THE DEVELOPMENT OF STIMULUS CONDITIONED AUTONOMIC SUPPRESSION (SCARS)

D.A. Quirk and George von Hilsheimer

In 1962 Douglas A. Quirk, a Canadian psychologist, was placed in complete charge of the therapy of 150 women who had been in the Queen Street Psychiatric Hospital for an average of 9 years. A panel of psychiatrists diagnosed these women as schizophrenic and judged that the patients could be placed on a behavioral ward without medication for at least 3 months. Biofeedback training did not begin until the patient had been drug-free for at least two weeks. The behavior ward clients had been hospitalized from 4 to 45 years, for an average of 9 years. Two of these clients had been lobotomized.

Quirk visited the Green Valley School and Hospital in Florida for the first time in 1962 and Doug entered into a mutual consultative role with its superintendent, George von Hilsheimer which lasted until Quirk died in December 1997.

RECIPROCAL INHIBITION THERAPY

Wolpe (1958) gave a week long course on Reciprocal Inhibition Therapy (RIT) in Toronto in 1962 which Doug Quirk attended. Even though Wolpe reported that psychotic patients did not do well with RIT Doug's patients enjoyed modestly good results when Quirk applied Wolpe's method.

Doug learned that many if not most of his schizophrenics could not visualize. Quirk reported that if his psychotic clients did visualize that it was in such a bizarre manner that they became hyperanxious. For example, when Quirk asked one patient to visualize going up in an elevator she saw herself hanging on by one hand to a razor-like bar on the bottom of the elevator and flying up through the roof of the skyscraper.

Schizophrenics also had probems relaxing. Often the patient's hands would remain up in the air when Doug checked to see if the client had relaxed. These hypnogogically catatonic responses were fairly common among Doug's schizophrenics.

Another problem was that schizophrenic patients had difficulty reporting subjective units of distress (SUBUDS). It was as if asking the question, "how much does this bother you?" bothered them. Even when they weren't bothered the clients could not decide.

GALVANIC SKIN RESISTANCE AND REFLEX

Von Hilsheimer suggested to Quirk that he use the galvanic skin response (GSR) to monitor SUBUDS and Quirk demonstrated that the GSR was a reliable and valid method of monitoring felt stress (Quirk, 1960; Fenz & Epstein, 1965, 1967).

The GSR and BSR of schizophrenics is not like that of normal folk. The schizophrenic basal skin resistance (BSR) is markedly higher than that of normal controls. The GSR

movement in schizophrenics is remarkably more variant and brittle than in normal subjects (Mednick, 1958, 1966).

Bleuler remarked (in Dementia Praecox as early as 1911) that the GSR of schizophrenics were severely different from that of normal individuals. Jung and Veraguth (ibid) described the patients as falling into a bimodal distribution; schizophrenics demonstrated extremely high BSR values, especially when they were acutely ill; but catatonics had significantly low BSR values. Recently Asberger (1998) has shown that rapid change in the skin conductance response is predictive for suicide.

Von Hilsheimer also suggested to Quirk that he replace the usual verbal hierarchy of stressors used in Wolpe's RIT and use picture slides of subjects familiar to the clients. Von Hilsheimer considered that the work of Mary Cover Jones was not only earlier than Wolpe (Jones, 1924, 1930 and in Watson, 1924); but that her work was also superior to that of Wolpe in that her desensitization of phobic subjects in situ and by use of mental imagery engaged the imagination of subjects more vividly than did Wolpe's dry and abstract verbal formulations.

Quirk created a library of slides which ranged from innocuous to distressing in thirty or so categories (Benton & Mefford, 1967). Von Hilsheimer suggested that immobility be substituted for the relaxation instructions in RIT and designed a light sensor which caused a loud signal to go off if the subject moved during a session (Rachman, 1968). This added an escape contingency to the RIT routine. Doug projected a picture on the screen, the skin resistance would drop and when the GSR recovered he would change the slide. This procedure was easily automated.

Quirk thought that what the client was doing was habituating, but Von Hilsheimer argued with him that we were contingently reinforcing the increase in skin resistance (Gavalas, 1967; Kimmel & Hill, 1960). Quirk agreed and then we altered the basis for changing the slide. Instead of changing the slide when the client's BSR had made a recovery to the value of resistance at the time the slide first came on (the so-called basal level) we changed the slide when there had been an increase to a value greater than the basal level. With schizophrenics we changed the picture at the instant the client had given us a rise of 1000 Ohms of resistance. We immediately observed that when we shaped the BSR higher than the basal level the clients got better more quickly than when we changed the picture for simple recovery to the base line. (See Lazarus, 1961; Lang & Lazovik, 1963; Land, Lazovik & Reynolds, 1965; Van Twyver & Kimmel, 1966.)

STIMULUS CONDITIONED AUTONOMIC RESPONSE SUPPRESSION (SCARS)

Quirk named the method of automated slide change responding to an increase of Ohms of skin resistance the Stimulus Conditioned Autonomic Response Suppression (SCARS). Quirk and von Hilsheimer were continually arguing over Quirk's love of alphabet soup, but in deference to his memory the pesky things are left in the text.

SCARS training began with temperature training of the hand. We trained temperature not

only for its direct effect on the CNS; but also in order to establish a model of biofeedback which the client could readily understand. The client continued to train her temperature until the client was able to raise her temperature to 96 degrees Fahrenheit within 10 minutes. The thermister was taped to the base of the index finger of the right hand. Temperature training was given at every single training session. We considered that temperature training was essential for establishing in the client a sense that the client was in control of her own body.

The GSR training started in the third session after the first introduction to temperature training. GSR training continued until the psychologist discharged the client or concluded that the client was not going to respond to the training. In our subsequent work the modal number of sessions was 40, which was close to the average number of 42 sessions. Because of the settings, a psychiatric hospital, and a prison, there was very little variation in number of sessions. Failure to attend the training session rarely occured.

We used Yellow Springs Instrument Company cup electrodes (filled with electrojelly to reduce transient effects of humidity, etc) which were placed on the palm and on the back of the non-handed hand. The GSR device was an an industrial quality Systron-Donner Multimeter which signalled the value of the skin resistance by large red light emitting diode figures.

All of the SCARS sessions were delivered by briefly oriented psychologically naive volunteers, mostly drawn from the unemployment compensation pool in Toronto.

RESULTS OF TRAINING BY SCARS

Quirk considered that 142 of the clients trained using SCARS could be discharged and the supervisory panel of psychiatrists agreed to discharge 128 of the 150 clients who had been transferred to the behavior modification ward and received SCARS training. Training failed to help seven of these women and one became worse after an event before training started on the behavior ward and this unfortunate soul never was trained. Both of the patients who had lobotomies were discharged as significantly improved.

Two years after discharge 123 women remained free of psychotropic medication; and had had no further training . These 123 women were living independently, and they were managing their own life-business. Social workers considered that these women enjoyed a "good quality of life". One woman had chosen to enter into outpatient psychotherapy and is carried as a failure. Four women had returned to hospital, and none of these four were one of the two patients who had experienced lobotomies.

CONCLUSIONS DRAWN FROM THE SCARS STUDY

As early as 1971 we had given a substantial demonstration that temperature and GSR biofeedback provides a robust method of training for severely ill clients whose disorders have left them chronically hospitalized.

Quirk did not wish to say that we had "proved" that SCARS does anything, except that it does not harm any patient. Von Hilsheimer, from his more prosaic perch in the real world of caring for patients without enough time, personnel or money to do the job well is quite happy to suggest that anyone with a lot of sick folk on his hands and little money, time, or help, might do much worse than to apply SCARS and to see what happens.

Von predicts that a happy outcome will result.

It should be remarked that the Queen Street Hospital in Toronto did not continue to use the SCARS method after Quirk left the hospital to work at the Clarke Psychiatric Institute in Toronto.

ICTAL AND SUBICTAL DYSFUNCTION

Two of Quirk's professors, North and Breen, liked a method of scoring the Bender-Gestalt published in a book by Hutt. However, the Bender figures weren't really adaptable to the Hutt method. North and Breen created new figures and called the test the Diagnostic Differential Test (DDT). Quirk took a course in administering the DDT and became expert at its interpretation.

A series of fortuitious events caused Quirk to suspect that individuals who had a good capacity for reproducing curved figures, but poor capacity for drawing angular figures suffered epileptiform activity in the diencephalon. Quirk reviewed his charts and discovered 70 clients who demonstrated this DDT evidence of inability to analyze and reproduce angles, but good capacity at drawing curves. All of these DDT identified subjects were diagnosed as epileptic by a neurologist who was blind to the DDT evaluation. All but one of the 70 produced typical seizure spindles on the EEG. Twenty-five per cent of the clients with a positive DDT sign had visible anomalies of the templar lobe structure on a CAT scan.[1]

When we later analyzed 10,000 reports[2] of Quirk's DDT analyses on felons Quirk noted that 40% of arsonists, 30% of assaultists, and 26% of rapists demonstrated the epileptiform sign on the DDT. We trained 2776 DDT positive imprisoned felons with

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[1] Quirk's insight that a great deal of maladaptive behavior might be epileptoid was reinforced by Jonas in ICTAL AND SUBICTAL NEUROSES, and by Alvarez in NERVES IN COLLISION.

Alvarez wrote an introduction of Brent Campbell's book, FOOD ALLERGY, in which he recounted that he himself had experienced a grand mal seizure after gobbling down a whole roasted chicken. Alvarez had lost his food over a cliff when he had been mountain climbing and when he returned to the base, famished, he had just seized a roasted chicken and bolted it down. Shortly thereafter he suffered a grand mal seizure - the only such event in his life.

Alvarez consequently stopped his family habit of a big chicken dinner on Sundays. He recorded that his Monday morning "blahs" disappeared with the chicken. We agreed with Alvarez and considered that Monday morning "blahs" and more might be a function of epileptiform brain activity.

[2] At the Ontario Correctional Institute, Quirk tested, evaluated and created training plans for about 500 new inmates every year. 10,000 men passed through his hands during his 20 or so years at the OCI.

temperature, SCARS and EEG biofeedback. The results of that treatment are reported below.

ELECTROENCEPHALOGRAM

Lord Adrian had set out to debunk Berger's discovery of the electroencephalogram, but he became convinced by the evidence and at the very opening of the century was feeding back EEG as sound and light. IN THE 1940's Shagass demonstrated that the EEG could be shaped by contingent reinforcement, and in the 60's Kamiya demonstrated that feedback of the EEG signal resulted in shaping of the EEG amplitude in selected frequencies. Kamiya had definitely proved that EEG activity is just another behavior subject to the laws of the conditional reflex and learning just like any other behavior.

Barbara Brown aggressively pursued this learning and became internationally famous for her insights and direction resulting in wide use of EEG biofeedback devices. Tim Scully, founder of Aquarius Electronics, became the first manufacturer of commercially available biofeedback works with a focus on the EEG.

The use of thermal training for the relief of headache and other purposes was been developed by Elmer & Alyce Green and by Ed Taub around the same time - early to mid 1960s.

EARLY BEHAVIORAL TACTICS

It may be remarked that positive reinforcement and punishment accurately delivered are forms of biofeedback. Although reward/ punishment is not continuous nor necessarily proportional they are presumably contingent upon the biological activity of the subject.

O. Hobart Mowrer, invented the alarm that goes off when the child wets the bed. This was one of the first biofeedback devices! Whether sold by Sears as a Wee Alert or by Von Hilsheimer as a Tinkle Bell, the device sent a signal to alert a brain unconsciously emitting an unwanted behavior. Since Mowrer's device actually dumped the poor enuretic out of bed, it worked quite well. The loud ringing bell may not have been an elegant continual signal, but the Tinkle Bell and its cousins really worked. Psychotherapy didn't dry beds but aversive biofeedback kept them dry. I have been told that Benjamin Franklin created a device which threw a bedwetter out of bed and must be give credit for this invention.

BARRY STERMAN AND THE EEG

Quirk went to a meeting in Boston in 1970 and heard Barry Sterman talk about his work with cats and with human epileptics. Sterman had been working with the effects of hydrazine, a jet fuel, which causes seizures in cats and humans. Since it was more ethical to provoke seizures in cats than in human beings Sterman was injecting cats with hydrazine which reliably causes seizures at some level. Sterman had discovered a group of cats in which hydrazine did not provoke seizures. Sterman found that he had earlier trained these cats to produce higher amplitude of 13 Hz in electrodes placed on each

hemiphere of the head over the Rolandic fissure. When he trained humans in the same manner he found they became seizure resistant and that those individuals who already had a seizure disorder before the EEG training no longer had the disorder after EEG training.

QUIRK'S STERMAN PROTOCOL FOR EEG TRAINING

Doug had lunch with Barry in 1970 and on his recommendation bought an Autogen 120a EEG feedback device. Quirk immediately telephoned me and I obtained one of the devices as well. The Autogen 120a differs from devices available in 2001 in that feedback is delivered by either a "shhhh" sounding white noise (or a mosqito-like = buzz) and by movement of needles on meters. One needle demonstrates the dominant or strongest frequency, and another the amplitude of the signal. The device is controlled by verniers (knobss which are infinitely adjustable between 0 and 100 uV, and between 0 and 20 Hertz frequency).

Quirk established a routine where he placed the ground in the center of the forehead and the two active electrodes at C-3 and C-4 (1/3 of the way up from the center of the ear-hole on a line to the opposite ear hole, C-3 on the left, C-4 on the right). He then fixed the amplitude at 10 to 30 uV. Quirk fixed the amplitude in this manner to exclude the artifacts of high amplitude bursts from slow wave activity. The Autogen EEG itself delivers a signal supporting immobility. Frequency was shaped down from 10 to 16 Hertz until 50% of the activity was demonstrated at 12-14 Hertz.

CRIMINALS IN JAIL

Quirk first completed two pilot studies evaluating the effect of SCARS and EEG training on the recidivism among OCI felons who had been discharged. He compared two sets of 55 pairs of high risk felons half of whom were trained and half received only counseling. These violent felons demonstrated the subictal pattern on the DDT and on the EEG. The felons were trained by SCARS administered by volunteers, and an average of 33.5 sessions of the EEG method described by Sterman which were also delivered by volunteers.

The felons' records were examined at two years after Quirk's initial study of 55 pairs, and two years after the second study of another 110 felons. Forty per cent of the trained felons had been rearrested, compared to 80% of the matched felons who received only counseling. In other words, 60% of the biofeedback trained felons were still free, while only 20% of the untrained felons had managed to remain free.

We completed a third study on 150 more felons trained by the same method of SCARS, including temperature training, and SMR EEG, matched with felons who had received counseling and no biofeedback training. The recidivism data on these 300 men was equally compelling: counseling had essentially no effect while three times as many of the biofeedback trained felons were outside prison as those who received only counseling.

An intriguing finding is that recidivism within this group is a function of the number of training sessions. Half as many felons who were trained for 16 sessions were successful at remaining out of jail as were those who received 32 sessions. There is some effect of training even in a few training sessions.

UNTIL HIS RETIREMENT IN 1995 Quirk trained 2776 incarcerated felons using SCARS training, and Quirk's Sterman protocol of EEG training.

In a preliminary write-up of one study of the effects of this treatment, it was reported that "Our outcome studies show that the overall recidivism rates for inmates incarcerated at the O.C.I. tend to run about 17% below the 65% recidivism rates of inmates who serve their sentences in other correctional facilities.[3] That the present study's subjects are relatively high at risk for recidivism (and dangerous acts) can be seen in the present untreated base-rate [65%] in spite of the fact that the inmates served their time at the O.C.I." Nevertheless, 65% of those subjects who received 0 to 4 treatment sessions had been convicted of further offenses within about a year and a half after they were released, while only 20% of those who had received 34 or more sessions had been convicted of further offenses during the same follow-up interval.

It should be remarked as well, that as a result of selecting criminals for the epileptiform EEG activity the criminals who were trained by Quirk's Sterman protocol at OCI were the most dangerous and violent of the prison population. They included child molesters, assaultists, murderers, rapists and other explosive types and were multiple offenders with multiple returns to prison.

Moreover, when we examined our private practice files, we found a similar pattern of productivity. Von Hilsheimer has dedicated his career to "treating the untreatable" and in the last decade to training those boys whose attention deficit disorder with hyperactivity is a prodrome for a career of criminality and mental illness. Quirk privately saw a substantial number of felons who had not been at the OCI but who were at high risk for dangerous behavior. Despite the substantial difference in our populations, we maintained a success rate of approximately 85% for all individuals who entered our offices and returned at least twenty times.

We were particularly impressed with the power of the multimodal biofeedback method in cases where we were not successful in completely restoring function after traumatic brain injury (TBI). Despite the persistence of substantial deficits these TBI clients demonstrated

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Given that recidivism in the general population of prisoners in North American is characteristically regarded as high ((Alter and colleagues (1997) rely on five reports to range the rates from 41 to 76%, while the range in Beck and Shipley is 42% to 78% in 11 states and Wallerstedt has it as low as 24% to 44% in 23 states – see Alter et al, 1997; Beck & Shipley, 1987; Wallerstedt, 1984; Langan, 1994. It must be said that the data on recidivism are variable, unreliable and puzzling; however, Langan (1994) is conclusive in saying that there is no good evidence in favor of probation or imprisonment or for one program or another in reducing recidivism)), it does appear that the results of the above study at least suggest that the combination of temperature, GSR and EEG training should be vigorously examined.

a marked reduction of complaint in general, and of anxiety, depression and inattention. On the whole, it seems reasonable and ethical to suggest to any client that a course of EEG biofeedback, enhanced by GSR and temperature training, will have substantially positive results globally increasing well being and competence.

SUMMARY

In the course of a long career Douglas A. Quirk in collaboration with George von Hilsheimer demonstrated the power of precise applications of biofeedback upon populations in which common practice has limited success. Prisoners notoriously become worse in correctional institutions. It is a cliche that we are very good at making seriously criminal adults out of mildly delinquent juveniles. Moreover, there is a general agreement that we are unable to do anything positive with schizophrenics other than to put them into a chemical straightjacket or to allow them to age out of their disease.

Our insight that schizophrenics and criminals may be deficient in imagination, or oversupplied with frightening paranoid visions caused Quirk to standardize a method of presenting graded trauma to clients; viz. the library of slide projected pictures used in SCARS. Monitoring arousal through the venerable and well researched GSR permits a precise and useful amelioration of the effects of stress. Temperature training provides a ready response to biofeedback training not only in the reduction of headache and an increase of relaxation. Finally, applying Sterman's work with epileptics to a population demonstrating evidence of sub-ictal deficits resulted in a quantum leap in the effectiveness of correctional programs.

In carefully controlled work with two groups of 55 pairs of violent young prisoners and a subsequent study of 150 pairs followed by a 25 year experience with 2776 predictably violent felons we were able to demonstrate that it is possible to reduce recidivism in a good program in an excellent correctional institution by using relatively inexpensive techniques applied by briefly oriented volunteer workers.

The GSR is somewhat more interesting than temperature. There is good evidence that GSR is a measure of some process which is central to psychopathology. Our work suggests that normalizing the GSR may result in normalizing the perception, emotion and behavior of severely ill individuals. It is abundantly evident that brain dysfunctions which derange the normal electrical activity measured on the skin are serious in their consequences. When we normalized electrical signals by using GSR biofeedback patients' perceptions, feelings and behaviors quickly normalized and improved. Over the course of a 35 year association Quirk and von Hilsheimer demonstrated that the use of simple biofeedback protocols, using relatively inexpensive equipment, and employing unpaid briefly oriented volunteers as technicians, was followed by a significant increase in the independence, freedom, and quality of life, not only for psychiatric patients, but also for felons and especially for their potential victims.

Douglas A. Quirk*

George von Hilsheimer

*D.A.Quirk died 3 Dec 1997 but completed three drafts of this paper before his death. George von Hilsheimer is responsible for the final form of the paper.

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