Behavioural activation: (5) Values (6) Committed action.	Exposure-based methods, experience-based methods, metaphor, any traditional behaviour therapy methods, a specified therapeutic stance that embodies the six processes.	Includes key processes that reduce varied feelings, thoughts, and behaviour into functional dimensions, includes "motivational" processes. Is underpinned by a basic level theory (i.e. RFT).	Outcome variables clear, independent variables clear and specific, scientific assumptions and principles clearly stated.	Empirically validated measures established for all processes apart from self-as-context. Has generated an explicit "process focus" in treatment, expansion of methods within CBT, and diverse formats of delivery, progress over time unclear as not yet tested. To date, effects of treatments based on PF model are comparable to other second and third wave treatments for chronic pain.
*The section on criteria for a good model represents a review of the ability of each model to organise and integrate current knowledge ("Integrate"), guide and organise researchers and treatment developers ("Organize"), and create progress, both in terms of measure development, but also new treatment methods and applications ("Progress").							