Behavior analysis of epilepsy: conditioning mechanisms, behavior technology and the contribution of ACT. Let us gird up the loins, sow dragon's teeth, and move forward.

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Early documentation of conditioning used to stop seizures

Among the earliest medical documentations of epileptic seizures we find stories of conditioning mechanisms and how they can be used to control seizures. Already in ancient Greek medicine, Galen, describes seizures as a process or predicable chain of behavior that can be interrupted by different stimulation to the body (Temkin, 1945). Much later, the British Neurologist Gowers (1881) is the first to classify epilepsy: grand mal, petit mal, and hysteroid and he publishes case studies where behavioral techniques are applied and successfully stop seizures. Epileptic seizure behavior is carefully documented and treatment interventions entail different ways of stimulating around the area of the seizure start. Both specific and general stimulation are described. In one example a specific stimuli like pressure is put on the hand where the seizure starts and in other more general, strong smells are used to evoke a general arousal contingent on seizure start. A French physician/physiologist presents a review of cases studies (Brown-Sequard, 1858) also demonstrating how seizures can be successfully aborted by the use of stimulating contingent on seizure start. Documentation of these behavioral interventions continues into the 19th century with a renown epileptologist, Jackson, who describes certain seizures as a "march" throughout the body and how it is brought to a halt by vigorous rubbing of that affect limb (Jackson, 1931).

From these early studies the principle of competitive recruitment evolves. At this point, based on clinical observations, the assumption is that by localizing hyper excitable brain areas, competitive recruitment stimulated in relatively normal brain areas will increase normal activity and reduce synchronization and prevent seizures. In other words, if you can identify an early link in the chain

of seizure behavior, and either apply stimulation around that area or initiate a "general arousal" you are likely to stop the seizure.

Drug industry, a sort of Aaron's serpent, provides what looks like a chemical solution; conditioning and behavioral know-how gets lost by the wayside

At the turn of the century, the drug industry enters the scene with the promise of a chemical solution to stop seizures. Antiepileptic drug treatment (AED) is based on the pathology model. Seizures are seen as the behavioral manifestation of an underlying temporary aberration of electrical activity. Causes of this organic dysfunction are usually attributed to improper alterations in neurotransmitter function or the dynamics of membrane ionic currents.
One-way causation between pathology and symptom is assumed and no consideration to conditioning in terms of precipitory or inhibiting factors is implied.

In behavioral terms, the seizure is seen as an unconditioned response to a group of "out of control" neurons that now and again for some reason get rowdy and recruit any willing neighbor neurons in sight and cause bedlam.

Anticonvulsant drugs, turns out to be a lucrative affair for the multinational drug industries and they, in turn, generously get involved with the medical education and conferences spreading information about AED as the treatment of choice for epilepsy. The general principle of AED's is to generally reduce neuronal brain activity, making the spread of epileptogenic activity less likely. None of the AED's produced thus far have any specific effect on the epileptogenic neurons causing the seizures but rather, slow down all brain cell reactivity. The drugs developed throughout the 20th century do, indeed, reduce seizure frequency for most people with epilepsy. Not all but about 67 percent of persons with epilepsy using anticonvulsants attain seizure freedom. Not, however, without a cost

In a review by Loring and Meador (2001) the effects of AED's on cognitive and behavior is significant. They report that the most common AED cognitive effects include psychomotor slowing,

reduced vigilance and impairments in memory. Phenobarbital and benzodiazepines showed the most aversive cognitive effects. The most commonly used AEDs carbamazepine,
phenytoin and valproate showed adverse effects influencing psychomotor speed, memory and mood. The AEDs produced in the last decade like Gabapetin, Lamotrigine, levetracetam, Oxcarbazepine, Tiagabine and Topirmate may have fewer effects but no long term follow-ups have yet been done. Loring and Meador conclude that patients report that quality of life is more adversely affected by the side effects of the AED's than of seizure frequency.

So what looked the solution to seizure control turned out to be a significant contribution to the puzzle but is far from the answer? And the cheap simple, free of side effects behavioral treatments are at best a curiosa from the past.

On a more personal side, many of the clients I worked with who were developmentally disabled were better off with an occasional seizure than the dulling effects of poly drug therapy commonly used for this group. Most of my clients felt their sense of integrity erode from the side effects of memory loss and weight gain. Most were left mentally and emotionally foggy and slow. While these are not life threatening, they do undermine a sense of confidence and competence. Life quality is reduced. The neurologist Oliver Sacks (1992) sums up the use of these drugs in a personal account. "The surgeon cannot tolerate the drugs that would reduce his symptoms of uncontrollable movement and gestures because they reduce him as well so that he no longer feels fully himself".

Everyone doesn't worship the golden calf.
Dissatisfaction is weathered.

Epileptologists around the world raise their voices in protest against the over simplistic pathological model and the sole use of antiepileptic drugs as the treatment of choice. The main arguments against, is that the medical model doesn't explain the peculiar patterns of seizure behavior, how they are triggered and how they are inhibited. Complaints regarding the antiepileptic drugs concern the

new problems they create. In addition, there are considerable theoretical inconsistencies regarding the lack of correlation between the pathology and the presenting symptoms.

Already, in 1968, Rodin, an epileptologist criticizes the pathological model and the associated medical research as being too simplistic and inadequate. “The great majority of neurochemical investigations still deal with the epileptic neuron. These are important studies but they are likely to be insufficient in providing the final answer to the problem. One should also ask, what are the factors responsible for the spread of abnormal electrical activity in this particular patient. Even more important would be the question, how does the patient’s condition differ on the five days of the week when he is seizure free from the 6th day when he has an attack” (Rodin, 1968, p 343). In 1989, Engel, makes an appeal for alternatives: “Epileptologists have relied heavily on pharmacological therapy, which is us is usually nonspecific and associated with disturbing side effects. Both basic and clinical research should focus on improving present alternative therapeutic approaches and finding new ones that may interfere more directly with precipitating and predisposing factors to prevent epileptic seizures without producing additional symptoms” (Engel, 1989, p)

Pediatric neurologists (Kuhn, Allen & Shiver, 1995) publish guidelines for primary care physicians treating children called “Behavioral Management of children’s seizure activity” where behavioral interventions are outlined as a viable alternative or compliment to drugs. Clearly, physicians have been aware of conditioning factors and open to behavioral treatment as a compliment or alternative to anticonvulsant drugs.

Theoretical problems with the pathology model show up in the discrepancies pertaining to causal effects. Seizures are proposed to be secondary or “caused” by repeated abnormal electrical discharges from the neural aggregates in the brain. The behavior of the seizure would, accordingly, be characterized depending on the location of the “epileptic focus” in the brain as well as the extent of the spread of the neuronal discharges over the cortex. One of the difficulties is that in as

many as 70% of cases of epilepsy, the etiology of the seizure symptoms remains unknown (Ross 1994). In addition, a significant percent of the "normal" population with no seizures, display epileptogenic activity on the EEG. There are seizures presented with no epileptogenic correlate visible on the EEG. Clearly, the evidence does not support a one-to-one correlation or causal relationship between the pathology of the "epileptic neuron" and seizure occurrence. The known pathology of the epileptogenic neurons set the stage for epilepsy but does not cause them to occur. In order to understand eliciting and inhibitory mechanisms of the epileptic seizures, conditioning must be understood.

The fat is in the fire. Animal behavior researchers present conditioning mechanisms in epilepsy and there is a first in human application.

The conditioning process of how epileptogenic activity is spread and interrupted is described between 1940-1950 by behavioral scientists studying animals (Eriksson, 1940; Gelhorn, 1947 Leao, 1944a, 1944b, 1947; McCulloch, 1949). These studies illustrate how epileptogenic discharges can be interrupted systematically through the use of contingent stimulation of different sorts.
By 1957, a case study is published by Efron, (1957) showing how seizures are arrested using second order conditioning of an olfactory stimulus to a bracelet and finally, just thinking about a bracelet to arrest an ongoing seizure. Efron, a behavioral clinician is treating an internationally known jazz singer who has seizures on stage while performing and is desperate for help to control them. He analyses the chain of her seizure behavior and sees that seizures are triggered by an increase in cortical activity as she winds up to perform. He introduces the idea of competing response knowing that the singer associates the smell of jasmine with calmness. Efron's idea is to break the chain of increased excitation triggering the seizure and introduce a "calming" competing response. The woman practices smelling her jasmine scent contingent upon any sign of seizure start and immediately the seizures subside. Efron goes further and conditions the smell of jasmine to a bracelet and finally to the thought of a bracelet. Following this training, the singer is able to perform by simply thinking about her

smell, counteracting any seizure start. This classical study marks the beginning of the use of conditioning procedures in the understanding and treatment of people suffering from epilepsy in this century.

A quiet revolution: what looked like an unconditioned response, the reflex seizure, turns out to be a conditioned response and is de-conditioned through exposure.

The technology of the EEG labs enables new breakthroughs in the understanding of the conditioning mechanisms. Forster, a neurologist spends more than three decade mapping out the process of conditioning and evaluating the habituating process of reflex seizures using continuous EEG's and video monitoring. Reflex epilepsy is seen as the cleanest form of an unconditioned stimuli (seizure trigger) and unconditioned response (seizure) since the seizure response acts reliably as a reflex to the stimuli. In 1964, Forster and his co-workers (Forster, Ptacek, Peterson, Chun & Bengzon, 1964) publish a study showing that it is possible to alter the seizure threshold through the process of habituation. In his EEG lab Forster and his team study the details of persons with reflex epilepsy and are able to discriminate exactly the level and frequency of the seizure trigger stimuli. Through the use of prolonged exposure close to the triggering frequency, Forster is able to demonstrate a habituation effect. This means simply that the child suffering from reflex seizures is no longer sensitive to the seizure triggering stimuli and thus experiences fewer seizures.

A few years later, another team publishes a report showing that seizures can actually be extinguished using desensitization and competing responses (Forster, Paulsen & Baughman, 1969), also here using continuous EEG and video recordings. Based on an individual seizure behavior analysis, young adults with reflex epilepsy are exposed to their identified seizure triggering stimuli and at the same time are instructed to perform a distracting ritual. These procedures result in nearly full seizure control and are verified by significant reductions in the epileptogenic activity on the continuous EEG recordings. By 1977, Forster presents data from over 30 single subjects designs of young people with varied forms of reflex epilepsy, using continuous EEG video monitoring and shows how the desensitization process essentially de-conditions all seizures activity and in addition reduces the epileptogenic activity.

Forster's research only dealt with "reflex" seizures which constitutes only 5% of those suffering from epilepsy but his work is a major contribution to how we understand the conditioning mechanisms and how they can be used to help people to control seizures with no drugs. Several of his findings are, in the least to say, disturbing if not revolutionary for the medical model. The mere name "reflex epilepsy" implies that the seizure is an unconditioned response. That, in fact, is the definition of a reflex. Every time the seizure trigger is presented as in a light flicker, sudden sound, reading, laughing, sudden movement and so on, the seizure is eliciting 100% of the times. It may have looked that way but Forster shows that these so called "reflex" seizures responses are, in fact, conditioned responses that can be de-conditioned.

In the heads of disciples of the medical model, how are the obvious conditioning mechanisms explained?

How do physicians with little education in conditioning mechanisms process these anomalies to the medical model? I remember listening to a Norwegian neurologist and epileptologist from the National Center for Epilepsy speaking to an international audience about reflex epilepsy. "I have found a very unusual case of reflex epilepsy that I actually have on a EEG video to show you today". "Believe it or not, it is a case of a refrigerator reflex epilepsy". Thinking to myself "how in God's name could a refrigerator be an unconditioned stimuli". Sure enough, the neurologist had a young woman on tape hooked up to online video EEG. The woman was speaking to the same neurologist and telling him that all she had to do was to look at the refrigerator and she got a seizure. A small refrigerator had been placed in the room earlier and was covered by a blanket. The woman seemed anxious to demonstrate her unusual form of "reflex epilepsy" to the doubting neurologist. She tells him to remove the blanket, which he does. She takes one look at the refrigerator, closes her eyes and, sure enough, within 10 seconds she has a full-blown tonic clonic generalized seizure verified by EEG as authentic. The neurologists in the audience agree that this is, indeed, an unusual form of reflex epilepsy. Obviously, the refrigerator was a conditioned stimulus, but how does a lonely operant psychologist

from Venus talk about that a room full of medical model guys from Mars.

The operant psychologist understands conditioning has taken place. The sight of the refrigerator has become a seizure trigger that the woman herself predictably elicits. Anyone with behavioral training can help this woman with exposure, to desensitize herself to the sight of the refrigerator. Habituation training, similar to that which Forster applied would simply involve exposure training to the conditioned stimuli while keeping an eye on the EEG. The woman is exposed to the CS as long as there is no epileptogenic response. It was also interesting to note on the video that this woman did not look at the refrigerator and then get a seizure. She looked at the refrigerator, shut her eyes and 10 seconds later had the seizure. What happened when she shut her eyes? We know that for persons with epileptogenic activity, there is almost always an increase in paroxysmal activity when the eyes are shut. What would have happened if she simply kept her eyes open and looked at the refrigerator? These are the types of analysis of seizure chains and behavioral experiments that operant psychologists do.

In contrast, the neurologist finding predictable seizure triggers follows the pathological model and advises this woman to AVOID the sight of the refrigerator. Unfortunately, advising individuals with epilepsy to avoid whatever might be associated with epilepsy is common practice. You and I know what that leads to. As if it isn't enough to have epileptic seizures and suffer the side effects of AED's the established health care system reinforces seizure phobia and life quality narrows.

More revolution. Extensive EEG biofeedback studies show that people with epilepsy learn to normalize brain activity and stop seizures.

At the same time, different groups of behavior researchers show how operant conditioning mechanisms can be used to develop antiepileptic brain waves and protect against seizure activity. Two larger pockets of research teams develop EEG biofeedback techniques aimed at helping individuals to normalize brain wave activity by learning a state of cerebral activity assumed to elevate seizure

threshold. The Sterman group publish a number of studies (Sterman, 1993; Lantz & Sterman, 1988) between 1970-1981 showing evidence both in cats and with humans with epilepsy that a specific rhythm, called sensory motor rhythm, SMR, functions in an antiepileptic fashion. These studies show seizure frequency reductions between 35 and 50% at a one-year follow-up. The behavior correlate to SMR is observed to be an active inhibition of peripheral motor activity and mental state described as a concentrated alertness.

Another group led by Birbaumer (Birbaumer, Lutzenberg, Rockstroh, & Elbert, 1992; Rockstroh, Birbaumer, Elbert, & Lutsenberger, 1984) presents evidence of how instrumental conditioning of slow cortical potentials (SCP) reduce epileptogenic activity. Functional analyses are performed on the EEG behavior and these researchers redefine epilepsy as an inability to control cortical excitability. This team present evidence for a hypothesis of the mechanisms of epilepsy and conditioning that show how behavioral programs can be set up.

Birbaumer and co-workers show that all organisms have a tendency to seize as the brain fluctuates in cortical activity. Normally, feedback mechanisms within the brain control these transitions in excitability. Individuals with epilepsy show over excitability of cortical tissue due to a failure of these down-regulating mechanisms, which lead to an explosive chain reaction of excitation among the neuronal networks. The sort of seizure symptom, which presents itself, depends on where and how much of the network is involved. Treatment with SCP biofeedback trains the person with epilepsy to shift his or her cortical excitability and thus reduce the risk of a seizure. This SCP research is built on a functional analysis of behavior as compared to the other biofeedback studies. The SMR studies aimed at teaching one kind of antiepileptic brain rhythm intended to protect the individual in much the same way as drug therapy. The SCP training is built on an awareness of the chain of seizure behavior and requires the individual to generate up or down-going responses of cortical activity depending on the baseline.

Finally, A theory of conditioning and the epileptic seizure is presented

Fenwick (1994) steps up to the challenge and presents a theoretical framework as a possible platform for the behavioral treatments. Fenwick presents evidence from animal studies that he claims clearly shows the close interrelation between seizure activity and behavior. He goes on to say that seizures do not occur in a vacuum and are not merely the result of pathological activity. Fenwick points out that from the animal research, available today, there is an understanding of the epileptic focus and its connections to surrounding cerebral systems showing, clearly, that the seizure process is significantly influenced by the behavior of the organism.

Fenwick states that epileptic seizures should not be thought of as arising randomly but rather, act in predictable manners. He describes focal seizures as occurring when pools of neurons surrounding the focus are sufficiently excited and generalized seizures occurring when the level of cortical excitability has reached a point at which thalamic recruiting volleys generalize and spread. Fenwick, not only presents a plausible theory for conditioning, he also describes a functional analysis of the chain of seizure behavior and how a behavioral treatment can be created. Fenwick suggests to treating physicians to make a detailed clinical history of the "aura" or start of the seizure along with details of the characteristic spread of the seizure. He advices the medical professionals that this information provides the "engine" which drives the creation of a counter measure and is likely to stop seizures. He says that the functional analysis of the seizure chain is the heart of this behavioral treatment and will define those aspects of behavior that both trigger and inhibit seizure activity. In conclusion, Fenwick states to the medical community, that a complete treatment of epilepsy not only involves medication but includes teaching the patient about their brain and its functioning and how they can use their feelings, thinking and behavior to control their epilepsy (Fenwick, 1994).

Fenwick bases this model on the animal research of Lockard and Ward (1980). This theoretical model is far from the one-way pathology---symptom. It suggests that pathology or a set of dysfunctional neurons only sets the stage for epilepsy but does not

cause it to occur. Lockard and Ward call the pathological epileptogenic pace maker set of neurons for group one. They are clearly the troublemakers, but they can't cause an epileptic seizure unless they can mobilize recruits among the neighboring "group two" neurons who mostly act in the normal functional manner. But occasionally, the group two neurons either let down their guard, get drowsy or over excited and quick as a cross-fire, the group one's have caught the two's and are on their way exploding across the neuronal network. As soon as group one passes over to group two, the individual notices that something is going on. Depending on the location of the group one "hold up", and where they make their "dash" the individual will feel sensations of the explosions. In the animal studies, Lockard and Ward using EEG video recordings observed how the brain damaged monkeys appeared to notice the spread and how some of them responded by getting active while others did not. One of the significant observations was that although the monkeys' brains had been damaged in exactly the same place, and all showed abnormal EEGS from the group one neurons, only some of them developed epileptic seizures. The conclusion was that while damaged neurons create a predisposition for epilepsy, the behavioral response to the dysfunction is critical. Lockard and Ward speculate that the monkeys who got active at the first signs of spreading of the dysfunctional signals counteracted and stopped the spread of the "would be" seizure. What this theory means is that if the individual can detect the first signs of the seizure development, it is possible to "counter" the seizure by mobilizing the healthy neurons which are in the vast majority and stop the seizure. Most simply, any activity eliciting a general arousal done in time contingent on the first sign of the seizure is likely to stop it.

A new concept of epilepsy is born and with it new possibilities for treatment. Epilepsy is approached behaviorally as a complex consisting of an organic predisposition to seize, and intrinsic and extrinsic factors that influence the probability of seizure occurrence. Understanding how those factors work to increase or decrease the likelihood of a seizure response falls clearly under the behavior therapist profession.

Recently, Wolf, (2005) summarizes the rational for the new paradigm of conditioning.
"Epileptic seizures can be triggered by both nonspecific facilitating factors such as sleep withdrawal, fever, or excessive alcohol intake, and specific reflex epileptic mechanisms. These consist of sensory or cognitive inputs activating circumscribed cortical areas or functional anatomic systems that, due to some functional instability, respond with an epileptic discharge. Interruption of seizure activity at the stage of the aura (i.e., locally restricted discharge) also can be achieved by nonspecific (e.g., relaxation or concentration techniques or vagal nerve stimulation) or by specific focus-targeted sensory or cognitive inputs. The latter, again, activate circumscribed cortical areas. Intriguingly, in some patients, the same stimulus can either precipitate or abort a seizure. The response depends on the state of cortical activation: seizure precipitation occurs in the resting condition, and seizure interruption occurs when the epileptic discharge has begun close to the activated area. These relations can be understood on the background of experimental data showing that an intermediate state of neuronal activation is a precondition for the generation of paroxysmal depolarization shifts, whereas a hyperpolarized neuron will remain sub threshold, and a depolarized neuron that already produces action potentials is not recruitable for other activity. Sensory input meeting an intermediately activated pool of potentially epileptic neurons is adequate to produce a seizure. In another condition, the same stimulus can depolarize a neuron pool in the same area sufficiently to block the further propagation of nearby epileptic activity. Understanding these interactions facilitates the development of successful nonpharmaceutical therapeutic interventions for epilepsy" (Wolf, 2005, p 15).

Wolf demonstrates the paradigm shift from the pathology model to a paradigm that is built on the principles of conditioning. Epilepsy is seen here as a predisposition that can be both triggered and inhibited by certain interactions and behaviors and cognitions. It is interesting to note that Wolf shows an understanding of the complexity of the behavior analysis in his description that directly follows the Slow cortical potential feedback evidence of how to interrupt a seizure. Depending on the baseline of the "state of cortical

excitation" a stimulus can both trigger and inhibit a seizure. Wolf states the importance of doing careful experimental data in order to generate hypotheses regarding the relationship of the contingencies for each seizure.

From theory to practice: behavioral treatment guidelines emerge

Based on the functional analysis treatment strategies is tailor-made to help the individual with epilepsy to *predict* the seizure response by discrimination of intrinsic and extrinsic factors associated with seizure start, to *prevent* seizure occurrence by applying exposure procedures to "high" risk situations or activities associated with seizure occurrence*; interrupt or counteract* an ongoing seizure response by initiating an appropriate "correcting", competing response and *reinforce* oneself for doing so. Details for how to do functional analyses and tailored treatment procedures are presented in a handbook for behavioral treatment of epilepsy, Dahl, 1992). Just as a matter of information, there are basically two categories of seizures, generalized and focal seizures. Generalized seizures occur when the level of cortical excitability, has reached a point at which thalamic recruiting volleys generalize and start to spread. Focal seizures when the pools of neurons surrounding the epilepsy focus are sufficiently excited for seizure activity to spread.

Discriminating "high risk" factors and early seizure signs, so as to *predict*, is done using seizure dairies, seizure behavior observations, and if possible using EEG video recordings. Antecedents can be specific factors that enhance excitation and synchronization in discrete areas of the brain uniquely receptive to these particular influences like certain frequencies of light, sounds or patterns. On the other hand the triggers may be non-specific feelings that also generally enhance shifts in neuronal excitation like anticipation, stress, conflict, fear or physical exertion. The most reliable way to identify the discriminative stimuli is to check how the individual relates to, responds to what they believe to be the trigger. Another given antecedent is the physical sensation at the start of the seizure. Not all seizures have a clear-cut sign. In the case of the simple partial and complex partial, it is fairly easy to identify the first sign of the seizure. The seizure response itself has often been observed a

number of times and may be on video. In the case of the generalized seizure, antecedents will be found in associated emotional, physical or environmental factors. In a study by Spector and co-workers (Spector, Goldstein, Cull, & Fenwick, 1994) 88% of individuals with epilepsy were able to reliably identify seizure precipitory factors.

Several studies (Spector, et al, 1994) have shown evidence that fear and stress increase the risk for seizure occurrence and consequently, *preventive* treatment studies have targeted these reactions. Several studies have evaluated the effect of teaching relaxation techniques (Dahl, Melin, & Lund, 1987; Tan, & Bruni, 1986; Pushkarich, Whitman, Dell, Hughes, Rosen, & Hermann, 1992) and yoga (Ramaratnam, & Sridharan, 1999) to provide a general protection from the stress response. In nearly all of these studies, the relaxation, breathing or yoga positions are taught generally and not contingent on the seizure occurrence.

Interrupting an ongoing seizure may sound bizarre but in fact most individuals with epilepsy have at some time already done this either by consciously experimenting or by accident (Antebi & Bird, 1993; Cull, Fowler, & Brown, 1996; Dahl, 1992). Influencing the seizure process can mean for example: postponing, getting to a safe place, triggering at the time and place of your choice, nipping it in the bud, and or shortening or lengthening the course of the response. Figures vary but reports show between 23% (Finkler, Lozar & Fenwick, 1990) and 53% (Spector et al 1994) has experience of aborting a seizure. The most common ways individuals do this is simply by increasing or decreasing cortical activity depending on the upward or downward shift of the antecedent (Dahl, Melin & Leissner, 1988; Dahl, 1992; Spector, et al, 1994). The functional analysis would help the individual to determine in each situation, which direction the counter-measure should aim for. In other words, if the trigger is characterized by a high excitation, the counter measure would be a slow transition downward, and if the trigger, this time is a drowsy state, the counter-measure would warrant a soft increase in neuronal excitement. In several studies (Dahl, Brorson, & Melin, 1992; Dahl, Melin, Brorson, Schollin, 1985; Wolf, 2005) a menu of tools for changing cortical activity were taught so that the individual could

choose appropriate counter measures depending on the particular situation. It should be noted that in cases where of developmentally challenged individuals, caretakers to help interrupt seizures could use counter measures. Examples of "up-going" counter-measures used are; whistles, strong smells like a raw onion, strong tastes in the mouth like fresh ginger, singing, shouting, tactile stimulating with massage or pinching oneself, jumping up and down. Examples of down-going counter-measures used are breathing exercises, inducing muscle relaxation, focusing concentration on a song, a mathematical problem or a calming picture. Betts and co-workers (Betts, Fox, & MacCallum, 1995; Betts, 1995b) present several studies of how aromas are used to stimulate a general arousal contingent on seizure resulting in immediate halt to seizure activity.

Seizure triggers and seizure response are constantly changing along with the infinitive variations of contingencies. The art of the analysis and therapy is to teach the individual with epilepsy the principles of a seizure behavioral analysis and how to apply the behavioral analysis swiftly at the start of each seizure and generate an appropriate counter measure. There is also an obvious difference in "self efficacy" with regard to how the individual relates to epilepsy. On the one hand, epilepsy is seen as an uncontrollable illness and seizures threatening and unpredictable, where medication is the only alternative, and on the other epilepsy is viewed as a tendency to seize and where seizures are predictable and controllable.

The trickiest part of behavior therapy in particular for seizures is the analysis and treatment of the *function* of the epilepsy and seizure behavior. At first glance, an epileptic seizure would probably not be viewed as functional. In fact, when medical professionals use the word functional seizures, they mean "non-epileptic" seizures or pseudo-seizures. In the operant way of thinking all seizures would be called functional since they all "function" or operate on the environment in some way. To the observer, seizure behavior looks scary, painful, embarrassing, and to say the least, unattractive. Larger seizures are likely to be brain damaging. To the observer, neither the seizures themselves, nor their effects on the environment would seem to have any reinforcing qualities. Think

again. While parents, caretakers, teachers and physicians may want to get rid of seizures, most children report wanting to keep at least some seizures. Why? Can you think of a better way to effectively influence your environment? Seizures scare the living daylights out of most people while the person having the seizure hardly notices it. Children and young people report positive reinforcement like receiving; special privileges, special attention, physical contact, being someone special, and that the seizures themselves are experienced as stimulating, a rush and as a euphoric experience. Young people and adults also report seizures leading to negative reinforcement such as a means of escaping non-desirable situations, reducing anxiety and tension. Dostoyevski describes his seizure experience as follows " the air was filled with a big noise and I tried to move. I felt the heaven was going down upon the earth and that it had engulfed me. I have really touched God. He came into me myself. Yes, God exists. I cried, and I don't remember anything else. You all, healthy people… can't imagine the happiness we epileptics feel during the second before our fit… I don't know if this felicity lasts for seconds, hours, or months but believe me, for all the joys that life may bring, I would not exchange this one (Alajouanine, 1963)."

In a long-term follow- up of children with drug refractory seizures (Dahl, 1992) it was found that social skill competency was inversely related to seizure frequency in social situations. The better the social skills, the less the seizures occurred in social situations. Children reported that seizures led to desirable social consequences such as being held, being seen, being the center of attention. Seizures that were reported as stimulating were often maintained while others were controlled. It was also found that seizures for adults that led to anxiety reduction were maintained.

This collage of the possible functions of a seizure shows how complicated and sophisticated the functional analysis must be. If the individual's seizures function in a desirable direction or effectively reduce something undesirable, no treatment is going to stop the seizures. The issue of function is a difficult one for all treating professionals. Do people choose to have seizures? In our experience, people can influence the probability of a seizure occurring, and once it

starts, they can choose to some degree the course it will take. The job of the behavior therapist is to find out the nature of the function and to help find better alternatives to serve these functions.

A flurry of studies of behavior therapy and epilepsy establish a behavioral technology for seizure control. The Cochrane Library rules, thumbs down, with regard to evidence of efficacy. Did we miss something?

More evidence about conditioning comes from clinical and the laboratories during the 70's and 80's. A clinical study, 1975 is published by Zlutnick, Mayville and Moffat (1975) presenting a series of single subject design. These behavioral clinicians find plausible seizure antecedents and, in each individual case, show how establishing a competing response, interrupts the chain of seizure behavior. The study shows how individuals suffering from frequent drug refractory seizures of several different kinds, become essentially seizure free.

Studies evaluating behavior therapy as a treatment for epilepsy have presented and reviewed at a number of times in the past 3 decades. Sixty studies were reviewed 1977 (Mostofsky and Balaschak, 1977), Kraft and Poling (1982), reviewed an additional 11 studies from 1960-1980), Goldstein (1990) reviewed the studies published from 1980-1990 and most recently the Cochrane library reviews psychological treatment of epilepsy (Ramaratnam, Baker, & Goldstein, 2003). Methodological inadequacies from the first reviews discussed focus on low number of subjects used, lack of blood serum levels showing the consistency of anticonvulsants during treatment phases, lack of objective physiological measures and in many case using self-rating as the only measure. Goldstein summarizes the studies in the 1980-1990 showing improvements in experimental designs, and including objective dependent measures. She presents 7 studies which she regards as fulfilling evidenced based qualifications as for example: using experimental group designs with EEG verifications, use of blood serum controls, sufficient number of subjects, one-year follow-ups and reliable use of statistical methods (Dahl, et al 1985; 1987; Fried, Rubin Carton & Fox, 1984; Lindsay & Baty, 1986; Montgomery & Epsie, 1986; Rosseau, Hermann, & Whitman, 1985; Tan & Bruni, 1986). These studies also include

measures unique to CBT, like seizure diary including seizure frequency and duration, Situation, Response and Consequence. Social skills and coping skills are rated as well. Most dependent measures are tracked over a 10-week baseline providing the information for the seizure behavioral analysis. In these studies the treatment is tailored on each individual behavioral analysis but includes the principles of preventive exercises, discrimination of seizure triggers, training in seizure counter measures and contingency management.

In the most recent review for the Cochrane Library, (Ramaratnam, Baker, & Goldstein, 2003) all randomized or quasi-randomized studies assessing one or more types of psychological or behavior modification techniques for people with epilepsy are assessed. Using the strict criteria comparable to medical studies, this meta-analysis found all trials to be too small, methodology too weak and conclude that due to these methodological deficiencies and limited number of individuals studied, there is no reliable evidence to support the use of these treatments and further trials are needed.

Was treating "learning history" like pathology and following the medical model our mistake?

Behavior medicine evolves in the 1970's as an application of behavior analysis to the treatment of unhealthy long-term symptoms. Behavior medicine develops essentially as a compliment to traditional medicine. Usually, it was considered when all else failed. The integration of the medical model and the behavior medicine, despite what might seem different was fairly simple. While behavior therapy interventions are executed at the level of person/environmental interaction, the aim and focus is similar to that of the medical model, control and management of the symptoms. The first wave of traditional behavior therapy, and the second way, cognitive behavior therapy both adopted the position that psychological health is inversely related to the number and intensity of complaints (Hayes, in press). Whereas the medical model focus on biological malfunction, infectious agent or toxic insult, behavior therapists focus on pathogenic learning histories that generate negative

thoughts, emotions, physiological responses and self-destructive behavior patterns. These are the behavioral equivalents of tumors, viruses and bacterial that must be ousted in order for good psychological health to return.

Understanding the conditioning mechanisms of the epileptic seizure and teaching people to control their seizures is a significant step forward. In principle, these behavior interventions focus on providing the individual with a new learning history that stops or reduces the seizure process in seizure-producing contexts. A central aspect in these programs is systematic exposure to feared events that were associated with seizures. These applications of behavioral medicine are based on the behavioral principles of classical and operant conditioning and in more recent times on cognitive concepts. In the earlier behavior therapy interventions, the goal was to reinforce productive behavior and to stop the negative reinforcement of avoidant behavior and reduce the spread of epileptogenic activity through classical conditioning.

Exposure based treatments reinforced individuals to get closer to previously avoided situations, activities, thoughts and feelings believed to be seizure triggers. In the CBT approaches, the targets of intervention expand to include negative feelings and thoughts together with the traditional seizure triggering behavior. Newson, Goldstein and Fitzpatrick (1998) for example find that negative thoughts and feelings of fear are commonly conditioned to seizures and probably responsible for deterioration of the skills needed for self-management of seizures. Many of the more recent CBT program included, relaxation, meditation, stress management, and cognitive restructuring Goldstein, 1990). Due to the methodological difficulties, there is little empirical support for the role of cognitive mechanisms in CBT had any advantage over the traditional behavior therapy without cognitive components.

In both the medical and the behavior medicine models, pathology and symptom reduction is in focus. This know-how is essential but what if the pathology and presenting symptoms, actually function as avoidance or positive reinforcers. What happens in the case where focusing on seizure control becomes an occupation. How

many of us haven't heard the client say, "If I could only get my seizures under control, I could start living my life". What do you do with a client who puts "living life" on hold in the service of controlling seizures? What happens to the client's life quality, when battling seizures is the purpose of life. The answer to all of these questions is that the seizures obtain a powerful position and life quality narrows. Our job as psychologists is not merely to lessen suffering, it is also to help our clients to live the valued, meaningful life of their choice, if seizures were not stopping them.

The contribution of the Acceptance and Commitment therapy coupled with behavior technology in seizure control.

Tobias Lundgren 05-7-16 0.45
Kommentar: Här kommer det lite förslag på ändringar för bättre flyt i texten och för läsarens förståelse. I det här stycket skriver du om acts bidrag. Du har börjat med att skriva varför studierna är gjorda och jag vet inte om det passar här. Kanske skulle du sätta ihop det med protokollet som kommer efter nästa rubrik. Vi tar upp varje del av hexaflexen i ACT och beskriver kort vad varje del innebär.

Nästa del där vi beskriver studien tar vi sedan upp hur varje del passar med Epilepsi. Mycket av varje process koppling till epilepsi i Uppsatsen plus att du redan jobbat med det i artikeln som den ser ut nu. Detta är ett förslag och vi skulle kunna jobba med detta under Washington vistelsen om du vill.

Jag tänker att det skulle vara roligt sedan att titta på varje process sedan och se hur väl de medierar resultaten.

Recently an ACT protocol including the behavior technology of seizure management was created, and evaluated for groups of individuals with refractory epileptic seizures in India and in South Africa. These countries were chosen due to the author's chairmanship in a commission for development of psychological treatment of epilepsy in the International bureau of Epilepsy working in cooperation with the World Health Organization. In these countries, the majority of people with epilepsy will not have access to anticonvulsant drugs and cheap, assessable alternative treatment is essential to develop. The results of these studies will not be presented here, but rather a summarizing description is provided.

Tobias Lundgren 05-7-16 0.36
Kommentar: Referens till uppsatsen.

The design of both studies is randomized controlled group with two conditions, ACT and a control condition. Essentially the same ACT treatment protocol was used in the studies in both countries. Participants include persons between the age of 15 and 60 with verified refractory and frequent epileptic seizures. Treatment entailed only 4 sessions in the following order: one individual session, two group sessions, and one final individual session, for a total of 9 therapy hours.

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The principles of the ACT approach are: acceptance, defusion, contact with present moment, self as context, values and committed action. These concepts are discussed extensively in the ACT literature (Hayes, & Strosahl, 2005). Only ACT as it is used in

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this protocol is presented here. *Acceptance* as a concept is used here to mean, accepting the parts of having epilepsy that you cannot change. And at the same time learning how to change what you are able to change. In this ACT protocol, the clients learn to accept the predisposition, or tendency to seize and all the fears and negative thoughts and emotions associated with epilepsy, rather than going to war with them. The terms clean and dirty epilepsy are used. Whereas clean epilepsy is the tendency to seize when conditioned thoughts and reactions occur, dirty epilepsy would be the entire struggle against everything conditioned to epilepsy. Preventing, avoiding, or interrupting the seizures itself is a skillful and desirable thing to do but avoiding everything associated with epilepsy is not. The first may save you life and the second may handicap you for life. Learning how to control seizures is a life skill and makes having a seizure a choice. Fighting against yourself is a war where you lose. Learning how to accept the risk of having seizures and live life fully together with that risk is also a life skill.

An example of the power of acceptance and its effect on seizures, and one, which many with epilepsy have experienced, is that which happens in EEG examinations. Both the client and the neurologist prefer to see a seizure with EEG correlates to verify the diagnosis of epilepsy. In this situation, most clients "try" to have seizures and it is exactly this "trying" or acceptance that usually leads to NO SEIZURES even among those with very frequent seizures. When this happens at the Norwegian Center for Epilepsy, they have a special trick. The lab assistant and neurologist tell the client that the examination is over and they are no longer filming, although they are. When the client stops "trying" to have a seizure and returns back to "normal", seizures are usually forthcoming. It seems that acceptance of a seizure and even trying to have it, lessens the probability of it, while fear and avoidance increase the probability.
Defusion in the application of epilepsy involves learning to see thoughts as an ongoing process rather than a window on reality. Thoughts, stigmatization and rules about epilepsy and seizures are looked at rather than looked from. The client learns to use thoughts and the thinking process when it is helpful and just notice it when it is

not. Mapping out the rules, client associated with epilepsy as well as their function is an essential part of the analysis.

Contact with the present moment meant helping the individuals to get present to positive reinforcement right here and now. A common problem is that individuals struggling with epilepsy believe that they need to get somewhere else other than here to begin to live. Learning how to contact the here and now gives individuals a way to let go of the struggle with one's insides and start creating the life they want.

The most important of these processes in ACT may be *values* since values provide the motivation to step up to the difficulties and make changes. The common problem is that the more an individual struggles and organizes life around prevention, avoidance, control of the seizures, the less he or she is involved in valued life activities. As the avoidance agenda grows, life quality diminishes. Contacting constant valued directions provides a way forward toward a meaningful and vital life and shows the individual how far off course, avoiding seizures has taken them.

The treatment protocol

Treatment in ACT condition consisted of four sessions entailing one individual, two group sessions followed by one individual. Session one focuses on establishing the "life compass" (for a description of how this is done, see Dahl, et al 2005), finding discrepancies between how the participant wants to live (valued directions) and how he or she is actually living now, examining what symptoms or problems are presented as barriers to living in valued directions, examining control strategies for reducing those barriers and finally, examining the participant's experience of how these control strategies actually function. The chain of seizure behavior is also examined along with what the individual believes "triggers" the seizures and if he or she is able to control them and if so how. Associations and "rules" about the seizures are also mapped out. Typical rules presented are: I would like to study, but I have epilepsy, I would like to have a partner and have a family but no one wants someone with seizures.

Sessions two and three took place in-group sessions consisting of 6-8 individuals during a 3-hour period. The aim of the group sessions was to help the participants to understand, experience and practice the concepts of taking steps in valued directions together with obstacles, seeing thoughts as thoughts and not truths, exposure to fears and experiencing the difference between clean and dirty epilepsy, learning and practicing seizure control strategies and making public commitments towards creating the vital life of their choosing. The principle used in each group session was that each point that was taken up was dramatized in role-play so that participants understood with their intellect but also experienced through practice. The group practiced doing functional analyses on each other's seizures and brainstormed possible seizure interruption methods.

The aim of the final individual session was to summarize and evaluate how the participant was applying the treatment components: taking steps in valued direction, diffusion of less useful mind chatter and using seizure control techniques. New commitments of steps in valued life directions were made.

Measurements of treatment effect

Dependent variables used to measure the effects of this treatment model are seizure frequency and duration, life quality, vitality, and experiential avoidance with regard to epilepsy. Seizure frequency and duration are combined to a measure called the seizure index, used previously in several behavioral studies (Dahl, et al 1992; Dahl, et al 1985) three standardized life quality measures are used to evaluate the larger context of many aspects of life World Health Organization Quality Of Life (WHOQOL-breif) (World Health Organization Geneva, 1996), the Subjective Wellbeing Life Scale (SWLS) (Diener, Emmons, Larsen & Griffin, 1985) and Personal Wellbeing index (PWI) (Cummins 1997, Cummins 1996 and Deiner et al 1985). The new instruments developed for this study are two and the first is a variation of the AAQ called the AAEPQ and the the second is the Bulls-Eye instrument of vitality and persistency. The AAQ has showed god reliability and validity. The test- retest

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reliability has the values 0.89 and 0.92 (Cronbach´s alpha) (Hayes, 2002).

AAEPQ is a 12-item instrument developed to measure acceptance and emotional avoidance related to epilepsy. The participant's answers how well they agree with the statement on a Likert scale (between 1 = never true – 7 = always true). Two of the questions are reversed. The scores are summarized and low points show high emotional avoidance and low acceptance. High points show low emotional avoidance and high acceptance.

Bulls-Eye is a functional measure which is created for this study to measure consistency with vital valued areas in life and persistency in taking action in chosen important areas even in the face of difficulties. The Bull's-eye measurement consists of 4 dartboards. For the first three dartboards, the client is asked to choose one valued direction per dartboard that he or she would like to develop/improve/have that they don't have today. The bull's eye of the dartboard represents 100% consistency with of a defined vital valued direction. Using the first three dartboards the subjects are asked to mark how close he/she is living in the defined vital direction in that chosen value. On the last dart board the client is asked to describe the barriers of living as he or she values then to rate how often he or she generally follows valued life directions in the face of the described difficulties and barriers. The distance between bull's-eye and the end of the dartboard is 4.5 centimeters. On the first three dartboards measurement is figured by taking the distance between the X placed by the subject and the bull's-eye. Measurements from these three dartboards are summed and average into an index. The last dart board is measured the same way as the first three but is presented by as a single measure

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Results

The results of both studies are presently being processed. From the South African study, at the one year follow-up most all of the participants from the ACT condition are free of seizures as compared to only a couple of those in the control condition. Overall the ACT intervention produced a greater than 90% reduction in total amount of time in seizures from baseline to the one year follow-up.

The quality of life also significantly improved for the ACT participants, using the World Health Organization measure, which taps into psychological health, physical health, environmental health and quality of social relationships. Interestingly, that improvement was not significant at post, but was at a six-month follow-up and by the one-year follow-up; the effect size was very large (Cohen's d= 1.57). Not only was the outcome positive but also the model itself was supported. For example the post score on the Epilepsy AAQ, the combined values attainment Bull's-eyes, and the persistence in the face of barriers Bull's-eye all showed a very large effect in favor of the ACT condition, with effect sizes between 1.95 and 3.23 depending on the measure. These processes fully mediated the effect seen one year later both in seizures and (more impressively since these changes emerged only over time) quality of life. For example, the three process scores at post accounted for between 43 and 53% of the variance in quality of life outcomes seen a year later, depending on the specific process examined.

Discussion Lets Gird up the loins, and move forward

We have a theory about the conditioning mechanisms involved in epilepsy and we have maps showing us how to get there. We have reason to develop cheap alternative and even drug-free methods for treating epilepsy and do evaluating research. For those who do not have access to medication, and for those who do but suffer from unwanted side effects and for those who want to develop their own potential in seizure control, we need to develop behavioral treatments. Behavioral technology for seizure control is well established though much more research is needed. The contribution of ACT in these studies show that individuals with epilepsy do not simply want to control their seizures, they want to live a dignified life of their own choice. The combination of re-identifying constant life values, taking steps towards those values, exposure to fears of seizures, seeing thoughts and rules as just thoughts rather than truths, learning how to stop a seizure and committing one-self to stepping up to a vital life appears to hit home.

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