GETTING WIRED

The EEG alpha rhythm is a regular wave pattern with a frequency of 8–13 Hz, deriving from the back of the head. With electrodes pasted gently to your scalp, they hook you up to a machine which monitors and amplifies your alpha, and sends it back to you in the form of a tone. And people have shown remarkably rapid progress in controlling that tone, i.e. in producing more or less alpha at will.

The implications of this voluntary control of brainwaves are great, and a number of psychologists more knowledgeable than myself have contributed a paper on that subject to this issue. I want to stick more closely to the actual experience of the alpha state which has gained much attention as an altered state of consciousness.

Hugh Macdonald, alpha experimenter in the Department of Psychology, Stanford University: If you're always very much in the world, and somewhat paranoid, always using your eyes to kind of check things out, then you close your eyes, relax, and alpha blossoms. If you can learn to get into that state with your eyes open, it seems very weird to most people.

A person sits there and gets alpha and is in a very relaxed state, but he can't fall asleep. Fall asleep and alpha disappears. So in alpha feedback training, we give you a tone which keeps you awake and tuned into your alpha for an hour or so.

People who know nothing about it learn very quickly how to get into this state. They say it's like ballet or football or skating or playing billiards, something that's flowing and enjoyable. If they know it has to do with meditation, they say it's very meditative. But the longer they train, the more they say it's not that. It's essentially doing nothing, being awake but doing nothing. You let your mind go off and do what it wants.

Most of the effect, I think, is that for once people are sitting alone quiet with themselves. How many people just sit alone for an hour or so a day and just do nothing, unless they're meditating?

S. S.: Do they say they like it?

Hugh: Yes, but for how long? We did seven sessions in one study, and by the sixth and seventh session at least 50% of the people were starting to fall asleep. They weren't very interested any more. It had lost its appeal. Like meditation. At the beginning you get this high and then after a while, "Oh, so what?" Like eating butterscotch pudding every day.

S. S.: Why do they fall asleep?

Hugh: Wouldn't you? You feel nice and warm and cosy in front of a heater, and then you fall asleep.

Normal alpha isn't actively turning it on. It's just closing your eyes, really turning your eyes off. With eyes open in a feedback situation, people go from producing a little bit of alpha to a lot. But to actively get it above that lots of alpha stage to your normal eyes-closed alpha, from 70% to 90%, is very hard for people to learn. You have to really try. The medium highs, they have lots of alpha, it's all over the place and plenty enough for us, but pretty soon they're just doing nothing. And it gets boring. They want excitement, stimulation, more contact with the world. Conversely, if you give people alpha-off training, they want to relax and let go. Huge bursts of alpha follow alpha-off training.

Once again, it's like meditation, like everything, like all skills, and it is definitely a skill. We had only one guy who did alpha work with enough regularity to really get good at it, and he found that once you passed the boredom stage, things got extremely good. Meanwhile, it's tedious, painful, and takes a lot of effort.

So the alpha state is a kind of high which takes a lot of work to get you very high. Some experimenters are trying to link alpha level with hypnotizability, or with psychic powers, but with no significant correlations yet. My friend Hugh measured 3 or 4 persons with naturally occurring psychic phenomena and they had no alpha rhythm at all. Blind people don't either, and neither do a small number of other people for reasons no one understands. Maybe they have a wholly different way of seeing. In any case, no one has found a way to increase alpha where there is none to begin with.

A relatively new field for research is lateral alpha activity. Generally, there is more alpha from the right side of the brain, long considered the center for processing music, imagery, spatial information, and gestalt tasks, than from the analytical, mathematical left side. Recent experiments (Ornstein & Galin, 1971, and Morgan, McDonald, & MacDonald, 1971) show that during analytical or logical problem solving alpha goes down on the left side, while during imaginative tasks it decreases on the right. These experiments add to the growing body of evidence for independent functioning of the two cranial hemispheres, as well as supporting the notion of alpha as a relaxed cortical state.

-S.S.

Implications of Physiological Feedback Training

by Ralph Ezios

With the invaluable assistance of Barbara B. Brown, Eleanor Criswell, Lester Fehmi, Elmer Green, Joseph Hart, Joe Kamiya, Hugh Macdonald, David Nowlis, and Robert Ornstein.

In a much-cited passage, Weston LaBarre explicates his idea of *evolution-by-prostheses* in the following way:

> With human hands, the old-style evolution by body adaptation is obsolete. All previous animals had been subject to the *autoplastic* evolution of their self-substance, committing their bodies to experimental adaptations in a blind genetic gamble for survival. The stakes in this game were high: life or death. Man's evolution, on the other hand, is through *alloplastic* experiments with objects outside his own body and is concerned only with the products of his hands, brains, and eyes — and not with his body itself. (1954, p. 90.)

As LaBarre implies, man's technological evolution so far has allowed him to gain better and better discrimination of, control over, and ability to communicate about all manner of events and processes in his environment.

Included in the ever increasing comprehension of the environment, with concomitant ability to manipulate it, through science man has come to learn more about all organisms' internal events and processes. However, man's ability to discriminate, control and communicate about his own personal internal events and processes has never been markedly aided by technological development, and thus the prosthetic evolution has primarily had its effect on man's external environment and only indirectly has it effected him internally.

Physiological feedback training is exciting in this context because it is a small beginning in expanding and changing the direction of *evolution-by-prosthesis* and for the first time making it possible for an individ-

ual man to use technology to come to know himself better. The basic mechanism employed in feedback training is an electronic system which amplifies and informs the person as to the on-going activity of a selected physiological process, thereby aiding the person in discriminating the presence of events or stages in the process, thereby enabling him to gain some degree of voluntary control over this process, and also allowing him to develop a degree of sophistication in communicating about the process previously out of his scope. Although it could be argued that the mirror and the bathroom scale are considerably earlier instruments designed to give personal feedback on intrapersonal processes, the type of feedback is useful primarily in monitoring internal processes only indirectly as they effect externally apparent aspects of a person using them.

Therapeutic Applications: Biomedical and Psychological

Hart (in press) points out that feedback training tends to obscure somewhat the normal expert-patient relationship in therapy. Feedback devices allow a patient to know himself better, while allowing him to develop his own attitudes about what he finds out.

The development of inexpensive and portable devices to give feedback opens up a number of therapeutic possibilities. One may begin by considering some applications in the field of psychosomatic medicine. For example, Shapiro, *et. al.* (1969) have shown that people can learn to lower their blood pressure. Thus patients with high blood pressure could be given small portable devices for checking themselves regularly against high blood pressure. If the blood pressure were unusually high, they could then employ techniques that they had previously learned to lower it, and could make sure that they had succeeded by checking themselves against the portable device. This procedure either could be used at bedside in the hospital, or the device could be rented or purchased to be used in the patients' regular daily life. Thus the physiological consequences of states of mind engendered by environments or actions which the patient would be likely to encounter could be better comprehended, thereby allowing the patient to get insight into the psychological component of his particular illness, and even providing an opportunity to learn to control the symptomotology after developing this insight. While the patient should not be led to overly high expectations about curing his illness, the ability to use such devices could well be morale boosting to the patient who otherwise feels he has no hand in combatting his own illness, and that his fate is in the hands of the experts alone.

Many variations on the theme exist. A portable device for monitoring psychogalvanic skin response is already in production. Similarly a device that has been built by Hugh Macdonald with integrated circuitry capable of giving feedback on EEG, EMG, heart rate, skin temperature, vasoconstriction, and GSR exists and could be mass produced for sale at very

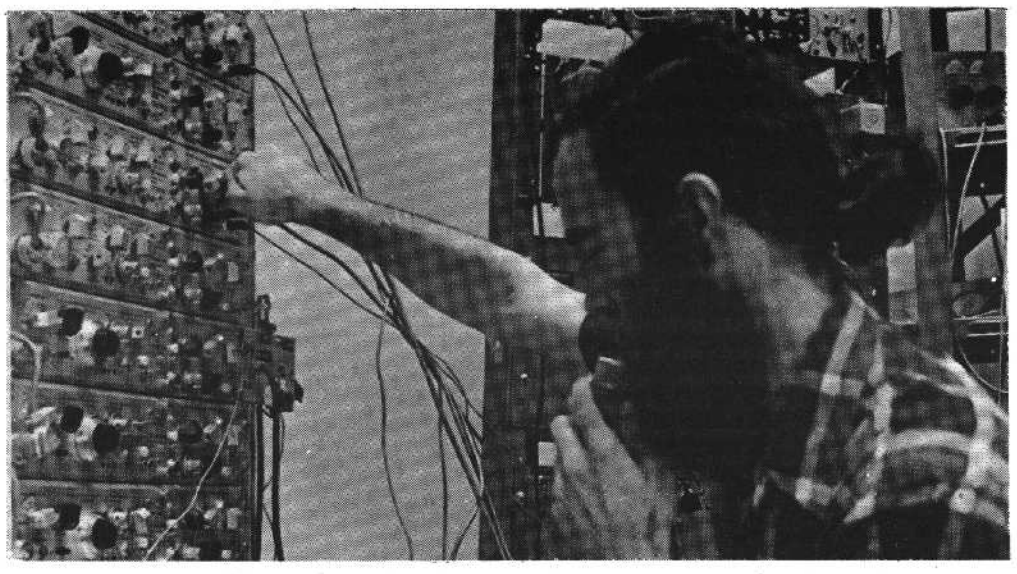
low prices. Patients with irregular EEGs predisposing to epilepsy, who get headaches or backaches from tense muscles, who have irregular heart beats at times, or who have any relevant physiological irregularities which vary with their psychological state might find these devices helpful. It would even seem in the realm of possibility to build small, inexpensive devices for feedback concerning stomach acidity, of potential use to patients with ulcers. Or feedback devices could be developed to allow a patient to listen to his intestinal functioning, to aid in proper digestive actions. Miller (1969) has shown that control over intestinal and digestive functioning can be developed very rapidly in animals.

A number of alternatives exist as to the type of feedback that would be given in these portable devices. In one potential type, most useful as a portable constant monitor, a physiological process would be monitored and the patient would receive a signal only if the process should cross a criterion indicating it was moving in an unfavorable direction (blood pressure too high, stomach acidity too high, heart becoming irregular, etc.). In another approach, most useful as a portable means for learning or regaining control, the feedback would be more analogous to the full process. Tiny variations in the physiological parameter would be brought to the attention of the patient and the patient could then engage in mental activities which would help to bring out desirable functioning.

In the area of psychiatry and clinical psychology such devices could also possibly be used with patients who had no specific somatic complaints. Because it is now possible to simultaneously monitor overt behavior, covert moods, and physiological processes in the natural setting (Nowlis & Cohen, 1968) procedures could be developed whereby both patient and therapist could develop more understanding of the covert moods and physiological patterns of behavior accompanying exposure to various aspects of the patients' environment. Then the patient could choose internal events which he would like to have occur more regularly, or more voluntarily, in his daily life and could begin a program of training, first at some training facility, then attempting to produce the pattern in the desired situation in his natural setting. Such procedures could increase the number of petients that a therapist could see, decrease the cost of psychotherapy, and decrease the problems associated with therapists' perceiving and dealing with patients from a single value system. In this type of therapy program, patients would have an unusual degree of freedom to choose their own goals, experiment with implementing and modifying the goals as they progressed in therapy, and test the results of the therapy in a very direct way against their actual life situation.

Another psychotherapeutic use of feedback technology could be in sensitivity training. Two people could use the feedback devices mutually in a number of meaningful ways. For example, one person could learn to help a naive person to reach certain physiological states. The naive person would receive no feedback, but the other person would behave in various ways to attempt to deliberately bring about various states in the first person. Or two people could observe the effect of various kinds of behavior on each other. Or, again, two people could together attempt to control a feedback loop designed to cue them only when both were in the same desired physiological state.

Furthermore, whole groups can learn to control certain feedback devices together. For example, the portable device previously mentioned designed by Buryl Payne, now available commercially to be used in giving visual and auditory feedback as to GSR, can easily be used by a large group holding hands, with two people in the group each holding one electrode instead of each other's hand. Groups could then attempt to together learn to increase and decrease their GSR, either alone or while being exposed to various stimuli. This kind of learning situation might be quite useful to certain groups. For example, any group of people who have to work together under conditions of high stress might want to learn to keep their GSR low, first alone, and then while exposed to stress provoking messages. Presumably, each individual would be learning not only to keep his own responses low, but would also be learning ways to help his fellow team members stay relaxed.



More basic research needs to be done on understanding physiological relaxation. Most of the physiological processes which have been successfully conditioned in our various laboratories are apparently influenceable by relaxation; that is, subjects learning to generate more alpha rhythm in their electroencephalogram, or lower muscle tension in their electromyogram, or lower heart rate, or warmer skin temperature, or larger vasodilation, or lower galvanic skin responsivity all tend to say that there is an element of relaxation involved in moving the process in that direction. Interestingly, our early findings also tend to agree that a subject who, through relaxation, has learned to influence one of these processes is not necessarily making any change in the other processes apparently influenceable by relaxation — for which the subject has not been given feedback. In fact, the processes appear to be remarkably independent in spite of the similar reports of relaxation. However, because relaxation is clearly involved in some way in the learning of each, one wonders if feedback training could in any way be used as a substitute for relaxant and tranquilizing drugs with patients suffering from anxiety symptoms, especially if the patients were trained to relax by multiple physiological criteria.

Entertainment and Aesthetics

There are at least two, rather different, applications of feedback technique to entertainment, one of the Kahn procedure, the other of the Kamiya-Brown procedure. Both applications however are based on the same general strategy, namely that the feedback signal itself need not be just a tone or a light, but can be slides of paintings of fine art, a motion picture, recorded music, or any of a large number of aesthetically pleasing stimulations *(e.g. a video synthesizer — ed.)*.

It has been called to our attention that there are now multi-media environment systems available, where as many as 12 film or slide projectors are controlled simultaneously and as many as 5 tracks of sounds. It could be both entertaining and instructive to have such a presentation controlled by a number of on-going physiological processes in a single individual, entertaining because of the person's sense of being intimately linked with the presentation, and instructive because in the past one of the most difficult aspects of psychophysiology to grasp has been the simultaneous intervariability of many physiological parameters.

Another potentially entertaining and instructive situation would be to have two or three people control with their physiological processes various aspects of the multi-media presentation. The people at first would just enjoy watching and hearing the patterns they were producing, and then could begin to test the effects of various kinds of interaction with each other on the blendings and discordances of the displays.

Not surprisingly, you can now own your own brain wave feedback device for just a fraction of the cost of a portapak. Phenomenological Systems, Incorporated, 72 Otis Street, San Francisco, California 94103, *will sell you a 4" x 2" x 1" unit for $190.00, including one free computer analysis of a cassette tape made by plugging into the output jack of your unit. PSI has sold 1000 units this year and are well into their third generation of equipment design, fortunately with no compatibility problem. From 4 or 5 information requests per day a year ago, they get thirty to forty today. In a few years, the devices will be produced like transistor radios, for $5 to $10 each.*

Like every technology, biofeedback devices have their Big Brother potential, which make surveillance cameras on the streets look benign. As physiological processes become increasingly linked to computers, someone may decide to make the communication two-way. Remember that the government has always been one of the foremost experimenters in the field of responsive environments, with propaganda, censorship, and surveillance the basic modes applied to each new technology, from time-honored newspaper censorship to modern day wiretapping. Imagine a few giant transmitters sending out patriotic vibes at the appropriate frequency, and before you can salute, the dimestores run out of flags.

But it's really nothing new. In the same way that so many of us have pushed aside the bullshit of broadcast television, we'll deal with what comes. Free universities will offer courses on cortical jamming techniques and Radical Software *will be a hologram of How to Build an Alternate Brain Wave Network.*

-S.S.

Education

One of us, like his subjects, has learned to control to at least some extent his EEG, EMG, vasodilation, GSR, heart rate, and skin temperature. The most fascinating and pleasurable experience for this experimenter was in the brief time he spent working on the skin temperature of his hands. Within ten minutes the person could warm or cool his hands, deliberately altering the direction on command when another of us signalled with a click from a nearby instrument room, the click signaling "go in the opposite direction". The experimenter could alternately cool and warm his hands even when the clicks came as rapidly as one a second. The process involved was one the experimenter had lived with all his life but had never had any insight into or voluntary control over until the ten minute feedback practice period. It was almost like discovering a new frontier, still needing to be charted and explored although close to us for millennia.

Some feel that oriental meditators are among the very few people who have developed sophisticated perceptual skills for internal processes. Such considerations might be useful in explaining why one aspect of the feedback training technique has been of particular fascination to many lay people (e.g. Luce and Segal, 1966) and professionals alike. This aspect is the potential application of feedback training to the western practice of eastern meditation. A number of independent studies done in India and Japan (e.g. Anand, 1961; Kasamatsu and Hirai, 1962) agree that there are physiological patterns which are strongly related to deep meditation, particularly in the EEG and EMG. The alpha rhythm is markedly increased in both yogic and zen meditation and is generated over areas of the cortex normally not involved in alpha production. Meanwhile, the EMG tends to fall to very low levels.

continued ⟶

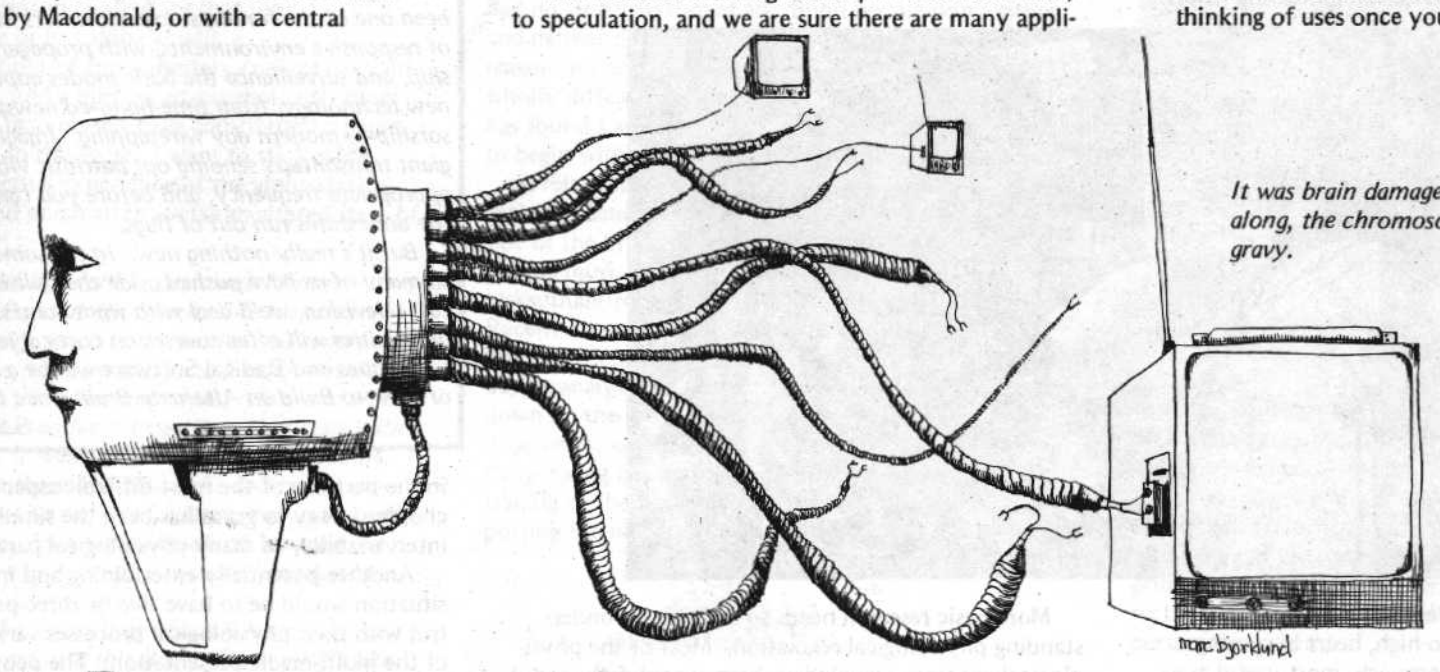
BIO-FEEDBACK (cont.)

By this time some yogis and zen monks have actually had the opportunity to try feedback training, and to listen to themselves as they meditate. They have tended to agree with westerners' speculations that such devices might be useful in teaching people the elementaries of meditation. In other words, westerners could overcome handicaps of cross-cultural translations and busy schedules in imitating the physiological patterns of expert meditators, thereby perhaps learning the basic state of mind for at least the beginning stages of meditation. Subjects can learn to control their EEG to a measurable extent after only a brief period of practice (Nowlis & Kamiya, 1969; Nowlis & Macdonald, 1969). EMG control, depending on the muscle used, is also not difficult to achieve. Thus a student with either a portable feedback device similar to that designed by Macdonald, or with a central training facility available, for example at his college health service, could learn to meditate in a state of mind similar to that of a zen monk or a yogi.

Thus feedback devices and feedback training may be helpful in providing people with a chance to explore the internal, and in a socially constructive way. Perhaps because western society and western education are so oriented to discrimination and control of external events, the opposite abilities, perhaps providing some relief from practice of the others, are highly prized among the younger generation. Certainly feedback training is less dangerous and more constructive than drug use, or "dropping out", alternatives which attract large numbers of bright and potentially highly valuable young members of our society (H. H. Nowlis, 1968)

Concluding Remarks

The feedback training technique lends itself easily to speculation, and we are sure there are many applications beyond what we have mentioned here. When inexpensive portable feedback devices are commercially available, for example, we are sure people will think of many more creative uses. We have only mentioned our more straight forward and practical ideas. Much more speculative thinking has gone along the lines of (1) could a feedback device be built to cue a woman as to her time of ovulation, (2) could feedback devices be used to get two or more people into very similar states, thus allowing demonstration of mental telepathy and other phenomena of parapsychology, (3) could feedback devices be helpful in the training of creative artists, training the artists to bring out internal states appropriate to various types of aesthetic productions, (4) could such devices be used in controlling artificial limbs, so that voluntary physiological changes would change the position of the limb, (5) could awareness of various muscle activities through EMG feedback be useful to athletes, etc. It is hard to stop thinking of uses once you begin trying it.



It was brain damage that we had in mind all along, the chromosome damage was just gravy.

—SB

ACID PROGRAMMING

Programming and Metaprogramming in the Human Biocomputer — Theory and Experiments
John C. Lilly, M.D.
1967, 1970 (reprinted by Portola Institute); 112 pp.
$1.50 postpaid
from:
Whole Earth Catalog
558 Santa Cruz Avenue
Menlo Park, California 94025

John Lilly charts a self-exploration with a mixture of acid and sensory deprivation, in the language of a model of the human brain as a gigantic biocomputer, thousands of times larger than today's machines, with unknown boundaries in the body. The software of the human computer, all the programs and metaprograms, is the mind. Consciousness is itself a particular program. Self-programming can be achieved through the metaprogramming of the higher level systems of the brain and self-metaprogramming is done consciously in metacommand language, with the resulting programming continuing below the threshold of awareness. The levels expressed in metacommand language cover large segments of the computer's operation, rather than local detail.

LSD is a reprogramming substance which introduces white noise (randomly varying energy) into the computer's systems. The noise adds enough uncertainty to the meanings of the usual signals in the circuits to make new interpretations easy. *"In such noise one can project almost anything at almost any cognitive level in almost any allowable mode."* For example, hallucination is simply a visual display projected onto white noise. LSD grants the powers of display of data patterns, programs, or storage contents, replay of past experiences, and variation of the motivational charge attached to stored material.

Attenuation of external stimulation frees circuitry for inner cognition. *"In the maximally attenuated environment (92 to 95 degrees F. isothermal skin, saltwater suspension, zero light levels, near-zero sound levels, without clothes, without wall or floor contacts, in solitude, in remote isolation, for several hours), the addition of LSD-25 allows one to see that all the previous experiences with 'outside screens' (for projection) are evasions of deeper penetration of self."* Once various anxieties and fears have been overcome, thought and feeling expands into the circuitry usually preoccupied with external reality. *"The self is still centered at one place but its boundaries have disappeared and it moves out in all directions and extends to fill the limits of the universe as far as one knows them."*

Lilly is interested in using these powers for self-analysis with the goal — *"make the computer general purpose."* That means *"there can be no display, no acting, nor an ideal which is forbidden to a consciously willed metaprogram. Nor is any (of these) made without being consciously metaprogrammed."* Lilly ducks laying out a methodology for this self-analysis but describes personal experiments he conducted *after* having overcome the fears which made inner exploration difficult. The experiments involved attempts during LSD-physical isolation sessions to self-metaprogram such unusual basic beliefs as : *"the existence of beings in whom humans exist and who directly control humans."* Although the trips were full of experiences consonant with the beliefs, straight analysis of the material, coupled with further sessions, convinced him of the inner origin of the apparently external contacts.

Let me underscore that the book is replete with warnings of danger in these methods, with prescriptions for what steps *must* preceed each stage, and with details of tight precautions absolutely necessary. Please, please, if you're tempted to try this stuff, read the book first, and, at the very least, do what he says.

The problems usually considered to be the concern of the therapy needed by us neurotics are, to Lilly, just those fears and anxieties which must be overcome before his methods can be fully utilized. Unrealizable programs, while tripping, are symptoms of taboo areas and repressed material. Sessions are full of such evasive defensive maneuvers as unprojectable images, flickering or distorted projections, intrusion of the external reality program, and inability to project on "blank screens". Evasions avoid programs too threatening for the subject. The repressions, their defenses, and the resulting program restrictions encountered with acid are clearly magnifications of the same effects while straight.

All that Lilly offers on this subject is: *"After a thorough exploration of the various evasive metaprograms, it can be shown that the only thing to fear in this area is fear itself, in overwhelming amounts. With sufficient training it can be shown that one can convert the motivational sign of the experienced emotion from negative to positive. As to whether or not one must go through some of the negative emoting in order to experience enough of the punishing aspects to avoid them is a moot point. A great deal of self-discipline is required in this instance to pursue the negatively tinged programs and metaprograms stored in memory."* Yeah, yeah, John, but this fearful stage is where *we're* at. What's this sufficient training like, man. Your moot point is our burning issue. You've been through it all, friend, why not lend some help where it's needed.

Although the book sidesteps this important topic of acid therapy (and I just got to recomment *LSD Psychotherapy* by W. V. Caldwell and the incredible forthcoming book by Stanislav Grof on that subject) it does have much to offer. The ease I experienced in writing this review alone convinced me of the use-value of the computer-model language; don't be too quick to belittle it as old hat. The mind-brain distinction is a fruitful one, and the notion of general purpose biocomputer becomes a neat simile for that hard to define phrase — self-actualized personality.

Most exciting to me are the prospects which Lilly maps out for self-experimentation once I can regularly (in my language) experience ego-death. Playing with basic belief hypotheses appeals greatly, and I look forward to discovering the details of my metacommand language. I am reluctant to give up my religious interpretation of disappearing boundaries of self, but I think I'm willing to submit it to experiment. Sensory deprivation is an intriguing notion and, while I may forego the 95° saltwater flotation tank, a dark · quiet bathtub trip is on my mind.

(Reviewed by Robert Willig)