

## FEATURE

# Whole-Body Breathing, II: A Systems-Based Process Model for Relaxation Training

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*The article is the second in a three-part series on whole-body breathing. This segment examines the unpredictability of outcomes from simple relaxation interventions. The article introduces a systems-based process model for training relaxation and stress management. Biofeedback is conceived as a training process, tuning the individual to perceive and use any resulting changes within the body as cues for internal self-regulation. A case study illustrates the individualization of the relaxation training. Finally, the author presents a comprehensive model integrating awareness of external stress and of internal tensions and a variety of active and passive forms of self-regulation.*

### A Model Derived From the Biofeedback Process

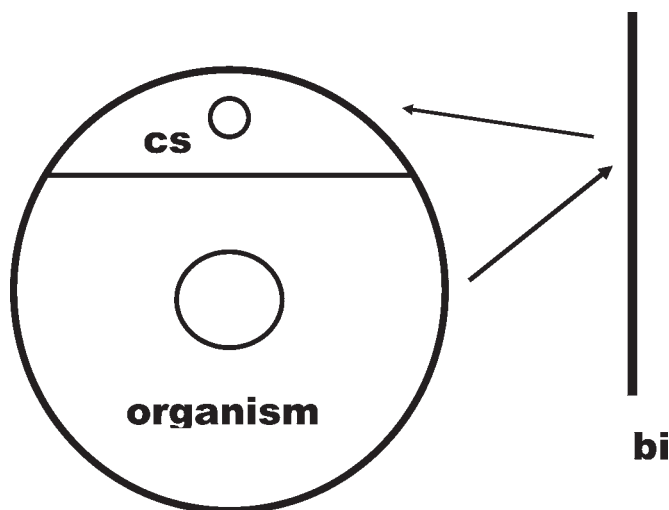
In part 1 of this article, a process model was described for relaxation therapy, or more generally, for self-regulation of tension. A key concept in it is the unpredictability of the outcome of any technique for tension regulation. The modalities of the intervention as well as the responses are categorized into several groups, for instance, muscle relaxation as an intervention modality and somatic tension reduction as an outcome category. One would assume that muscle relaxation would lead to muscle tension reduction and thus to somatic tension reduction, assessed as, for instance, a drop in electromyography (EMG) levels and/or heart rate. Numerous outcome studies would confirm that, on average, a drop can be found. However, does it occur in all participants, and only after muscle relaxation? Are there other measures of somatic tension reduction that change as well, for instance, skin conductance level (SCL), respiration rate, finger temperature? How about heart rate variability and electroencephalography measures? How about changes in other realms: attention, awareness, cognition, renewal of energy, ease and functionality of breathing, posture, and ease of movement? And, most important, which of all these potential effects of the intervention are really relevant for the subject under treatment?

The process model assumes unpredictability of specific relationships. There is no one-to-one correspondence

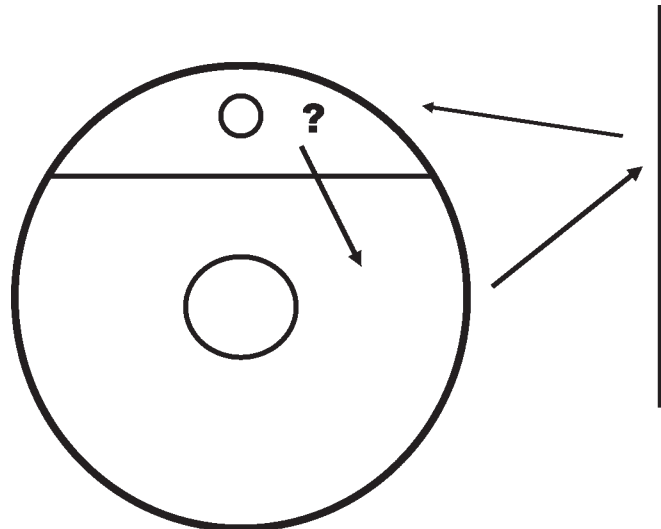
between the intervention and the response. This forces the practitioner to carefully observe what is really happening in the individual. Instead of aiming for specific changes, the treatment goal according to the process model is global and formulated as a search for any meaningful change. The choice of treatment techniques is variable. One may employ any of the treatment options without following a hierarchy among them (Smith, 1999), as long as it contributes to the occurrence of a meaningful change.

In the 1970s, I started one of the first biofeedback clinics in a hospital in the Netherlands, using first EMG biofeedback and gradually increasing the number of instruments, notably to include temperature feedback and SCL. From the operating room in the hospital, I received two old capnometers, and for my research with cardiac patients, the hospital paid for a polygraph, recording beat-to-beat variation in heart rate and breathing movement in the chest and abdomen. All of these assessments are in the category of somatic tension, but it became clear to me that they do not change uniformly in response to relaxation instructions. However, no matter which direction any of these parameters would change, the success of biofeedback and relaxation instruction seemed to depend primarily on the occurrence of a perceptible, concrete, and meaningful change within oneself. That is, the perceived ability to influence or regulate oneself. The external information provided by the biofeedback instrument can be helpful and serves as a mirror, but the key element is the experience of a change within oneself.

In essence, biofeedback is the procedure in which information collected from the body is fed back to the individual, who consciously perceives the changes in his or her body. Figure 1 displays the basic setup. The arrows indicate the information traffic from the sensors to the machine, which filters, amplifies, and displays them in a proper form to the individual. From this setup, the individual subject may engage himself or herself and become interested in the changes he or she witnesses in the feedback signal. Somehow the information reflects changes within oneself. Thus, the subject has to become attentive to changes that occur within



**Figure 1.** Model of biofeedback set up. cs = conscious subject, bi = biofeedback instrument.



**Figure 2.** External information and internal regulation.

oneself rather than focusing exclusively on the information in the external world (Figure 2). This attentional shift enables the subject to gradually or suddenly correlate the internal (first person) and external (third person) information and to learn how to induce a change within oneself.

Proper guidance of this process is crucial, and the role of instructions during feedback training is fundamental (Conde, Javier, Sanz, & Vila, 2008). When the parameter is easily amenable to change, feedback is positive, results in a sense of self-control, and enhances motivation for self-regulation. However, when the objective parameter is not easy to change, continued feedback may lead to feedback frustration and consequent aversion to self-regulation. When the subject continues to try to control himself or herself in the same way one controls the outside world, by active manipulation, the importance of passive attention, listening, and mentally following needs to be explained (Peper, 1979). Instructions may be offered that somehow modify the parameter measured to help regulation; by contrast, instructions for attending passively to oneself without trying to change or influence anything may be proper.

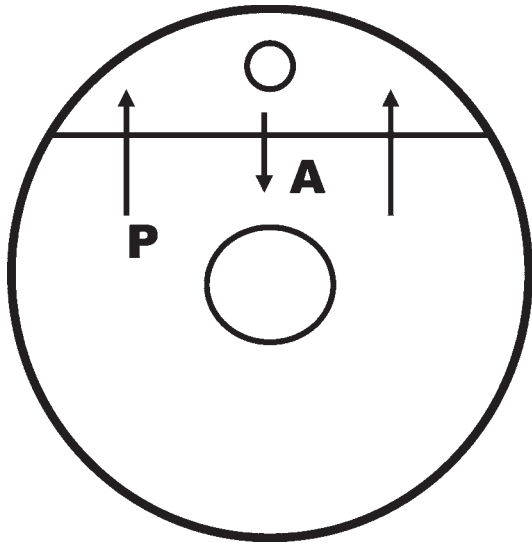
### Internal Self-Regulation

The practice of biofeedback helped me to clarify the understanding that self-regulation of tension is an internal affair, in which conscious awareness is directly engaged in one's own internal functions and events. It differs from the usual concept of self-regulation, which entails using a change in the environment to elicit a change within oneself. Biofeedback complies with the usual concept of self-regulation because it consists of an instrument in the (external, objective) world that helps by providing hard, objective

readings. However, these seemingly hard data reflect changes that are derived from one's internal world, which includes one's experiential first-person reality. Thus, any change within this reality may serve as a source of information as well: "Your body, biofeedback at its best" (Jencks, 1977). This realization led me to focus even more on the exact nature of instructions. Jacobson used deliberate, specific, local, and conscious muscle tension to be able to identify the subjective experience of it and monitor its decrease (Jacobson, 1929). Although he emphasized a passive mental state to monitor tension reduction, his research focused on objective EMG measurements, and his instructions are known for conscious muscle contraction and release.

My formulation would be that an instruction is a strategy to bring one's attention inside, elicit a change within oneself for a short period of time, and then stop doing this and passively attend to any response from one's system. Thus, an instruction is an alternation between active attention, doing something within oneself, and passive attention, being attentive and perceptive of the changes that remain after having stopped the active part. Figure 3 depicts the basic structure of an instruction (Dixhoorn, 1995).

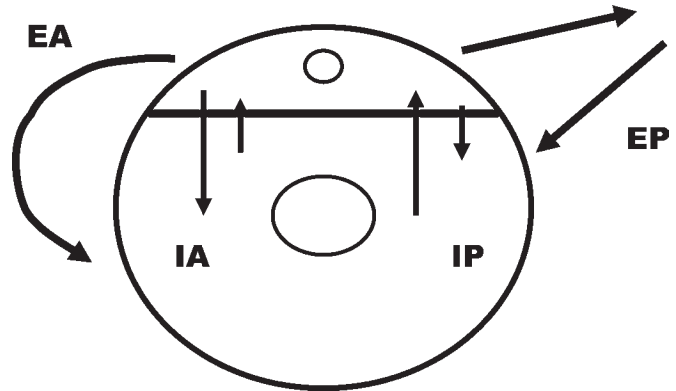
This model shows both the need for instructions to elicit a concrete change within oneself (active attention, downward arrow) and the unpredictability of its outcome (passively attending to the response, upward arrow). As a consequence, I gradually developed a whole set of new instructions, each of which offers a clear contrast in the active part of it that elicits a perceptible difference in the passive part, without indicating in any way the nature of the perceived change. Any outcome will do. Its nature is determined by the system's response rather than the nature of the stimulus.



**Figure 3.** Basic procedure of tension regulation technique. P = passively attending, A = actively doing an instruction.

To my mind, this concept of the process model reflects the clinical reality of relaxation and breathing instruction more adequately than the concept of a linear relationship between intervention and response. The main reason is that instructions are weak stimuli. They are invitations to the system to respond to rather than dominant influences. Thus, when a client does not notice any change, the clinician should refrain from the tendency to increase the force of the stimulus and instead use strategies that help the client to focus attention to small differences. For instance, the clinician simply waits, remains neutral, and repeats the instruction, without suggesting or expecting that one should have to notice a change. This neutral, passive attitude tends to evoke a similar attitude in the client. The clinician is the expert in teaching instructions and observing responses, but the first-person reality of the client is equally acknowledged. The client has to observe internal changes and has to interpret whether the changes that occur during home practice are in any way meaningful.

This model fits well with a system's view of breathing that describes the importance of indirect, nonlinear influences on respiration, through changes in the mental or physical tension state. Of course, in practice, the search is to find individually effective techniques that enable the client to increase the ability for self-regulation of tension. The point is that the clinician does not pretend to know in advance which exact technique is going to be effective for a given client. Even in the rare case of an instruction, which results in a specific change in say 80% of subjects, it is still more important and meaningful for each subject to discover this on his or her own, rather than being told what experience to expect.



**Figure 4.** Model of self-regulation of tension. EA = external active, EP = external passive, IA = internal active, IP = internal passive.

### Case History

A 12-year-old girl was quite bright with regard to school work, and she was active in sports as well. She recently began high school and was asked to participate in a sports competition at a fairly high level. Because she was ambitious, she wanted to do this, but she also now had more homework from school. She started sleeping poorly, had breathing difficulties during running (possibly a revival of childhood asthma), developed headaches, and was often tired. Her father was a businessman who had benefited from my treatment at a time when he had to stop working because of burnout. He asked me to see her after medication for her lungs and manipulation of her upper spine proved insufficiently effective.

She was indeed quite bright and very alert. One of the instructions I used was to have her roll her head from side to side a little, slowly and easily. After some time, I asked her to pay attention to the movement the face makes. Then I asked her to feel the back of the head and pay attention to the shift in pressure of it on the cushion when rolling. There is a clear shift in pressure that one notices only when one really brings attention to the backside of the head. I asked whether she could do bring her attention to the back, and I asked whether this made any difference in the way the head was rolling. We alternated rolling the head and having the head lie still, as well as rolling with attention to the front and to the back. She got interested in the small but clear changes that occurred within herself and enjoyed engaging in this process. Each time we stopped and the head was lying still, she found herself lying more quietly and comfortably. Then I asked whether she was willing to try doing this at night in bed, and she was.

Another intervention involved holding both her shoulders and letting the hands follow the respiratory movement of the upper ribs. After this had become comfortable for her and even eased respiratory effort a little, I asked her to breathe in slowly and in the direction of her feet a couple of times.

This resulted in a larger tidal volume and a larger breathing movement, which was better distributed along the whole of the trunk (Dixhoorn, 2007). Afterward, the biofeedback instruments showed that the tightness around the shoulders diminished somewhat, respiration rate slowed down, and the whole body was more involved in breathing. She did not notice these changes, but the instruction to inhale to her feet felt OK and pleasant to practice at home.

In three to four sessions, we added additional instructions, but the most valuable process for her turned out to be identifying a shift in attention from active to passive. She learned to elicit this shift herself, and this helped her to fall asleep. She also realized that the hours before going to sleep were better spent a bit more quietly. The shoulder tightness diminished, but she did not notice any respiratory changes. Although her tiredness, headaches, and sleep quality improved, her ambition remained. The breathing difficulties during running improved sufficiently to allow her to continue her sports. Her parents began to discuss with her how many duties and activities she could and should take upon herself. She continued to practice and sought relaxation treatment closer to her home to help sustain her balance.

What happened? A number of instructions were offered: attention, movement, breathing directly and indirectly, manual techniques (see table 1 in the previous article). The main process for her turned out to be an attentional shift. There were also respiratory and cognitive changes, and there was a reduction in tension, but these changes appeared to be secondary. My speculation would be that a repeatedly evoked meaningful change somehow modifies and resets a set point of tension regulation, which results in generalization as well as the occurrence of other processes. It is beneficial for the organism as a whole, and the system responds to that. It is the clinician's/researcher's responsibility to unravel the processes in detail; for the client, a beneficial improvement in his or her complaints is sufficient.

This client's complaints, which seemed due to an overload in daily duties, improved but were not entirely eliminated. Thus, they were partially due to unnecessary and dysfunctional tension. However, her daily tasks were many, and a realistic discussion followed within the family regarding how much she should continue or reduce them. This introduces the last issue in this model of tension regulation: an increased and realistic awareness of (external) stressors.

## A Model for Tension Regulation

Figure 4 shows the complete model, representing the options for the conscious subject to deal with increased signs of tension, coming from the organism to conscious

awareness (Dixhoorn, 2000). One option is to ignore the signs and raise the threshold of internal perception. This can be represented by thickening the dividing horizontal line between organism and the conscious part. It is a necessary option, which everyone acquires in childhood. It assumes that the organism regulates the tension signal by itself, which usually it does. Another option is to start thinking about the increasing tension and to attempt to find a cause. This is external, active self-regulation (EA): One thinks about it in the third person. One thinks of different causes, and one tries different tactics to influence the tension and so on, in the same way one would think about dealing with it for another person. This is the usual meaning of self-regulation. Another option is to ask for help, the external passive form (EP): This involves having someone else examine your body, do something to your body, or talk about your perception of the signs you notice. Then there are two internal forms. The most common is internal, active (IA): changing something within yourself. Muscle tension, posture, movement, breathing, self-talk, imagination—all the relaxation modalities are possible. They are done in a top-down direction, and one receives feedback (arrow down is larger than arrow up). One tries to change the signs and the tension actively. This supposes that one's choice of top-down influence is correct and relevant. The final option is internal, passive (IP): One changes something in oneself, in the same way as in IA but in a less directive and less dominant fashion, and one is more attentive to the response of the system (arrow upward is larger than arrow down). One waits for a response that may clarify the tension problem, provide a clue as to its nature. One is simply open to any response, without specific expectation.

When the first option is practiced too often, the threshold of internal perception is raised permanently and one is out of touch with one's organism. As a result, tension may build up, at first unnoticed but finally expressing itself in complaints and dysfunction. The best way to remedy this state is to practice IP, which lowers the threshold for internal perception. Interestingly, when the complaints were caused by the build up of tension because of insufficient attention, then simply attending to oneself solves them. This is the meaning of the process body awareness. It implies that one receives more internal information, which is relevant and proper, and helps self-regulation as a whole. Thus, the individual as a whole functions better and becomes stronger. By contrast, when complaints were not caused by such tension, then attending to it does not help and will only increase the complaints. Simply feeling more is not the point and is not always good. Often, however, there is a mixture of the two, and attending internally requires a careful dosage

of the different self-regulation strategies to have the benefit outweigh the disadvantages.

On the other hand, the internal passive form makes one more sensitive, which includes increased awareness of the effects of external stressors. This helps the EA form and clarifies to the conscious subject what specific factors are bothering and what specific effects they have. Thus, one may make more proper decisions as to changes in one's life situation. Internal self-regulation helps external stress management. The different forms of self-regulation complement each other. This is shown in our case history. The girl as well as her parents became more clear about the degree that complaints respond to internal tension regulation, on one hand, and the influence of factors in the life situation, on the other hand. This differentiation is extremely important because the way to deal with them is quite different. One should not try to cope with real-life stressors by trying to relax. It is a major lesson that I have learned, that the margin for internal self-regulation is very real but also small. It is certainly no panacea.

## References

- Conde, P. M., Javier, M. F., Sanz, M. T., & Vila, A. E. (2008). The influence of respiration on biofeedback techniques. *Applied Psychophysiological Biofeedback*, 33, 49–54.
- Dixhoorn, J. v. (1995). Breath relaxation: Stress management in East and West. In T. Kikuchi, H. Sakuma, I. Saito, & K. Tsuboi (Eds.), *Biobehavioral self-regulation: Eastern and Western perspectives* (pp. 58–66). Tokyo/Berlin: Springer.
- Dixhoorn, J. v. (2000). Body awareness and levels of self-regulation. In Y. Haruki & K. T. Kaku (Eds.), *Meditation as health promotion: A lifestyle modification approach* (pp. 65–80). Delft, the Netherlands: Eburon.
- Dixhoorn, J. v. (2007). Whole-body breathing: A systems perspective on respiratory retraining. In P. M. Lehrer, R. L. Woolfolk, & W. E. Sime (Eds.), *Principles and practice of stress management* (pp. 291–332). New York: Guilford Press.
- Jacobson, E. (1929). *Progressive relaxation*. Chicago: University of Chicago Press.
- Jencks, B. (1977). *Your body, biofeedback at its best*. Chicago: Nelson Hall.
- Peper, E. (1979). Passive attention: The gateway to consciousness and autonomic control. In E. Peper, S. Ancoli, & M. Quinn (Eds.),

*Mind/body integration: Essential readings in biofeedback* (pp. 119–124). New York: Plenum.

Smith, J. C. (1999). *ABC relaxation theory*. New York: Springer.



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