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FROM THE EDITOR

Special Issue: Remembering and Honoring Thomas H. Budzynski

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Editor's Introduction

The cover of this Winter 2011 issue of *Biofeedback* shows a photo of Thomas H. Budzynski, a pioneer in both biofeedback and neurofeedback. Tom died February 14, 2011, at the age of 77. Tom was born in Grand Rapids, Michigan, in 1933 and initially pursued a degree in electrical engineering at the University of Detroit. His early engineering career involved cutting-edge aerospace work for Honeywell, including his role in developing the inertial guidance system for the Blackbird spy plane. Fortunately for the field of biofeedback, Tom pursued new directions in the late 1960s, and brought his engineering acumen into the field of psychology. Tom earned a PhD in psychology at the University of Colorado, and the rest is biofeedback history.

Tom Budzynski was a pioneer from his graduate student days onward. He produced a prototype surface electromyography biofeedback device, which served as the focus of his doctoral dissertation and his first publication with Johann Stoyva (Budzynski, 1969; Budzynski & Stoyva, 1969). In collaboration with Johann Stoyva and Charles Adler, he developed a protocol for headache treatment (Budzynski, Stoyva, & Adler, 1970). He pioneered many areas of neurofeedback as well. In this special issue, Tom's widow and several close friends and colleagues recall his personality, wit, and gift for pursuing the furthest edge in biofeedback technology and applications.

Professional Issues

This professional issues section presents an article by Fred Shaffer and Judy Crawford on ''savvy marketing strategies'' for Biofeedback Certification Institute of America (BCIA) certificants. The authors report increased consumer interest in biofeedback and neurofeedback services, an increase in enrollment in BCIA accredited training programs, and an increase in applications for BCIA's three certification programs. They describe a series of strategies that some BCIA certified biofeedback practitioners are following to promote both their practices and the field of biofeedback.

Special Issue Articles

This special issue opens with an article by Tom Budzynski's co-researcher and widow, Helen Kogan Budzynski. Helen narrates Tom's activities in biofeedback during each decade of his professional life: from the 1960s and graduate school; the 1970s during which his electromyographic biofeedback device went into commercial production and during which he introduced the twilight learning process; the 1980s when he began his work with photic and auditory stimulation; the 1990s during which he extended his research on sound and light stimulation into new applications.

Next, three of Tom's closest collaborators, Johann Stoyva, Kirk Peffer, and John Picciottino, each share memories of their friendship with Tom, as well as observations of his greatest contributions to biofeedback instrumentation and biofeedback practice principles. Tom combined the gifts of an innovative engineer and inventor, with the business acumen to manufacture and market both biofeedback equipment and therapeutic audio programs, and the curiosity of a scientist intent on understanding the human brain, the human energy field, and the principles of feedback learning.

Niels Bierbaumer describes his initial 1971 encounter with Tom's work through an unpublished paper by Tom Budzynski and Johann Stoyva, and the lifelong friendship and collaboration which followed. He honors Tom especially for conceptualizing a psychophysiological foundation for psychotherapy, for developing one of the first useable neurofeedback devices, and for his twilight learning protocol.

Tom Allen tells the story of his friendship with Tom, and emphasizes Tom's use of storytelling as a therapeutic tool. He expresses gratitude to Tom for mentoring him in his early work developing the Windows-based Biograph™ software system for multi-modal biofeedback, and for unflagging support throughout the years of their friendship.

Robert Austin narrates the two decades of his friendship and collaboration with Tom, including Tom's two years as Director of Research for Austin's company, Synchromed, LLC. He describes Tom's scientific investigation of sound and light stimulation systems, as well as his use of such

devices in a clinical context. He also mentioned Tom's ''Hemifield'' project, and his development of subliminal audio techniques.

Richard Williams relates his own experiences with a ''guy named Tom.'' Williams honors Tom especially for his work on aging and regeneration in the Ponce de Leon Project, and his ''brain brightening project.''

Special Features: Twilight Learning Revisited and a Bibliography

This issue also includes an essay written by Tom Budzynski, *Twilight Learning Revisited*, in which he reviews the scientific background from which he developed the twilight learning protocol. He discusses the protocol and compares it to Eugene Peniston's protocol, which was developed for the neurofeedback treatment of substance abuse. This essay is published here with the permission of FutureHealth, which originally included this essay in an e-book. (Our thanks to Rob Kall of FutureHealth.)

We also provide a bibliography of the published works of Tom Budzynski. This bibliography is based on Tom's own records, with edits by Helen Budzynski and Donald Moss.

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Donald Moss

Proposal and Abstracts

Authors are invited to submit manuscripts on any topic in applied psychophysiology and biofeedback. Articles are welcome presently for special issues on Advances in Neurofeedback and Quantitative EEG *for Summer 2012*, Advances in Surface Electromyography and Rehabilitation *for Fall 2012*, Developments in Pelvic Floor and Digestive System Biofeedback *for Winter 2012, and a Spring 2013 issue on* Heart Rate Variability. *Proposals and Abstracts are also invited for additional topics for future special issues of* Biofeedback.

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SPECIAL SECTION

The Tom Budzynski That I Knew

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Keywords: Thomas Budzynski, biofeedback, neurofeedback, twilight learning, photic stimulation

Helen Budzynski, widow and collaborator of Thomas Budzynski, describes his life and work, from his early involvement with the SR-71 Blackbird, through his doctoral dissertation research on the use of feedback to induce muscle relaxation, to the first commercial production of a muscle biofeedback device, the development of the Twilight Learning neurofeedback protocol, and his research on the use of sound and light stimulation to modify brain processes.

Introduction

What stood out about the young Tom Budzynski and his equally young fellow engineer Herb Weed, such that they were chosen from a whole lineup of experienced engineers to help develop this undercover low-profile costly secret project, the stealth SR-71 BlackBird? Tom was the inertial navigation systems chief for Honeywell on that first SR-71 Blackbird in the early 1960s. How does a person get chosen to develop the advanced inertial navigation system for a never before built complex machine like this?

The Development of His Lifelong Theories and Approach

As I mull this question over, I wonder about what other happenings occurred that then became part of the fabric of Tom's life. Did he choose or did he get directed into a line of psychophysiological study that now seems to have become whole cloth, cleverly woven of his electrical knowledge and physiology? A marriage of the two fields of engineering and psychophysiology was not easily visualized in the 1960s, when Tom was in graduate school. Were it not for a staunch supporter, namely Johann Stoyva, Tom's vision could not have been achieved. Tom's doctoral dissertation in psychology, on feedback-induced muscle relaxation, was initially pronounced to be an ''engineering project'' and rejected by his first doctoral committee (Budzynski, 1969). With Johann's careful politicking, a second dissertation committee accepted it.

The integration of the two fields soon became an integral part of his innovations in the treatment of the brain. The brain, for Tom, was always the master. For him, it was natural to use the concept of frequencies, as recognized in electricity and as seen in electroencephalogram (EEG) frequencies of the brain, to link photic and sound frequency activities. Could they interface with brain frequencies and augment change? Tom's theoretical foray into energy medicine seems finally to have created his image of the human body as a complex bioelectrical machine, directed by the brain. Tom took the book *The Body Electric* (Becker & Selden, 1985) seriously. He dipped into the literature of energy medicine in which he found that stimulation of specific frequencies in the body encouraged the manufacture of the body's required body substances, thus controlling the body's maintenance of health. What guiding force led to these mergers, thus promoting the direction of Tom's professional life?

The 1970s

Tom's pervasive orientation, even when he produced the first digitized myographic biofeedback platform as his dissertation project in 1968, was that the muscles are powered by the brain. That dissertation prototype—a muscle biofeedback device—went into production by 1975. But it was not long before he was using brain stimulation to help patients restore their muscle activity.

Before the end of the 1970s, Tom had also developed a prototype of the Twilight Learner. With this device, he tried to articulate how the brain was dictating behavior and emotions, particularly with reference to the unconscious. The device was a concept whose limited instrumental organization could not power the connections of the brain behavior without the backing of a very intuitive therapist to work the machine. All of Tom's research studies with the Twilight Learner (case studies with often remarkable results) were interesting but not replicable by others using the device. The device suffered from the elementary status of the computer technology of that day. (An article by Thomas Budzynski on the concepts and development of the Twilight Learner also appears in this special issue of *Biofeedback*).

But if one lives long enough, or even after passing away, some ideas come back to life. The Twilight Learner seems

to be reviving. Now the concepts no longer need to be powered by hardware. They can be achieved by software alone. So now at least two of Tom's friends and colleagues are re-creating the Twilight Learner, indubitably in different forms, to restore the concept into a protocol for use in clinical treatment. Tom Allen, a long-term friend programming for Thought Technology, Ltd. (Montreal, Canada), plans to release a form of the Twilight Learner as an add-on to the Biograph Infiniti™ software platform. Dick Williams, a close companion from Grand Rapids days, plans a Twilight Learner program in conjunction with the BioExplorer™ software (CyberEvolution, Inc.).

The 1980s

The next wave of developments in Tom's work focused on the effects of delivering stimulation in various frequencies—through photic driving, binaural beats, and musical features—upon the brain and its left/right lateralized functions. These stimuli, along with rescripting, became the basis for a wide array of audiotapes for stress reduction, revitalization, self-esteem, reduction of pain, reduction of insomnia, and reduction of smoking. These audiotapes have taken on a life of their own, now distributed online as CDs and MP3s by Sam Caldwell.

This was an era in which everything was being used experimentally. Tom also experimented. He tried to fit the idea of consciousness into his working practice, exploring subliminal tracking and hypnotic states for use in his projects and practice. Tom considered Erickson to be the master hypnotic therapist, using often no more than a suggestion accompanied by gesture to open minds. This Ericksonian approach remained as a tool for the rest of Tom's life and clinical practice.

The 1990s

In the 1990s, Tom was given grants to do research on light/sound instrumentation by Synetics, Inc. (now MindPlace, Robert Austin). He was overjoyed to be able to study the EEG patterns produced by the variety of stimuli used in light/sound equipment. The 1990s were declared the ''Decade of the Brain.'' This national attention to the brain opened funding opportunities for research on the brain and generated high public interest during the years of the Clinton presidency. A high demand for workshops pressed Tom into joining the cadre of workshop trainers. What this decade did for Tom was to consolidate his theories about the use of light/sound. Tom now used light/sound in conjunction with neurofeedback as a therapeutic stimulus. It is sad that more clinicians have not have used these modalities in tandem. Tom's research gave support to the work of such developers as David Siever and Chuck Davis, who refined various forms of sound and light stimulation as tools to hasten treatment.

The Turn of the Century

Has the fabric of Tom's professional life after the turn of the century become more like a patchwork quilt? I will suggest here the remarkable variety of directions that he pursued in the final years of his life.

The basic passion of his career remained his clinical practice. In the last decade of his life, Tom began to apply his neurofeedback practice to major problems of the elderly and long-term disablement. Health insurance now has allowed payment for long-term rehabilitation for these patients. For Tom, each patient became a research project. The patients' years with Tom in neurofeedback training allowed each patient to find markers of brain progress by charting their gains over the years. And they loved Tom Budzynski—a gentle, positive, attentive therapist, such as most of them had never had in their lives.

It was those patients who drove Tom into finding more about the energy organization of the human body. Acupuncture had its successes, but Tom was not fully sympathetic with theories of Chi or transmission of body states. Yet the Meridians traced by Chinese scholars over 5,000 years and passed down through Chinese Medicine held much relevance for many problems of pain and other bodily symptoms causing debilitation, often relevant for symptoms not attached to a diagnosis.

Just accepting the fact of electromagnetic energy somehow flowing throughout the body was not enough. What was its organization? Tom spent many hours in his final decade of life exploring the scientific basis of many of the energy medicine therapies, at the frontiers of energy medicine. Tom met many Rife supporters and studied the remarkable history of Royal Rife and his advanced technology. This led Tom to the volumes of records of tracings of specific frequencies in the human body and of their functional activities within the body. Tom recognized their relevance in his efforts to identify the therapeutic effects of the stimulation of specific frequencies via light, sound, and direct current.

Tom studied the Rife beam ray therapy and even purchased a beam ray device to research it. Other machines using frequency bands were emerging. Probably the most dominant one is the micro-current, which puts out 1/1,000,000 amperage and whose research is traced back to Becker's studies of healing. Tom was also loaned a cold laser machine to demonstrate to a workshop, and this device provided almost instant pain relief. After the

workshop, the machine became unavailable, and Tom could not buy one (probably a Food and Drug Administration issue). Tom was left with only his micro-current machines.

Then LifeWave, Inc., sought him out. This company has been using a nanotechnology process of altering amino acids, thus changing the molecule's properties so that when transmitted by electrical conduction into the body, they serve as a photic receptor to stimulate the specific frequency that the inventor (David Schmidt) wished to have stimulated. Wrapping these molecules in nontransdermal patches and applying them to an acupuncture site caused photo receptor activity to stimulate the intended electromagnetic frequency. The patches were initially developed by David Schmidt at NASA to extend the energy level of Navy Seals who had to be positioned in posts for an extended period of time, such as during the rescue of U.S. boats from the Somalian pirates. The energy patches would immediately and continuously generate adenosine triphosphate for the muscle mitochondria to avoid muscle fatigue. Tom researched numerous patches for the company, initially to see that the patches were generating an increase in electrical conductance.

Tom's long-term study was conducted with carnosine patches. Carnosine is one of the natural substances of the body that declines as the body ages. It is a dipeptide that regulates metabolism. With its decline, the body rapidly loses the regulatory ability for metabolism, and the body resorts to advanced glycosylation, an oxidative stress process forming advanced glycation end toxins responsible for destruction of collagen, wrinkles, cognitive decline, diabetes, and, gradually, cataracts. The study of a month of carnosine patches showed a remarkable significant improvement in cognitive processes (the dependent variable) as compared with a control group.

Tom's penchant for a solid theory about the electromagnetic system of the body was satisfied when a literature research unearthed studies as far back as 1964 when two Asian scientists, one in Korea and one in Japan, were able to study the structure of the electromagnetic system through a specific dye. This dye was able to reveal a fine mesh of ducts (called Bongham ducts for the first inventor) covering all major organs and even within blood vessels. Thus far, recognition of this structure is evident only in European and Asian literature since the 2000s. So Tom found himself no longer dependent simply on acupuncture theory, although the acupuncture points (where the ducts are more often located) was useful to Tom.

I would have left a tag end out of Tom's theoretic practice if I didn't mention his last groping toward his lifelong considerations about consciousness. Some ideas were reawakened by Lynne McTaggart's (2007) book *The Intention Experiment: Using Your Thoughts to Change Your Life and the World.* While trying to understand homeopathy and spiritual healing, the author had moved ''the field'' into quantum physics. Tom's bite into it was only a nibble.

Death in February 2011

I think that Tom's weaving of a theoretical fabric of the human body took many turns. Though his theoretical model was never fully articulated, it provided a solid basis for his clinical practice as it evolved over the years. Tom passed away on February 14, 2011. His technician, Lonnie Hubbard, posted the news of Tom's death on his Facebook page, and more than 200 responses came back that day. Among the friends were many former patients. That week, Lonnie met with the patients as each one's appointment time came, and for Lonnie it was a week of repeated wakes for Thomas Budzynski.

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SPECIAL SECTION

In Memoriam: Tom Budzynski, Friend and Colleague

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Keywords: Thomas Budzynski, SEMG feedback, stress disorders, EEG feedback

Tom Budzynski's background and professional life are described. Born in Grand Rapids, Michigan, Tom earned his electrical engineering degree at the University of Detroit, then worked for the aerospace industry in Southern California for several years, a period that included work on the Blackbird spy plane. Later, while a graduate student at the University of Colorado, he developed the first practical surface electromyogram feedback device, receiving his PhD in experimental psychology in 1969. In his biofeedback studies, he worked extensively with stress-related disorders, pioneering many widely used techniques. In his later years, he carried out research and clinical studies using electroencephalogram brain wave feedback. We recognize Tom both as a major innovator in biofeedback and as a great friend.

Introduction

This article will take the form of narratives about Thomas Budzynski, his life, and his contributions to biofeedback by three friends and colleagues. First, Johann Stoyva will present his tribute, then Kirk Peffer, and then John Picchiottino.

A Tribute from Johann Stoyva

To begin with, I will (shamelessly) take credit for introducing Tom Budzynski to the idea of biofeedback. Admittedly, this statement needs a slight qualification, because what happened was completely unintentional on my part, although the episode does illustrate the role of accident in the diffusion of ideas. Let me explain.

First, the backdrop. I had just given a talk on electroencephalographic (EEG) studies of sleep and dreaming to a psychology graduate seminar at the University of Colorado in Boulder (probably in the spring of 1966). Afterward, Tom—then a novice graduate student—asked if I wouldn't mind lending him Gay Luce's book on sleep research. This was a slim, soft-cover volume summarizing recent rapid eye movement and electroencephalography (REM/EEG) studies of sleep and dreaming, most of which had been supported the National Institute of Mental Health.

Luce's book included a description of Joe Kamiya's studies of alpha EEG feedback, research begun in the late 1950s while Joe was still at the University of Chicago. I had resolutely ignored this pioneering work, despite having worked in Joe's sleep lab, first in Chicago, then later in San Francisco. But Tom—as a former aerospace electrical engineer, and someone very much tuned in to the potential of feedback control systems—immediately sensed the possibilities opened up by Joe's work in applying information feedback to the control of human physiological activity.

In fairly short order (probably the fall of 1967), Tom built an alpha EEG feedback device. This unit was great fun to experiment with, and I frequently had the privilege of serving as the test animal. In my case, as for many, the alpha state was experientially associated with an ''emptying of conscious,'' combined with an absence of mental effort. Alpha seemed to blossom between one's thoughts.

Research on alpha feedback and consciousness dovetailed with the reigning passions of the ''hippie'' counterculture, a flourishing, if somewhat noisy, movement that peaked in the late 1960s and early 1970s. At the time, there was a great deal of excitement about altered states of consciousness and how to reach them—whether these were naturally induced as in meditation, hypnosis, or dreams or drug-induced as with mescaline or LSD. Electronic feedback of brain rhythms held out the possibility that with biofeedback training, individuals could learn voluntarily to produce many different mental states, some of them perhaps novel to human experience! Possibly, as well, the mental states mastered by Eastern meditators only after years of arduous practice could be reached fairly quickly by means of EEG feedback. There was even talk of ''instant Zen'' or ''Skinnerian Zen.''

In turning from engineering to psychology, Tom had become quite interested in behavior therapy and particularly in Joseph Wolpe's anxiety desensitization technique. So he began to experiment with using alpha feedback in the systematic desensitization process, both as a means of inducing a mentally relaxed state and as an indicator of tension buildup during the imaging of anxiety scenes. Tom

employed alpha EEG feedback in successfully desensitizing several patients with phobias. But the method had some problems. Some individuals displayed little or no alpha EEG. Some showed high amounts most of the time and exhibited little change between anxiety-evoking imagery, pleasant imagery, or no imagery. In these cases, alpha EEG wasn't a particularly accurate indicator of a relaxed condition.

These and other problems with alpha EEG led to the question: Why not use muscle tension, in the form of surface electromyogram (SEMG) feedback, for relaxation training? All humans possess skeletal muscle activity and have it all the time, though at varying levels of tension. Moreover, there were important historical precedents suggesting the clinical utility of muscle relaxation. One major older source was Edmund Jacobson's progressive muscle relaxation technique. There was also Joseph Wolpe's desensitization procedure in which an abbreviated form of progressive relaxation was employed to counter anxiety.

Although SEMG feedback was simple enough in principle, it turned out to be ticklish electronically. For one thing, SEMG signals in the near-relaxed muscle are very tiny—close to the noise levels of then-current preamplifiers and thus not easy to tease out clearly. Also, the range of signals in muscle is very large: 10 to 10,000 Hertz versus 8 to 12 Hertz in alpha rhythms. Tom solved these and related problems after about a year of concentrated work, carried out in close collaboration with John (Pitch) Picchiottino, a long-time friend from the aerospace industry in Southern California. Pitch, an electrical engineer, inventor, and entrepreneur, subsequently became president of Bio-Feedback Systems, Inc., of Boulder, Colorado.

Like alpha feedback, SEMG feedback was great fun to experiment with, and a number of interesting observations emerged: (a) the SEMG unit generated minute-by-minute quantification of SEMG levels, thus providing continuous data on SEMG patterns during desensitization; (b) not infrequently, anxious patients reported themselves as being relaxed even when they were not—as judged by SEMG criteria; (c) frontalis SEMG proved to be a very sensitive indicator of anxiety increases during the desensitization process (during visualization of anxiety scenes, frontalis SEMG began to rise 5 to 15 seconds before the patient's overt report of anxiety); and (d) SEMG feedback training, especially of the facial muscles, produced central nervous system changes. Relaxed subjects showed a reduced capacity to discriminate paired flashes of light. Specifically, in the relaxed condition, the time interval between paired flashes of light needed to be longer for subjects to see the flashes as two rather than one, an indicator of lowered cortical arousal (Budzynski, 1969). (These, and related observations, were published in Budzynski & Stoyva, 1973.)

A useful study we launched in the early 1970s had to do with tension headache. Here again, accident—or semi-accident—played a role. A visiting psychiatrist, commenting on SEMG feedback, remarked, ''Why don't you guys try this stuff on tension headache''? Actually, we didn't know anything about tension headache or that it was a recognized diagnostic category and not simply an invention of the advertising industry.

Because our results with a pilot study of five patients were quite encouraging, we decided to launch a controlled-outcome investigation. This study, which included a pseudo-feedback group and a no-treatment group in addition to the SEMG-feedback group, confirmed the pilot study results. Again, there was a strong treatment effect. Treatment patients showed strong decreases in both headache activity and medication usage, whereas headache decreases in the control groups were modest and episodic (see Budzynski, 1989; Budzynski, Stoyva, Adler, & Mullaney, 1973).

The observed effect was robust and has subsequently been confirmed in three meta-analyses (summarized in Penzien, Rains, & Andrasik, 2002). In the Penzien et al. article, which focused mainly on various behavioral treatments of tension-type headache, the most robust effect occurred with SEMG feedback and relaxation in combination (about a 55% improvement). In contrast, the three available controlled studies using amitriptyline—the standard pharmacological treatment of the time—showed only a 33% average reduction in headache activity, a decrease lying at the low end of the effect range achieved by behavioral therapies (Penzien et al., 2002, p. 169).

The tension headache study, we like to think, was valuable for the biofeedback area since it was the first controlled investigation demonstrating a treatment effect for a recognized—and common—stress-related disorder. As Tom liked to remind us, this favorable report had emerged against a backdrop of skepticism. For many psychologists and physicians, biofeedback remained a gray area at best. Just a bit of New Age flim-flam. Nothing had been proven; at least nothing that was clinically useful.

Viewed in retrospect, the tension headache studies did a lot to encourage further work on the clinical uses of SEMG feedback. These and similar reports suggested the possibility that SEMG feedback might have various clinical applications. As noted by Yates (1980), the well-known

Australian behavior therapist, it was following the publication of these studies that ''the slow build-up of research and clinical application in the area of biofeedback became a torrent of activity'' (p. 10).

SEMG feedback, and its use in promoting muscle relaxation, generated a ripple of excitement and sense of intriguing possibilities. For one thing, it connected with several impressive older practices and disciplines, all of which focused around the core idea of self-regulation. There was Edmund Jacobson's progressive muscle relaxation, already mentioned. More recently arrived on the scene was Joseph Wolpe's systematic desensitization method, in which muscle relaxation was used to counter and defuse anxiety reactions. Then there was autogenic training, well known in Europe but virtually unknown in America. Developed primarily by the German physician Johannes Schultz, it involved a combination of relaxation techniques, auto suggestion, and meditative-type exercises. This body of techniques had been applied to a wide spectrum of stress-linked disorders, thus suggesting problems for which biofeedback could be useful. Also originating in Europe were the Spiritual Exercises of St. Ignatius, which, though fascinating psychologically, remained little known outside the Jesuit order. And of course, there were the Eastern meditative disciplines, procedures that had developed within a variety of religious traditions. Also exciting was the emerging idea that a thorough relaxation response might possess a broad-gauge effectiveness in countering excessive stress reactions and consequently might be useful in treating a variety of stress-linked conditions. Perhaps biofeedback could expedite the learned modification of physiological responses and their associated states of consciousness already pioneered in these older traditions.

Tom, perhaps in connection with his engineering background, always maintained a keen interest in the practical applications of biofeedback. In the early 1980s, he and Kirk Peffer, also a former electrical engineer who became a psychologist, started the first—or one of the very first—private clinical biofeedback practices in the country, the Biofeedback Institute of Denver. Most of their apparatus was produced by Bio-Feedback Systems of Boulder, the main producer of biofeedback equipment at that time.

The majority of patients were seen for one of the following diagnoses: chronic tension headache, anxiety disorders, common and classic migraine, psychophysiological-type insomnia, Raynaud's syndrome, cardiac rehabilitation, irritable bowel syndrome, and a variety of other stress-related conditions. The program emphasized stress/coping in three general systems: cognitive, physiological, and overt behavioral. Details of the treatment program are described in Budzynski, Stoyva, and Peffer (1980).

The late 1970s and the 1980s became a time of spreading the word about biofeedback. Our lab organized workshops in many different cities around the country. These were strenuous endeavors, but great fun, and we met a lot of interesting people. Our first venture in this direction—and probably my favorite location—took place in Snowmass, Colorado (close to Aspen). It was a 5-day program held in August 1974, just around the time Richard Nixon was poised to ''abdicate.'' One curious thing about the workshops was that a certain amount of spinoff occurred. I guess you could call it a chain reaction. Not too long after attending, some of the participants would in fact be announcing their own workshops!

Quite apart from the workshops, but due at least in part to contact with our lab, a number of talented people became interested in biofeedback. Among them were John (Jac) Carlson, Niels Birbaumer, Carol Schneider, Francine Butler, Alex Weinstock, and others, all of whom went on to make their own distinctive contributions to the area.

Finally, I remember Tom as a good-humored and even-tempered person and as someone who remained cool under pressure. He was always curious about the quirks and oddities of human nature and always tolerant of assorted departures from the usual and the ordinary. He was a great person to be with, both on and off the job. In retrospect, I can say that my life would have been very different had it not been for that initial (accidental) encounter with Tom.

A Tribute from Kirk Peffer

Tom possessed a real flair for developing innovative and practical procedures. Although these particular innovations have not yet run the gauntlet of full-dress comparative studies, they have often proved useful for some patients. One technique he worked on was the concept of psychophysiological profiling. Depending on the individual's unique physiological response pattern—especially when stressed—biofeedback training could be tailored accordingly. Thanks to electronic monitoring, the therapist could determine whether an adverse physiological pattern had been altered or not. Had there been change at more than simply the level of verbal report?

Another strategy was the pervasive anxiety technique, a variant of systematic desensitization. Here, patients first learn to master a good relaxation response. Then they are instructed ''to think about various thoughts—including anxiety thoughts—but at the same time to maintain good relaxation.'' If SEMG levels increase beyond a certain level,

the feedback tone comes back on. The patient then breaks lock with the scene and resumes working on getting back to a relaxed SEMG level. Once the patient has regained a satisfactory relaxation level, the feedback tone is gradually turned off, and visualization resumes. As in systematic desensitization, the goal is to be able to think about disturbing material but to do so in a relaxed fashion. (Note the similarity to certain procedures from the meditative disciplines, particularly mindfulness meditation.)

Tom also designed the Twilight Learner, a device that turned on a prerecorded audio change statement, or statements, only when the individual displayed a specific brain wave pattern (i.e., typically when the EEG indicated a ''twilight'' state of consciousness). The underlying idea was that perhaps change statements presented during twilight states would bypass the usual filtering and rejecting mechanisms present in the patient's normal, waking consciousness. Many patients found this procedure useful. Again, the Twilight Learner illustrates the value of pooling knowledge and skills. The idea was first conceptualized by Tom; then functionally mapped out by Tom and Pitch (John Picchiottino); electronically implemented by Tom, Pitch, and myself; and then produced by Bio-Feedback Systems in Boulder as their Model TL-1^{TM}.

The start of my friendship with Tom had a definite chance element to it. I had been working as a graduate research assistant at the University of Colorado Health Sciences Center, mainly on a project that had to do with impulsive violence. Part of this job involved interviews with serious offenders at the state penitentiary, some of whom were on Death Row, and some—as I found out later—who were responsible for multiple murders. Happily, the interviews took place in the comparative security of the associate warden's office. Anyway, this project was ending.

One fortunate day, Johann Stoyva and I ran into each other on the quadrangle just outside the Colorado Psychiatric Hospital (then still called the Colorado Psychopathic Hospital). During our conversation, he offered me a job as a graduate research assistant in his biofeedback lab at the University of Colorado Health Sciences Center. So I had the good fortune of working with Tom and Johann on several significant projects over the years. Thanks to their projects, I had steady work through most of my doctoral studies.

When Tom developed the first private biofeedback clinic in the United States, he was generous enough to offer me a position in the clinic while I completed my doctorate at the University of Colorado in Boulder. Despite the many endeavors Tom was involved with, he always had time to supervise me, so that I could meet part of the requirements to be licensed in Colorado. There is no way I could repay the kindness bestowed on me by Tom during our many years working together. An extra bonus of working in biofeedback was the lifetime friendships I've enjoyed over the years with Johann Stoyva, John Picchiottino, and Tom Buzynski, until Tom's untimely death.

A Tribute from John Picchiottino

Tom and I first met by chance when we were both signing in at the personnel offices of Hughes Aircraft in Culver City, California. That encounter was June 1958. It led to a 53-year friendship and fellow ''adventurer-ship.''

I was signing in for the Master of Science Fellowship Program as an electrical engineering student and was immediately put to work on the GAR 9 Missile Project. Tom's position was as design engineer for interceptor electronics (on fighter aircraft) working on aerospace inertial navigation systems. Both of us had received draft deferments by reason of working in a critical industry (for national defense). Later, Tom worked for Honeywell on the super hush-hush SR-71, a high-altitude Cold War spy plane, also known as the Blackbird. Security there was extremely tight. Even now, the details of this project remain murky. But I do remember hearing that when employees were being bused to the work site, the bus's windows were sealed over tightly. Nobody could see in, and nobody could see out.

After Tom had moved to Colorado for graduate school, the two of us collaborated extensively in developing the original SEMG feedback device. Then, in 1971, we formed a company to produce these units: Bio-Feedback Systems (BFS) of Boulder. Tom was vice-president, and I was president. Later, in May 1976, BFS became the first biofeedback company to register with the Food and Drug Administration as a medical device manufacturer. In the 1980s, Tom started some other commercial ventures as well. One was Mindbyte, which produces various self-help tapes. Its Web site is Mindbyteproducts.com.

Over about the past decade, Tom returned to his original interest in EEG brain wave feedback. Here, again, his enthusiasm for novelty and experimenting with various new procedures is clear to see. Some of this work involved using EEG feedback for patients suffering from mild to moderate closed-head injury. This flair for innovation is clearly reflected in the book he coedited with his wife, Helen, and with James Evans and Andrew Arbarbanel (2008), *Introduction to Quantitative EEG and Neurofeedback: Advanced Theory and Applications.*

Tom was born in 1933 and died of a heart attack on February 14, 2011. Born and raised in Grand Rapids, Michigan, he took his electrical engineering degree at the University of Detroit, then worked for the aerospace

industry in Southern California. In 1969, with Johann Stoyva as his advisor, he received his doctorate in psychology at the University of Colorado in Boulder. From 1974 to 1975, he served as president of the Biofeedback Society of America. Further details about his life and career are available on his Wikipedia entry. We will all miss Tom: he enriched our lives and left us with many good memories.

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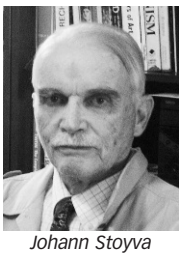

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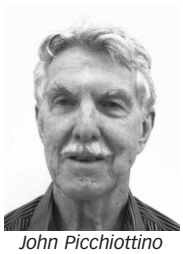

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SPECIAL SECTION

Twilight Learning Revisited[1]

Thomas H. Budzynski, PhD (1933–2011)

Keywords: twilight learning, hypnagogic state, hypnosis, EEG, change messages

If you bring forth what is within you, what you bring forth will save you; if you do not bring forth what is within you, what you do not bring forth will destroy you.

—Gnostic gospel

The late Thomas Budzynski developed Twilight Learning technology in the 1970s. Twilight Learning utilizes EEG neurofeedback to train the subject to enter a theta rhythm dominant brain state (4–7 Herz), and then presents auditory ''change messages'' to the individual while in this hypersuggestible state. The article reviews the scientific background from which he developed the Twilight Learning technology, including research on hypersuggestibility and enhanced learning in ''twilight brain states.'' The author compares the Twilight Learning approach to the Peniston Protocol, which was shown to have well-documented therapeutic effects with alcoholism and post-traumatic stress disorder.

Perhaps as long as 20,000 years ago, shamans used a variety of procedures to prepare their ''clients'' for the magical words and incantations that would remove the evil spirits that affected the mind, body, and spirit. Almost every one of these healing techniques could be said to be comprised of two factors:

1. The preparation, which involved the production of what we might now call an altered state of consciousness.
2. The delivery or presentation of the healing or ''change message.''

A question that is not usually asked is, Why the preparation? Why not just say the magical words? Most modern scientists would agree that the majority of these primitive healing procedures were just placebo ceremonies enhanced by the preparatory exercises that often produced an altered state. Then the question might be asked, why does an altered state enhance the power of the magical words? We wondered about this question in 1970 as we struggled with the then very new cognitive therapy. Why was it that with some depressed clients the positive thoughts that were prescribed would backfire? As one client told us, ''When I think the positive thought about myself a little voice says, 'Like hell you are.' ''

Little Voices, Defenses and Sleep Stages

What was this negative little voice that undid the affirmations even when they were realistic? Is this related to the common observation that conscious plans (''I'm going to lose 25 pounds after the holidays'') often seem to go awry? It seemed to us that it might have something to do with the processes called defense mechanisms by Freud. About this time some research carried out by Foulkes and Vogel (1965) seemed very relevant. At the University of Wyoming these researchers found that as people passed from full wakefulness through a drowsy Stage 1 to a deeper asleep Stage 2, they sequentially passed through distinct stages in the processing of information.

An important conclusion was that as the individual passed from wakefulness to sleep a *loss of volitional control over mentation tended to occur first*, followed by loss of surroundings, and finally, loss of reality testing.

Vogel, Foulkes, and Trosman (1966) examined subject reports for ego functions and concluded:

1. As individuals become drowsy and pass into sleep, their brain rhythms change from predominantly alpha, to fragmented alpha, to low amplitude theta.
2. Paralleled (though not perfectly) with these EEG patterns are sequential ego states showing an *increasing impairment of ego functions.*

[1] This article was previously published in an online e-book: R. Kall, J. Kamiya, & G. Schwartz (2003), *Textbook of Neurofeedback, EEG Biofeedback, and Brain Self Regulation*, http://bit.ly/budzynski and is reprinted with the permission of Futurehealth, Inc.

Many others have studied the unusual properties of the twilight state. For example, Froeschels (1949) postulated that: ''rules of association radically different from the rules of the waking state govern the formation of thought in the hypnagogic state. He concluded that the unconscious plays a major role in hypnagogic thought'' (p. 24).

T. X. Barber (1957) had his dissertation featured in *Scientific American.* His study looked at the hypersuggestibility of the twilight sleep. Barber found that subjects were just as suggestible in a light sleep or in a drowsy condition as when they were hypnotized. A quote from one of his subjects is illuminating: ''I was just sleepy enough to believe what you were saying was true. I couldn't oppose what you wanted with anything else'' (p. 59).

Barber believed it was possible that suggestions could be presented to people in a light sleep to help overweight people reduce, heavy smokers to cut down, and timid people to gain confidence.

A dissertation by Felipe (1965) at Yale produced results that supported Barber's conclusions. Testing the effects of tape-recorded attitude change information presented during waking, drowsy, and deep sleep conditions, Felipe found that the information changed attitudes toward interracial dating *only in the drowsy condition*.

Svyandoshch (1968), a Russian sleep researcher, has said, ''Speech assimilated during sleep, in contrast to that assimilated during the waking state, *is not subjected during assimilation to the critical processing*'' (p. 112).

The Russian scientists have studied the effects of sleep learning for years, and for years Rubin (1970) studied them. In his book *Current Research in Hypnopaedia,* Rubin (1968) concluded that the common denominator among successful sleep-learning studies is that ''superficial sleep'' (Stages 1 and 2) is the psychophysiological background for maximum receptivity. It's interesting to note that the Russian sleep-learning technique involved repetitive sessions over *weeks or months.* They also placed emphasis on establishing the correct set or expectancy for learning and retention prior to the sleep session. In contrast, most sleep-learning studies in the United States, which were inconclusive, did not establish a positive set and did not incorporate multiple sessions.

Emotional vs. Intellectual Suggestions

Quite a while ago DeManaceine (1897) was interested in the degree of suggestibility present in a drowsy or twilight state. She gave her subjects two types of suggestions while they were in transition from waking to sleeping: ''intellectual'' suggestions (e.g., math, such as $3 \times 2 = 5$) and ''emotional'' suggestions (such as, The building is burning down). A suggestion was considered successful if the person repeated the experimenter's statement or accepted it without protest. Among adults, the intellectual suggestions were 25% successful and the emotional ones were 45% successful. However, the children showed an 85% repetition/acceptance of the intellectual suggestions and a 97% repetition/acceptance of the emotional ones (Schacter, 1976). In light of the more recent theories of left-right hemispheric functioning we might say that the children were more ''right-brained,'' or less defended than the adults. The psychodynamic model would predict that as people grow into adulthood, they layer on more defenses, which operate even down through the unconscious levels of the mind.

Sperry and Galin: The Unconscious and the Right Brain

The 1960s and 1970s were a period of time of incredible discoveries about the human brain. Roger Sperry of Cal Tech received the Nobel Prize for his research on the lateralization of function in the left and right hemispheres. David Galin, in a landmark article in the *Archives of General Psychiatry* (1974), brought all the new lateralization facts to bear on Freud's model of the unconscious. The functions of the nondominant hemisphere did indeed appear to provide a good fit with Freud's model (Budzynski, 1976, 1986). Even the great neuroscientist Sir John Eccles noted, ''Strictly speaking, therefore, we can state that the actions effected by the right cerebral hemisphere are unconscious actions'' (1976, p. 118).

A more recent update of this model was forwarded by neuroscientist and clinician R. Joseph (1992), who noted in his book, *The Right Brain and the Unconscious,* ''Indeed, a few neuroscientists and researchers who specialize in the study of the brain (such as I) have argued that the so-called unconscious mind is in fact a manifestation of right-brain and limbic-system mental activity'' (p. 21).

Given that the right brain appears to play a major role in the implementation of unconscious process, and that much of the ''deep rooted'' negative self-image and early trauma material is buried in the unconscious, how does one get past the critical-screening left hemisphere in order to change the negative scripts into more positive, adaptive ones? Interestingly, our development of Twilight Learning preceded the brain lateralization breakthroughs of the mid-1970s. The rationale for the device was based in part on the hypnosis literature, and on the dynamic model postulated by Freud and examined by Foulkes and Vogel as noted above (Budzynski, 1971, 1972, 1986).

Additional research considered in the design included the vigilance studies of Dimond and Beaumont (1972, 1974). In the early 1970s these researchers carried out an interesting series of studies using a vigilance paradigm. They managed to separate left and right hemispheric performance on vigilance tasks. This is what they concluded:

> The left (hemisphere) is capable of sustaining high levels of performance, but as intense activity to detect small and infrequent signals from the environment is particularly demanding, performance cannot be consistently maintained, and hence, the decline sets in.
>
> The right hemisphere, however, while apparently not capable of such high levels of performance, unless sustained by the left, maintains its performance steadily, beyond the point at which performance of the left hemisphere has deteriorated seriously. The right hemisphere appears therefore to provide a skeleton service in vigilance, a minimum service capable of maintaining performance after decrement occurs in the left hemisphere (p. 69).

These vigilance studies lent support to the concept that the right hemisphere remains functioning at cortical arousal levels, which are either too high or too low to support critical thinking in the left hemisphere. The key, then, to the puzzle of why the high arousal of some primitive healing ceremonies or the low arousal of Stage 1 sleep should produce a hypersuggestibility may be the fact that significant changes in cortical arousal, either high or low, result in a shift from left dominance to right. This premise was diagrammed in a *Psychology Today* article (Budzynski, 1977), and a later chapter on hemispheric asymmetry and restricted environmental stimulation (Budzynski, 1990).

Essentially, one can imagine a continuum of functional cortical arousal level range that is smaller for the dominant hemisphere, i.e., this hemisphere's proper functioning requires an arousal level that is neither too high nor too low. In contrast, the nondominant (usually the right) hemisphere can function at both higher and lower arousal levels than can the dominant. The ''windows'' at the high and low ends exist at the levels where the left cuts out but the right is still functioning. It is at these windows that critical screening and many of the defense mechanisms are inactivated, yet these windows also permit the change message (whether taped affirmations or the therapist's voice in the microphone) to be absorbed as best it can by the right or nondominant hemisphere. Hypnosis using a deep relaxation induction would be one example of rescripting through the lower window.

Hypnosis and Lateralization

Based on the explosion of left-right lateralization research and theorizing, we wondered if stand-alone EEG feedback machines with digital quantifiers could detect switching in lateralization as subjects were hypnotized. We hypothesized that individuals entering the hypnotic state would show a shift toward increasing right hemisphere activation. If so, it would fit the model we were refining that postulated that a predominant shift toward right brain dominance would be characterized by an increase in the left/right (L/R) alpha ratio and an increase in suggestibility. In 1974 we used two Alpha/Theta (AT-1) stand-alone feedback units driving two Digital Quantifiers to measure accurately the alpha band voltage from the T3–T4 monopolar leads as subjects underwent hypnotic induction.

Figure 1 shows a typical graph of the L/R ratio as it changed from the baseline (B1) and gradually increased as the hypnotic induction proceeded. Each 5-trial block represented an average of 5–30 second samples read out on the Digital Quantifiers. The CO designation is the first average taken as the subject was ''coming out'' of the trance under the direction of the hypnotist.

The B2 level shows that even after awakening the L/R ratio remained higher than before the induction. We saw this effect linger as long as 20 minutes in some cases. Only one of the six subjects reported afterward that she had *not* been hypnotized and Figure 2 shows the graph from this session. Note that the L/R ratio actually decreases, indicating an increasing left dominance as this individual resisted ''going under'' as she referred to the hypnotized state.

More recent studies (Bick, 1989; Sabourin, Cutcomb, Crawford, & Pribram, 1990) indicate that high-hypnotizable subjects show more theta in their waking EEGs than low-hypnotizable subjects, although both types show increased theta, or lowered cortical arousal while hypnotized. Wickramasekera (1988) has shown that lowered frontal EMG levels increase hypnotic susceptibility.

One might conclude, if somewhat tentatively, that suggestibility increases as the nondominant hemisphere increases in activation relative to the dominant side, and/or as cortical arousal lowers.

Can a Theta State Be Facilitated?

In a 1969 PhD dissertation, Budzynski showed that the lowering of facial and neck EMG levels through EMG feedback resulted in a decrease in cortical arousal and the appearance of theta frequencies in the EEG. This phenomenon was verified in later studies (Budzynski & Peffer, 1973; Sittenfeld, Budzynski, & Stoyva, 1976), which indicated that

theta energy in the EEG was inversely related to frontal EMG. Moreover, subjects who presented with high frontal EMG levels required EMG feedback to lower those levels *before* they could use theta feedback to increase theta energy. In contrast, those with initial low levels of frontal EMG were able to use theta feedback to increase their theta levels without any preliminary EMG training.

Does REST Do It?

In addition to the research noted above, the use of the procedure known as REST (restricted environmental stimulation) has contributed to the body of knowledge supporting the model of the brain that hypothesizes an increase in suggestibility as cortical arousal lowers. REST is usually taken to mean the sensory deprivation chamber or the float tank environment. Postulating a Dynamic Hemispheric Asymmetry model, Budzynski (1990) endeavored to show that the increased suggestibility developed in individuals in the float tank or sensory isolation chamber was the result of a change in dominance from left to right hemisphere. The basic paradigm for addictions applications involved a set for decreasing the behavior, the experience of the sensory isolation, and, in most cases, the presentation of tape-recorded change suggestions at intervals during the isolation.

Suedfeld and Baker-Brown (1987) found that 3- and 12-month follow-ups showed smoking reductions of 51% and 34% respectively. Borrie and Suedfeld (1980) had earlier shown that 24-hour chamber REST plus weight loss suggestions resulted in a greater weight reduction than just REST alone or other control conditions. Cooper, Adams, and Scott (1988) reported that only 2.5 hours of REST plus a message produced a mean reduction in alcoholic intake of 55% after two weeks. At a three month follow-up the mean alcoholic intake was reduced 61%, and after six months the reduction was still good at 59%.

We have sampled here a small amount of the large body of research, which shows that one can in various ways elicit a theta state, accompanied by hypersuggestibility, enhanced absorption, and a decrease in critical and defensive operations. This research supports the possibility of producing and maintaining such a state, in order to make changes in maladaptive habits, addictions, and poor self-image, and to set a strong course for achieving goals. This is the state where the ''little voice'' is not heard.

The question then becomes, ''How can this state be produced reliably without hypnosis, waiting for the individual to fall asleep, or using an exhausting primitive ceremony''? A second question might be, ''How could such a state be maintained for at least the better part of a therapy hour''?

Facilitated Theta and Preparatory Emotional Imagery

Bertini, Lewis, and Witkin (1969) also studied the hypnagogic or twilight state but with the goal of developing an experimental technique that could facilitate drowsiness, reverie, and free association. They reasoned that, ''The transitional nature of the hypnagogic state makes it an especially fertile period for the production of primary process material. Loosened controls partly resulting from the drowsy state seem to make the primary thinking more accessible to observation'' (p. 94).

Their induction technique involved the generation of a monotonous white noise and the use of ''ganzfeld'' glasses made up of halves of ping-pong balls to produce a homogeneous visual field. In addition to this mild sensory deprivation technique, Bertini and colleagues also stimulated their subjects with highly emotional material. With this state attained just after the presentation of the conflict material, they could study the work of the primary process in resolving the conflict. The subjects reported recall of experiences, images, and feelings from childhood, woven in with thoughts about current events in their lives. One could say that there was an integration of early emotional material with the present day adult perspective.

When we tried Bertini and Witkin's technique we discovered that subjects either found it uncomfortable or they went to sleep. Moreover, white noise is harsh and grating on the nerves. Therefore, when we incorporated part of their technique in Twilight Learning we used a variation of white noise called pink noise. It is a softer sound, somewhat like a wave washing up on the beach.

A Serendipitous Finding That Indicated the Plasticity of the Brain

As we refined Twilight Learning, a good deal of trial and error was required. A perfect setting of the thresholds meant that the filters were adjusted such that when the individual was showing theta, the tape-recorded theta message was played. The subjective impression afterward was of being aware of having heard a voice but not recalling any of the material.

After we had found the perfect settings of the filters for my EEG, I began using a self-esteem enhancing tape each night. About the fifth session I was surprised to find that I could hear the message. Although I immediately assumed that there was something wrong in the electronics, the unit checked out perfectly.

On a hunch I had a friend do a quick single channel EEG on me. Over the years I had many such records made in the course of our studies. To my surprise, my formerly ''clean'' theta was now interspersed with alpha and beta. My brain

had learned to turn on the tape recorder with the theta, and it had later learned to mix in some higher frequencies so that it could consciously listen in on the message. In those years brain plasticity was not part of our model and the sole result of the discovery was that we added logic to the circuitry so that the theta recorder could not turn on if alpha or beta energy was also present in the EEG (i.e., it would only trigger on ''pure'' theta). The goal was a system that would be able to present verbal affirmations outside the awareness of the critical screening. It is interesting to speculate how and why my brain suddenly learned to hear the theta message. Present-day neurofeedback research has indicated the brain's remarkable degree of plasticity and its ability to change its EEG patterning.

The Final Design

Taking into account everything we uncovered in the research from the many areas investigated, together with John Picchiottino, we designed an EEG biofeedback system that would detect 4–7 Hz theta EEG over the left hemisphere and then turn on a tape recorder with the affirmation message. The tape recorder would turn off instantly if the theta energy changed toward increasing arousal as characterized by increasing alpha and beta energy. This change in the EEG would mean that the conscious critical screening ''shields'' were going up and the acceptance of the affirmations would be blocked. To guard against the subject falling asleep, the system was designed to cause the volume of the message to increase as the theta frequency decreased toward delta, or if the theta amplitude increased. This ''bump'' circuit also had a second function. There was research to show that if a learner were to experience an increase of adrenalin right after the learning had taken place, then he or she would better remember the material (Budzynski, 1976; Koukkou & Lehmann, 1968). It is as if the ''bump up'' in arousal helped store the material in long-term memory. Finally, the therapist can watch the alpha/theta meter and inject his or her own voice through a microphone to the client's headphones if he or she does not wish to use the audiotape.

Case Studies with Twilight Learning

It may be instructive to look at some actual case studies to gain insight into how the Twilight Learning procedure works. These cases span more than 20 years of clinical practice.

The Scientist with the Dual Goals

HK, a 55-year-old researcher, was seen in the clinic for chronic back pain. He had heard of Twilight Learning and wanted to try it for his pain problem. His back pain did not extend down his legs, which hinted at a possible psychogenic factor. Moreover, HK also wanted to add suggestions for weight control because he had been more than 30 pounds over his ideal weight for 25 years.

The change messages were presented together, although he was warned that usually we didn't do multiple goals in the same session. However, HK was concerned about the cost of the therapy and stated that he ''would take his chances.'' After two sessions per week for three weeks, HK reported that the back pain was lessening. During the eighth session he demonstrated that he could touch the floor with his fingers. There was no more back pain and the only thing that kept him from reaching the floor easily was his girth, which had not changed.

Three more sessions did not produce any change in his weight and he decided to terminate therapy satisfied that the troublesome back pain had ceased. As we discussed the weight problem in the last session HK stated that his wife was also overweight and they had, after 32 years of marriage, settled into a comfortable relationship in which eating out had become their primary pleasure. It was then obvious that a significant loss of weight might endanger the dynamic of the relationship. Somehow, we were not as wise as HK's unconscious. This outcome caused us to more carefully examine the possible effects of changing an individual through Twilight Learning. After defining goals we now ask the client to imagine himself having achieved the goals and interacting with family, friends, and fellow workers. If the new persona doesn't feel comfortable, we discuss the situation and possibly change the goal somewhat before starting the Twilight Learning sessions.

The Businessman Who Couldn't Say No

One of our earliest cases, Mr. GY, a 37-year-old individual, though moderately successful in his professional life, found it very difficult to say ''no'' to authority figures. Three years of psychotherapy had not resolved the problem. In the first few Twilight Learning sessions, GY experienced imagery related to a repressed early memory in which his authoritarian father slapped him viciously for saying ''no'' to his father's request.

In subsequent Twilight Learning sessions, phrases such as, ''It's OK to say no,'' ''Saying no is good sometimes,'' ''I can say no when I want to,'' and ''I can say no to my father,'' were presented during theta. After five of these sessions, the anxiety associated with turning down an authority figure had vanished.

This case illustrates that a Twilight Learning session can result in material ''welling up'' from unconscious memory

stores. This unrepressed trauma memory material can then be woven into the rescripting suggestions that will follow in subsequent sessions. A careful debriefing after each session is needed to identify these often subtle and fleeting feelings and images.

The Grad Student Who Couldn't Pass the Spanish Exam

Graduate students at most universities need to pass exams on two foreign languages before they can get their PhDs. Mr. LG, a 24-year-old, had already flunked the Spanish exam. He had only one more chance to pass. However, he found it impossible to even sit down to study because the anxiety would build quickly. The Twilight Learning sessions were of two kinds: presentations of Spanish words and English equivalents, and the presentation of suggestions that he would be able to relax and study the material and retain it for the exam. There were approximately four sessions of each type, and he easily passed the exam. However, we later found that a twilight state is probably not ideal for rote learning, whereas *attitudes* about studying are more effectively changed.

The Self-Sabotaging Businesswoman

A local newspaper happened to do an article on Twilight Learning in which it was said that some individuals suffer from negative scripts from the past that often undermine present adult behavior. There was a surprising response to the article from a large number of readers consisting primarily of professional females. Ms. NP, a 34-year-old middle-level manager in a computer hard drive company, was typical of those clients. Her complaint was that after reading the article she realized that she had been sabotaging her own success over the last 10 years. Dropping out of graduate school to move away with her lover, she found that she soon tired of keeping house for him in another town and sought a job of her own. NP, a bright individual, rose rapidly through the ranks to become a supervisor, whereupon she reported that she had a basic disagreement with her female supervisor and was soon thereafter let go as the company downsized slightly. As she recalled, there were at least two other incidents where self-sabotage hindered or even temporarily stopped her progress. She wanted to end this self-induced maladaptive behavior.

We have found that approximately two-thirds of Twilight Learning clients want the therapist to make the affirmation or change message tape in his or her voice. However, all clients want to have a say about what is put on the tape. NP, knowing her tendency to self-sabotage wanted the therapist to make the tape. She didn't even want to know the exact affirmations. Consequently, we made a tape using material generated over several sessions with NP. The affirmations were ''heard'' by NP only in the theta state. Some examples of the phrases were: ''You deserve to succeed,'' ''It's OK to be a success,'' ''You can progress now,'' ''You are a bright person,'' and ''You are in control of your life.''

After 12 sessions, NP became aware of a new feeling of self-worth and a significant decrease in the anxiety she felt in the working environment. A six-month follow-up found NP reporting no evidence of self-sabotage. In fact, she had received a promotion and a bonus.

It has long been known in the hypnotic literature that subjects given *amnesia* for post-hypnotic suggestions are more likely to carry out the suggestions than those subjects who were allowed to remember them. It would seem that when the conscious brain is aware of the suggestions, the defenses may interfere with their implementation. In the same fashion, the defenses of certain clients might reject the affirmations if known by the conscious mind before the Twilight Learning sessions. These clients would benefit more by having the therapist make up the affirmations and record them without the client knowing the exact affirmations. Conversely, another type of client insists on generating, with the help of the therapist, the actual phrases, and even wants to record them in his or her own voice. The most common choice however, is for the client to speak of the goal(s) to be achieved and then allow the therapist to generate the phrases and go over them with the client before the Twilight Learning sessions.

The Man with No Life

Perhaps the most satisfying case was NW, a 46-year-old single man who worked as a printer's helper and lived in a boarding house. He had survived a brutal childhood on a Kansas farm where his father beat him and repeatedly told him he was no good and ''wouldn't amount to anything.'' Close to monosyllabic, NW spent all his meager wages on therapy. He had tried seven years of psychoanalysis and four years of Scientology yet still felt terribly alone and unhappy. He had no friends and no hobbies.

NW came to us expressly for Twilight Learning after having read about the technique in an article about biofeedback in a local newspaper. The positive script was difficult to develop because NW had an extremely negative self-image. He strongly objected to the statement, ''I am good,'' because he said he was definitely not good. After approximately 10 minutes, NW announced that he could live with the statement, ''I am adequate.'' We finished the session with NW asking for the specifications for an appropriate script, because he wanted to do it at home and bring it to the

next session. He had been told by us that the right hemisphere of the brain was thought to be the seat of unconscious process and the right brain processed voice intonation contours such that an effective set of affirmations might be spoken with a good deal of intonation. Surprisingly he came back with a verse that he actually sang while accompanying himself on an old guitar, which he had not touched in 25 years. The verse was quite well done and incorporated most of the phrases we generated in the preceding session.

After six Twilight Learning sessions, NW said something happened at work. He had injured a finger because he was not attending to the job. He said he was thinking about finding a better job. After the ninth session, he felt he had experienced enough change to terminate therapy. A man of few words, NW gave us no clue as to progress other than, ''He was feeling and thinking differently.'' Six months later we called the printer's shop (he gave us no home phone) and they told us he now worked at another print shop, and we then called there to reach him. Now NW was willing to talk some and told us that he had a better job, was living in his own apartment, and had joined a bowling and fishing group at work. We considered that a very successful outcome.

The case of NW illustrates the importance of allowing the client to play a major role in creating the affirmations, in fact, it may be very important for some clients to actually record the phrases on the tape in their own voices. We ask the client to choose which type of presentation he or she feels would be most effective.

The Change Message: A Right-Brain Language

As we refined the Twilight Learning procedure we were cognizant of the fact that the verbal comprehension capability of the right, or non-dominant, hemisphere was much less than that of the verbal left hemisphere. Consequently we studied the aphasic literature to learn what individuals with damaged left hemispheres could understand. We found that the intact right hemisphere had difficulty with negatives, especially double negatives. It also had trouble with abstract, low frequency (not frequently used in everyday speech) words. The right brain responds to nouns and action verbs, especially if the sentences or phrases are spoken with a great deal of voice intonation, rhythm, or emotion (Blumstein & Cooper, 1974; Zaidel, 1985). A useful technique for getting aphasic patients to understand is called Melodic Intonation Therapy or MIT. Thus, patients would be taught to ''sing for their supper.'' The right hemisphere is also specialized for handling ''degraded'' information such as subliminal presentations.

Twilight Learning, Subliminal Process, and Alcohol Addiction

As far as we know there has been only one dissertation (De-Haan Bearden, 1985, unpublished) that incorporated Twilight Learning (at least three other Twilight Learning dissertation proposals at different universities were not allowed because one or more committee members declared that it was brainwashing or mind control). While working with alcoholic clients at the Center for Alcohol Rehabilitation and Educational Services in Medford, Oregon, Rita De-Haan Bearden decided to combine Twilight Learning with subliminal process (or priming tapes as they might now be called) for her PhD dissertation for United States International University in San Diego (De-Haan Bearden, 1985). The subliminal audiotapes were of two themes: one contained left/right messages that focused on overcoming alcoholism, and the other contained primarily self-esteem enhancing suggestions. As prepared by Budzynski, the affirmations were placed approximately 15–20 db below a mountain stream sound. When used with the Twilight Learning unit, the tapes would be ''heard'' only when the subject showed theta energy over (at least) the left hemisphere. The fascinating idea that addictions such as alcoholism are so deep-seated that change affirmations must be doubly-guarded from at least some critical screening defenses that extend down and are still operative in twilight sleep, must have occurred to Dr. De-Haan Bearden.

In addition to the two groups mentioned above there was a control group, which received the typical alcoholic treatment (as did the other two) but no Twilight Learning. Because the tapes were subliminal the study could be, and was, double blinded. De-Haan Bearden gave the two Twilight Learning groups three preliminary relaxation training sessions and then continued with five Twilight Learning sessions. Figure 3 shows the decrease in alcohol consumption in the three groups pre–post and in a 3-month follow-up. Greater increases in quality of life and adjustment to work were seen as well. Taken as a whole, the results showed a significant trend in the desired direction although no one measure alone reached significance. It is quite possible that with a larger number of training sessions the results could have reached significance.

Green and Green's Six Steps in Theta Programming

For years Elmer and Alyce Green of the Menninger Biofeedback Laboratory disagreed with our Twilight Learning procedure in that we were presenting affirmations during a theta state. The Greens believed that one could attempt to skim off unconscious material

(''subliminal dredging'' as Dr. Green referred to it) but should not attempt to input anything. However, in 1986, in a chapter in Wolman and Ullman's *Handbook of States of Consciousness*, the Greens outlined a six-step theta programming technique for physiological and psychological change:

> 1. Move first into a state of EMG quietness and peripheral warmth.
> 2. While in this state, *construct* the visualization that is to be planted in the unconscious, a visualization that has already been carefully planned by the cortex, with ambiguities eliminated (for the unconscious is like a computer in some ways, and tends to take instructions literally).
> 3. Allow awareness to sink down into the theta state with the idea that the unconscious is now listening; it is now in "record mode."
> 4. Gently project the visualization into the "field of mind" as a gestalt, with as little left-cortex activity as possible.
> 5. Terminate the session with a quiet command, such as "do it," "so be it," "the instruction is now terminated," or the like, in order to terminate unconscious receptivity (similar to using the "enter" key in programming a computer).
> 6. Bring awareness back to the surroundings carefully so as not to disturb the planted instruction (pp. 575–576).

Peniston and Kulkowsky Carry On

We like to think that the procedure developed by Peniston and Kulkowski (1989) represents the most recent evolution of both the Twilight Learning and the Greens' programming technique. These two researchers, working with inpatient alcoholic clients at a VA Hospital, applied their variation (essentially the six-step approach of the Greens) in a massed-practice, 36-session protocol. Later, they successfully applied their alpha-theta brainwave neurofeedback approach to Vietnam veterans with PTSD (Peniston & Kulkowski, 1991). Their success helped launch the modern era of EEG biofeedback, which has been labeled ''neurofeedback'' or ''neurotherapy.''

A Comparison of Twilight Learning and the Peniston Protocol

Separated in time by 18 years, the two techniques have some common characteristics and some differences.

Commonalities

1. Both involve the absorption of positive content material while the client manifests primarily a theta or alpha/theta EEG pattern (a twilight state).
2. The Twilight Learning positive-change verbal affirmations are developed by the client and therapist together. In the Peniston Protocol, each of the change message image templates (as determined by Peniston) is personalized by the client, so that just as with the Twilight Learning scripting, the Peniston scenes are a creation of both the therapist, (using Peniston's templates), and the client.
3. Both techniques assume that certain characteristics of the theta or alpha/theta EEG pattern allow a more effective absorption of the material.
4. The ''bump'' feature of Twilight Learning assures that at intervals the client will be boosted to a higher cortical arousal at which time the unconscious material that may have emerged can be integrated into the adult psyche, and the affirmative material can be stored in long-term memory (although perhaps on the unconscious level). In like fashion, the client using the Peniston Protocol typically moves up and down the cortical arousal continuum with some material emerging to be integrated and the imaged material stored in long-term memory, at least part of the time.
5. Both Twilight Learning and the Peniston Protocol assume a deeper, more lasting learning process than would be obtained with the material presented during the normal waking state.
6. This learning manifests more in the emotional and attitudinal realms than in the verbal realm. Behavioral changes are more automatic or unconsciously guided rather than consciously directed.

Differences

1. The material presented in the Twilight Learning procedure is of a tape-recorded or therapist-spoken verbal form, although associated visual imagery almost always develops spontaneously. The Peniston Protocol uses goal imagery as its rescripting medium.
2. The Twilight Learning technique can be used in an automatic mode, in which the presentation of the material is contingent upon the system detecting the presence of theta EEG. If theta is not present, the material is not presented. If the theta drops out, the verbal presentation is stopped also. The Twilight Learning system thus determines if the appropriate EEG pattern is manifest before the material is presented. In the case of the Peniston Protocol, the client is often unaware of whether the correct EEG pattern is present because of the lowered cortical arousal level and/or because he or she is trying to focus on the imagery.

3. Because the self-produced imagery in the Peniston Protocol is not automatically stopped and started, it is possible that a certain percentage of the time the client's arousal level slips back up to full consciousness, with the result that the imagery acceptance may be blocked by the more conscious critical screening.
4. The Twilight Learning system incorporates a sleep guard (the ''bump''), which prevents the client from falling asleep. It proportionally increases the audio volume as theta decreases in frequency and/or increases in amplitude. Typically, the volume increase bumps the cortical arousal up to alpha or beta, at which point the tape recorder is stopped. After a short interval, the client falls back into the theta state and the tape recorder is started again. This cycling back and forth across the alpha/theta border is characteristic of the Twilight Learning experience. Interestingly, this very characteristic is identical to what Rubin (1968) noted was the most efficient sleep-learning pattern found in a large number of Russian studies. The Peniston Protocol, as originally detailed, involved the therapist leaving the room as the client ''entered theta'' and attempted to take in the structured imagery with him. The client might easily fall asleep under these circumstances and remain there for the rest of the session.
5. The Peniston Protocol requires about 30 alpha/theta feedback sessions following the 6 sessions of hand temperature and imagery training. As originally conceived in 1970, the Twilight Learning incorporated 6 to 12 sessions and frontal EMG feedback was provided only if the client had relatively high facial tension. Earlier work in our biofeedback lab at the University of Colorado Medical Center had shown that individuals with low forehead EMG could transition easily into theta as they relaxed, whereas those with high EMG levels required preliminary frontal EMG biofeedback or they would not be able to produce theta (Sittenfeld, Budzynski, & Stoyva, 1976). Peniston's work shows that perhaps 30 sessions of Twilight Learning training may result in a higher success rate than the 6 to 12 as we originally thought.
6. Finally, one technical point that might be important: We designed the Twilight Learning's logic so that it would not allow the verbal presentation if alpha or beta energy was mixed with the theta. In other words, we wanted ''pure'' theta because we reasoned that ''adulterated'' theta allowed a certain amount of consciousness (and therefore, critical screening) to counter the affirmative material. The feedback units in the Peniston research probably allowed theta feedback (tone) even when the theta was mixed with higher frequencies. But, was this all bad?

It would appear that the occurrence of beta or alpha in the presence of primarily theta energy allows the conscious mind to play a role in the processing of the incoming material as well as any emergent feelings or images from the unconscious mind. Of course, with consciousness comes the critical screening, like the ''little voice'' mentioned above (e.g., ''No, you're not really like that,'' or ''It won't last for long,'' etc.). This can even reverse the effect of the suggestions. On the other hand, if extremely traumatic feelings and memories break through repressive bounds, the fact that there is some consciousness available to help integrate the material may help avert an uncomfortable abreaction.

But, There Is a Tradeoff

Peniston and Kulkowsky's (1991) research with Vietnam veterans suffering from PTSD has demonstrated the need for some degree of beta consciousness, at least by the end of the session, to help soften the abreaction. The tradeoff is that if there is too high a level of consciousness during the session, the trauma material may never emerge to be integrated. It will therefore continue to cause trouble for the client. Modern neurotherapy techniques, however, can meter the degree of consciousness by means of the theta/beta ratio. An increasing ratio above a certain level indicates the possible breakthrough of such material. The neurofeedback computer can be set to sound an audio tone when the ratio goes too high. Access to unconscious material can then proceed without excessive abreaction. *Note:* Some therapists feel quite confident in working with abreactions and therefore welcome an increasing ratio.

The Twilight Learning Process Also Allows Access to Unconscious Material

If one of the goals in a particular session is to uncover unconscious trauma memories, the client is instructed to give a quiet verbal response of one or two words if any hypnagogic material is noticed. At the end of the session, the client can usually flesh out the imagery corresponding to the word cues. Given the set for uncovering dissociated material, the resulting hypnagogic imagery may be an actual memory or a highly disguised derivative of the memory. The hypnagogic imagery in the case of the ''businessman who couldn't say no'' described above involved this sort of uncovering. During one of these early sessions he drifted into a ''theta state.'' Soon thereafter he softly whispered, ''No!'' During the debriefing afterward he was able to recall that the long, drawn-out negative was associated with the

childhood memory when he had said ''No'' to his father and received a vicious slap across his face for so doing. He recalled that the slap not only stung and left his ear ringing, but caused him to feel embarrassed and shamed. It appeared obvious to the boy that his father hated him at that moment—hated him for saying ''No.'' It is not surprising that an early trauma of this sort could result in an inability to say no to authority figures throughout life.

The Manager Whose Mind Blanked

One of the most intriguing examples of fear of authority was a 52-year-old master machinist whose many patents caused him to be promoted to management status, whereupon his troubles began. His complaint was that during certain negotiations he would suddenly go blank and couldn't think. With a set for recovering whatever images he could during a Twilight Learning session, he verbalized ''beating'' about 15 minutes into the session. We had already ascertained during the intake that he had grown up in Poland during the horrifying German occupation in World War II, so we suspected that the beating cue might be associated with those years. Although the post-session debrief revealed that the client could not immediately recall the trauma, a ''tracking'' of the Twilight Learning generated cue word allowed him to remember that something horrible had happened during the war. At this time he could only say that he lost his mother and father during the war and was reunited with his sister afterward. The sister had died recently in Europe. He believed his parents died in a concentration camp but he had a ''blank'' for the actual events preceding this.

In his next Twilight Learning session the set was to remember more details and that he would be able to handle whatever came up. Approximately five minutes into the primarily theta pattern he said quite distinctly, ''They beat him—the Nazis beat him—in the basement.'' The Twilight Learning session was terminated immediately as the client was quite agitated. He was then able to recall the entire memory of how the Gestapo came to their home and started to pummel his father. They knocked him down the basement stairs and continued to beat him in the basement. The boy, his sister, and mother were ordered to remain upstairs. With feelings of rage, helplessness, and shame the boy finally blanked out. He remembered that when he ''came to,'' his mother and sister were ministering to the dying father in the basement. The next day the Gestapo returned and took the mother. Once again the boy felt helpless. The children huddled together in terror for two days, when a neighbor told them they must flee, for the Gestapo were coming for them. As they ran down the street, the sister fell and was caught by the agents. The boy was snatched by a farmer who was driving his truck back to the farm. The farmer hid the boy through the war. He never found out why the Gestapo wanted his family.

As the client related the story, he unleashed a torrent of fist pounding emotion with tears and cursing. Finally he quieted and that session was ended. In the two subsequent sessions later that same week, we discussed the fact that in the face of such overwhelming odds he automatically entered a state in which his conscious mind escaped the horror. We also rescripted the event and the client saw himself heroically fighting the Gestapo agents in a valiant effort to defend his family. The satisfying result of the therapy was that the client no longer ''blanked out'' when negotiating with unreasoning authority figures.

Twilight Learning, 2000

What does the future hold for Twilight Learning? An important goal will be to enhance the incorporation of goal images into the twilight state. Perhaps this could be facilitated by conditioning an aroma to the goal scenes. Here is a procedure that will be explored in the near future:

1. The goal images are developed by the client and therapist.
2. The images are checked for appropriateness by client and therapist (i.e., the client ''tries on'' the image to see if it feels good in a variety of imagined situations).
3. The first scene is then imagined by the client and when clearly in mind, the client signals the therapist.
4. A fan is blowing across the client's face as the scent is then brought close to the client's nose. The aroma is held there until the client signals the scene fading or changing, at which point the scent is removed. The fan evacuates the aroma immediately. This is repeated at least five times so that the conditioning of the scent to the scene is strengthened.
5. It is hypothesized that during the ''theta state'' the presentation of the conditioned scent will facilitate the incorporation of the goal image. Thus, when the therapist sees that the client's EEG is showing primarily theta rhythms, the scent is presented. It is removed if the client increases cortical arousal as signaled on the theta/alpha meter.

Certain scents, such as Johnson's baby powder, Crayola crayons, etc., presented during the Twilight Learning theta states might also facilitate the recovery of early memories, especially since theta is the dominant frequency during the early childhood. *Note:* One could also think of these procedures as examples of *state dependent learning*.

Visual Imagery Incorporated into Twilight States Through Verbal Suggestion?

Another way that goal images may be able to be taken into the twilight state is simply by the use of suggestions on the Twilight Learning audiotape to visualize the goal image. This has never been explored in a systematic way and may be included in the aroma paradigm to act synergistically.

Subliminal Messaging in the Twilight Learning Audiotapes

Rita De-Haan Bearden's dissertation indicated that in cases of alcohol addiction, subliminal messaging presented in a twilight state might affect positive changes in only six sessions. Recent careful research by reputable investigators (Swingle, 1992) lends new positive evidence that subliminal stimulation may affect food addiction, obesessive-compulsive disorder, and even systemic lupus erythematosus. Subliminal messages can be combined with supraliminal suggestions on the Twilight Learning tape. We hope to test the efficacy of this approach in the near future.

An Ideal Goal Programming State?

Some clinicians feel that the ''Peniston-type'' protocol works best if the client can be kept conscious, but deeply relaxed. For example, Wuttke encourages his patients to remain as alert as possible as they train through alpha and progress to theta (1992). If the state of ''theta with awareness'' is characterized by one's being conscious of what is usually unconscious, and the detachment means that critical screening is ''lowered,'' we would agree that this would be the physiological end-goal of the technique. On the other hand, if the detachment is not secured, than the theta witness state could mean that the critical screening is intact, or if not, would instantly spring into place if emotional memories were tapped. In this case, the goal imaging may be no more effective than someone relaxing and visualizing the images with full consciousness.

The Twilight Learning system can be adjusted to allow varying degrees of ''leakage,'' by which is meant that some alpha energy can occur without turning off the theta message. It could also be adjusted to accommodate even some degree of beta energy, but this almost ensures that critical screening will pop up soon after emotionally toned memories arise, unless the client is trained in ''detachment'' beforehand.

Our early thinking about Twilight Learning and the brain postulated that each trauma experienced by an individual results in a change in the brain's defensive structure. The more trauma, the more the defenses are hardened. Stronger defenses mean more rigid critical screening. The degree of critical screening would be inversely related to the acceptance of change messaging. Thus, those individuals who are most in need of a change in belief systems concerning themselves were the most resistant to suggestions for change. If this model is correct it would suggest that clients with less severe trauma histories could accept positive change messaging while in a more conscious state, whereas those unfortunate clients who experienced more severe trauma in their early lives would require a greater degree of lowering of cortical arousal (or critical screening) before the messaging would be accepted. Twilight Learning can require that all conscious screening be lowered (a ''pure'' theta state) before messaging is presented or, by changing the settings of the filters, the Twilight Learning can present the change messaging with some degree of alpha/beta consciousness. If the degree of defending could be determined before the Twilight Learning training then the filter adjustments could be made accordingly. Future research may incorporate such testing of defenses prior to Twilight Learning.

Twilight Learning as a Medium for Physical Healing?

Another area of Twilight Learning exploration will be its possibility as a technique for aiding in the healing of physical disorders, an example of which was the case described above of the overweight scientist with the low back pain. The question is: Do Twilight Learning suggestions and/or images have a more positive effect on the healing process than the same suggestions and/or images presented in the waking state? The ancient healers would no doubt argue for the former.

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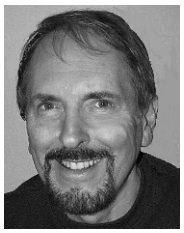

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SPECIAL SECTION

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