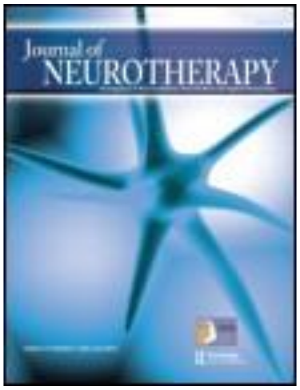

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Composite Biofeedback Conditioning and Dangerous Offenders: III

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Composite Biofeedback Conditioning and Dangerous Offenders: III

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Seventy-seven offenders, selected as subject to deep-brain complex seizures, were treated with varying amounts of a composite EEG-SMR and GSR-SCARS biofeedback conditioning procedure. Subjects were selected through successive screens, culminating in evidence of a perceptual-motor anomaly shown to predict to various types of dangerous criminal conduct. The lack of a recognizable prodrome that these subjects might use to cue voluntary self-regulation made it seem necessary to abandon the usual method of continuous analog biofeedback. An operant conditioning method was employed, which provided discontinuous and contingent reinforcing feedback during all occurrences of EEG sensorimotor rhythm (SMR) and for successive 1K ohms increases in skin resistance (GSR). The mean duration of post-release follow-up was eighteen months. Criminal recidivism rates were shown to decrease roughly in proportion to the number of treatment sessions received. Recidivism rates varied from 65% for those receiving essentially no biofeedback treatment to 20% for those receiving more than 33 half-hour sessions. The results were interpreted as holding out hope for the identification and treatment modification of one subset of dangerous offenders.

Introduction

The difficulty of recognizing dangerous offenders has been well documented in the psychological literature (Quinsey & Maguire, 1986). The problem of treating them is even greater. If the variables controlling dangerousness cannot yet be specified in order to identify people who will manifest this attribute, it is obvious that those variables cannot yet be subjected to treatment modification to alter this human quality.

The psychological literature is replete with observations of borderline or atypical electrophysiological and neuropsychological indicators among offenders, and particularly among dangerous offenders. Unfortunately, few definitive criteria have appeared to permit any particular subgroup of offenders to be identified for specific investigation. Obviously, sub-groups of people have to be identified if the inferred causes which control their conduct are to be evaluated, for example, by discovering the effects of modifying those causes in treatment. The task of this paper is to investigate the relevance of a specific causal process to the dangerous criminal conduct of a definable sub-group of offenders.

Background Observations

The confluence of several separate observations provided a basis for recognizing one subset of dangerous offenders. Each of these observations requires brief comment.

Relevant Functional Neuroanatomy

There is a small area of the old brain, described by Olds and Milner (1954), and Olds and Olds (1965), called the 'drive center'. If separate parts of this area are stimulated electrically, the animal subject responds as though it was experiencing rage, sexual arousal, hunger, satiety, or pleasure-reinforcement. If electrical stimulation of the drive center were to be achieved in ambulatory human subjects, it seems possible that the results might include dangerous or uncontrolled behaviors, that is, acts unregulated by the usual organizing effects of conscious cortical processing. Depending on the location stimulated, the actions might include "blind rages" (assaults, malicious damage?), inappropriate sexual acts (sex offenses?), unexplained over- or under-eating, or escalating violent or addictive behaviors.

There are other centers, relevant to the present study, which lie in close proximity to the "drive center." Some posterior roots of the hypnogenic tract lie in this area; electrical stimulation of these roots might result in disturbed sleep or sleep onsets (black-outs?). Another place in this area, if ablated, interferes with an animal's ability to discriminate visual angle in suitably designed learning tasks; might electrical stimulation of this location also interfere with the accurate perception of visual angle?

Relevant Electrophysiology

Artificial electrical stimulation or ablation of these brain centers in order to observe their effects in human beings would obviously be unacceptable. However, nature and accident have arranged for just such electrical stimulation in some human subjects. These are some of the people who are subject to deep-brain epileptic events. The relative proximity of these functional regions to one another makes it seem possible that seizure events occurring in one of these areas might activate associated disorders from or interfere with other nearby functional areas. That is, it is possible that ictal events activating one area's functions (e.g., the drive center's rage-evoking locus) might spread to involve another nearby area's functions (e.g., interference with perception of visual angle).

In a human subject, if an epileptic event occurs in this region of the old brain, any of the drive-related behaviors mentioned may occur. These non-convulsive and behavioral old-brain epileptic events are referred to as seizure equivalents, paroxysmal behaviors, or partial and complex seizures.

There is a problem in the diagnosis of these deep, old-brain epileptic events. They are not reliably recognizable in a single diagnostic electroencephalogram (EEG). Like any epileptic event, these events occur only periodically. However, unlike in many cortical epilepsies, these events are not readily evoked by photic stimulation, hyperventilation, or other standard procedures used in conventional diagnostic EEGs. In order to diagnose these deep-brain epilepsies, a series of EEGs may have to be undertaken until a paroxysmal event occurs during the time sampled by one of them. The experience of the EEG labs used by the writer has been that verification of these deep-brain epilepsies may require as many as six diagnostic EEGs. Such an effort is cumbersome and costly. But there may be another way to identify people subject to this group of epilepsies.

Relevant Neuropsychology

The Differential Diagnostic Technique (DDT) is a perceptual-motor test developed to provide stimuli which take better advantage of the criteria employed in Hutt's method for scoring the Bender Gestalt than the figures of the latter test. The DDT was created by two Canadian psychologists (Breen & North, 1948) to serve the needs of experiments conducted for their doctoral dissertations. No manual for the test is yet available (but see Weininger, 1986).

The DDT uses twelve compound geometric forms, four of which are comprised of straight-lines (H-figures, fixed visual angles), four of curved-lines (P-figures, constantly changing visual angle), and four of mixed straight- and curved-lines (HP-figures). The reproductions of the three groups of forms are scored, separately (H, P, and

HP) and together (T-total), from figures both copied and reproduced from memory (M, "stress condition"). Scoring weights are assigned for various manifestations of control (retracings, drawing guides, and other evidences of effort at performance accuracy) and loss-of-control (rotations, changes in position of parts, figure shapes, or line types, etc.) in the drawings.

An index of control is calculated for each of the above five (H, P, HP, T, M) groups of figures. Control Indices (CI) are computed by subtracting the sum of the weighted loss-of-control indicators from the sum of the weighted control indicators.

The main index derived from scoring the DDT is called the Differential Index of control (DI), calculated by subtracting the Control Index for the curved-line figures from the Control Index for the straight-line figures. The Differential Index (DI) thus expresses the direction of variation and the relative degree of control achieved in the reproductions of the straight-line as compared to the curved-line figures. The Differential Index (DI) typically varies between -8 and +8. DIs exceeding eight are encountered most often from patients whose psychiatric diagnoses are among the several categories of "psychosis." As might be expected, these patients' Memory ("stress") control indices are typically much poorer than their Total control indices.

An anomalous situation exists when the DI is numerically greater than eight, but the Memory and Total control indices (CI) are nearly equal. One hypothesis to account for some occurrences of this anomaly might be that accidental epileptic stimulation of the old-brain septal region has interfered with the perception of visual angle. In such a case, one might find performances with fixed visual angles (straight-line figures) to be executed less accurately than those concerned with constantly changing visual angle (curved-line figures). This results in high negative DIs without concomitant impairment of memory (stress) performance.

Pilot Study 1: The DDT in Sub-ictal Partial and Complex Seizures

Eight psychiatric patients, who had already been diagnosed as being subject to deep-brain epilepsies following several diagnostic EEGs, were referred for psychological assessment. In all of these cases the scored DDTs displayed a syndrome in which, a) the DI numerically exceeded eight, b) the DI's sign was negative, and c) the Memory CI was essentially equivalent to the Total CI, the anomalous case described in the last paragraph. On the strength of this finding (Quirk, 1967), the hypothesis was formulated that this DDT syndrome might serve as a diagnostic procedure for deep-brain, non-convulsive or behavioral epilepsies.

The next seventy patients encountered who displayed this DDT syndrome received a series of diagnostic EEGs. Within a maximum of six EEGs, all but one were eventually diagnosed by a neurologist as being subject to deep-brain epilepsy. The study was flawed, since no patient who did not show the DDT syndrome was given the series of diagnostic EEGs. Nevertheless, the findings were taken as tentative/partial verification of the DDT syndrome as a diagnostic indicator for a deep-brain epileptic focus, most likely associated with irritative interference in the perception of visual angle, and possibly implicating nearby regions such as the drive center.

Pilot Study 2: The DDT Syndrome and Criminality

DDT tests were administered to 95% of the approximately five hundred annual admissions of offenders to the intake unit of the Ontario Correctional Institute (O.C.I.). The above defined DDT syndrome was found in 40% of fifty of the offenders convicted on a serious arson charge, 30% of sixty offenders convicted of serious assaults, and 24% of fifty offenders convicted of rape. By way of contrast, under 2% of another group of offenders exhibited this DDT syndrome. This other group of offenders was comprised of over two hundred inmates whose offenses were limited to incest, gross indecency, break and enter, theft, fraud, driving offenses, etc. These observations suggest that at least a subset of relatively dangerous criminal offenders can be identified by means of the DDT syndrome (DI < -8 and CIm+4 > CIt) described above.

Pilot Study 3: Modifiability of Criminality

Two biofeedback studies were undertaken using incarcerated offenders displaying the above DDT syndrome. All the inmates in both pilot studies were treated in the manner to be described below. In the first study, 50 of these inmates were treated by other inmates trained for the purpose. In the second study, 106 inmates were treated by trained correctional volunteer workers. In both studies, a) subjects were treated until released, resulting in differing amounts of treatment, and b) subsequent criminal recidivism was obtained from justice system records an average of one year after release from the O.C.I. treatment sentences.

I: In the first study, qualifying subjects transferred or released before treatment was started (n = 5) recidivated at an 80% rate, those receiving minimal treatment (n = 23) at a 35% rate, those receiving moderate amounts of treatment (n = 11) at a 27% rate, and those receiving essentially "complete" treatment (n = 11) at a 9% rate. The results seemed "too good to be true."

II: In the second study, subjects receiving minimal amounts of treatment (n = 44) recidivated at a 55% rate, those receiving medium amounts of treatment (n = 56) at a 43% rate, and those receiving high amounts of treatment (n = 6) at a 17% rate. In this study, treatment of longer-stay inmates, coupled with conditioning inefficiencies due to inconsistent volunteer attendance, resulted in a larger number of sessions. However, this group's recidivism rates seem more believable. These two studies suggested that the relatively dangerous criminality of these DDT-positive (probably subject to deep-brain ictal events) people might be modifiable.

Biofeedback was handled here in a way which differed from that in most conventional biofeedback practice. Instead of providing continuous analog feedback to permit voluntary self-regulation, the attempt was made to establish a new automatic habit of responding, whether or not the subject later wilfully reinstituted the learned behavior. The reason for this variation requires explanation.

To be effective, the to-be-learned physiological behavior to be instituted in the offender subjects would have to be present in a wide variety of life settings and circumstances, and would not be cued by any known or recognizable prodrome (e.g., an aura or pain). It seemed appropriate to arrange for the desired physiological behavior to be reset as a continuous, and hopefully self-strengthening, non-wilful habit. Accordingly, biofeedback was modified to the use of *discontinuous and contingent* (that is, reinforcing, analogous to animal learning) feedback for the desired types of the physiological behavior being monitored.

The purpose of the EEG conditioning was to increase the amount of SMR available to the brain in order to inhibit any epileptic events (Sterman, 1972), especially those evoking strong drives that might give rise to uncontrolled or criminal actions. However, in a few former non-offender patients treated for paroxysmal symptoms with SMR alone, suppression of associated symptoms seemed to have been extinguished following a panic attack. While panic is usually easy to treat, it seemed important to ensure that panic suppression be accomplished for subjects in lock-step with the SMR training. This might be achieved by concomitant use of another procedure.

Stimulus Conditioned Autonomic Response Suppression (SCARS) involves monitoring GSR while the subject views slides (Quirk, 1973). Each slide depicts something else in a category of anxiety stimuli. The slide tray categories available represent a variety of common phobic stimuli, including A-Ambiguity, B-Body boundary permeability, C-Condensation of images, D-Distortion, E-Exhibition, F-Authorities, etc. The slide trays to be used with a subject are selected from responses to a Fears Survey keyed to the available phobic stimuli. The *purposes* of these pictorial slide stimuli are, a) to provide a context for the treatment to foster transfer of the SMR and SCARS training from the lab to life circumstances where panic or anxiety might be most at risk, and b) to afford a visual stimulus which can be *changed discontinuously and contingently* to serve as "reinforcement" for desired GSR behavior.

Three aspects of GSR behavior appear to be differentially related to anxiety (Duffy, 1957), such that anxiety might be susceptible to modification by conditioned elevation of basal skin resistance. 1) Learned increase in basal skin resistance (BSR) might reduce the need for avoidant *defenses* which moderate anxiety and thereby mute the BSR arousal level. 2) Learned elevations of skin resistance (GSR) might compete with tonic downwards responses to stressor agents which appear to relate to *strength* of anxiety or the autonomic nervous system's orienting response. 3) Learned increase in BSR might compress the GSR against its own natural ceiling to moderate GSR variability which is related to anxiety *reactivity* or nervousness. SCARS (Quirk, 1973) is intended to perform these tasks.

The following hypotheses were to be tested:

1. The percentage of SMR activity, as defined, will increase progressively over time and sessions as an indication that the brain is learning to increase its available SMR activity as a new and generalizing habit.

2. Any recordable increase in the defined SMR activity will be followed by changes in the person's subjective state (e.g., resistance to depression, reduced intensity of anger, or improved skill development in reading or arithmetic).

3. Any stable upwards modification of the GSR across sessions will be followed by reduction in subjective anxiety on the part of the subjects.

4. The amount of treatment (number of sessions) received by the test-selected inmate subjects will be inversely related to subsequent criminal recidivism.

5. Any stable upwards modification of the GSR across sessions will be followed by enhanced maintenance of any demonstrable resistance to future criminal recidivism.

Subjects

The Ontario Correctional Institute (O.C.I.) is a 220-bed correctional center where treatment is the correctional program. The O.C.I. serves adult (age > 17 years) males sentenced to less than 2 years of incarceration. Sentenced inmates are sent to the O.C.I. from jails and detention centers if they match selection criteria for treatment assessment, which include:

1) voluntary application for treatment while incarcerated,

2) court recommendation for assessment or treatment,

3) sexual, arson or violent offenses,

4) mental or emotional disorders,

5) complexities of classification (usually substance abusers or inmates whose offenses seem strange or unexplainable).

Although application may be made after the offender has resided on the intake unit for a few weeks, only inmates who apply voluntarily are admitted to a treatment unit from the O.C.I.'s intake unit.

Subject Selection

It is clear from the second pilot study (above) that the DDT syndrome in question is a rare event, even among offenders. In view of the difficulties encountered in predicting any rare event, psychometric lore dictates that a series of successive screening procedures be used to identify members of an atypical group. This dictum was followed in selecting subjects for the present study.

Screen 1: Offender. Only convicted offenders were considered.

Screen 2: Anomalous behavior. Only inmates needing treatment (see above criteria for admission to the O.C.I.) were included.

Screen 3: Related behavior. Only inmates whose histories and/or behavior suggested the possibility of a deep-brain ictal condition were selected for DDT testing for this study. Histories of learning disability, hyperactivity, attention deficit disorder, epilepsy, running away from home, arson, sudden occurrences of property destruction, repeated sexual or physical assault, manifestly sadistic acts, any kind of severe reaction to any particular type of alcoholic beverage, complaints that offensive behavior seemed ego-alien, and/or a subjectively flat or empty chronic depression were noted to justify administration of a DDT. The DDT was administered to inmates passing this screen.

Screen 4: The DDT syndrome. If the DDT's DI was negative and exceeded 8, and if the Memory and Total control indices (CI) were essentially equal, the inmate was offered biofeedback treatment.

The present study used as its subjects all of the O.C.I. treatment-unit inmates who had been selected in the above manner, and who had been released at least six months prior to the point at which follow-up was to be undertaken (N = 77).

Independent and Dependent Measures

The independent variable in the present study is the number of half-hour biofeedback treatment sessions received by each subject. The number of sessions varied widely from 0 to 124, depending on the availability to treatment of the subjects selected. Some were granted parole; some were transferred elsewhere. Some had short and some had long remaining sentences.

The only follow-up information available at the time was whether or not these former inmates had reentered the Ontario justice system's records as charged (here given half-credit for recidivism) or convicted recidivists. Thus their recidivism status served as the dependent variable in the present study. The mean follow-up interval was eighteen months after these former inmates had been released from the O.C.I.

Procedure

Treatment in the SMR-SCARS biofeedback lab at the O.C.I. involved several specific conditions and procedures. Each merits brief comment.

Treatment sessions were one half-hour each, and were held once or twice per week, starting when psychologist time was available, and continuing until the inmate was transferred or released. Sessions were scheduled in fairly tight succession. Consequently, little by way of conversational activity between subject and therapist was possible, or encouraged.

Sensorimotor Rhythm (SMR) training

Based on the writer's understanding of Sterman's (1970) early work in SMR training to treat the epilepsies, contact electrodes were installed near the C3-C4 EEG sites, with a ground electrode installed in the center of the forehead. Bipolar recordings were used since the absolute output of sensorimotor (SMR) activity was not at issue, as it would be in a single diagnostic EEG run. The purpose was to recognize and respond to *any* identifiable SMR activity in the EEG over a series of EEG training sessions.

The EEG signal from the C3-C4 sites was input into an Autogen 120a feedback EEG unit. The EEG signal is digitized by the unit in order to permit fairly accurate, square-wave response to the limits established for feedback. The limits set were 12-14 Hz and 10-30 microvolts. EEG activity below 10 and above 30 μV was excluded to reduce the risk of responding to low-frequency beta or high-frequency alpha, respectively.

The range 12 to 14 Hz was used to represent SMR frequencies. During early sessions, when some subjects were producing very little recognizable SMR, these limits were expanded slightly in the direction of the subject's predominant frequency. These expanded limits were then returned slowly toward the above defined range to "shape" the EEG activity toward the defined SMR range.

The attempt was made to permit the index of learning that was used (% time in SMR, cumulation interval at 1,000 seconds) to be stable and to afford two readings during each session, about half-way through the session and at the end of the half-hour session.

The whistling, frequency-modulated tone was used as standard feedback, unless the subject did not like that sound. The feedback was turned on automatically when the EEG was recording activity in the selected frequency (12-14 Hz) and amplitude (10-30 μV) frame, and turned off when frequency *or* amplitude was outside the defined frame. The feedback was thus *discontinuous* and *contingent*. The sound was interpreted to subjects to mean "good."

Stimulus Conditioned Autonomic Response Suppression (SCARS)

Concomitant treatment of the subjects was undertaken using a GSR conditioning method (Quirk, 1973) called Stimulus Conditioned Autonomic Response Suppression (SCARS). For this purpose, contact electrodermal electrodes were attached, one to the palm and the other to the back of the right hand of all subjects undergoing the biofeedback treatment. The electrodes were connected to a SCARS programming unit. This unit responds to successive 1K ohms increases in skin resistance (GSR) by, a) storing each new GSR value for continuing comparisons, and b) activating slide-change of a projector connected to it. Slide *change* was interpreted to subjects as meaning "good."

Results

The first hypothesis, that the amount of SMR recorded from the C3-C4 sites would increase over training sessions, was confirmed. Although a half-dozen cases showed no appreciable increase in the percentage of time in SMR, all the remaining cases displayed fairly steady increase in SMR output across treatment sessions. Excluding only cases receiving under seven sessions, the mean percent time in SMR for the remaining subjects rose from about 12 (+12, absolute) percent during the first sessions, to about 40 (+20, absolute) percent during the last sessions. It should be noted here that only approximations can be expressed in these figures since the equipment's percent-time meter does not afford precise values.

The second and third hypotheses, that over-sessions increases in SMR activity and BSR level would be followed by changes in reported subjective states, could not be confirmed or rejected. The means by which such reports were recorded were altered during the time when these subjects were being treated. Reports were made spontaneously by many of the earlier-treated subjects. Reports were requested from later-treated subjects on a form using subjective units to rate mood, energy, anger, and anxiety. The rating forms proved awkward for most subjects to use, and their variability outstripped any systematic effects.

The fourth hypothesis, that amount of treatment would be inversely related to criminal recidivism as determined at follow-up, was confirmed ($p < .03$). Table 1 displays the mean follow-up interval and the rates of recidivism in subject groups formed according to the number of treatment sessions received. Table 1 shows that 65% of those subjects who received 0 to 4 treatment sessions had been convicted of further offenses within one-and-a-half years after they were released. It shows that only 20% of those who had received 34 or more sessions had been convicted of further offenses during the same follow-up interval.

The fifth hypothesis cannot be confirmed or rejected in the present data. All subjects treated received both the SMR and the SCARS components. Thus, it is not possible to discover from these data whether the GSR conditioning had a special role in maintaining the therapeutic benefits attendant upon the SMR treatment.

Discussion

The present study was intended to replicate two pilot studies in which major effects were found on criminal recidivism from the same composite biofeedback treatment program using concomitant EEG-SMR and GSR-SCARS conditioning. In spite of a weak design, the present results are more than a little encouraging. They seem to justify the conclusions that this type of biofeedback program can reduce criminal recidivism among a group of offenders prone to dangerous or physically damaging offenses, and that it may serve to modify subjective distress at the same time.

The GSR conditioning procedure, although reassuring to this clinician, introduced some unmanageable features into the present study. First, the often-noted problem with initial values was certainly encountered in processing the GSR data. Second, the relationship between basal skin resistance levels and subjects' clinical and subjective states is clearly non-linear in this study, as in previous studies with the same procedure. That is, although the BSR increased during and between sessions at first, in addition to periodically occurring negative GSR slopes, its ceiling tended to decline in later sessions. Clinical improvement seemed to occur as the GSR baseline and ceiling descended to moderately low ranges, roughly 100K to 300K. Third, unlike the benefits from the SMR training, the anxiety reduction which appears to be attendant upon GSR training tended to be delayed, perhaps until the learning effected could be consolidated in the general personality. Fourth, inadequate forethought did not provide for groups treated with the SMR and GSR procedures separately, nor for reliable monitoring of associated subjective states. One result was that the independent facilitative contributions of each method could not be evaluated.

At the same time, the verbal reports given across sessions justify the belief that the hypotheses about subjective changes might be capable of confirmation in a tighter study. Nearly all the subjects reported a lift in mood and some improved control over angry feelings between the third and ninth treatment sessions. This phenomenon had not been observed in non-offender patients treated in the past by means of SCARS alone. Consequently, this effect is attributed tentatively to the SMR component. A few subjects who received twenty or more sessions, and who were also taking a literacy course, reported that they seemed to be learning the material more quickly and easily. And subjects did tend to report reduced anxiety over the course of the treatment.

Table 1
Recidivism rates in offender groups based on number of biofeedback treatment sessions received.

Number Sessions Half-Hour Each	N	Mean Age	Follow-up Mean Months	Recidivism Rates Number and Percent
0 - 4	17	25	16 months	N=11 65%
5 - 10	17	24	20 months	N=8 47%
11 - 16	15	23	19 months	N=6 40%
17 - 33	18	24	17 months	N=7 39%
34 or more	10	24	18 months	N=2 20%

However, reports of anxiety modification were not linearly related to GSR increases, and they tended not to occur until after session sixteen. Even then, the reports did not indicate complete or extensive anxiety reduction. Only those few subjects receiving more than thirty-five sessions seemed satisfied with the extinction of their anxiety.

The present study has several other manifest weaknesses. First, the costs involved prevented subject selection from being based on a complete diagnostic assessment, including diagnostic EEGs, C.A.T. scans, neuropsychologicals, and the like. Second, the equipment employed permitted only rough values to be recorded in order to estimate factors such as learning gradients for either the EEG or the GSR. Third, limited therapist time resulted in less than ideal provisions for treating subjects. Fourth, it would have been nice to be able to use yoked control subjects. Fifth, it would have been desirable to control for the length of stay at the O.C.I. to discover whether other generic forms of treatment had any catalytic effect on the results. Sixth, more detailed information about subsequent offenses from justice system records would have been helpful. Seventh, the methods for monitoring participants' subjective states were far from adequate. The weak monitoring methods used made meaningful evaluation of three out of five experimental hypotheses impossible.

Research is needed which addresses all of these limitations. Some of the deficiencies in the present study have been addressed in an ongoing replication. However, in particular, satisfactory subjective monitoring methods require more attention. The lack of satisfactory means to monitor therapeutic change as it is occurring is a thorny issue which has impaired evaluation of psychotherapy of all types. One of the problems encountered in long-term studies is that improved methods may emerge while studies are in progress. When a new (especially if superior) method comes along, it is hard to retain unmodified the original methods of data collection in order to maintain consistency for research purposes. This mistake was made in the present study in seeking to improve the methods used to monitor subjective states during data collection.

Another weakness of the present study was that no record was kept of other treatments received by its subjects, or of the length of time they were residents in treatment at the O.C.I. It remains possible that the low recidivism subjects might have served more time at the O.C.I. or received more treatment services than the high recidivism ones. This possibility cannot be assessed in the present study. However, gross duration of stay at the O.C.I. was not relevant to therapeutic effects on test measures or recidivism rates in two unrelated studies of experimental therapy programs targeting criminality (Reynolds & Quirk, 1995), and drug and alcohol addictions (Quirk, 1995).

One strength of this study is that its data permit the costs and savings involved in the treatment to be computed. Using half-hour treatment sessions, it ought to be possible for a full-time technician to treat as many as 20 or more inmates at a time (or more than 50 per year), with each inmate receiving two or three sessions per week. It is easy to calculate the costs of supporting one technician and the relatively inexpensive and robust equipment involved. On the other side, it should be fairly easy to estimate the savings involved in police detection, court prosecution, loss of property (from insurance), incarceration (from per diem), social security support of families while a bread-winner is in prison, treatment for victims, and the like. It would then be easy to compute the number of subjects prevented from future criminal recidivism from the percentage of the number treated who would, but do not, recidivate (e.g., 65% - 20% = 45%), presumably adding some part of that same number for those "saved" during succeeding years. From this study's figures, the savings from one such laboratory were roughly estimated to exceed 1.5 million dollars annually.

Moreover, as Pilot Study 2 implied, it seems clear that offenders exhibiting the described DDT syndrome are prone to offenses which are unexplainable, bereft of ordinary self-control, or potentially very dangerous to the persons of others. In this respect, the savings are inestimable. Indeed, although not yet specifically documented, it is the writer's impression that, among offenders generally (see Pilot Study 2), this DDT syndrome is associated with disproportionately high rates of rape and murder.

The results of the present study seem to warrant at least the preliminary conclusion that a sub-group of dangerous offenders can be identified, understood and successfully treated using this kind of composite biofeedback conditioning program.

Summary

Seventy-seven incarcerates were enrolled in a composite biofeedback treatment program. All of these men were offenders, and were considered to be troubled people,whose histories and/or correctional behavior conformed to a series of criteria for irritative brain, and whose perceptual-motor test behavior warranted the conclusion that they were subject to a deep-brain ictal disorder. The biofeedback treatment involved concomitant conditioning of increases in both sensorimotor rhythm (SMR) in the EEG and galvanic skin resistance (GSR). The subjects varied in the amount of treatment, the number of half-hour treatment sessions they received. Their status was evaluated for criminal recidivism an average of eighteen months following release from the sentences during which they were treated. Their criminal recidivism varied in inverse proportion to the amount of treatment they received. Those who received essentially no biofeedback treatment were convicted of subsequent offenses in 65% of the cases, and those who received essentially complete treatment were subsequently convicted of offenses in 20% of the cases. In addition to the strengths of the studies reported, their weaknesses, over-sights, and limitations (some addressed in an on-going replication) were identified.

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Doug Quirk is a psychologist who has employed biofeedback as an element in his treatment strategies for patients since 1959. He began working in GSR conditioning with a large number of schizophrenics. When Kamiya reported on Alpha enhancement, Doug tried it with epilectics, but gave that up quickly. Later, he used Sterman's SMR method with several hundred epilectics. He has used conditioning of skin temperature with migraines and hypertension, of EMG with major tics, and of phallometric responses with some sex anomalies. He has worked in hospitals, mental health practices, and, for the last twenty years, in a correctional center in which treatment is the primary correctional program. The work reported here was undertaken in this latter setting. Given another century or two, he thinks he might manage to get bored with psychology.

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