

SPECIAL ISSUE

Mindfulness- and Acceptance-Based Biofeedback

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Mindfulness and acceptance practices have become increasingly popular and better accepted in Western culture in the recent decades. There now exists a wealth of empirical evidence demonstrating the positive effect of mindfulness meditation on physical and mental health, as well as its ability to influence brain structure and function. Mindfulness and acceptance skills may enhance internal awareness of physiological states, facilitate passive volition, improve learning, memory, and attention, and encourage structural and functional brain changes conducive to lower sympathetic arousal. All of these factors are vital to biofeedback success. This paper will introduce a framework for integrating mindfulness and acceptance skills into biofeedback and provide treatment relevant example of using these skills.

I find myself staring intently at my computer screen, wishing for the green line indicating finger temperature to go up, silently chanting “go up, go up, go up,” feeling more and more defeated as the green line goes down and down and down. I look at my client, Tom, who is sitting with his eyes closed, a look of concentration on his face, one hand gripping an arm of his chair, the other hand lying flat with sensors attached to his fingers. I ask Tom to open his eyes and tell me about his experience. “I tried to bring my finger temperature up, but my hand feels colder now.”

If you can relate to this experience in any way, then this paper may be helpful to you and your clients. Biofeedback is often described as a way to help people control their physiological responses. However, extensive research shows that efforts to *control* one’s internal experience can be counterproductive and may exacerbate the problem. So, the very tools we use to ameliorate the problem sometimes end up making it worse. Rather than emphasizing controlling one’s internal experience, the mindfulness and acceptance based approach to biofeedback can help people experience change through mindful, nonjudgmental awareness and acceptance.

This paper will provide a framework for incorporating mindfulness and acceptance into your biofeedback practice.

The framework consists of several necessary elements. Most elements are aimed at being seamlessly integrated into the biofeedback practice itself. Mindfulness meditation is a powerful complement to biofeedback training, which is best practiced separately in the initial stages of learning biofeedback. As biofeedback training progresses, mindfulness meditation and biofeedback skills may be combined together. The next sections are dedicated to each of the following elements:

- Observation and labeling
- Giving up futile efforts of control
- Changing the intention
- Letting go of the struggle
- Mindful language
- Value-based action
- Mindfulness meditation practice

The final section of the paper presents a mindfulness- and acceptance-based skill, called FLARE, that incorporates most of the above elements and may be useful in difficult situations.

Some of the material in the following sections is based on the first chapter of *The Clinical Handbook of Biofeedback: A Step-by-Step Guide for Training and Practice with Mindfulness* (Khazan, 2013).

Observation and Labeling

Awareness and observation are essential to biofeedback success. Nonjudgmental observation allows us to differentiate what we can and cannot change and, therefore, allows to direct our efforts towards controllable outcomes. As we stop to observe and label, we enable ourselves to disengage from unhelpful thoughts and emotions, make space for the present experience, and free up resources for choosing a response instead of responding automatically. A lot more will be said about control versus choosing a response in later sections of this paper.

Labeling, or giving a name to our emotional experience, is an important step to being able to choose a response. Research shows that nonjudgmental labeling may change

the way our brains respond to the present experience. Studies, such as those by Lieberman et al. (2007) and Creswell, Way, Eisenberger, and Lieberman (2007), have shown that finding words to label emotions is associated with *less* activity in the amygdala (the part of the brain responsible for fear and anxiety) and *more* activity in the medial prefrontal cortex (the part of the brain responsible for emotion regulation and decision making). The implication of this finding is that labeling enables us to better regulate strong emotions, such as anxiety and fear, and be better able to decide how to respond to a difficult situation.

For biofeedback, labeling allows our clients to step away from an intense emotional response and be able to use biofeedback as a part of a thought-through healthy response to distress.

Giving Up Futile Efforts of Control

One of the most common myths perpetuated in our society is that we *should* have control over our thoughts and emotions. How many times have you heard, or even said, words such as “Don’t worry about it” or “Just stop thinking about it” or “You’ve got to have control over your thoughts”?

Let’s try this together—right now, please do your best to NOT think about the white bear. What’s the first thing that comes to mind? Daniel Wegner and his colleagues (Wegner, Schneider, Carter, & White, 1987) conducted exactly this experiment. He asked one group of students to spend 5 minutes thinking about the white bear and another group of students to do their best to not think about the white bear during the same 5 minutes. Both groups were asked to record the number of times thoughts of the white bear entered their minds. You probably won’t be surprised to hear that it was the group instructed *not* to think about the white bear that had the most thoughts about it.

So now we have evidence that we cannot control our thoughts. What about emotions? After all, shouldn’t we be able to control those? Research shows that not only are we not able to control our emotions, but we waste valuable resources in our attempts at doing so. One study by Roy Baumeister and colleagues (Baumeister, Bratlavsky, Muraven, & Tice, 1998) asked two groups of students to watch a clip from the movie *Terms of Endearment*, where a young mother is dying and saying goodbye to her children. One group was instructed to just watch the clip. The other group was instructed to control and suppress their emotions while watching the clip. After watching the clip, both groups were asked to solve a difficult anagram.

The group that had been controlling their emotions performed significantly worse on the anagram than the group that was allowed to have their emotions as they arose.

In a follow-up study, Gailliot and colleagues (2007) demonstrated that while performing acts of self-control and emotional suppression, the group that controlled and suppressed their emotions had blood sugar levels significantly lower than both their own pretask baseline levels and the posttask levels of the group that was allowed to have their emotions as they arose. Furthermore, lower blood sugar levels were associated with worse performance and giving up more quickly on solving difficult anagrams.

These studies very elegantly support the point that efforts to control what is out of our control, namely our thoughts and feelings, literally drain us of glucose, a fuel necessary for proper cognitive function. Wasting this fuel on futile efforts to control leaves us with a lack of resources for other, more productive activities. Therefore, the point is to be able to choose our response and how to allocate our internal resources, placing our efforts on actions that are under our control.

For biofeedback, the idea is to direct biofeedback skills towards achievable goals, such as releasing muscle tension in a tense part of the body, rather than making pain go away in that moment, or regulating breathing, rather than making anxiety go away.

Changing the Intention

In order to direct our efforts towards activities that are under our control, we need to attend to the intention of performing the activity in question. That is, the intention for our action needs to be a possible one, rather than one that would get us stuck in futile efforts to control the uncontrollable. Oftentimes, our clients don’t need to change the action itself in order to engage in a productive response to distress. They only need to change the intention of the action that they would have performed previously. For example, if a client practices biofeedback breathing skills in order to make anxiety go away, she is directing her efforts and her resources towards a futile task. If she were to practice her breathing skills in order to take better care of herself when she is anxious and/or in order to balance her respiratory physiology, then she is directing her efforts towards a possible end, something that is actually under her control. In another example, a client may practice electromyography (EMG) biofeedback skills in order to make back pain go away, potentially getting caught in a struggle with pain and thereby increasing pain further. Alternatively, if the client uses the same EMG biofeedback

skills to release tension in the muscles of his back when he experiences pain, he is more likely to experience tension release, with a possibility of reducing pain as a result.

Letting Go of the Struggle

In order to direct our efforts and resources towards achievable goals, we need to stop struggling with our present experience. For as long as we are struggling with what we cannot control (our thoughts and emotions), we will continue to get stuck in misery and be unable to step away long enough to choose a helpful response.

An Acceptance and Commitment Therapy (ACT) metaphor is a wonderful illustration for the experience of this struggle:¹ Imagine you are walking, going about your business, and unexpectedly step into quicksand. Your legs sink up to the ankles. What is your initial automatic reaction? You try to get away by lifting one leg out. And as a result, you reduce the area of your body in contact with the quicksand, increase the pressure, and sink some more. The more you struggle, the more you sink. How do you get out? Your best bet is to move slowly to change your position and lie down on your back to allow your body to float on the quicksand. This way you are reducing the pressure on quicksand, by increasing the surface area of your body in contact with the quicksand. You can actually float on quicksand much easier than on water because quicksand is denser than water. Once you are floating on your back, you can paddle to the edge of quicksand, come out, and move on.

Here's one more fact about quicksand you may not have known—it is actually not nearly as dangerous as people often think it is. It is almost impossible to drown in quicksand, as it is rarely more than a couple of feet deep. It is possible to get stuck in quicksand and have difficulty getting out (that is the main danger of quicksand), which happens mostly if you struggle. Giving up the struggle and allowing as much of your body to touch quicksand as possible is the way to get out and move on.

People's experience of getting stuck in the cycle of difficult thoughts and feelings is very similar. When we first notice the presence of difficult thoughts, emotions, or physiological sensations, the initial automatic reaction is to struggle and attempt to escape the experience. The effort to get away increases the focus on and the resources devoted to the difficult experience and gets us stuck. Just like with quicksand, the more we struggle, the more stuck we get. Similarly, the solution is to open up to the difficult

thoughts, emotions, or physiological sensations, “float” on them and eventually be able to move on. Again, just like quicksand, these difficult feelings are rarely dangerous; people only think that they are. Giving up the struggle and allowing ourselves to have our thoughts and feelings just the way they are is the way to get unstuck and move on.

With the practice of mindfulness, we learn to recognize the automatic struggle reaction and pause long enough to choose the most helpful response. Our clients can learn to let go of the struggle in using biofeedback to escape from painful or unpleasant experiences, and instead use it to become more aware and more open to the present experience as it is.

Mindful Language

Mindful language plays a significant role in letting go of the struggle, in changing the intention of biofeedback practice, and in promoting helpful physiological changes during biofeedback skills practice. The human mind forms strong associations between words and certain automatic reactions, including those of the autonomic nervous system. Choice of words may make the difference between activation of the sympathetic and parasympathetic nervous system.

Words like “control,” “effort,” “try,” and “work” have strong associations with sympathetic activation. How many times have you heard your clients say things like “I tried to relax and I just couldn't do it”? The word “try” is strongly associated with effort and is very likely to trigger sympathetic activation, preparing the body for action. Relaxation involves parasympathetic activation. Both sympathetic and parasympathetic branches of the autonomic nervous system cannot be dominant at the same time. Therefore, “trying to relax” is physiologically impossible. The term “trying to relax” is an oxymoron.

When our clients talk and think about their biofeedback skills using words like “work” and “try,” they are that much more likely to end up fighting and struggling to produce a response that is only possible with a gentler, more passive attitude. Examples of words that are likely to activate the sympathetic nervous system are:

- Try
- Control
- Effort
- Work
- Hard
- Push
- Must
- Should

¹ Description based on one initially made in the first chapter of *The Clinical Handbook of Biofeedback: A Step-by-Step Guide for Training and Practice with Mindfulness* (Khazan, 2013).

Examples of words more likely to promote parasympathetic activation include:

- Allow
- Permit
- Let
- Guide
- Effortless
- Gentle

Remember Tom, the client who was trying hard to increase his finger temperature? It turns out that our blood vessels are innervated only by sympathetic nerves, with no parasympathetic innervation. So, any effort, any kind of trying, is likely to bring about sympathetic activation and vasoconstriction. In order for peripheral blood vessels to dilate, we need to bring down sympathetic activation. With temperature training, mindful language is particularly important. Once Tom was able to let go of trying to increase his finger temperature and allowed himself to focus on his image of warmth, his fingers gradually warmed up.

Value-Based Action

As human beings, we need a reason to engage in most actions, especially those that come with difficult emotions or pain. We have a choice between the immediate relief from difficult feelings (through escape or avoidance) and mindful opening to the experience of difficult emotions and pain. We have to have a good reason to engage in the latter. Knowing our values, what is important to us in life, will help us make the choice between immediately relieving, but ultimately unhelpful, action, and the potentially difficult action that leads to a healthier outcome.

Our clients will not be willing to experience the pain or the discomfort for the sake of experiencing pain and discomfort. But they may be willing to become open to those sensations in the service of a larger value, if the action is consistent with something important in their lives. For example, being open to anxiety may allow a parent with a history of panic in crowded places to attend his daughter's softball game. Therefore, being open to anxiety would allow an action that is consistent with the value of being an involved and supportive parent. For an athlete, being open to physical pain of an injured leg may allow quicker return to walking and be consistent with the value of physical fitness and self-care.

As just described, values are our chosen life directions; they are the statements of what is important to us. Values are not judgements, not statements of what is good and what is bad. Values are not what we think we *should* do. Similarly, values are not what other people think is

important or things we think would please other people. Values are what are important to us, truly, no matter what others might think. Values are not feelings, because feelings change moment to moment, while values are more stable. Values could gradually evolve over time, but they do not change as much as feelings do. And finally, values are not goals. We can make a list of goals, and cross them off as we achieve them. Values are not something we can cross off a list. Values serve as a guide, not a reachable goal. Goals may be set as a way of acting in accordance with our values. For example, someone who values education may set goals of finishing college and graduate school. However, achieving those goals does not mean the value is no longer a value, it just means new goals reflective of that value may be set (i.e., reading at least one book each month, or learning a new language).

As your clients encounter difficult situations, you could ask them to think through their values in the areas described below (Forsyth & Eifert, 2008). Whenever a challenge comes up in experiencing their thoughts, emotions, and physical sensations, ask them to think about which action would be most consistent with the relevant value. Ask them to think about how using biofeedback may be a part of the action consistent with that value.

1. Intimate relationships: What kind of partner would I like to be? How do I want to treat my partner? What is important to me within my intimate relationship?
2. Parenting: What type of a parent do I want to be? How do I want to treat my children? How do I want to communicate and interact with my children?
3. Family of origin: How do I want to interact with my family members? What type of sister or brother do I want to be? What type of son or daughter do I want to be?
4. Friendships (social life): What kind of friend do I want to be? What does it mean to be a good friend? How do I treat my best friend? What is particularly important to me in a friendship?
5. Work/career: What is important to me about my work (for example, financial security, intellectual challenge, independence, prestige, interacting with, leading, or helping people, and so on)?
6. Education/learning/personal growth: What is important to me about education? What skills or training are most important for me to acquire? What do I want to learn about the most?
7. Health/self-care (physical and emotional): Why is self-care important to me? How do I want to take care of

my body (e.g., nutrition, exercise, etc.)? How do I want to take care of my mind?

8. Spirituality: In what do I have faith? What are the things that inspire me? How do they inspire me?
9. Community life/environment: What is important to me about the community I live in? In what way do I want to be part of that community (e.g., volunteering, voting)? What is important to me about the environment? How do I want to contribute to taking care of the environment (e.g., recycling, conserving energy)?
10. Recreation/leisure: What kind of activities do I enjoy (e.g., hobbies, sports)? What is important to me about these activities?

Mindfulness Meditation Practice

Mindfulness meditation is the one part of this guide that is intended to, at least initially, be practiced separately from biofeedback. The value of mindfulness meditation practice lies in both the experience itself and in the brain changes observed as a result of continued practice.

Sara Lazar, Britta Hölzel, and their colleagues at Massachusetts General Hospital in Boston studied the changes in brains of people who have undergone an 8-week Mindfulness Based Stress Reduction (MBSR) training (e.g., Hölzel et al., 2010, 2011). Results of these studies demonstrated that mindfulness meditation produces both structural and functional changes in the brain, leading to increased awareness, attention, memory, learning, emotion regulation, and empathy, as well as decreased fear and anxiety. These findings have direct implications for biofeedback. Awareness, attention, memory, and learning impact the client's ability to learn and utilize biofeedback skills. Improved emotion regulation and a reduction in fear aid biofeedback when working with clients struggling with anxiety, pain, or any other kind of chronic condition with symptoms that evoke fear.

There is a lot to be said about the practice of mindfulness. I provide you with a brief overview and encourage you to learn more, using texts such as the *Mindful Path to Self-Compassion* by Germer (2009) and *The Mindfulness Solution* by Siegel (2010).

The practice of Mindfulness Meditation typically consists of three components:

1. Concentration (*Shamatha*), or focused awareness, practice provides our attention with an anchor to gently focus on and return to whenever the mind wanders off. This is the best practice for beginners.
Concentration practices produce a calming effect in the moment and are often useful in situations where the

client feels overwhelmed or emotional intensity is particularly high. Continued practice of concentration skills trains stability and flexibility of attention as well as the ability to re-interpret distracting and/or distressing events as fleeting and momentary with acceptance. In biofeedback, concentration practices are helpful in training attention, awareness, and mindful acceptance of physiological sensations, such as breathing, muscle tension, and heart rate. The following are examples of Concentration practices:

- Mindfulness of the breath
- Mindful eating
- Mindfulness of sound
- Mindful walking
- Here-and-now stone

2. Open awareness (*Vipassana*), or what would be called true mindfulness practices, involves open monitoring of *whatever* predominates in moment-to-moment awareness: thoughts, feelings, physical sensations, sights, sounds, smells, etc. Open awareness practices encourage experiencing current cognitive, emotional, and sensory events without evaluation or interpretation, thereby cultivating insight and equanimity (steadiness of mind under stress).

In biofeedback, open awareness practices help the client to be aware of the current experience without getting caught up in it, and therefore being able to practice the specific biofeedback skill without engaging in distracting or distressing stimuli. Mindfulness skills are helpful in learning to allow physical sensations to be the way they are at the moment in order to make mindful changes to the way the client responds to those sensations. The following are examples of open awareness practices:

- Body scan or body awareness
- Mindfulness of emotion in the body
- Sitting meditation

3. Loving kindness and compassion (*Metta*) can be thought of as good will training, providing comfort, soothing, and acceptance. The topic of compassion is covered in detail elsewhere in this issue. In meditation, compassion is incorporated both as a compassion-focused practice, such as the *Metta*, and as an overall tone for other practices. A compassionate stance towards the self (self-compassion) during meditation gives us the ability to treat the experience of distracting thoughts, emotions, and other sensations with kindness rather than harsh-

ness. A compassionate stance in other areas of life allows us to let go of blame and judgment and find ways to take better care of ourselves.

In biofeedback, self-compassion practices allow for gentle and encouraging self-talk during skills training and acceptance of what might otherwise be termed as “failure.” The following are examples of compassion practices:

- *Metta*, or loving kindness meditation
- *Tonglen*, or giving and taking meditation

Meditation practice can be either formal or informal. For formal practice, you would set aside time, find a quiet space where you would be undisturbed, and engage in one of the aforementioned practices. For informal practice, all you need is to bring mindful attention to your experience at any moment. You could take a mindful shower, brush your teeth mindfully, drink your morning beverage mindfully, walk to work mindfully, or wash the dishes mindfully. The beauty of informal practices is that you don’t need to set aside specific time; just choose something you are already doing and do it mindfully. Therefore, informal meditation is a great way to start a meditation practice and then gradually move on to setting aside time for formal practice. Help your clients set a realistic goal for frequency and duration of meditation practices. For some, one mindful shower a week is a good place to start and more would be unrealistic. For others, one mindful activity a day is a realistic start. Once an informal practice becomes part of the client’s routine, encourage him or her to build in time for formal practice, starting with as little as 5 minutes a day and building from there, ideally getting to about 30 minutes a day.

FLARE

One way to incorporate most of the above elements in the moment of distress, allowing the client to choose a healthy response to a difficult situation, is to use the following skills, abbreviated in the acronym FLARE:

Feel: Notice preverbal awareness of the experience. This step allows you to observe the present moment.

Label: Assign a descriptive, nonjudgmental label for your experience (thoughts, feelings, physiological sensations). The tone of the label matters—use gentle, accepting tone. Possible labels include: anxiety, worry, sadness, anger, frustration, predicting, planning, questioning, uncertainty, tension, discomfort, unhelpful thinking. This step allows you to put some distance between yourself and your experience and to change the way your brain is responding in the

moment (as described in the observation and labeling section).

Allow and validate: Acknowledge that it is okay for your thoughts and feelings to be there. It does not matter whether you know why you feel the way you do. It does not matter whether you think you *should* feel the way you do. Because your thoughts and feelings are not under your control, your only choice is to allow them to be. Remember that you are validating the presence of your thoughts and feelings, not the content of what they are telling you. For example, you may acknowledge that it is ok to be afraid to get on a plane, but that does not mean that the plane is indeed going to crash. This step allows you to stop struggling with the difficult experience.

Respond: Choose the response that is in your best interest, one consistent with a valued direction in your life. This step allows you to focus on a controllable action with an outcome that is under your control. Biofeedback skills are often a great way to respond to distressing physical and emotional sensations. Use them not in order to make those sensations go away, but because it is a good way of taking care of yourself at the moment of difficulty.

Expand awareness: Once you’ve chosen your response, take note of what is going on and around you—the sky overhead, the sound of the birds chirping or the hum of the air conditioner, the color of the walls, the person standing next to you, the fragrance of your lunch—as well as internal sensations, such as your heart beating and your body breathing. This step allows you to see the difficult experience as just part of your experience, as opposed to all of your experience.

Conclusion

Using mindfulness and acceptance skills such as the ones described above may enhance your clients’ success in biofeedback by allowing them to focus on what is under their control in ways that produce results rather than a futile struggle. I find that the most helpful way to integrate mindfulness and acceptance skills into a biofeedback practice is through the following three steps:

1. Initial evaluation and biofeedback assessment conducted as usual.
2. Introduce mindfulness and acceptance skills to increase awareness and let go of the struggle with present experience, making no changes.
3. Introduce appropriate biofeedback skills, making mindful changes in accordance with the elements described previously.

References

- Baumeister, R. F., Bratslavsky, E., Muraven, M., & Tice, D. M. (1998). Ego depletion: Is the active self a limited resource? *Journal of Personality and Social Psychology*, 74(5), 1252–1265.
- 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.
- Forsyth, J. P., & Eifert, G. H. (2008). *The mindfulness and acceptance workbook for anxiety: A guide to breaking free from anxiety, phobias, and worry using acceptance and commitment therapy*. Oakland, CA: New Harbinger Publication.
- Gailliot, M. T., Baumeister, R. F., DeWall, C. N., Maner, J. K., Plant, E. A., Tice, D. M., Brewer, L.E., et al. (2007). Self-control relies on glucose as a limited energy source: Willpower is more than a metaphor. *Journal of Personality & Social Psychology*, 92(2), 325–336.
- Germer, C. K. (2009). *The mindful path to self-compassion: Freeing yourself from destructive thoughts and emotions*. New York: Guilford.
- Hölzel, B. K., Carmody, J., Evans, K. C., Hoge, E. A., Dusek, J. A., Morgan, L., Pitman, R. K., et al. (2010). Stress reduction correlates with structural changes in the amygdala. *Social Cognitive & Affective Neuroscience*, 5(1), 11–17.
- Hölzel, B. K., Carmody, J., Vangel, M., Congleton, C., Yerramsetti, S. M., Gard, T., & Lazar, S. W. (2011). Mindfulness practice leads to increases in regional brain gray matter density. *Psychiatry Research*, 191(1), 36–43.
- Khazan, I. Z. (2013). *The clinical handbook of biofeedback: A step-by-step guide for training and practice with mindfulness*. Oxford: John Wiley & Sons.
- Lieberman, M. D., Eisenberger, N. I., Crockett, M. J., Tom, S. M., Pfeifer, J. H., & Way, B. M. (2007). Putting feelings into words: Affect labeling disrupts amygdala activity in response to affective stimuli. *Psychological Science*, 18(5), 421–428.
- Siegel, R. (2010). *The mindfulness solution: Everyday practices for everyday problems*. New York: The Guilford Press.
- Wegner, D. M., Schneider, D. J., Carter, S. R., III, & White, T. L. (1987). Paradoxical effects of thought suppression. *Journal of Personality & Social Psychology*, 53(1), 5–13.



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