

Current Directions in Psychological Science

<http://cdp.sagepub.com/>

Inside the Mindful Mind: How Mindfulness Enhances Emotion Regulation Through Improvements in Executive Control

Rimma Teper, Zindel V. Segal and Michael Inzlicht
Current Directions in Psychological Science 2013 22: 449
DOI: 10.1177/0963721413495869

The online version of this article can be found at:

<http://cdp.sagepub.com/content/22/6/449>

Published by:



<http://www.sagepublications.com>

On behalf of:



[Association for Psychological Science](http://www.sagepublications.com)

Additional services and information for *Current Directions in Psychological Science* can be found at:

Email Alerts: <http://cdp.sagepub.com/cgi/alerts>

Subscriptions: <http://cdp.sagepub.com/subscriptions>


Reprints: <http://www.sagepub.com/journalsReprints.nav>

Permissions: <http://www.sagepub.com/journalsPermissions.nav>

>> [Version of Record](#) - Dec 3, 2013

[What is This?](#)

Inside the Mindful Mind: How Mindfulness Enhances Emotion Regulation Through Improvements in Executive Control

Current Directions in Psychological Science
22(6) 449–454
© The Author(s) 2013
Reprints and permissions:
sagepub.com/journalsPermissions.nav
DOI: 10.1177/0963721413495869
cdps.sagepub.com


Rimma Teper, Zindel V. Segal, and Michael Inzlicht

University of Toronto

Abstract

Although the psychological benefits of mindfulness training on emotion regulation are well-documented, the precise mechanisms underlying these effects remain unclear. In the present account, we propose a new linkage between mindfulness and improved emotion regulation—one that highlights the role played by executive control. Specifically, we suggest that the present-moment awareness and nonjudgmental acceptance that is cultivated by mindfulness training is crucial in promoting executive control because it increases sensitivity to affective cues in the experiential field. This refined attunement and openness to subtle changes in affective states fosters executive control because it improves response to incipient affective cues that help signal the need for control. This, in turn, enhances emotion regulation. In presenting our model, we discuss how new findings in executive control can improve our understanding of how mindfulness increases the capacity for effective emotion regulation.

Keywords

mindfulness, executive control, self-control, emotion regulation, affect, emotion

Over the past several decades, the practice of mindfulness training has steadily gained popularity in Western cultures, including as a topic of study for psychological scientists. Mindfulness comprises two facets—present moment awareness and nonjudgmental acceptance of emotions and thoughts (Cardaciotto, Herbert, Forman, Moitra, & Farrow, 2008). Mindfulness seems to offer a number of benefits, but the focus of this article is its salutary effects on executive function and emotion regulation. Why does mindfulness confer such benefits?

A common misconception about mindfulness, and meditation in general, is that it involves emptying the mind of thoughts and emotions. Does mindfulness foster better executive control and emotion regulation because it eliminates emotional responding? We think not. Instead, we suggest that these effects accrue because mindfulness promotes an openness and sensitivity to subtle changes in affective states, which are essential in signaling the need for control and in energizing its execution. We propose that understanding how awareness and acceptance relate to executive control can provide a clearer understanding of the relationship between mindfulness and emotion regulation.

Mindfulness Enhances Emotion Regulation

The connection between mindfulness and improved emotion regulation is certainly an intuitive one, given the emphasis on the *nonjudgmental* acceptance of thoughts and emotions that is at the core of this practice (Kabat-Zinn, 1990). Practitioners learn to intentionally observe and accept affective states, and they are able to reduce habitual tendencies to ruminate about their feelings (Brown, Goodman, & Inzlicht, 2013; Creswell, Way, Eisenberger, & Lieberman, 2007) as well as strengthen more adaptive processing of emotional information (Farb, Segal, & Anderson, 2012; Perlman, Salomons, Davidson, & Lutz, 2010).

Because mindfulness promotes the early awareness and nonjudgmental acceptance of emotional stimuli (Goldin & Gross, 2010), it allows people to engage in regulation early

Corresponding Author:

Rimma Teper, Department of Psychology, University of Toronto, 1265 Military Trail, Toronto, Ontario, M1C 1A4, Canada
E-mail: rimma.teper@gmail.com

in the time course of stimulus processing, before intense emotional responses occur. Mindfulness can be categorized as a unique antecedent-focused type of regulation (Gross & Thompson, 2007) that focuses on changing a person's relationship to his or her emotions rather than the nature of the emotions themselves. The present-moment awareness cultivated by mindfulness is involved at the level of attentional deployment, prompting the practitioner to attend to primary sensations with refined attunement. Mindful acceptance, in turn, promotes a nonjudgmental attitude toward these sensations, counteracting rumination, fantasy, and suppression. For example, instead of a habitual focus on the "story" behind a person's anger, mindfulness encourages an awareness and openness to the primary physical sensations of anger. This allows people to flexibly attend to the somatic features of emotional experience, instead of habitual cognitive reactions, and doing so often attenuates the need for reappraisal (Brefczynski-Lewis, Lutz, Schaefer, Levinson, & Davidson, 2007; Farb, Anderson, Irving, & Segal, in press). Novices, however, may use acceptance as a type of cognitive reappraisal when experiencing a maladaptive reaction toward their emotions.¹

Mindfulness, therefore, does not reduce initial affective reactions but helps to lessen the negative consequences of their long-term activation (Williams, 2010). The precise nature of the connection between mindfulness and emotion regulation is not yet fully understood, however. Here, we propose that mindfulness improves emotion regulation by improving executive control (Schmeichel & Tang, in press). In the following sections, we discuss precisely how the two facets of mindfulness—awareness and acceptance—help enhance executive control and how this, in turn, helps to promote effective emotion regulation. We begin by discussing the integral role that affect plays in this relationship.

The Function of Affect

Our guiding premise is that emotions are mostly adaptive. Emotions evolved to deal with evolutionarily recurrent situations and may represent "best guesses" about what to do in those situations (Tooby & Cosmides, 2008). For instance, it is adaptive to recoil in fear upon encountering a snake, and the mechanism by which this affective experience recruits adaptive behavior is probably quite primitive neurologically (Panksepp & Bivens, 2012). This view suggests that emotion is information, and that it evolved because it conferred a survival advantage. Although our modern environments are quite different, affective experience clearly still helps us effectively navigate our worlds (Damasio, 1994).

It is important, however, to differentiate transient affect and more sustained emotional experiences. Whereas

full-blown emotions can be relatively slow, complex responses involving changes to conscious experience, behavior, and physiology (Mauss, Levenson, McCarter, Wilhelm, & Gross, 2005), transient affects can be conceptualized as very fast "pangs" that may be preconscious and very short-lived (e.g., a twinge of anxiety upon making an error) (Zajonc, 1980). The effect of mindfulness on prolonged emotions has been well described (Williams, 2010): Mindfulness leads to a dampening of these emotions by fostering attentional deployment to primary affective experience. However, the effect of mindfulness on transient, preconscious affect may be quite different, as mindfulness heightens visceral sensations and thus amplifies the experience of these quick affects (Williams, 2010). As it turns out, these affects are essential for executive control.

Executive Control and Mindfulness

Executive control is an important capacity that influences many domains of life, such as academic success and healthy eating (Hofmann, Schmeichel, & Baddeley, 2012; Robinson, Schmeichel, & Inzlicht, 2010). Models of executive control have focused on three primary dimensions: information updating and monitoring, mental set shifting, and inhibition (Miyake et al., 2000). An important question for those who study executive function is the question of how people know when to control themselves. One answer, based on cybernetic and cognitive neuroscience models of control (Botvinick, Braver, Barch, Carter, & Cohen, 2001; Carver & Scheier, 1981), is that control is instigated by a process that compares current behavior with a goal state. And when this "conflict-monitoring" process detects an incongruity between mental representations of intended and actual responses, it signals the need for control. There may be a natural parallel between such conflict-monitoring and mindfulness, because the act of meditation requires that practitioners monitor conscious experience and refocus on the present moment when they detect that their minds have wandered.

Awareness

Given this theoretical link, many empirical studies have documented beneficial effects of mindfulness training on executive control, finding that mindfulness is linked to cognitive flexibility (Moore & Malinowski, 2009), improved attentional processing (Chambers, Lo, & Allen, 2008; Jha, Krompinger, & Baime, 2007), and the inhibition of prepotent responses (Teper & Inzlicht, 2013). One possible reason for this link is that mindfulness cultivates present-moment awareness of all elements in the experiential field (Cardaciotto et al., 2008). This allows people to more closely attend to those instances when control is

needed. Mindfulness, that is, promotes conflict-monitoring by refining attention to the sensory cues that are crucial for instigating control. Although the connection between the attentional skills inherent in mindful awareness and executive control may be self-evident, the connection between *mindful acceptance* and control may be less so. However, the results of a recent experiment (Teper & Inzlicht, 2013) suggest that, in fact, the nonjudgmental acceptance of thoughts and emotions are integral to the effective initiation of executive control.

Acceptance

Teper and Inzlicht's (2013) study examined the effects of meditation practice and mindfulness on the behavioral and neuroaffective correlates of executive control. The results suggest that experienced meditators exhibited stronger neuroaffective brain responses to their own errors. Specifically, these meditators had an amplified *error-related negativity*, which is an evoked brain potential thought to be generated by the anterior cingulate cortex (Dehaene, Posner, & Tucker, 1994). Error-regulated negativity is thought to index the detection of cognitive conflict (Botvinick et al., 2001) and perhaps the affective response to such conflict (Hajcak & Foti, 2008). It is noteworthy that participants who scored high on the acceptance facet of mindfulness had higher error-related negativity scores and committed fewer errors on a Stroop task—a canonical measure of executive control. Meditation experience presumably fosters an open acceptance of one's errors and the affective response to such errors, thereby facilitating control. That is, people who are able to accept the "pang" of making an error may experience this quick affective state more keenly and may thus be more likely to attend to their errors and prevent them from happening on future trials. These people may be better able to control their behavior because they are more accepting of their errors and associated conflict. This study is consistent with an emerging view suggesting that affect is integrally involved in the process of executive control (Inzlicht & Legault, in press).

Evidence now suggests that affect-dampening tools such as the misattribution of arousal (Inzlicht & Al-Khindi, 2012) or the ingestion of anxiolytic agents (Bartholow, Henry, Lust, Sauls, & Wood, 2012) can decrease neural and behavioral indices of executive control. Although past work suggests that conflicting goals (e.g., naming a color vs. reading) instigate control, this new work suggests that control may be instigated not by mere conflict but by the aversive affect that accompanies such conflict (Schmeichel & Inzlicht, 2013). Because such states are typically unpleasant, people are motivated to avoid them while allowing them to serve as a kind of alarm—one

that orients people to situations that require control and motivates instrumental action to re-establish control. When people are accepting of their emotions, they may feel these transient affective signals more keenly and thus be in a better position to do something about them, including engaging in the control of their behavior.

Research suggests that both facets of mindfulness are crucial for promoting enhanced executive control. Mindful awareness is probably involved in the early detection of affective cues necessary for recognizing goal conflict, whereas mindful acceptance may be important for cultivating a nonjudgmental openness to such cues. We suggest that awareness and acceptance are iterative and interdependent processes that enhance executive control and that a new understanding of this mechanism may help reveal precisely why mindfulness helps to improve executive control and consequently emotion regulation.

The Awareness and Acceptance of Affective Cues

Although plenty of evidence links mindfulness to enhanced emotion regulation (see Chambers, Gullone, & Allen, 2009 for review), the precise mechanics behind these relationships are not fully understood. However, a burgeoning body of research suggests that mindfulness may actually increase sensitivity to primary visceral cues (Farb, Segal, & Anderson, 2013). If the awareness and acceptance of such cues is necessary for instigating control, this work could also help explain why mindfulness enhances emotion regulation. For instance, mindfulness training results in less neural activity in posterior cortical midline areas (which are responsible for self-referential processing while viewing sad stimuli) but leads to greater signal intensity in regions responsible for primary processing, such as the insula and basal ganglia (Farb et al., 2010). Likewise, although meditators exhibit decreased activity in the amygdala (a region associated with the evaluation of affect) while subjected to pain, they show activations in the anterior cingulate cortex, thalamus, and insula—regions associated with primary pain processing (Grant, Courtemanche, & Rainville, 2011). We suggest that mindful awareness increases responsiveness to interoceptive signals, which provide insight about the body's affective responses to events. When such visceral sensations signal conflict, people who are able to mindfully attend to them can efficiently mobilize self-regulatory resources, thereby avoiding the rumination that often ensues. For instance, if someone is able to focus on the incipient bodily sensations of anxiety (e.g., rapid breathing), he or she can quickly recognize that control is needed.

Acceptance is another integral facet of mindfulness that allows the person to be open to all elements in the experiential field without trying to alter their perception of them (Roemer & Orsillo, 2002). Here, we propose that acceptance vitally contributes to the mechanism by which mindfulness achieves its effects with executive control and consequently contributes to emotion regulation. Because acceptance fosters a nonjudgmental openness to primary sensations, people can respond efficiently to affective signals that are vital in initiating adaptive behavior (i.e., regulation) instead of elaborating on them or suppressing them. Openness to such signals is vital for the initiation of regulation, because these primary affective cues provide the information and motivation needed to recruit regulatory resources. In other words, an acceptance of affect that signals a need for control may facilitate emotion regulation by providing access to information about emotion-regulation goals that are not being met and also by delivering the motivation needed to recruit regulation.

The Current Model

We propose a model that describes the relationship between mindfulness, executive control, and emotion regulation (see Fig. 1). We suggest that mindfulness improves executive control because it fosters present-moment awareness—a refined attention to subtle changes in affective states, including phasic changes in somatic sensations and levels of arousal—and acceptance—a

nonjudgmental openness toward these sensations and experiences. We suggest that these two capacities work iteratively. Specifically, we suspect that awareness facilitates acceptance by effectively detecting the affective cues that are then “accepted,” which facilitates awareness by fostering an open mindset that allows for cue detection. Thus, mindfulness promotes executive control by enhancing experience of and attention to transient affects—the control alarms—that arise from competing goal tendencies. For instance, if a person who wants to manage his or her anger is attuned to and accepting of changes in phasic affect, he or she will notice the transient affective states (e.g., quickened heartbeat) indicating that his or her anger management goals are endangered. Early awareness and acceptance of these sensations is advantageous, because it allows people to efficiently recruit regulatory resources.

Conclusions

New research is beginning to support the notion that mindfulness may heighten quick affective reactions. This work allows us to revise our understanding of mindfulness so that it does not entail a mind that is empty of thoughts and emotions. New views of executive control that give affect a prominent role may help us understand precisely how mindfulness improves emotion regulation. This new research suggests that emotion regulation does not equate to “not feeling.” On the contrary, we suggest that people who are able to feel and accept the initial “pang” of affect will also be able to quickly mobilize the necessary regulatory resources, minimizing the negative consequences associated with full-blown emotional reactions. Although emotions have been caricatured as artifacts of our ancient animal pasts, it is becoming increasingly clear that some of the most positive outcomes of mindfulness, such as improved executive control and emotion regulation, rely on an ability to attune to and accept one’s emotional states.

Future Directions

Important questions about mindfulness remain unanswered. For instance, when do adaptive affective signals cease and maladaptive emotional reactions begin? Does mindfulness enhance the experience of primary affective states or does it allow people to attend to these responses with greater precision. Finally, although some work has investigated the effect of mindfulness on the processing of positive affect (e.g., Brown et al., 2013), the implications of this work for emotion regulation theory are not clear, because it is not evident that people would consciously aim to regulate such affect. These are all important avenues for future study.

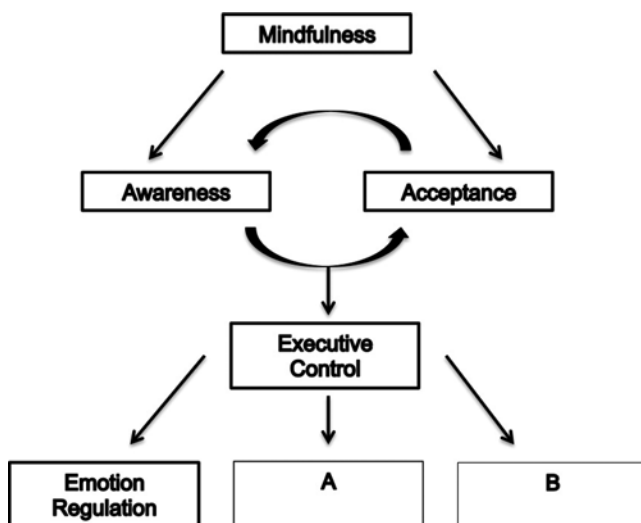


Fig. 1. Mindfulness enhances executive control through its two facets—awareness and acceptance. These facets work iteratively and interdependently to facilitate executive control and thus emotion regulation. Boxes A and B represent other hypothetical consequences of improved executive control that are not discussed here.

Recommended Reading

- Baer, R. A. (2003). Mindfulness training as a clinical intervention: A conceptual and empirical review. *Clinical Psychology, 10*, 125–143. A comprehensive and detailed review for those who wish to learn more about the clinical applications of mindfulness.
- Farb, N. A. S., Segal, Z. V., & Anderson, A. K. (2013). (See References). Outlines the effects of mindfulness on interoception.
- Holzel, B. K., Lazar, S. W., Gard, T., Schuman-Olivier, Z., Vago, D. R., & Ott, U. (2011). How does mindfulness meditation work? Proposing mechanisms of action from a conceptual and neural perspective. *Perspectives in Psychological Science, 6*, 537–559. Reviews in detail the mechanisms and neural consequences of mindfulness meditation.
- Teper, R., & Inzlicht, M. (2013). (See References). Discusses the effects of meditation and mindful acceptance on neuroaffective reactivity and self-control.
- Williams, J. M. (2010). (See References). Reviews recent studies on mindfulness, outlining the psychological processes by which mindfulness influences emotion regulation.

Declaration of Conflicting Interests

The authors declared that they had no conflicts of interest with respect to their authorship or the publication of this article.

Note

1. Although we believe that highly mindful people often exhibit default states of acceptance, thus attenuating the need for reappraisal, we also recognize that this may not be the case for novices. Specifically, in cases in which people's automatic reaction toward emotional experience is maladaptive, acceptance might act as an effective cognitive reappraisal strategy.

References

- Bartholow, B. D., Henry, E. A., Lust, S. A., Saults, J. S., & Wood, P. K. (2012). Alcohol effects on performance monitoring and adjustment: Affect modulation and impairment of evaluative cognitive control. *Journal of Abnormal Psychology, 121*, 173–186.
- Botvinick, M. M., Braver, T. S., Barch, D. M., Carter, C. S., & Cohen, J. D. (2001). Conflict monitoring and cognitive control. *Psychological Review, 108*, 624–652.
- Brefczynski-Lewis, J. A., Lutz, A., Schaefer, H. S., Levinson, D. B., & Davidson, R. J. (2007). Neural correlates of attentional expertise in long-term meditation practitioners. *Proceedings of the National Academy of Sciences, USA, 27*, 11483–11488.
- Brown, K. W., Goodman, R., & Inzlicht, M. (2013). Dispositional mindfulness and the attenuation of neural responses to emotional stimuli. *Social Cognitive and Affective Neuroscience, 8*, 93–99.
- Cardaciotto, L., Herbert, J. D., Forman, E. M., Moitra, E., & Farrow, V. (2008). The assessment of present-moment awareness and acceptance: The Philadelphia Mindfulness Scale. *Assessment, 15*, 204–223.
- Carver, C. S., & Scheier, M. F. (1981). *Attention and self-regulation*. New York, NY: Springer-Verlag.
- Chambers, R., Gullone, E., & Allen, N. B. (2009). Mindful emotion regulation: An integrative review. *Clinical Psychology Review, 29*, 560–572.
- Chambers, R., Lo, C., & Allen, N. B. (2008). The impact of intensive mindfulness training on executive cognition, cognitive style, and affect. *Cognitive Therapy and Research, 32*, 303–322.
- Creswell, J. D., Way, B. M., Eisenberger, N. I., & Lieberman, M. D. (2007). Neural correlates of dispositional mindfulness during affect labeling. *Psychosomatic Medicine, 69*, 560–565.
- Damasio, A. (1994). *Descartes' error: Emotion, reason, and the human brain*. New York, NY: Random House.
- Dehaene, S., Posner, M. I., & Tucker, D. M. (1994). Localization of a neural system for error detection and compensation. *Psychological Science, 5*, 303–305.
- Farb, N. A. S., Anderson, A. K., Irving, J. A., & Segal, Z. V. (in press). Mindfulness interventions and emotion regulation. In J. J. Gross (Ed.), *Handbook of emotion regulation* (2nd ed.). New York, NY: Guilford Press.
- Farb, N. A. S., Anderson, A. K., Mayberg, H., Bean, J., McKeon, D., & Segal, Z. V. (2010). Minding one's emotions: Mindfulness training alters the neural expression of sadness. *Emotion, 10*, 25–34.
- Farb, N. A. S., Segal, Z. V., & Anderson, A. K. (2012). The mindful brain and emotion regulation in mood disorders. *Canadian Journal of Psychiatry, 57*, 70–77.
- Farb, N. A. S., Segal, Z. V., & Anderson, A. K. (2013). Mindfulness meditation training alters cortical representations of interoceptive attention. *Social Cognitive and Affective Neuroscience, 8*, 15–26.
- Goldin, P., & Gross, J. (2010). Effect of mindfulness meditation training on the neural bases of emotion regulation in social anxiety disorder. *Emotion, 10*, 83–91.
- Grant, J. A., Courtemanche, J., & Rainville, P. (2011). A non-elaborative mental stance and decoupling of executive and pain-related cortices predicts low pain sensitivity in Zen meditators. *Pain, 152*, 150–156.
- Gross, J. J., & Thompson, R. A. (2007). Emotion regulation: Conceptual foundations. In J. J. Gross (Ed.), *Handbook of emotion regulation* (pp. 3–24). New York, NY: Guilford Press.
- Hajcak, G., & Foti, D. (2008). Errors are aversive: Defensive motivation and the error-related negativity. *Psychological Science, 19*, 103–108.
- Hofmann, W., Schmeichel, B. J., & Baddeley, A. D. (2012). Executive functions and self-regulation. *Trends in Cognitive Sciences, 3*, 174–180.
- Inzlicht, M., & Al-Khindi, T. (2012). ERN and the placebo: A misattribution approach to studying the arousal properties of the error-related negativity. *Journal of Experimental Psychology: General, 14*, 799–807. doi:10.1037/a0027586
- Inzlicht, M., & Legault, L. (in press). No pain, no gain: How distress underlies effective self-control (and unites diverse social psychological phenomena). In J. Forgas & E. Harmon-Jones (Eds.), *The control within: Motivation and its regulation*. New York, NY: Psychology Press.
- Jha, A. P., Krompinger, J., & Baime, M. J. (2007). Mindfulness training modifies subsystems of attention. *Cognitive, Affective, & Behavioral Neuroscience, 7*, 109–119.

- Kabat-Zinn, J. (1990). *Full catastrophe living: Using the wisdom of your mind to face stress, pain and illness*. New York, NY: Dell.
- Mauss, I. B., Levenson, R. W., McCarter, L., Wilhelm, F. H., & Gross, J. J. (2005). The tie that binds? Coherence among emotion experience, behavior, and physiology. *Emotion, 5*, 175–190.
- Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. G. (2000). The unity and diversity of executive functions and their contributions to complex “frontal lobe” tasks: A latent variable analysis. *Cognitive Psychology, 41*, 49–100.
- Moore, A., & Malinowski, P. (2009). Meditation, mindfulness and cognitive flexibility. *Conscious Cognition, 18*, 176–186.
- Panksepp, J., & Bivens, L. (2012). *The archaeology of the mind: Neuroevolutionary origins of human emotion*. New York: W.W. Norton.
- Perlman, D. M., Salomons, T. V., Davidson, R. J., & Lutz, A. (2010). Differential effects on pain intensity and unpleasantness of two meditation practices. *Emotion, 10*, 65–71.
- Robinson, M. D., Schmeichel, B. J., & Inzlicht, M. (2010). How does the self control itself? Questions and considerations based on a cognitive control perspective. *Social and Personality Psychology Compass, 4*, 189–200.
- Roemer, L., & Orsillo, S. M. (2002). Expanding our conceptualization of and treatment for generalized anxiety disorder: Integrating mindfulness/acceptance-based approaches with existing cognitive-behavioral models. *Clinical Psychology: Science and Practice, 9*, 54–68.
- Schmeichel, B. J., & Inzlicht, M. (2013). Incidental and integral effects of emotions on self-control. In M. D. Robinson, E. R. Watkins, & E. Harmon-Jones (Eds.), *Guilford handbook of cognition and emotion*. (pp. 272–290) New York, NY: Guilford Press.
- Schmeichel, B. J., & Tang, D. (in press). The relationship between individual differences in executive functioning and emotion regulation: A comprehensive review. In J. P. Forgas & E. Harmon-Jones (Eds.), *The control within: Motivation and its regulation*. New York, NY: Psychology Press.
- Teper, R., & Inzlicht, M. (2013). Meditation, mindfulness, and executive control: The importance of emotional acceptance and brain-based performance monitoring. *Social Cognitive and Affective Neuroscience, 8*, 85–92.
- Tooby, J., & Cosmides, L. (2008). The evolutionary psychology of the emotions and their relationship to internal regulatory variables. In M. Lewis, J. M. Haviland-Jones, & L. F. Barrett (Eds.), *Handbook of emotions* (3rd ed., pp. 114–137). New York, NY: Guilford Press.
- Williams, J. M. (2010). Mindfulness and psychological process. *Emotion, 10*, 1–7.
- Zajonc, R. B. (1980). Feelings and thinking: Preferences need no inferences. *American Psychologist, 35*, 151–175.