

FROM THE EDITOR

Special Issue: The Emergent Science and Practice of Heart Rate Variability Biofeedback

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This special issue overviews the rapid development of research and clinical applications for heart rate variability (HRV) biofeedback. This is one of the most promising newer areas of biofeedback, with applications to the treatment of medical conditions, the enhancement of human performance, and the achievement of higher-level health. The cover of this special issue shows the Cardiosignalizer biofeedback instrument, developed by the Russian firm Byosvyaz about 1990. This photo reflects the Russian origins of HRV biofeedback.

The Russian physiologist Evgeny Vaschillo began research on HRV in 1975 in the Department of Ecological Physiology at the Institute of Experimental Medicine in Leningrad (now St. Petersburg). His initial goal was to investigate the mechanisms of heart rate regulation. He learned that his subjects could not consistently decrease or increase heart rate using biofeedback but could produce high-amplitude oscillations in heart rate. He also learned that oscillations at certain frequencies had much higher amplitude. He already had some understanding of the close relationship between the structure of HRV and human health from research conducted for the Russian space program in the 1960s.

Vaschillo began several courses of research, showing that the production of higher variability in heart rate could improve task performance in human operators, and developed protocols to treat cardiovascular dystonias, neuroses, asthma, and heart failure. In order to increase HRV, he trained patients to produce larger-amplitude oscillations in heart rate. Over time, he developed a model that emphasizes identifying a resonant frequency, the frequency of heart rate variations at which total variability is greatest. This resonant frequency is also the frequency of heart rate fluctuations that is optimal for each individual's overall health and functioning. Typically, breathing diaphragmatically at a rate somewhere between five and seven times per minute serves to produce this optimal frequency in heart rate variations, although the exact frequency varies from person to person.

A private firm, Byosvyaz, developed a commercial HRV biofeedback device, the Cardiosignalizer, in 1990 and pioneered larger-scale treatment of patients with asthma, producing significant reductions in asthma symptoms.

The Odyssey of HRV Research and Practice: From St. Petersburg to New Jersey

In 1992, a American psychophysiological researcher, Paul Lehrer, visited St. Petersburg for personal reasons. On his way to Russia, he read an ad in the *APA Monitor* inviting American psychologists to visit St. Petersburg State University. We include here Dr. Lehrer's own account of the visit and his discovery of Russian HRV research:

When I landed, I called them. I also had previously arranged a visit to the Pavlov Institute there. This was a rough time in Russia. Communism had just fallen apart, and a new system had not yet emerged. Poverty and struggle were palpable. The struggle was one against the elements, as well as against the economic conditions; the temperature hovered around 40 below zero for most of my stay, and the sun rarely made it above the horizon.

On my visits to these institutions, as a biofeedbacker, I, of course, asked if anyone in town was doing biofeedback. The reply: "only" a private-practice group. This was the typical academic attitude, in Russia, apparently, as well as in the United States. I made arrangements to visit them.

The name of the group was Byosvyaz. They were a medium-sized outfit, bigger, probably, than most Western biofeedback companies. They also ran a rehabilitation clinic and were in the business of importing surgical instruments from abroad.

My research at that time involved using respiratory sinus arrhythmia (RSA) to study cardiac vagal tone in asthma patients. There was some evidence that asthma patients have higher RSA and that this may contribute to stress-induced asthma exacerbations, because parasympathetic activation causes constriction of the smooth muscles in the lung. I was really surprised to learn that the Byosvyaz

people were actually teaching asthma patients to increase the amplitude of their RSA! We had quite a frank discussion about this (mediated, to some extent, by a young bilingual military officer who also was a psychophysicist working with HRV, and who, I think, included some of his work in our discussions at unpredictable times). The Byosvyaz people held their own against my skepticism and were quite insistent that they were helping almost all of their asthma patients.

During the discussions, Alexander Smetankin, the president of the organization, expressed an interest in extending his business to the United States and asked for advice. I suggested that the best way to do this would be to study his method impartially and publish results in an international journal. So he lent me several machines, and I set about trying to find some money to support a small research study. I got the money from the Fetzer Institute, which had been supporting an asthma relaxation trial in my lab at the time. The results were dramatic. With only about 6 subjects in a group, we found significant effects for Smetankin's method of HRV biofeedback, compared with both a relaxation/EMG biofeedback condition and a no-treatment control. Later Dr. Smetankin sent me pulmonary function results from a series of 20 consecutive patients at his clinic, who also showed dramatic results. Both of these studies were published. References are below.

I still did not really understand why this worked, and I tried tortuously to put together a rationale, which even I could not quite understand or believe in. A year or so later, I returned to St. Petersburg. By now Evgeny Vaschillo was working for Byosvyaz. He had simultaneously been head of the physiology laboratory at the Lesgoff Institute, an Olympic-training, physical-culture institute in St. Petersburg. However, the university system was by now bankrupt, and professors were scrambling for private employment to make ends meet, so he was now "moonlighting" with the Byosvyaz organization. In one of the most memorable encounters in my career, Evgeny brought a copy of his doctoral dissertation to the office and explained to me the rationale for HRV biofeedback, based on his very careful work, where he found that HRV biofeedback effects could be explained by resonance characteristics of the cardiovascular system. Less important than the effects of HRV biofeedback on autonomic balance was its effects on an important reflex that modulated autonomic and, indirectly, emotional reactivity: the baroreflex. Understanding this work required some cross-cultural education for me, less in understanding Russian scientific culture than in understanding the culture of

engineering and systems physiology, the basis for Evgeny's work, and the concept of resonance, which explains the HRV biofeedback effects. It was quite an education!

As luck would have it, Evgeny's wife, Bronya, had applied to an immigration lottery through the U.S. Consulate, so she could join her son Sasha, who was then studying in the United States. She won and brought Evgeny along. The next year I landed a larger NIH (National Institutes of Health) grant to continue our studies of HRV biofeedback as an asthma treatment. The Vaschillos came to work with me on this project and have remained here ever since. We have published a number of papers together, including results of Evgeny's work in Russia. References to this work can be found below.

This special issue of *Biofeedback* features a number of reports on research and clinical applications of HRV biofeedback, all of which owe their origins to the early work of Russian physiologists and to the fortunate circumstances that led Dr. Lehrer to bring this approach to North America. My thanks go out to both of our special guest editors, Paul Lehrer and Richard Gevirtz, who together have created an awareness in the United States and Europe of the nature and promise of HRV biofeedback.

Professional Issues

Sebastian Striefel provides a discussion of ethical practice guidelines in practicing HRV biofeedback, which apply equally well to any other newly emergent biofeedback treatment approach. The principles proposed in his article should become everyday knowledge for all practitioners, to inform treatment planning and, of course, to help protect practitioners against claims of negligence or accusations of engaging in unethical behavior.

Next, Fred Shaffer, Randy Neblett, and Judy Crawford provide an update on progress at the Biofeedback Certification Institute of America, including strategic planning in order to address current problems in the biofeedback world, expansion of the current database on biofeedback practitioners, and attention to potential marketing strategies for biofeedback and neurofeedback.

The Emergent Science and Practice of HRV Biofeedback

Paul Lehrer and Evgeny Vaschillo introduce our special issue by discussing the emergence of HRV biofeedback, the relevant physiology, and its potential for application to a broad range of disorders, including asthma, hyperventilation syndrome, hypertension, hypotension, anxiety, depression, fatigue, and pain. As reported above, Dr. Vaschillo was a pioneer in developing HRV biofeedback in Russia, and Dr.

Lehrer has been the single most influential proponent of HRV biofeedback in North America.

Andre E. Aubert and Bart Verheyden, researchers at the Laboratory of Experimental Cardiology at the University Hospital Gasthuisberg, Belgium, provide an overview of the emerging field of neurocardiology. The authors describe the relevant physiology of the cardiovascular system and the most important clinical applications of HRV.

Maria Karavidas presents new research showing that HRV biofeedback for the treatment of major depression can produce a significant reduction in depressive symptoms, with minimal adverse effects. Karavidas emphasizes the evidence for autonomic nervous system dysfunction in depression and the power of HRV biofeedback to enhance autonomic nervous system function.

Next, two different research teams report on applications of HRV biofeedback to the challenging problem of posttraumatic stress disorder (PTSD). Each team has developed a distinct protocol, combining biofeedback with other interventions, and both teams report positive outcomes. These preliminary reports are promising, given the current upsurge in PTSD cases among veterans of the Iraq war.

Richard Gevirtz and Constance Dalenberg describe a treatment protocol combining psychoeducation, cognitive behavioral therapy, acceptance and commitment therapy, and HRV biofeedback for intervention in PTSD. They provide a case history illustrating the treatment process.

Robert Whitehouse and Diane Heller combine HRV and other biofeedback modalities, including temperature and respiratory biofeedback, with the Somatic Experiencing clinical approach developed by Peter Levine.

HRV: The Manufacturers and Vendors Speak

The field of clinical biofeedback advances by the dual engines of research and technological advances. The Russian Cardiosignalizer on the cover of this special issue represents technology of only two decades ago. The Cardiosignalizer is an excellent training tool, yet it seems cumbersome and primitive by today's standards. Since that time, HRV training technology has advanced in two key directions—toward sophistication in real-time analyses and displays of more complex measures and indices of HRV and toward miniaturization and portability of home training devices.

Due to the key role played by technology in biofeedback, this section includes reports by manufacturers, vendors, and trainers who provide communications about the products they have developed or which they promote. Each

spokesperson has provided information about the product and reports where available on current research using the specific device.

Rollin McCraty is director of research for the HeartMath Institute, which has carried out a significant body of research on the effectiveness of HRV biofeedback in stress management and emotional self-regulation. The HeartMath Institute also manufactures the emWave home training device and the desktop instrument, the emWavePC (formerly known as the Freeze-Framer). McCraty provides an overview of the HeartMath approach to emotional re-education and a discussion of the use of HRV biofeedback in emotional self-regulation.

Frederick Muench is director of clinical research and development for the Helicor Company, which manufactures the StressEraser portable HRV training device. Muench provides a discussion of the effectiveness of HRV biofeedback in general and discusses current research on the use of the StressEraser device for stress-related problems. He advocates especially for appealing user-friendly devices, which facilitate better client adherence to training and practice goals.

Tony Hughes, a widely respected trainer for the STENS Corporation, has taught the foundations of biofeedback skills and knowledge to more than 9,000 students in recent decades. He provides a discussion of the advanced technical features of the NeXus multimodal biofeedback system, developed in The Netherlands and marketed in the United States by STENS.

Future issues of *Biofeedback* will provide space for other manufacturers and interested parties to provide information on their HRV and multimodal biofeedback systems. The selection of specific articles for this special issue provides a sample of current technology but does not constitute an endorsement or recommendation of one product over another.

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Donald Moss



Paul Lehrer



Richard Gevirtz

Proposals and Abstracts

Proposals and Abstracts are now invited for future special issues of *Biofeedback*. Articles are welcome for two scheduled special issues: Advances in Respiratory Physiology and Respiratory Biofeedback, for Summer 2008, or Advances in Neurofeedback and Quantitative EEG, for Winter 2008. The editor also welcomes proposals for future special issues of *Biofeedback*.

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