

Decision Making, Mindfulness, and Mood: How Mindfulness Techniques can Reduce the Impact of Biases and Heuristics through Improved Decision Making and Positive Affect

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Abstract

The decision sciences and mindfulness theory both focus on attention to thought processes and the exploration of the roots of those cognitions. Historically, these two models of viewing thought have, however, diverged. The decision sciences focus on better understanding the patterns and impacts of human decision making, particularly in instances of flawed decision making. Within this literature, mood state has been repeatedly shown to influence decision making patterns, with negative affect and anxiety increasing a person's tendency toward decision making biases. Mindfulness emphasizes willingness to view one's thoughts and behaviors from an open standpoint and has also been shown to be a valuable tool in reducing negative affect and anxiety. In this paper, we briefly explore both the decision sciences and mindfulness, including aspects of decision making that may be affected by mood. We also look to future directions in which mindfulness and the decision sciences could inform each other and lead to more effective interventions for problematic decision making tendencies. Through greater coordination between these two theoretical areas, it is possible that practical mechanisms of change may be more accessible.

Keywords: Mindfulness; Cognitive biases; Heuristics; Depression

Introduction

The decision sciences and mindfulness theory both focus on attention to thought processes and their roots. Historically, these two models of exploring thought have, however, diverged. Research and theory in the decision sciences have focused on the understanding of biases, heuristics, and what some might call mistakes, in decision making. In the decision sciences, efforts have been aimed at highlighting the effect of these mistakes, and on demonstrating flawed cognitions in order to illustrate the need for more "rational" responses to stimuli. While the decision sciences provide valuable information about the ways in which people make important, and not so important, choices, efforts to reduce the effects of biases on decision making have had mixed results [1], and little is currently known about how to improve decision making outcomes in the face of biases.

Mindfulness theory on the other hand, emphasizes willingness to view one's thoughts and behaviors with an openness of mind. Through a better understanding of one's thoughts, mindfulness interventions aim to move beyond unwanted or unhelpful cognitions using, in some cases, acceptance. Historically, mindfulness has been viewed as a state of being rather than a psychological orientation, but recent research has demonstrated that mindfulness based interventions can be helpful in reducing the impact of unwanted or unhelpful thoughts. In addition, mindfulness techniques are useful in reducing negative affect and have been successful in treating individuals with depression, anxiety, and other psychopathology.

While the decision sciences and mindfulness have been separately explored, little research exists to describe how enriching a person's

mindful tendencies could help to achieve the goals of the decision sciences in reducing rash thinking and responding, or in creating a better underlying understanding of the processes behind decisions. Those who have identified the potential link between these important areas have suggested that mindfulness techniques may be important strategies to help reduce the effects of biases on human decision making [2]. Both mindfulness and decision sciences are represented by broad literatures, and we do not attempt to review either concept fully. Rather, we very briefly explore each area, particularly describing evidence suggesting that affect impacts decision making. Next, we describe mindfulness techniques and their emergence in modern medicine, including various ways in which mindfulness has been integrated into mental health treatments. Finally, we suggest that mindfulness techniques may improve decision making outcomes through multiple mechanisms, including the observation of mood states. Through greater coordination between mindfulness and the decision sciences, it is possible that practical mechanisms of change in decision making may be accessible.

Decision Sciences

Decision making is inherently cognitive, yet is influenced by variables such as environment, individual history, and affective state. The human condition involves imperfect decision making in variable situations. Decision making is sometimes aided by heuristics, shortcuts, or biases that can be beneficial or harmful to the outcome of a decision. Rules of thumb that individuals use for decision making use information that may not always be accurate in an effort to make decisions quickly, or as an unconscious means of reducing the discomfort related to the decision making process. While these rules of thumb may be helpful for rapid decisions on a daily basis (i.e., it would

be paralyzing to carefully think through each minor decision we make in a day), they can also lead to negative outcomes.

The terms bias and heuristic are often used to describe these decision making short cuts. Biases tend to imply a decision making

mistake or error, in which the individual has ignored or misinterpreted valuable information in favor of a quick decision (Table 1).

Bias	Explanation/Example
Time category	
Hindsight bias	When decision makers with outcome knowledge exaggerate the chances that they would have predicted the outcome in advance.
Sunk cost fallacy	Persisting in a negative expected value activity because a significant investment has already been made.
Projection bias	Projecting onto the future not only affective states but any state that influences preferences.
Ignore category	
Omission bias	The tendency to choose not to do something when doing something might cause harm.
Attribution bias	Incorrectly determining who or what was responsible for an event or action.
Base rate neglect	Ignoring empirical statistics when making a probability judgment.
Confirmation bias	Seeking information that, if consistent with the current hypothesis, would yield positive feedback and to interpret evidence as consistent with the hypothesis.
Egocentric bias	Subjects will over report their contribution and underreport their group member's, contributions.
Paternalistic category	
Anchoring	Different starting points yield different judgments which are biased toward the initial values.
Framing effects	Variations in framing information yield systematically different preferences.
Diversification bias	More variety is chosen when choices are bracketed together than when they are bracketed individually.
Unit bias	The tendency for people to eat less when serving sizes are smaller and more when serving sizes are larger.
Risk/loss category	
Ambiguity avoidance	People avoid gambles with an unknown distribution of possible outcomes.
Loss aversion	Losses loom larger than gains.
Regret avoidance	Averting a feeling that a decision will have an undesirable consequence.
Status quo bias	Preference to remain in the current state.

Table 1: Examples of cognitive biases [1]

Heuristic	Explanation/Example
Recognition heuristic	If one of two alternatives is recognized, infer that it has the higher value on the criterion.
Take-the-best	To infer which of two alternatives has the higher value: (a) search through cues in order of validity, (b) stop search as soon as a cue discriminates, and (c) choose the alternative this cue favors.
Availability Heuristic	Probability of an event is estimated by the ease with which instances or occurrences can be brought to mind.

Table 2: Examples of heuristics [1].

The term heuristic on the other hand allows that some decision making shortcuts might be useful in order to make quick decisions when time is scarce. Heuristics are strategies that people employ in order to avoid getting bogged down in the decision making process. Heuristical decision making may not take into account all information, but is not inherently flawed (Table 2).

These biases and heuristics may lead to “bad decisions,” and the impact of those decisions can have lasting consequences for a person’s adjustment and well-being. Negative consequences occur when individuals make decisions that conflict with their own values, or that are not consistent with reality.

According to previous work [1], decision making biases can be divided into four categories. Time biases represent those in which a person misconstrues facts based on the passage of time. The Ignore heuristics are those in which the person fails to note important information when making a decision. The Paternalistic category describes those heuristics in which a major factor in decision making is outside of one's control. Finally, the Risk/Loss heuristics are those in which the decision maker tries to decrease perceived loss. Each of these categories encompasses a number of biases that affect everyday decision making (Table 1).

Decision making outcomes are variable and diverse. It is possible that decisions made through biases may have no directly negative consequences. It is also, however, possible that these decisions could guide individuals toward unhelpful or even destructive outcomes. Even far-reaching constructs such as racism, poor numeric reasoning, jury bias, flawed physician decision making, and negative economic outcomes have been linked to decision making biases [3-7].

In addition to the direct effects of biases on decision outcomes, decision making can influence a person's sense of self and self-efficacy. Post-decision regret, for instance, can occur when a person feels that their decisions do not reflect their true values, or when they find that they have made the "wrong" decision for their life, contributing to self-blame [8,9]. Uncertainty in decision making or feelings of low efficacy can also contribute to a lowered sense of confidence and increased negative affect [10]. In addition, concerns about what decision is right or how best to approach a situation requiring a decision may increase a person's level of anxiety, leading to rumination or obsession.

Because decision points are often the genesis of behavior, they are important to overall well-being. The decision sciences focus on understanding the origins and consequences of decisions that deviate from the expected, or "rational," choice, in a given circumstance. Given that humans have developed a strong ability to shorten the decision making process through heuristics and biases, it is clear that it serves some purpose. Yet, these shortcuts can also lead us to ignore important information and facts and to make decisions that are flawed. Efforts to increase awareness of decision making patterns and the frequent application of heuristics and biases might improve a person's overall decision making quality, particularly in high-stakes situations. Decision sciences, however, focus little attention on remedying flawed decision making. Given the greater understanding of how decision making biases can negatively impact outcomes, it is crucial that research continue toward improving decision making outcomes and overcoming negative decision making patterns [11].

How Affect Impacts Decision Making

Many studies have looked at the impact of mood state on a person's decision making [12-17], and it has become increasingly apparent that mood states affect the outcome of decisions and that an individual may make very different decisions depending on their level of negative affect (NA), anger, sadness, or anxiety (Table 3). Decision making and affect interact at the time of decision making, after a decision has been made, and in the anticipation or memory of affect [18].

Sadness and feelings of depression may influence decision making because individuals are aiming for "reward replacement," or decisions that might improve the chances of a positive outcome [12]. NA may make a person more prone to being affected by framing effects, such that individuals experiencing NA show higher levels of risk taking [19]. These mood states can be brought on or exacerbated by medical

conditions such as chronic pain [20], as well as psychiatric disorders like depression. NA may also increase a person's tendency to perceive risks [21]. When making decisions while experiencing NA, individuals tend to look less at their personal historical experiences, and to focus more on the immediate feelings associated with the decision [22].

Mood state	Biases possibly affected
Anxiety	Ambiguity Avoidance Loss Aversion Regret Avoidance Status quo bias Risk Aversion
Depression/Sadness	Framing Effects Confirmation Bias Projection Bias Status quo bias Risk Aversion
Anger	Attribution Bias Egocentric Bias Confirmation Bias Risk Aversion Regret Avoidance Projection Bias

Table 3: Mood states and their effects on decision making biases.

The affective state of anger also influences decision making and can make a person more prone to stereotyping and more likely to use heuristics in decision making [23]. These effects have been shown to be distinct from those found among individuals with sad NA [23]. People experiencing angry affect tend to minimize their future risks and are therefore more likely to make higher risk decisions [24]. In addition, they may pay more attention to surface level details than to deeper meanings or evidence [24].

Several studies have indicated that individuals with high state anxiety tend to be more risk averse and make decisions based on lowering eventual risk as much as possible, even at the expense of possible rewards [12,25,26]. In addition, individuals with anxiety disorders tend to demonstrate greater risk aversion in decision making tasks [25]. It has been demonstrated that these decision making tendencies in highly anxious individuals may be the result of a drive toward reducing uncertainty [12]. Anxiety during decision making also contributes to physiological arousal and may make it more difficult for individuals to weigh the decision options appropriately [27].

In addition to the direct impact that affect can have on a person's well-being, various mental health conditions have been shown to directly affect a person's ability to make decisions that reflect their values and best interest. Individuals with bipolar disorder, for instance, have been shown to struggle with using information in their surroundings to arrive at accurate conclusions [28]. This raises the possibility that certain biases and heuristics are disproportionately represented in decision making styles of groups with specific psychopathologies.

Decision making itself can be an exhausting process and can take a toll on individuals. Several studies have demonstrated the draining effect of decision making, indicating that it can deplete a person's resources and make them less likely to perform other functions at a high level [29]. The exhaustive process of decision making can make a person less able to fully analyze future decisions, and may make them more prone toward future decision making errors. This process may compound the effects of negative mood on decision making so that as fatigue increases, so too does one's ability to make well-reasoned decisions moving forward [16,29].

Positive affect (PA) has, conversely, been shown to have a beneficial impact on decision making such that those experiencing PA have a greater ability to think flexibly about decision making and to incorporate relevant information [30]. PA has been tied to reduced framing effects and risk taking [19], and can contribute to more efficient decision making strategies [31]. It may also reduce the impact of the anchoring heuristic and help individuals better integrate information [32]. It is important to note that PA does not guarantee good decision making, and indeed certain biases and heuristics (e.g., the Pollyanna principle, the optimism bias, overconfidence effect) may actually be tied to the experience of PA.

The effects of mood and effect on decision making are broad and not fully understood. Despite this, it is apparent that a person's mood or affective state greatly influences his or her decisions when faced with a choice or a need for action. In particular, NA may increase framing effects [19] and the perception of risk [21]. Anxiety may also increase risk aversion and increased tendencies toward the sunk-cost bias [33], as may anger [34]. Because many of these mood states affect decision making outside of the person's awareness, it is unlikely that an individual will be able to attribute his or her decision making process to the mood experienced at the time. Increasing awareness of mood states and improving the ability to name and identify those moods may help raise understanding about the impact of effect on a person's decision making. In addition, the effects of PA indicate that improving overall mood and increasing well-being may be an important step in reducing negative decision making patterns [30].

Mindfulness

Mindfulness as an orientation and practice emerged from Buddhist theories [35]. The work of Jon Kabat-Zinn in the 1970's, amongst others, popularized mindfulness theories in the western world and pushed toward incorporating mindfulness into medical care. While mindfulness exercises have been adopted informally in the Western world for a long time (e.g., telling someone to breathe deeply when they have experienced a stressor), it was only fairly recently that mindfulness interventions began to be studied extensively and were shown to improve clinical outcomes in medical and psychological settings. More recently, these interventions have been increasingly adopted by physicians and psychologists alike.

The tradition of mindfulness is based on the idea that less is more. While mindfulness has been linked to increased positive affect, this is not the primary goal of these activities. Rather, mindfulness encourages its practitioners to reduce the extraneous thoughts in their heads (within the bounds of reason) in order to ameliorate those things that are impinging on their happiness, ability to function, etc. Mindfulness is not a non-cognitive state, nor an empty space, but rather it is a state of measured response and intentional cognition (Table 4).

Meanings of being mindful
Being "tuned in"
Avoiding extraneous thoughts
Noticing small details
Accepting the world as it is
Empty one's mind

Table 4: The many meanings of mindfulness.

Mindfulness-based interventions have been used in psychological practice as well as in alternative medicine for many years. These activities have been shown more recently to have significant impacts on individuals' experiences of anxiety, sadness, and other emotions. Mindfulness can play an important role in increasing overall well-being and can be particularly useful because it can be taught and maintained more easily and cost effectively than some other interventions [36]. Technology has increased access to mindfulness-based interventions such that individuals can now learn breathing exercises and mindful meditation skills using their phones or computers.

Several empirically supported psychological treatments including acceptance commitment therapy, dialectical behavioral therapy, and cognitive behavioral therapy have incorporated elements of mindfulness practices including meditation and self-observation. Mindfulness has been shown to be particularly effective in reducing the experience of anxiety (and its physiological correlates) and depression, and has even been shown to be effective in reducing pain and other somatic complaints [37] (Table 5).

Uses of being mindful
Stress reduction
Improved outlook
Pain relief
Reduction of depression symptoms
Gathering one's thoughts

Table 5: A selection of areas in which mindfulness-based interventions have shown effects.

These strategies have been shown to be effective for reducing stress reactivity and anxiety [36,38,39] as well as depression [38,40], and can improve comfort levels and well-being measures in individuals with medical illnesses [41]. Mindfulness is strongly linked with reduced negative affect [42] and can reduce anger and aggression [43].

Mindfulness strategies can be used on their own, particularly in stress-reduction exercises, but are frequently used in conjunction with other interventions. Mindfulness, as previously noted, can have many different meanings and these variable interventions can be viewed as tools within a practitioner's toolbox (Figure 1). These techniques are not "silver bullets," but when used in conjunction with other evidence-based practices, can have meaningful impacts on patient outcomes, and have been increasingly incorporated among health providers and mental health practitioners.

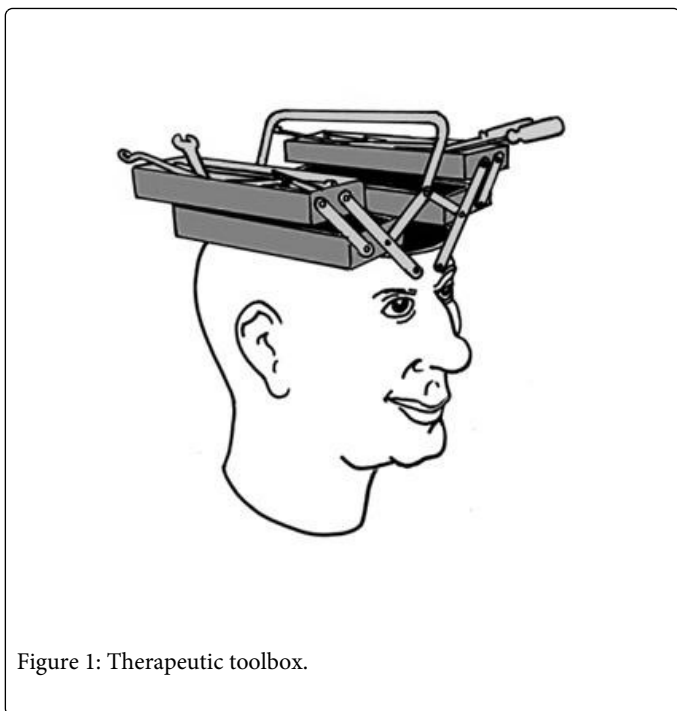


Figure 1: Therapeutic toolbox.

Mindfulness and the Brain

Various mindfulness-based approaches have been shown to affect physiological processes including heart rate, breathing rate, and neurological functions. One study showed increased cortisol reactivity to a stressful speaking task in individuals who had undergone brief mindfulness training compared to those who received cognitive analytic training [44]. Authors hypothesized that mindfulness increased engagement and active coping in dealing with stressors [44]. Changes in gray matter were identified in multiple areas of the brain in a 2011 study by Hölzel and colleagues. This study found increases in gray matter of the left hippocampus, posterior cingulate cortex, the temporo-parietal junction, and the cerebellum in individuals participating in a Mindfulness-Based Stress Reduction (MBSR) program compared to controls [45]. A separate study of individuals who had completed a MBSR program also showed greater interconnectedness of brain regions including between sensory systems (auditory and visual), and connections that indicate increased attention, sensory processing, and sensory awareness [46].

Mindfulness has been found to be an effective tool for reducing the experience of pain, particularly in chronic pain patients. Several studies have indicated that this may have its roots in neural changes resulting from mindfulness-based interventions [47]. Mindfulness-based interventions have also been linked to differential neural reactivity in cases of sadness induction, with a pattern that may support resiliency and result in reduced likelihood of experiencing depression while still experiencing negative emotion [48].

Some neurological evidence suggests that the anxiety-reducing effects of meditation and mindfulness-based approaches are based in the brain. For instance, Zeidan and colleagues showed that individuals who reported greater anxiety relief from a meditation exercise showed greater activation in the anterior cingulate cortex, ventromedial prefrontal cortex, and anterior insula [49]. In contrast, those who experienced more anxiety had greater activation in the posterior

cingulate cortex [49]. This suggests that the activation of certain brain regions during mindfulness interventions may facilitate its efficacy. In addition, regular meditation is associated with greater activation of the left-sided anterior brain, an area associated with positive affect [50] demonstrating the neurological underpinnings of the effect of mindfulness on affect.

Mindfulness and Decision Making

The act of opening one's mind to the present and to multiple experiences and perspectives has been suggested to be an important aspect of improving decision making [30]. In the case of reducing biases and heuristics, mindfulness interventions may impact decision making outcomes in many ways in order to contribute to more well-reasoned decisions. Additionally, mindfulness-based interventions allow individuals to better explore their own values and priorities, potentially making decisions more genuine and in-line with an individual's sense of self. While few studies have directly explored the effects of mindfulness training on decision making outcomes, those that have present promising results.

Hafenbrack and colleagues, for instance, have shown that mindfulness meditation reduces the impact of the sunk cost bias on decision making [51]. Another study found that individuals with higher dispositional mindfulness performed better on a gambling task indicating that they had a more realistic sense of confidence and risk when completing the task [52]. This study also demonstrated that frequent gamblers have lower dispositional mindfulness [52]. Others have found that mindful individuals are more likely to make ethical decisions, a phenomenon that they link to reduction in self-deception, self-serving cognition, and unconscious biases [53]. A separate study following this one demonstrated that training in mindfulness practices improved ethical decision making, in addition to other positive mental health outcomes [54]. This indicates that the positive impacts of mindfulness on decision making do not only apply to dispositional mindfulness, but can be taught.

Mindfulness may help to improve decision making in many areas including recognition that a decision needs to be made, the formulation of options, confidence in one's ability to make a decision, and in the ability to reflect realistically on a decision previously made [2]. In addition, mindfulness training such as acceptance commitment therapy or meditation allow for ambiguity and can help to increase comfort with not knowing, and may allow individuals to better sit with the uncertainty that comes with decision making [2]. Increasing evidence suggests that decision making heuristics may be adaptive and positive aspects of human decision making [55]. Mindful approaches to decision making allow for the acceptance of this uncertainty, as well as the ability to weigh options in order to make the best possible decision.

Mindfulness can also influence appraisal style and a person's sense of urgency with regard to decision making. It may help to frame decisions so that they do not seem so daunting at the outset. This can help to decrease the anxiety that goes along with decision making as well as bolster individuals' sense of efficacy and empowerment when making decisions. Appraisals have been shown to be important in a person's ability to reflect realistically on their strengths and weaknesses, and more positive and realistic appraisals have been linked to improved mental health outcomes and resilience [56].

Mindfulness-based procedures also draw one's attention to immediate feelings and emotions, with the effect that individuals

practicing mindfulness techniques are better able to identify emotional states [57]. Given the important influence that emotional states have been shown to have on decision making, this aspect of mindfulness interventions may be very important in improving decision making. This may also make it easier for mindful individuals to learn from past decision making in order to improve upon mistakes in the future [2]. The effect of reducing negative affect through mindfulness in decision making is an important area of future study and may represent a fresh way to look at reducing problematic decision making tendencies.

Conclusion

Mindfulness provides a potential lens for better understanding decision-making heuristics and biases, and also a tool for reexamining some of those decision making points. Through mindfulness, an individual may gain the skills and attention to examine his or her own decision making process as it happens in order to better understand the effects of biases, and to correct for them when necessary. Mindfulness training requires intentional effort to harness skills of “unloading” one’s extraneous thoughts in order to reach root cognitions. Through this intentional training, however, the hope is that the process will become easier and more regular in an individual. In the context of decision making, a mindful approach would help to free one from the confines of necessary biases or heuristics in order to have more flexible decision making skills.

Given that individuals with certain conditions such as bipolar disorder may be more predisposed to decision making biases [28], mindfulness tools may be particularly helpful in work with those populations. Indeed, mindfulness-informed dialectical behavior therapy has been shown to be effective for individuals with bipolar and other serious mental health conditions [58-61]. These interventions may also be useful for individuals prone to negative affect, such as those with depression, anxiety, or difficulty controlling anger. Mindfulness-based treatments can reduce negative affect [62-70], potentially improving decision making.

For these and other individuals, mindfulness may increase awareness of emotional states and how they might impact one’s decision making. Through the development of a clearer idea of the cognitions behind decision making, individuals struggling with the decision making process may have improved clinical outcomes. It should be remembered that mindfulness approaches are not a complete source of relief for the symptoms of depression and anxiety or the effects of poor decision making, but rather they should be viewed as important tools for clinicians to use in addition to other techniques.

Future studies examining the impact of mindfulness-based training on decision making heuristics and biases may shed light on the viability of these interventions. While the history of the decision sciences clearly demonstrates that heuristics and biases may negatively impact decision making, little has been done to provide solutions to these problematic decision making patterns or to uncover the mental health implication of those patterns. It is possible that integrating mindfulness into the decision sciences would provide a path toward reducing individuals’ reliance on heuristics and biases, and instead make use of reasoned, open, and flexible approaches to decision making, which would encourage overall well-being. In summary, it is apparent that decision making biases continue to occur, particularly in the presence of negative affect, and that there are not effective strategies for reducing the impact of these biases. Mindfulness

practices may offer mechanisms through which to reduce biases both by increasing openness of thought and reflection, and by reducing negative affective states.

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