

Can mindfulness be too much of a good thing?

The value of a middle way

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Previous research has found that very few, if any, psychological or physiological processes are universally beneficial. Instead, positive phenomena tend to follow a non-monotonic or inverted U-shaped trajectory where their typically positive effects eventually turn negative. This review investigates mindfulness-related processes for signs of non-monotonicity. A number of mindfulness-related processes—including, mindful attention (observing awareness, interoception), mindfulness qualities, mindful emotion regulation (prefrontal control, decentering, exposure, acceptance), and meditation practice—show signs of non-monotonicity, boundary conditions, or negative effects under certain conditions. A research agenda that investigates the possibility of mindfulness as non-monotonic may be able to provide an explanatory framework for the mix of positive, null, and negative effects that could maximize the efficacy of mindfulness-based interventions.

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Introduction

The too-much-of-a-good-thing effect occurs when normally ‘positive phenomena reach inflection points at which their effects turn negative’ [1]. Recognized more than a century ago as the Yerkes–Dodson law of optimal arousal [2], accumulating evidence across multiple disciplines suggests that the inverted U-shaped curve or non-monotonic relationship between psychological or physiological processes and wellbeing or performance may be so ‘fundamental and ubiquitous’ [1] as to represent a ‘meta-theoretical principle’ [3]. Grant and Schwartz [1] demonstrate that even virtues and positive traits such as curiosity and optimism are non-monotonic; they have an optimum level above or below which are minimal

returns or undesirable effects. In concluding “there is no such thing as an unmitigated good,” Grant and Schwartz [1] hypothesize that mindfulness is also likely to have non-monotonic effects and recommend that researchers study its boundary conditions more carefully. Given the popularity and rapid proliferation of mindfulness-related programs and products, the investigation of optimal levels of mindfulness—which also entails identifying its boundary conditions and negative effects—would benefit not only the end-users, but also researchers, program developers, and providers.

This review follows Grant and Schwartz’s [1] suggestion to investigate the potential non-monotonicity or inverted U-shape trajectory of mindfulness. Non-monotonicity is not at odds with positive linear relationships between mindfulness and wellbeing or performance. Rather, it is a broader model and potential explanatory framework for mindfulness research, which encompasses positive [4], mixed, null, and contradictory findings [5•], differential and sometimes negative outcomes for some subgroups [6•,7•,8], and undesirable or adverse effects [9•,10,11,12•].

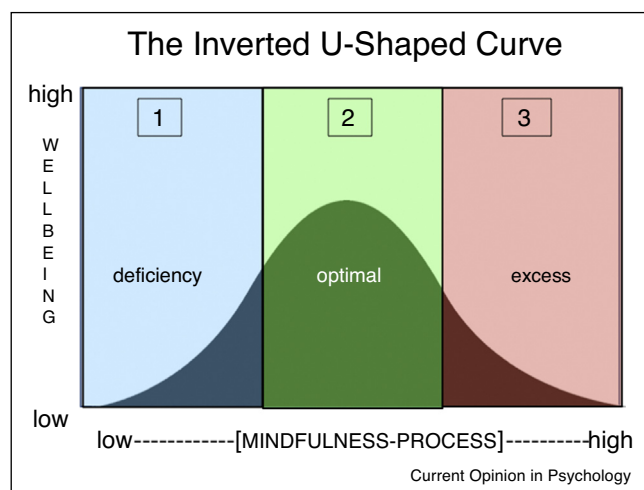
Given the multidimensional nature of mindfulness [5•] signs of non-monotonicity will be investigated in a number of different mindfulness-related processes (MRP), namely: mindful attention (mind–body awareness, interoception), mindfulness qualities, mindful emotion regulation (prefrontal control, decentering, exposure, acceptance), and mindfulness meditation practice [13]. Non-monotonicity will be explored in each MRP by first showing the positive relationship between that MRP and wellbeing (representing the upward slope of the curve, [Figure 1](#), panel 1), and then how that same beneficial process may also have undesirable effects under certain conditions, for certain people or when taken too far (representing the downward slope of the curve, [Figure 1](#), panel 3). Each MRP will be investigated first on its own, followed by a discussion of qualifying or influencing factors such as dose, baseline characteristics, balanced practice, and person-by-context interactions.

Mindful attention

Observing awareness

Intentionally directing attention to one’s present-moment experience—a central aspect of mindfulness—has been associated with many positive outcomes [4]. However, high levels of self-focused attention have also been found to be associated with psychopathology and negative affect [14,15]. Indeed, high levels of the

Figure 1



Illustrates an inverted U-shaped relationship between mindfulness-related processes (MRP) (horizontal axis) and wellbeing (vertical axis). Panel 1 shows how low levels or deficiencies in MRPs correspond with low levels of wellbeing. It also shows how wellbeing increases as the deficiency in MRPs is reversed. Panel 2 illustrates how optimal levels of MRP corresponds to maximal levels of wellbeing. Panel 3 depicts how an excess of an MRP, past what is optimal, corresponds to a reduction in wellbeing.

observing awareness facet of mindfulness have been repeatedly found to be associated with worse mental health, including increased depression, anxiety, dissociation, and substance abuse [8,16] and decreased ability to tolerate pain [17]. However, a few studies have suggested that the correlation between observing awareness and negative outcomes is reduced when observing awareness is correlated with non-judgment and non-reactivity, qualities that are often (but not always) considered essential dimensions of mindfulness [8,16].

Interoception and the insula cortex

Because deficits in interoception and insula cortex hypoactivation are associated with many forms of psychopathology, mindfulness training is hypothesized to bring about beneficial effects by increasing interoception or body awareness and insula activation [13,18]. In support of this hypothesis, mindfulness-related increases in body awareness are associated with greater wellbeing for chronic pain patients who tend to avoid their bodies [19]. Increases in the size and activation of the insular cortex have been found to result from both short-term and long-term meditation trainings, and correlate with the amount of practice [20–22]. However, while reversing interoceptive deficits may confer wide-ranging and transdiagnostic benefits, this does not mean that higher levels of interoception or insula activation beyond deficit reversal will continue to confer increasing benefit. High levels of interoception and/or insula activation are associated with a wide range of undesirable effects, including increased arousal and emotional intensity, depression,

sadness, anxiety, panic, traumatic flashbacks, and clinical pain syndromes [23–27], and all of these effects have been reported in the context of mindfulness meditation training [7*,9*,11,12*,19,28]. Further confirming the role of body awareness in increasing arousal in meditation, a recent RCT found that body-focused interoceptive training (body scan, breath awareness) produced the largest cortisol stress reactivity compared to other forms of meditation [30].

Mindfulness qualities

Mindfulness qualities are attitudinal factors that are considered an essential foundation for mindfulness practice [31]. While present-moment awareness may constitute the ‘what’ of mindfulness, mindfulness qualities constitute the ‘how’ [16] by balancing that awareness with qualities of nonjudgment, acceptance, curiosity, open-mindedness, optimism, self-efficacy, courage, trust, patience, persistence, kindness, empathy, generosity, gratitude, social intelligence, freedom, autonomy, and choice. While it is hard to imagine ever having too much of any of these qualities, Grant and Schwartz [1] demonstrate that all of these usually beneficial qualities are non-monotonic, or can have undesirable costs in certain situations, for certain people or when taken too far.

Mindful emotion regulation

Emotion regulation and prefrontal control

Mindfulness training has been found to increase prefrontal control over the limbic system and amygdala, which is associated with improved emotion regulation, anxiety, depression, and emotional reactivity [22,32]. However, high levels of prefrontal control of the amygdala can be associated with global emotional blunting and dissociation [33]. Indeed, meditation-induced dampening of the amygdala has been found to attenuate not just negative emotions but positive ones as well [34,35]. Multiple studies have found that mindfulness meditation training can result in reduced intensity, blunting, or complete loss of both positive and negative emotions and dissociation in some people [9*,12*,33,34,36]

Decentering and psychological distance

An essential part of mindful emotion regulation is decentering—the ability to ‘step back’ or to have psychological distance from instead of fusion with one’s experience, especially one’s thoughts and emotions [13,37]. Decentering has been found to mediate some mindfulness-related increases in wellbeing [38]. However, mindfulness shares some neurobiological correlates with dissociation, including high parasympathetic tone, prefrontal control over the amygdala (discussed above), and activation of the inferior parietal lobe (IPL) [33]. Farb *et al.* [39] hypothesize that mindfulness training recruits the IPL’s dissociative functions (out-of-body experiences and depersonalization) to create mindfulness’s ‘detached or objective mode of self-focus’ or the ability to switch from a 1st to 3rd person perspective. Given this overlap with dissociation, how does one ensure that mindfulness

produces the optimal level of psychological distance that 'steps back' far enough but not too far?

Exposure and experiential avoidance

By intentionally and consistently using an 'approach orientation' [37], 'turning toward the difficult,' and experiencing one's negative emotions fully, mindfulness is thought to exert transdiagnostic benefits by 'facilitating extinction of distress in response to strong emotions, leading to reduced emotional avoidance and, consequently, disorder symptoms' [40]. Drawing from empirical evidence that many disorders are caused and maintained by high levels of experiential avoidance, exposure theory predicts and has verified that those who benefit the most reduce high levels of experiential avoidance by deliberately attending to threat [41]. However, anxiety and other disorders can be caused and maintained not only by attentional bias *away* from (avoidance of) threat, but also by attentional bias *toward* threat [41,42]. Consequently, the most effective treatment will be the one that corrects the baseline problem. Avoidant individuals have been shown to benefit from exposure (attending to threat), while those with bias toward threat benefit most from cognitive bias modification (CBM), or training attention away from threat [41,42]. Thus, not only is exposure ineffective for those who are negatively biased, training attention toward threat in non-avoidant populations has also been found to increase rather than decrease anxiety in both adults and children [41,43,44]. Thus, the benefits and/or harms of exposure depend on the initial baseline level of the targeted problem (bias toward or away from threat), and can become either ineffective or iatrogenic when applied to people with levels different than the targeted one [29].

Acceptance and reappraisal

Mindful emotion regulation seeks to increase adaptive approach-related strategies like acceptance and reappraisal, and seeks to decrease maladaptive, avoidant strategies like distraction and suppression [13,37]. However, treating any one strategy as either consistently adaptive or maladaptive has been called 'the fallacy of uniform efficacy' [45]. Depending on the context and the person, favored strategies such as acceptance and reappraisal may be superior, inferior, or equal to disfavored strategies such as suppression and distraction [46] and are sometimes associated with adverse effects [47,48]. For example, re-appraising or accepting a situation can ease distress when there are no other options, but failing to take corrective action in a situation one could have changed can cause depression [47]. Thus, "few, if any, psychological processes are inherently and always adaptive" [47, p. 7]. Instead, the utility and benefit of *any* psychological process is dependent on the interaction between person and context.

Mindfulness meditation practice amount

The relationship between meditation amount and well-being shows signs of non-monotonicity, or a combination of positive, null and negative effects. In a review of mindfulness-based interventions (MBSR and MBCT), Parsons *et al.* [49] found that 25% of the studies reported significant positive relationships between mindfulness practice amount (up to 45 min per day) and positive psychological or physical health outcomes. For three-quarters (75%) of the studies, the correlation between practice amount and outcomes was not significant, and some studies found a significant relationship between practice amount and negative outcomes [49]. For example, Britton *et al.* [50,51] found an inflection point below which meditation practice was sleep-promoting and above which sleep-inhibiting. Low practice amounts in MBCT participants increased sleep duration, but as practice amount approached 30 min per day, sleep duration and depth began to decrease and cortical arousal (awakenings and microarousals) began to increase. Long-term meditators have also been found to have poorer sleep than non-meditators, with cortical arousal that is linearly correlated with lifetime meditation practice amount [52]. Thus, if one is seeking to improve sleep through mindfulness meditation, limiting rather than increasing practice may be the best recommendation. Similar findings have been found for gratitude practice, where less practice (once per week) was more effective for promoting wellbeing than more practice (three times per week) [53].

Mindfulness-related processes, non-monotonicity, and influencing factors

Like most other psychological processes, the above examples suggest that at least some MRPs are likely non-monotonic. That is, they are usually beneficial but under certain conditions, for certain people, or at certain levels, their effects can turn negative, have costs, or have undesirable effects. Considering non-monotonicity across multiple domains of mindfulness above also generated several testable hypotheses about conditions where non-monotonic positive and negative effects may be mostly likely to arise, as well as several 'influencing factors' that could moderate the effect.

Dose

According to the inverted U-shaped curve principle, too-much-of-a-good-thing-type adverse effects are caused by the same mechanisms and processes that also yield benefits. This model would predict that negative effects could occur with correct practice, and would be more likely at higher doses of practice or MRP. However, the location of inflection points could be further influenced by the following additional factors.

Baseline characteristics

The non-monotonicity model also predicts that both positive and negative effects will be more likely to occur

Table 1**Indications, contraindications, and potential adverse effects for different mindfulness-related processes**

Process	Indications (deficiency reversal)	Contra-indications (excess-causing)	Potential adverse effects (signs of excess)
Self-observation	Low self-awareness	High self-focus, especially without other mindfulness dimensions [8] acute stress, health crisis [6*]	Anxiety, depression, dissociation, substance abuse, [7*, 8, 9*, 11, 12*, 16]; increased symptom distress, social avoidance, decreased quality of life [6*]
Interoception/insula	Low body awareness, low emotional awareness	High body or emotion awareness	Anxiety, flashbacks, stress reactivity, pain [9*, 11, 12*, 30]
Emotion regulation/prefrontal control	Poor emotion regulation, high emotional reactivity	Emotional control, flat affect, dissociative tendencies	Emotional blunting, dissociation [9*, 34]
Psychological distance and decentering	Low psychological distance (high fusion with thoughts or emotions), lack of perspective	Normal to high psychological distance, dissociative tendencies	Dissociation, depersonalization, out-of-body experiences [9*, 12*, 36]
Exposure (attending to threat)	High experiential avoidance	Low experiential avoidance, negative attention bias [41, 42]	Negative attention bias, anxiety, depression [6*, 7*, 40]

Table 1 maps select mindfulness-related processes horizontally across the inverted U-shaped curve. The column labeled 'indications' represents the upward slope (Figure 1, Panel 1), where the deficiency of the mindfulness process is reversed and the corresponding impact on wellbeing is likely to increase. The 'contraindications' column refers to the downward slope (Figure 1, Panel 3), where the amount of the mindfulness-process has surpassed optimal levels and is beginning to have costs. The indications and contraindications columns contain hypothesized subgroup information predicted by the inverted U-shaped curve model. The potential adverse effects columns contain references to mindfulness studies that found negative or adverse effects that could be explained by excesses in the corresponding mindfulness-process.

in practitioners with particular baseline conditions: positive effects would be most likely to occur in those with low levels (deficits) of MRPs, while negative effects would be most likely to occur in those with high baseline levels of MRPs. **Table 1** displays these findings in terms of potential indications, contraindications and possible negative effects for the MRPs included in this review.

Balanced practice

High levels of a specific MRP may produce negative effects on its own, but can be counterbalanced by supplementing with other MRPs. While research has found that observing awareness can be balanced by non-judgment [8,16], additional research may benefit from investigating other combinations, for example: how interoception may counterbalance decentering to prevent dissociation, or how exteroception (awareness of surroundings) may counterbalance exposure to prevent flooding [29].

Person-by-context interaction

Interaction between all of the above factors could be summarized by a person-centered orientation: how much of which MRP is optimal for this specific person in this specific situation, according to this person's goals and values? "Mindfulness cannot be fully understood as 'more is better, less is worse.' . . . Rather, it's how the different mindfulness skills combine in a person that may be most important for his or her mental health" [8, p. 363].

Non-monotonic research agenda

Investigating the potential for the non-monotonicity of mindfulness has several advantages over assuming a ubiquitous, positive and linear relationship between

mindfulness and wellbeing. Rather than ignoring or downplaying null or negative results, non-monotonicity provides an overarching and testable explanatory framework for the mix of positive, null and negative effects found in mindfulness research. The framework values null and negative effects because they signify boundary condition violations or inflection points. These are important because they provide otherwise unavailable information about optimal versus ineffective or harmful doses of MRPs under different conditions or for different people. Thus, a comprehensive knowledge of both positive and negative effects would help maximize the effectiveness and minimize the harms of the practice, as well as provide indicators of when other approaches or counterbalances might be warranted. Researchers [1,54] have recommended a non-monotonic research agenda that asks: how much of each mindfulness process is too much, and when do negative effects occur? However, a number of existing practices create barriers to the necessary knowledge of the full range of effects.

Positivity bias

Mindfulness studies tend to overrepresent positive results, while negative findings are either not published or obscured by post-hoc subgroup analyses or creative re-interpretations [55,56*,57*]. In addition, very few MBI trials actively measure adverse effects [58*], relying instead on passive monitoring, which can underestimate the actual frequency by more than 20-fold [59,60].

Range restriction

"When researchers fail to discover non-monotonic relationships, the methodological artifact of range restriction may be the culprit" [1, p. 71]. In other words, the range

of measurement or sample may artificially truncate the full range of possible values [1,54]. For example, the most frequently used measure of mindfulness [61], the Mindful Attention Awareness Scale (MAAS) actually measures *deficiencies* of mindfulness (i.e. it measures *mindlessness*). Because it is measuring mindfulness in the deficiency-reversal phase (Figure 1, Panel 1), but not in the excess phase of the inverted U-shaped curve, it is more likely to be highly and linearly associated with gains in wellbeing or functioning and show few negative effects. Similarly, the range of meditation-related experiences is often truncated by sample restriction. Most MBI studies use data only from the treatment completers and lack data from long-term follow-ups and dropouts—the groups most likely to have negative effects [56,60]. Similarly, studies of meditation experts—ostensibly representing the consequences of high doses of meditation—are often prone to sampling artifacts that magnify positive traits. Long-term meditators who participate in research selectively represent meditators who still meditate, and not ex-meditators who no longer meditate because of negative or null effects [11]. Expert meditators with mental health issues are typically excluded from research, resulting in a selective representation of the effects from long-term practice [52].

Individual-level data

While a few studies have shown worse average outcomes (increased negative effects) for mindfulness training compared to control conditions [6,7,40,51], the use of means and effect sizes typically obscures individual differences and extreme scores [60]. Recommendations for improved detection of negative effects include visual inspection of data, qualitative descriptions or detailed case studies of outliers, including reasons for attrition or noncompliance, and displaying outcome data in quartiles [54,60]. Using the Reliable Change Index [62], which describes data in terms of clinically meaningful gains as well as deteriorations, is becoming required in high impact journals.

Conclusion

Mindfulness researchers and program developers have recognized that reversal of deficiencies in MRPs enhance wellbeing, but have paid less attention to how excesses in these processes could also undermine wellbeing. In other words, the field of mindfulness has been primarily focused on the upward slope of the inverted U-shaped curve, with insufficient attention to the downward slope of the curve. A mindfulness research agenda that employs a non-monotonic framework—one that includes the entirety of the inverted U-shaped curve—may be better positioned to make sense of positive, null, and contradictory findings, differential outcomes for different subgroups, and negative effects. A non-monotonic framework will help to maximize effectiveness and minimize harms in mindfulness-based applications by providing a

model that can chart a ‘middle way’ between ‘not enough’ and ‘too much of a good thing.’

Conflict of interest statement

Nothing declared.

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