

In Press: Biofeedback

Using the 'Aha' Experience with Biofeedback:
Enhancing Body-Mind Integration

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Abstract: The 'Aha' experience refers to moments of personal insight and discovery that occur both in therapy and in everyday life. This article reviews the psychological literature on the 'aha' moment, explores those 'aha' experiences that occur spontaneously in biofeedback treatment, and highlights psychophysiological conditions conducive to their occurrence. The authors introduce an approach using biofeedback to facilitate the occurrence of 'aha' insights.

Introduction

"I couldn't wait to tell you! While we have been working with biofeedback and breathing for my Repetitive Strain Injury (RSI), I never told you that I had hypertension and I've been on medication since my mid-20's. My last check-up with my family doctor showed that my blood pressure is much lower. Now I realize that my blood pressure problem was related to my breathing—and I probably wouldn't have gotten RSI if I'd done biofeedback years ago, when my doctor recommended it. Wow!"

-40 year old court reporter

Most clinicians have observed a client experiencing an 'insight,' 'illumination,' or sudden understanding of knowledge or information. This experience is known as the 'aha' effect. For over a century the sudden insight or 'aha' has been studied with varying hypotheses, research and theories about its effects. More recent experiments attempted to determine underlying psychophysiological processes that lead to the 'aha.' What seems simple—"Aha! Now I understand"—is actually a complex process.

What is the 'Aha' Experience?

Some individuals believe that the 'aha' experience is something that just comes, without effort or intent, as if a gift of the gods suddenly drops on one and the problem is solved or a new understanding is reached. Researchers have proposed that the 'aha' is a part of the creative or problem-solving process and that the 'aha' effect has a process of its own. The 'aha' experience was the third stage proposed by Wallas (1926) in his work on creative thoughts or problem solving: 1) preparation where information is gathered and conscious work occurs; 2) time for consciously working on the problem; 3) illumination or insight or 'aha' where the person sees or knows how to solve a problem; and 4) verification where a solution is worked out or checked for accuracy. Since that time several main theories have been proposed to explain how problem solving or creativity occurs and the role of insight in that process. For a comprehensive review and critique of the theories on the 'aha,' a recent chapter by Davidson (2003) is recommended.

Davidson (2003) summarizes the theories of 'Gestalt,' 'nothing-special' and 'puzzle problem' approaches as treating insight as a solitary, cognitive event. Contrarily, the 'great mind'

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and ‘systems approach’ theories of insight propose that all significant insights, while cognitive events, are also embedded within a social context. In general, all approaches support the concept that prior to having an ‘aha’ experience the person has either incomplete information, or failure to appropriately apply the information, or an impasse on being able to use the information. When these problems are resolved, the ‘aha’ or insight is believed to occur.

Beyond experiential reports, research supports that there is a ‘moment of aha.’ Based upon a relationship between what one looks at and what the person is thinking about, Knoblich, Ohlsson and Raney (2001) used eye movement measurements to enhance the study of problem solving and ‘aha’ experiences. They described solving problems as being more related to inappropriate or misleading information, rather than incomplete information. Jones (2003) also used eye movement measurements to show that there generally is an impasse in understanding or solving problems before insight occurs. It is possible that when a person relaxes self-imposed constraints and then breaks the problem into smaller units (decomposes the ‘chunked’ information), he becomes ‘insightful.’ The following example demonstrates how a client who believed that she was just getting old and arthritic was able to decompose her beliefs and experience an ‘aha’:

Wendy, a 40-year old office worker, came in for biofeedback training for repetitive strain injury (RSI) with upper extremity pain. When she demonstrated her mousing technique, she was quite surprised when asked if she had left hip pain, which she confirmed. She was asked if she believed that she was getting old and arthritic—again, affirmative to both. Once more she demonstrated reaching for the mouse with her right hand and was asked to observe the tension in her left hip. She realized that she was using it to anchor her reach. She was not feeling pain as a result of getting old, rather as a result of repetitive and sustained poor use of her body. She now looks at how she performs her various functional tasks with an eye toward observing how she uses her body.

The deleterious effects of aging are often the result of learned disuse and dysponesis (chronic inappropriate use) without regeneration. We forget that how we use our bodies shapes and develops the physiological/psychological structure, and that this structure constrains our functions.

In the on-going debate on whether general creativity ability correlates to the ability to generate ‘aha’ moments, Conti, Coon and Amabile (1996) assert that **there may be a personality predisposition to creativity, but that training, experience and task motivation can enhance creativity.** Jausovec (1997) monitored eight sites of electroencephalographic (EEG) measurement of alpha (7.5-13Hz) activity during problem solving, and reported that ill-defined problems demanded more mental activity (less alpha) during the preparation phase but less mental activity during the solution phase. He suggests that individuals were more relaxed during the solutions for problems that required more creativity. This would suggest that perhaps the timing of delivery of information to clients may influence if and when the ‘aha’ effect will occur.

Why the ‘Aha’ Experience is Valuable

Important learning can occur during ‘aha’ moments that may not be possible through other learning techniques. Insights or ‘aha’ experiences seem particularly suited for the integration of information from different domains. Additionally, when a person learns through insight or ‘aha’ the information is better remembered (Auble, Franks, & Soraci, 1979).

Our clinical experience confirms this research. Often, a client may have difficulty learning a concept—he or she may even have reached a plateau in learning. If the client experiences an ‘aha,’ significant progress can be made toward achieving training goals. The ‘aha’ often leads to a paradigm shift and positive feelings: The client begins to have a ‘can do’ attitude that replaces the belief that he/she is ill or injured and unable to perform fully. This shift can lead to conscious control, not only in the areas of training, but may be generalized throughout life. In short, it is our experience that the ‘aha’ can change clients’ belief systems: It leads them to awareness and control, which can affect confidence and competence.

“I took the idea that I could reset my breathing patterns to heart. I immediately noticed that I was breathing poorly in a variety of situations, not just at work. I started trying out the breathing techniques my therapist taught me everywhere: while driving, on walks, when talking, before going to sleep. One day during this period of hyper-awareness I was playing tennis and noticed I actually held my breath while serving the ball. Although I had developed a powerful serve in the few years I’ve been playing tennis, it had never been very consistent. That day, incorporating many of the tips I’d learned from my biofeedback therapist, I figured out a simple breathing pattern to use when serving, which dramatically improved the placement, power and overall success rate of my serves. I can consistently apply this technique now to hitting the ball during rallies as well. With improved breathing, I am able to see the ball much more clearly and have far greater control and speed with less effort.”

--Dawn Van Hee (Van Hee & Peper, in press)

Biofeedback as a Tool to Facilitate the ‘Aha’

We propose that biofeedback displays are a natural way to help individuals become aware of their internal processes and to understand that the mind and body affect each other—a moment of ‘aha.’ Clients see a connection between thoughts and actions and begin to understand that discomfort may be connected to patterns of movement and/or beliefs. Real-time feedback can be the bait that leads clients down a path of discovery and awareness, such as with the initial awe of observing unnecessary tension when mousing, especially when the same clients had believed that they were relaxed. When the clients develop the ability to relax at will while still continuing to work and maintain performance levels, their confidence is reinforced and they often continue exploring other mind/body options.

Following are some examples in which the clinician’s perceptive use of biofeedback helps create an ‘aha’ experience that results in an attitudinal change and increased motivation to implement appropriate interventions.

Group ‘Aha’: Changing Work-Style and Reframing the Etiology of Illness

In our work on discomfort at the computer, we frequently monitor a volunteer participant in front of large group. The audience can see the physiological signals as the person rests with hands on lap, typing at the keyboard and resting again. To their complete surprise the audience observes that the volunteer’s respiration rate usually increases by 30% or more, that the anterior deltoid and upper trapezius muscles stay activated during the typing tasks, and there are no momentary gaps/micro-breaks (momentary relaxation of the muscle to rest condition) as shown in Figure 1.

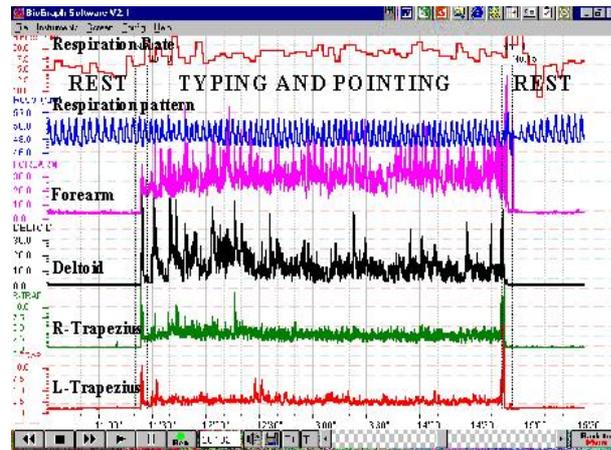


Figure 1. Representative physiological recording typing and pointing movements. Note that the respiration rate increases and there are no micro-breaks (momentary low SEMG values) during the typing and pointing (from Peper et al, 2003).

At the same time the person typing is oblivious of any of these physiological changes—this is simply standard operating procedure when typing. When the data are shown to the volunteer, both the volunteer and the audience are now persuaded that they are usually unaware that when they work at the keyboard:

1. Their shoulder muscles tighten.
2. Their breathing rate quickens.
3. There are no regeneration breaks during data entry.

While the audience watches, the volunteer is then taught quick muscle releases and proper breathing. When the typing demonstration is repeated the volunteer's success is obvious to all; and the audience usually provides social reinforcement through comments the person's ability to make quick changes. This demonstration totally changes the common perception that the only factor responsible for RSI is the ergonomic condition of the chair, keyboard, mouse or monitor. The audience often begins to shift their own individual beliefs through the group 'aha' experience.

Group 'Aha': Mind-Body Connection

Skin conductance response (electrodermal activity or EDA) is often used to demonstrate the mind-body connection: Any arousal will increase conductance. When this is demonstrated to subjects, they are often totally surprised by their own responses. The favorite games we use to demonstrate this experience are again done in groups.

After the EDA sensor is attached to the volunteer, we explore the volunteer's response to common stressors, such as a loud noise. Often after a 1-2 second delay, the conductance significantly increases. Yet, to demonstrate that this reaction also includes expectancy, thoughts and emotions, we then ask some one in the audience to come up and give the subject a kiss. In almost all cases, there is a dramatic increase in skin conductance response to the request -- without any actual kiss taking place. Similarly, one can ask for permission to place one's hand on the person's knee. After the EDA signal has habituated just ask if the person minds if you can

touch him/her higher. Again a large response occurs.¹ This is a powerful ‘aha’ demonstration of how our body reacts to thoughts, anticipated actions and intentions.

Clinically, EDA facilitates an ‘aha’ experience in which the client understands that he can integrate and thereby, change his cognitive style to facilitate health and change behavioral patterns. The following three case examples illustrate this ‘aha.’

1. Case Example: Fibromyalgia

A 50-year old woman with a 10-year history of Fibromyalgia experienced extreme fatigue, cognitive problems, joint and muscle pain, and trouble sleeping. The symptoms initially started after her son was involved in drugs and had dropped out of high school. For a number of months prior to attending biofeedback she had been taking morphine for the pain and had also developed panic attacks. The original family problems had been successfully resolved a few years prior and she had a supportive partner.

Training began with teaching her relaxation skills and slower diaphragmatic breathing, which she practiced at home. However, it was only after monitoring her EDA that the ‘aha’ experience occurred. Whenever she opened her eyes, her skin conductance increased significantly and took a long time to return to baseline. Even though she seemed totally relaxed and nothing appeared to change when she opened her eyes, her EDA consistently jumped the moment she opened her eyes. The therapist said to her, “When you opened your eyes, you literally jumped out of your skin.” Tears came to her eyes, as she finally felt that she understood what was happening—she was very reactive and sensitive to others emotions. The moment she opened her eyes she became hyper-vigilant—although she appeared totally relaxed.

This hyper-vigilance, triggering the autonomic reactivity, would also activate the trigger points and maintain the fibromyalgia. Once this concept was understood, she proceeded with further training, which consisted of inhibiting this arousal response. She practiced opening her eyes softly versus vigilantly (see Figure 2).

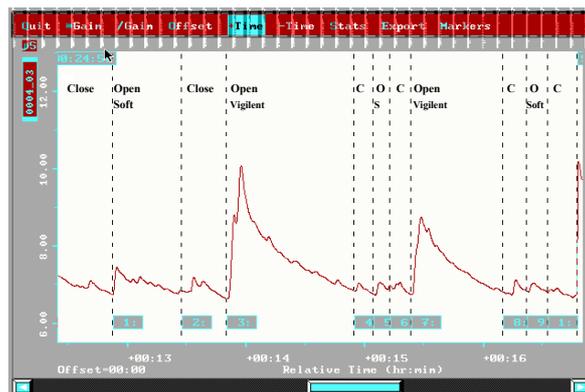


Figure 2. Subject opens her eyes trustingly (soft) or vigilantly (hard). Note the high electrodermal response when the subject opens her eyes with vigilance (hard) as compared to opening the eyes softly. She practiced this skill at home by alternating eyes closed, eyes open softly, eyes closed, and eyes open. In this process she learned to sense her vigilance, feel the body

response, and to learn to inhibit the response. A major focus was learning to open the eyes softly and to react to every vigilant response with an effortless exhalation, imagining she was blowing her breath down and through her legs while letting her eyes open softly. She began to listen to herself, trust herself and realize that she could also trust her sons and husband. She then applied these concepts to her Thanksgiving family gathering, which she generally loathed because she would be exhausted, anxious and in pain. She took responsibility to get everything ready for a party, and then practiced letting go and trusting that her grown sons and husband could fend for themselves (e.g., if they were thirsty they could ask or go to the refrigerator themselves). For the first time in ten years, she experienced no pain and was not exhausted after the party. Her health has continued to improve.

Her successful training was facilitated by her confidence in a therapist who helped her gain the insight ('aha') and provided a trusting and encouraging environment in which to address her fear response.

2. Case Example: Road Rage

A client in his mid-thirty's with road rage was referred by his supervisor. His job consisted of responding to equipment failures at different locations throughout Northern California. He had to drive to a facility and quickly fix the problem before being dispatched to another site, which could be up to 200 miles away. He spent approximately 80% of his work time in the car and was feeling increasingly frustrated with traffic congestion.

His supervisor was concerned that he was angry while driving and his family observed that he was frequently irritated. After the therapist took an initial history and recorded a baseline session, the training focused upon his relaxing while driving and changing driving habits—not tailgating—and asking himself if driving more quickly was worth “dying over.”

Although he did some of the homework he appeared unmotivated—as if he was simply present, knowing that he had to do the biofeedback. His involvement changed dramatically after we guided him through imagery, which involved visualizing driving with rage, and then relaxing (see Figure 3).

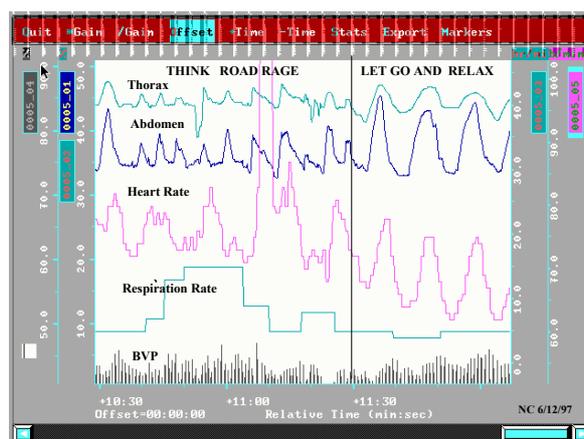


Figure 3. Breathing pattern and heart rate recording during imagined road rage and relaxation. Observe that during relaxation the average heart rate decreased by 16%.

When the data was shown back to him, the therapist pointed out that the client's average heart rate during imagined road rage was 80 beats per minute (bpm) and that during the relaxation and recovery period it slowed to 69 bpm. Hearing this, he noticeably paled as the therapist explained that this meant that his heart had to do 16% extra work during road rage (11 bpm more than during the relaxation). The client then shared that his father had died many years ago from a heart attack—he did not want this to happen to him and leave his wife and children behind.

With this 'aha' experience, his motivation changed significantly. He practiced the skills and began using the time while driving to listen to more classical music. He also began to listen to Spanish language audiotapes in preparation for a family vacation in Latin America. He now actively reframed being 'stuck in traffic' as an opportunity to learn more and almost looked forward to traffic jams. At a three month follow-up he had continued to drive without road rage and his wife reported that he was much less reactive and a more peaceful and mellow husband and father.

3. Case Example: Ghost in the System for the Therapist

A 20-year old professional male athlete showed repeated and consistent high frequency Beta (22-32Hz) in EEG assessment and training while training for attentional enhancement. The dominant high beta waves were explained as sometimes indicating anxiety or rumination from past experiences. He denied unusual anxiety or serious problems from his past life or sport history. I called the wave a possible 'ghost in the system.'

Many weeks later, he shared an experience that involved 'fear and freezing' in a family related incident when he was quite young in which he thought he or another member of his family might be killed due to his 'failure to perform.' His 'aha' moment came when he connected this past event with his recent professional performance when he had a 'fear of failure' and he responded like a 'deer in the headlights.' He is now cognizant of when this feeling begins to appear and why (fear). While the fear of failure is not extinguished, the events in which he experiences fear are less frequent. He practices self-regulation control mechanisms, which allow him to continue to perform at a high level. As he gained this insight, his high Beta EEG generally disappeared from his EEG recordings.

Factors Important for Facilitating 'Aha' Experiences

Biofeedback as a psychophysiological mirror is very often a covert procedure to induce an 'aha' experience. This experience can be facilitated when the therapist and client are open to deconstructing and reconstructing beliefs, providing a positive mood in which learning (not receiving therapy) is the goal, eliminating any sense of competition, and encouraging interactive communication. Following are suggestions for enhancing the 'aha' with these four elements:

1. Deconstruct/Reconstruct

Ask the person to write in detail the components of the problem that is to be resolved. When the client presents you with the information, put it in a hierarchical outline or summary on one page. This presents an overview of the entire problem, puts it into a framework defining the different aspects of the problem, and facilitates problem solving. Not only does a one-page deconstruction into elements provide a 'gist' of the problem, it also highlights which area is most important. For example, when an executive looks at a one-page psychophysiological profile and sees that he is at high risk for heart disorders, he tends to shift his focus from one argument with a

colleague to an attitude of ‘how do I prevent a heart attack and resolve this problem?’ After the deconstruction, the phase of relaxation or ‘letting go’ develops within the biofeedback session.

2. Eliminate Competition

Lessen the desire of the person to ‘compete’ with the biofeedback machine since competition interferes with solutions and ‘aha’ insights (Challey & Oldham, 1997). Emphasize within the session changes in motivation and use summary data to show progress. Reframe competition as exploration. Similarly, many clients are willing to do homework if it is explained as a week long experiment instead of as something one has to do forever.

3. Positive Mood State

A positive mood state without judgment enhances the possibility for an ‘aha’ experience. Interpret the biofeedback data in a positive framework. Emphasize the possibilities and develop the areas of competence.

4. Interactive Communication

We encourage the use of interactive communication as well as ‘therapeutic pauses’ delivered in a welcoming environment to enhance ‘aha’ (Wrobbles, 2003). The therapist can say ‘Yes’ in an encouraging tone, when the client’s hand temperature goes up or EDA activity goes down, and then invite the client’s perspective as to why or how these changes were achieved. Such interactions not only facilitate an awareness and recognition of mind/body interactions but also honors the client’s interpretation of the events.

Summary

Biofeedback is a powerful tool to demonstrate the ‘aha’ experience of body-mind unity. The use of visual/auditory biofeedback shows that changes have occurred in a person’s mind/body of which the person was often unaware. Once awareness has been achieved, the feedback can be used to demonstrate that transformation and mastery are possible (e.g., respiratory sinus arrhythmia may increase as breathing slows; focusing on certain topics induces a skin conductance response; or a certain behavior increases muscle tension or heart rate). We believe that biofeedback data, if used properly, can create insight or ‘aha’ moments for the client—a powerful transformational process. In a technologically dominated society, biofeedback can often be used to demonstrate and facilitate changing beliefs as well as motivating the client to do the home practices. And a sympathetic and supportive therapist, who understands the value of the ‘aha’ experience, can lead a client on a road to discovery that may continue to unfold well after the client completes biofeedback training.

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Notes

ⁱ We thank Richard Harvey for creating this useful demonstration.