

*Chapter 2*

## **NOVEL NEUROPSYCHOLOGICAL OPPORTUNITIES IN THE TREATMENT OF ANTISOCIAL BEHAVIOR**

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### **ABSTRACT**

Attention Deficit Hyperactivity Disorder (ADHD) and Substance Use Disorders (SUDs) are known to be important contributing factors in the development and exacerbation of various types of antisocial behavior. The treatment of patients who exhibit frequent antisocial behavior and suffer from these conditions is often experienced as challenging by therapists and usually produce very modest effects, if any at all. Recent advances in neuropsychology, however, may offer new perspectives concerning the efficacy of offender treatment in these patients.

This chapter will focus on two interesting new developments in offender treatment with patients suffering from ADHD and SUDs: Neurofeedback and the Relapse Early Warning And Response System (REWARS). Neurofeedback is a method of influencing the brain's activity by way of operant conditioning. REWARS is a daily test and intervention protocol for patients suffering from SUDs. It makes use of the attentional bias concerning stimuli that are related to the substance the subject is addicted to. This attentional bias is typically shown by the subject twelve to twenty-four hours before the onset of craving for the substance and subsequent relapse.

Both treatment methods will be explained extensively. Their empirical bases and implementability will also be discussed.

### **INTRODUCTION**

Substance Use Disorders (SUDs) and Attention Deficit /Hyperactivity Disorder (ADHD) are both important contributing factors in the development and exacerbation of many different kinds of antisocial and criminal behavior. They are also significant hampering factors in

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offender treatment, leading to a high rate of attrition, a low level of compliance to treatment, and a decreased ability in the patient to integrate new insights, new skills, and alternative behavior patterns ('t Hart- Kerkhoffs, 2010; Vermeiren, 2002; Wilson & Cumming, 2009). Treatment success in antisocial patients suffering from SUDs and/or ADHD is indeed a very rare phenomenon (Adshead & Brown, 2003; Van Outsem, 2009; Weijers, 2008; Wilson & Cumming, 2009). ADHD and SUDs are conditions that are often found among forensic patients, both juveniles and adults (Adshead & Brown, 2003; Van Wijk, 2005; Vermeiren, 2002; Wellton & Van Velsen, 1996; Wilson & Cumming, 2009).

Forensic psychotherapy as a whole faces many challenges. First of all, most treatment outcome studies in the forensic field reveal only limited sized effects, if any effects at all (Atkinson, 1999; Babcock & Steiner, 1999; Chambers et al., 2008; Craissati, et al., 2009; Gondolf, 1997; Gordon & Moriarty, 2003; Hanson et al., 2002; Hanson et al., 2003; Kohl & Macy, 2008; Lin et al., 2009; Loeber et al., 2001; Macy et al., 2010; Marshall et al., 1999; Peek & Nugter, 2009; Plichta & Falik, 2001; Seager et al., 2004; Van Wijk et al., 2007; Weijers, 2008). Consequently, the current forms of psychotherapy seem to be of only limited value in the efforts to prevent re-offense. Second, there is the problem of attrition and therapy compliance, not only in the patients suffering from SUDs and/or ADHD. In forensic psychotherapy, overall attrition rates tend to be very high and treatment compliance levels very low (Beech et al., 1998; Chambers et al., 2008; Lin et al., 2009; Loeber et al., 2001; Marshall et al., 1999; Miner, 2002; Peek & Nugter, 2009; Ryan & Lane, 1997; Seager et al., 2004; Van Outsem, 2009; Van Wijk et al., 2007; Weijers, 2008). In this respect, the problem of low compliance rates of medication intake, especially in patients with ADHD, should be noted. Third, many (forensic) patients have great difficulty in discussing their thoughts, feelings, and experiences adequately enough for psychotherapy to be fruitful. Among the main reasons for this are mistrust, shame, lack of introspective abilities, weakness of verbal expression, and cognitive disabilities (Van Outsem, 2009). Finally, especially in multicultural societies, there is the problem of language barriers. Insufficient mastering of the language in which the treatment is conducted can be a major problem in conducting the treatment successfully. It can be concluded that new approaches in forensic psychotherapy are needed to overcome these problems.

Recent advances in neuropsychology, however, offer new perspectives on the treatment of patients who frequently display antisocial and criminal behavior and who suffer from SUDs and/or ADHD. Two of these recent advances are those in the field of neurofeedback, and those in the field of attentional bias in SUDs.

## **WHAT IS NEUROFEEDBACK?**

Neurofeedback is a type of biofeedback that uses electroencephalography (EEG) to provide a signal that can be used by a person to receive feedback about his or her present cortical brain activity. It is also called neurotherapy, neurobiofeedback, or EEG biofeedback. The method makes use of real-time displays of EEG to illustrate cortical brain activity with the goal of controlling this activity, and thus reducing symptoms and/or enhancing mental capabilities. Sensors are placed on the scalp to measure activity. The measurements are displayed using video and/or sound. The process of neurofeedback is usually understood as

being based on a form of operant and/or classical conditioning. When cortical brain activity changes in the direction desired by the therapist directing the treatment, a 'reward' feedback is given to the patient. When the change is in the opposite direction from what was intended, then either different feedback is given or the provision of otherwise attained 'reward' feedback is inhibited. Rewards, or reinforcements, can be as simple as a change in pitch of a tone or as complex as a certain type of movement of a character in a video game. EEG pattern targets are based on extrapolations from research describing normal and abnormal EEG patterns. Different structures within the cerebral cortex play crucial roles in the origin and/or manifestation of different kinds of behavior and of emotional responses (Demos, 2005; Evans & Arbarbanel, 1999). Various forms of psychopathology are closely associated with specific dysfunctions in these cortical structures (Demos, 2005; Evans & Arbarbanel, 1999). Neurofeedback aims at restoring the activity of these structures to the level and pattern that is present in the corresponding cortical structures of healthy individuals by way of the conditioning process described earlier. The beneficial effects of neurofeedback on behavior and emotion are understood to be a consequence of the fact that the patient's cerebral cortex is trained to function in ways that approximate those of symptom-free individuals.

Several types of neurofeedback, so-called training protocols, exist. Each training protocol has its own specific purpose, technique, and effect. Different protocols are used for the treatment of different conditions, or for the enhancement of different specific brain functions. Some protocols are aimed at the regulation of the activity of a specific region of the cerebral cortex, other protocols target multiple cortical regions simultaneously. There are protocols that focus on the regulation of a single type of brain rhythm (i.e. a brain rhythm that falls within a certain frequency range), while other protocols work with brain rhythms of multiple frequencies. While some protocols aim at stimulating certain activities of the brain, others aim at synchronizing these activities. Probably the most well-known neurofeedback protocol is the so-called Alpha training (or Deep State training) protocol. This protocol aims at attaining a state of profound relaxation by stimulating a specific type of (low frequency) brain activity that reads on the electroencephalogram as 'alpha waves' (7.5- 12.5 Hz waves). Demos (2005) provides an extensive overview of all of these protocols, their techniques, and their effects.

Neurofeedback is mostly a non-verbal method, making it adequate for patients who do not express themselves easily verbally or who do not master the country's language sufficiently. The latter is an important advantage in multi-cultural societies since it makes the method suitable for patients of different cultures and languages (Kelley, 1997; Othmer, Othmer, & Kaiser, 1999).

Neurofeedback is still a rarely used treatment method in forensic psychotherapy and offender rehabilitation programs all over the world. The method is all but ignored despite of its reported success rates (Kwan, 2002; Quinn, Bodenhamer-Davis, & Koch, 2004). An important reason for this could be that there is a widespread belief that neurofeedback is not an evidence based treatment method. Therefore, many practitioners are reluctant to adopt it and many insurance companies and mental health care subsidizers are equally reluctant to finance it. The sometimes fanatical and uncritical manner, in which some publicists have presented neurofeedback to their audiences and readerships, often referring to research of insufficient scientific rigor, may also have contributed considerably to the skepticism concerning this method. Another reason why neurofeedback is ignored in the field of forensic psychotherapy could be that most psychologists, psychiatrists and other mental health care

workers are trained to perceive anti-social and criminal behavior mostly as a result of a problematic development and/or traumatic experiences. They usually have learned that the most effective way to treat these phenomena is to influence their patient's perceptions, thought patterns, and emotional reactions with the use of spoken (and written) word, role play, and medication. Neurofeedback's basic approach, i.e., healthier thinking, feeling and behaving by way of stimulating the brain to function in a healthier manner, is usually quite alien to them. The often perceived incompatibility of neurofeedback's basic approach and the basic approaches of traditional forms of psychotherapy may also account for some of the reluctance in the field to adopt this treatment method.

## **THE PRACTICE OF NEUROFEEDBACK**

First of all, neurofeedback, unfortunately, is not for everybody. Several exclusion criteria for the method are found in the literature. These exclusion criteria are related to the occurrence of adverse effects and/or symptom exacerbation in the patient when applying the treatment. General consensus exists on the following exclusion criteria:

- The diagnosis of schizophrenia and/or psychotic episodes in the patient's history.
- The diagnosis of borderline personality disorder.
- The diagnosis of bipolar disorder.
- The current daily use of significant quantities of alcohol and/or the frequent use of drugs. Patients suffering from SUDs need to be abstinent for at least one month before neurofeedback treatment can be administered. The detoxification phase of SUDs treatment needs to be completed before starting neurofeedback.

A neurofeedback treatment is usually completed after 30–60 sessions, depending on the severity of the symptoms that are treated and on the pace with which the patient's brain reacts to the treatment. Usually the treatment is discontinued if no change in the EEG readings is found after 10–15 sessions. The reason for this is that, in most cases, no further effects are to be expected if changes remain absent after 10–15 sessions (Demos, 2005). Neurofeedback can be incorporated in both inpatient and outpatient treatment programs. The frequency of the sessions can vary between once a week and four sessions a day. A typical neurofeedback session takes about thirty minutes to complete.

The application of neurofeedback protocols is relatively easy to be trained in for licensed psychotherapists and psychiatrists. Neurofeedback courses are available in a growing number of countries. There are also good quality neurofeedback courses to be found online.

High-quality neurofeedback equipment is easy to acquire and is quite affordable for most practitioners. A complete high-quality neurofeedback system should not cost more than three thousand U.S. dollars. Additional requirements include:

- A laptop computer.
- A comfortable chair, preferably a TV chair, for the patient to sit in.
- A second computer screen.
- A quiet room.

A typical neurofeedback session consists of the following elements:

- 1 The patient is welcomed.
- 2 The patient is briefly asked about his/her current emotional and physical state, about any recent consumption of alcohol or drugs, about any important recent events that may affect neurofeedback training, and about any positive or adverse effects the patient experiences during the neurofeedback treatment. The session will be cancelled if the patient is under the influence of alcohol and/or drugs, or if the patient is hung-over after consuming alcohol or drugs the previous day. The session will also be cancelled if the patient reports adverse effects of the treatment. In this case, it will be discussed with the patient whether the treatment will be continued using another protocol or whether the treatment will be discontinued altogether.
- 3 The patient is seated in the training chair and the electrodes are attached to the patient's head. This is done using a sticky paste that is a good conductor of electricity. Before attaching the electrodes, the specific locations on the scalp where the electrodes are placed are scrubbed gently using a special scrubbing gel. This is called a skin preparation gel.
- 4 The neurofeedback training is conducted, usually for a period of twenty minutes. With many patients, it is advisable to take a one-minute break halfway the training session. With some patients, a one-minute brake once every five minutes is necessary.
- 5 When the training is finished, the electrodes are removed from the patient's head and the remaining conductive paste is wiped off the patient's scalp and hair.
- 6 The course of the training is discussed with the patient. The patient is asked about his/her emotional state and the session is concluded.

It is inadvisable to combine psychotherapy and neurofeedback in one session. Although neurofeedback and psychotherapy are a complementary combination, conducting both psychotherapy and neurofeedback within the same session is often experienced as too fatiguing by many patients. Therefore, neurofeedback and psychotherapy should be conducted in separate sessions.

## **NEUROFEEDBACK IN THE LITERATURE THAT IS RELEVANT TO FORENSIC PSYCHOTHERAPY**

In a review of 31 research publications concerning the efficacy of neurofeedback in areas that are relevant to forensic psychotherapy (Van Outsem, 2011), beneficial effects of neurofeedback treatment were reported in all publications. In none of the studies that were reviewed, grounds were found to designate neurofeedback as a totally ineffective treatment method. Negative effects, or side effects, were found to be absent in 25 of the 31 publications. In the remaining six publications, the presence or absence of negative effects was not discussed.

The attrition rates of neurofeedback treatment that were reported in the reviewed publications were considerably lower than what is usual in most of the current forms of

psychotherapy. While attrition rates of 30–50% are very common among current forms of forensic psychotherapy (Van Wijk et al., 2007; Wilson & Cumming, 2009), the average attrition rate for neurofeedback treatment is found to be only around 15%.

In the reviewed publications in which neurofeedback was compared to other treatment methods, the reported success rates of neurofeedback exceeded those of the other methods, including cognitive behavioral therapy and medication (Gruzelier & Egner, 2005; Hammond, 2003; McKnight & Fehmi, 2001; Vernon et al., 2004). This was also the case when the effects were evaluated again after a follow-up period of 1–5 years (Butnik, 2005; Evans & Arbarbanel, 1999; Gruzelier & Egner, 2005; McKnight & Fehmi, 2001; Scott et al., 2002; Quinn et al., 2004; Vernon et al., 2004). However, because of the relatively small number of comparative studies that are conducted to date, one should be careful to draw definitive conclusions as to the efficacy of neurofeedback in comparison to other treatment methods in a considerable number of areas.

When investigating the efficacy of any method of treatment, it is necessary to assess the role of factors that are not specific to the treatment method itself, but which nonetheless may influence the measurements of its effects. Three of such factors, which are very important are the placebo effect, the patient–therapist relationship, and the therapist’s personal qualities. In the conducted review, two studies on the efficacy of neurofeedback were found which referred specifically to the role of these non-specific factors. Engelbrecht et al. (2010) concluded from their placebo controlled study that changes in EEG patterns after treatment were to be attributed to the neurofeedback program itself, and not to any extent to the placebo effect. In this study, no post treatment changes in EEG patterns were found in the placebo group. Conversely, the intended changes were found in the treatment group. The subjects in the placebo group had completed a sham neurofeedback program. According to the authors, all subjects were convinced that they had followed the real neurofeedback treatment. McKnight and Fehmi (2001) found in their evaluative study that the health benefits of neurofeedback that were reported by their subjects were independent of the skill or experience of the therapist who treated them. Also, no correlation was found between the treatment outcome and the reported quality of the relationship between therapist and patient. These findings are consistent with the premise that the effects of neurofeedback are not the result of non-specific factors. They rather constitute support for the efficacy of the treatment program itself.

To date, there is insufficient evidence to be found in the literature that neurofeedback could reduce aggressive and/or anti-social behavior in patients suffering from personality disorders. Personality disorders are regularly diagnosed among forensic patients (Nestor, 2002). The possibility exists, however, that this treatment method could alleviate some of the symptoms that are associated with the various types of personality disorders. Further research in this area is needed to determine whether, and if so to what extent, neurofeedback can be of value in the treatment of forensic patients suffering from personality disorders. Valid research on the effects of neurofeedback in patients suffering from psychotic disorders like schizophrenia is also still scarce. So far, it cannot be determined whether neurofeedback could be of any use in the treatment of psychotic forensic patients.

In most of the reviewed publications, it is not in any way advocated that neurofeedback should replace traditional forms of psychotherapy altogether in the areas of treatment for which evidence of neurofeedback’s efficacy exists. While neurofeedback may create an ability in the patient to achieve behavioral and emotional change by optimizing certain brain

functions, other forms of psychotherapy, e.g. cognitive behavioral therapy, can provide guidance as to the directions in which this change could take place. For instance, partial or total recovery from (long-term) addiction and/or psychopathology often places the patient in a situation in which a new personal life-style has to be developed. The patient may change his/her choice of friends, change his/her way of relating to other people, take up a new career, etc. Counseling is generally considered as being very useful when a patient stands before the challenge of designing and adopting a new personal life-style. Therefore, neurofeedback and traditional forms of psychotherapy should be seen as complementary partners rather than as competitors.

## **POSSIBLE APPLICATIONS OF NEUROFEEDBACK IN OFFENDER TREATMENT**

According to the literature, neurofeedback could play a role in the following areas of offender treatment:

### **Aggression, Anti-Social, and Criminal Behavior Related to Substance Abuse**

Substance abuse, especially the abuse of alcohol, opiates, cocaine, and amphetamines, is a well-known cause, catalyst, and perpetuator of aggressive, anti-social, and criminal behavior such as theft, burglary, street-robbery, physical and sexual violence, drug trafficking, etc. (Glass, 1991; Martin & Johnson, 2005; Nestor, 2002; Wekerle & Wall, 2002). In most of these cases, solving the substance dependency problem is tantamount to solving the total behavior problem (Glass, 1991; Wekerle & Wall, 2002). Since neurofeedback has shown good results in helping patients to recover from their addiction and to stay abstinent, it should be seriously considered when substance abuse is a pivotal factor in the patient's problem behavior.

### **Domestic Violence**

In the field of domestic violence, there are several processes in which neurofeedback could prove helpful. First, there is again the problem of substance abuse. The abuse of alcohol is by far the most powerful predictor of re-offense after treatment in domestic violence offenders (Lin et al., 2009). Second, much of the violent behavior within intimate relationships is caused by conditioned emotional responses to cues, which are interpreted as a confirmation of certain aversive cognitions (Dutton, 2006; Hamel & Nicholls, 2007; Hampton et al., 2006; Jackson, 2007; McCue, 2008; Van Outsem, 2001). The most common of these responses are pathological jealousy (a strong emotional response to a perceived confirmation of the thought that the subject's partner is being unfaithful), fear of abandonment (which occurs strongly when the subject perceives any cue as a sign that his/her partner is planning to leave him/her), and sense of disqualification (a strong response of anger and humiliation when the subject perceives any cue as a confirmation of his/her conviction that his/her partner

does not take the subject seriously, does not care for the subject, or puts the subject's abilities into question). Neurofeedback could be used here as a tool to enhance the subject's flexibility of thinking and of emotional response as is described by McKnight and Fehmi (2001). As a result, the patient may become more able to challenge and modulate his/her own negative cognitions and to generate more constructive behavioral responses to perceived negative cues. Third, again as described by McKnight and Fehmi (2001), neurofeedback could be effective in relieving stress, which results from the unconscious effort to maintain habitual forms of focused attention. This translates into the stress which is experienced in daily life and which is usually accompanied by the phenomena of rumination and 'gripping' (i.e. hyperfocusing on stress-provoking cues). These phenomena often play an important role in fuelling domestic violence (Dutton, 2006; Hamel & Nicholls, 2007; Hampton et al., 2006; Jackson, 2007; McCue, 2008; Van Outsem, 2001). The enhancement of flexibility of thinking and of emotional response is also here a key process of recovery.

Neurofeedback may also be a valuable tool in the treatment of other forms of violent and anti-social behavior, i.e., that takes place outside intimate relationships, in which an important role is played by the phenomena that are mentioned above.

### **Aggression Problems and Delinquency Caused by, or Catalyzed by, Attention Deficit Hyperactivity Disorder (ADHD)**

Aggression problems and criminal behavior are often a part of the total problem behavior that is displayed by patients suffering from ADHD ('t Hart-Kerkhoffs, 2010; Peniston et al., 1993; Vermeiren, 2002; Wilson & Cumming, 2009). The efficacy of neurofeedback in treating ADHD, as is reported in the literature, may offer possibilities for the reduction of the impulsive aggressive behavior that is often associated with this condition. This may especially be the case in patients who do not react satisfactorily to medication or who fail to comply with the medication regime.

### **Aggression Problems and Delinquency Caused by, or Catalyzed by, Autism Spectrum Disorder (ASD) and Post Traumatic Stress Disorder (PTSD)**

These disorders are also sometimes accompanied by aggressive outbursts and delinquent behavior ('t Hart-Kerkhoffs, 2010; Vermeiren, 2002; Wilson & Cumming, 2009). The efficacy of neurofeedback in treating these specific conditions is less empirically supported than that in treating ADHD and SUDs, although some evidence does exist (Kouijzer et al., 2008; Martin & Johnson, 2005; Peniston et al., 1991, 1993; Peterson, 2000; Smith & Sams, 2005; Van Outsem, 2011).

#### ***Prevention of Delinquent Behavior***

Neurofeedback could also play a role in the *prevention* of criminal behavior. The early treatment of conditions such as ADHD, Post Traumatic Stress Disorder (PTSD), and SUDs could probably reduce the probability of development of criminal behavior in (young) patients who are treated successfully. Also, the treatment of learning difficulties with the use

of neurofeedback may, at least to some extent, prevent drop-out from school. This may also have a preventive effect on delinquency. According to a growing body of research, neurofeedback offers good results in the treatment of various types of learning disabilities (Fenger, 1998; Fernández et al., 2003; Hammond, 2007; Tansey, 1991; Thompson & Thompson, 1998)

## **EMPIRICAL SUPPORT FOR THE EFFICACY OF NEUROFEEDBACK IN ADHD AND SUDS**

The two areas of treatment in which neurofeedback's efficacy is most empirically supported, and which are relevant for offender treatment, are ADHD and SUDs.

### **ADHD**

In this area, the efficacy of neurofeedback is well established and documented (Arns et al., 2009; Butnik, 2005; Carmody et al., 2001; Fuchs et al., 2003; Gruzelier & Egner, 2005; Heinrich et al., 2004; Kaiser & Othmer, 2000; Linden et al., 1996; Lubar & Lubar, 1999; Masterpasqual & Healey, 2003; Monastra et al., 2002; Monastra et al., 2005; Nash, 2000; Patrick, 1996; Robbins, 2000; Rossiter & La Vaque, 1995; Schulenburg, 1999; Thompson & Thompson, 1998; Tinius & Tinius, 2000; Vernon et al., 2004). In these publications, a total of 1232 subjects were studied. Randomized controlled trials are the most prevalent in this area of treatment (five studies). Heterogeneity was not significant ( $I^2 = .22$ ,  $p = .15$ ). No significant publication bias was found (Egger's  $p = .9$ ). Symptom reduction was found in patients of all age groups. Around 80% of patients show measurable improvements, which, in most studies, are corroborated by parents, teachers, and/or spouses. These improvements consist of increases in concentration and self-control and of the amelioration of social behavior in general. The social behavior of the treated patients tends to become more empathic, while impulsive and aggressive behavior toward others significantly decreases. The magnitude of the desired effects of neurofeedback in patients with ADHD is at least comparable to that of stimulant medication therapy, and is in many cases greater (Arns et al., 2009; Fuchs et al., 2003; Gruzelier & Egner, 2005; Heinrich et al., 2004; Kaiser & Othmer, 2000; Linden et al., 1996; Monastra et al., 2002, 2005; Rossiter & La Vaque, 1995). Arns et al. (2009) concluded from their meta-analytic study that neurofeedback can be considered efficacious and specific as a treatment for ADHD since both prospective controlled studies and studies employing a pre- and post-design found large effect sizes for neurofeedback on impulsivity and inattention, for both Hedges'  $\hat{g} = .8$ , and medium effect sizes on hyperactivity, Hedges'  $\hat{g} = .6$ . Most authors name as an important advantage of neurofeedback over stimulant medication treatment for ADHD that the desired effects remain for a prolonged period of time after treatment, and that these effects are often permanent (Arns et al., 2009; Fuchs et al., 2003; Gruzelier & Egner, 2005; Heinrich et al., 2004; Kaiser & Othmer, 2000; Linden et al., 1996; Monastra et al., 2002, 2005; Rossiter & La Vaque, 1995; Schulenburg, 1999; Thompson & Thompson, 1998; Vernon et al., 2004). Conversely, the effects of stimulant medication end when the intake of these substances ends. Moreover, the often present side effects of

stimulant medication, which have a strong negative effect on compliance with this type of treatment, are totally absent when neurofeedback is applied (Fuchs et al., 2003; Gruzelier & Egner, 2005; Kaiser & Othmer, 2000; Monastra et al., 2002, 2005; Rossiter & La Vaque, 1995; Vernon et al., 2004). The temporary worsening of symptoms of ADHD when medication is not taken on time, the so-called rebound effect, is also not a problem when neurofeedback treatment is chosen (Fuchs et al., 2003; Gruzelier & Egner, 2005; Heinrich et al., 2004; Kaiser & Othmer, 2000; Rossiter & La Vaque, 1995). The advantages of neurofeedback over stimulant medication therapy in patients with ADHD are especially eminent in the light of the fact that in stimulant medication therapy compliance is usually very low and attrition very high (Fuchs et al., 2003; Gruzelier & Egner, 2005; Linden et al., 1996; Monastra et al., 2002, 2005; Rossiter & La Vaque, 1995).

## SUDs

Considerable documentation on neurofeedback's effectiveness in the area of alcohol and drug dependency can be found in the literature (Burkett et al., 2005; Kelley, 1997; Peniston & Kulkoski, 1999; Scott et al., 2002; Scott et al., 2005; Quinn et al., 2004; Trudeau, 2000). In the studies of abstinence (0–4 uses after completion of treatment) versus relapse (more than four uses after treatment completion) during a follow-up period of 1–5 years, the computed effect sizes (odds ratio) ranged between 4.1 (crack cocaine, 1-year follow-up) and 6.7 (alcohol, 5 years follow-up). Effect sizes in studies on the self-reported number of uses during 1–5 years after treatment completion ranged between Hedges'  $\hat{g} = .6$  (crack cocaine, 1-year follow-up) and  $.9$  (alcohol, 5 years follow-up). According to four studies, the efficacy of neurofeedback exceeds that of current treatment methods in this area after a follow-up period of 1–5 years (Burkett et al., 2005; Callaway & Bodenhamer-Davis, E., 2008; Quinn et al., 2004; Trudeau, 2000). After completion of conventional forms of substance abuse treatment, 65–70% of patients take (any amount of) alcohol or drugs again within the first year (McKay et al., 1999). For neurofeedback treatment, this rate is 45–50% (Burkett et al., 2005; Quinn et al., 2004; Trudeau, 2000). Of the evaluative studies that were selected on neurofeedback as a treatment method for alcohol and drug dependency, three were randomized controlled studies. Significant heterogeneity ( $I^2 = .79$ ,  $p = .002$ ) was found. This was caused by the fact that patients with different types of addiction were studied. Relapse in crack cocaine addiction was considerably more prevalent than in addiction to alcohol or marijuana. No significant publication bias (Egger's  $p = .4$ ) was found. A total of 511 subjects participated in these studies.

Two large studies in Texas (Callaway & Bodenhamer-Davis, 2008) showed quite remarkable results. One study was done within the state corrections system, the other with addicted homeless people (95% of whom were crack cocaine addicts). Three-year follow-up data was strongly indicative of success using the neurofeedback treatment. Sixty-nine patients completed treatment and have been followed for from six months to one and one-half years after treatment. Success was defined very stringently, through four criteria, all of which had to be met:

- 1 Not on drugs (verified through random urine analysis).
- 2 Not homeless.

- 3 Not unemployed (at work or in school).
- 4 Not arrested.

None of these patients were employed or had a home when they entered treatment, and all had lengthy police records. After one and one-half years 83% of patients were successful in meeting all four criteria.

## NEUROFEEDBACK IN ADHD

The neurofeedback protocols that are used in treating ADHD are all so-called qEEG-guided, or qEEG-informed, protocols. These are protocols that are based on the result of the patient's qEEG.

The qEEG (quantitative electroencephalogram) is also known in popular terms as a "brain map". An electroencephalogram is a report on electrical activity within the brain that provides detailed information about brain function. The report is produced by a biomedical device called an electroencephalograph. A quantitative EEG differs from a traditional EEG in that it performs an extensive set of computerized statistical analyses on the collected raw EEG data. The EEG patterns from an individual's brain are compared with a normative database containing data from a large number of other individual EEGs. The EEG data within this database are collected from a group of carefully-selected, symptom free, healthy people of different age groups. The individual's EEG is always compared to the EEG data in the normative database of other individuals in a similar age group. This statistically analyzed EEG, the qEEG, provides the clinician with a great deal more specific information about brain function than a traditional EEG.

Important kinds of information quantified by the qEEG include:

- A measure of the amount of electrical activity (in a range of different frequency bands) at many standardized scalp locations. This information is called a "power analysis".
- A measure of the nature of the connections, or communication pathways, between different locations on the brain's cortex. This information is called a "coherence analysis".

More in-depth information about the qEEG is found in the introductory book by John Demos (2005). Interpreting a qEEG is a complex matter with a steep learning curve. However, it is also possible for the clinician to only collect the raw EEG data and to have them analyzed by specialized professionals. These professionals will usually also provide the neurofeedback treatment protocol to be used based on the qEEG report.

In treating ADHD with neurofeedback, qEEG-guided protocols are preferred to standard protocols. The reason for this is that different variants of dysfunctional EEG patterns exist within the group of patients suffering from ADHD. The two most common EEG patterns found in ADHD patients are:

- Frontal slowing: This is an excess of slow synchronized activity in the range of 1 to 12 Hz located in the frontal areas of the cerebral cortex. Around 70% of patients suffering from ADHD show this EEG pattern (Thompson & Thompson, 2003).
- Diffuse Beta: This is an excess of fast desynchronized activity (usually above 20 Hz) that is found over the entire cerebral cortex. This pattern is found in about 20% of all ADHD patients (Thompson & Thompson 2003).

The remaining 10% of ADHD patients show various kinds of atypical EEG patterns.

In the case of frontal slowing, most qEEG-guided neurofeedback protocols that are used target frontal, prefrontal and central cortical areas and are designed to reduce slow frontal activity and to enhance faster desynchronized frontal activity. In the case of the diffuse Beta variant, the protocols that are most frequently used target central and parietal cortical areas. These protocols are designed to eliminate the excessive fast and desynchronized cortical activity. The general idea is to customize the neurofeedback protocol so that it stimulates every individual patient's brain to counteract its own specific dysfunctional cortical activity pattern.

## NEUROFEEDBACK IN SUDS

Patients suffering from SUDs are eligible for neurofeedback treatment when they are abstinent for at least one month. The detoxification phase of SUDs treatment needs to be fully completed before starting neurofeedback.

The best empirically supported neurofeedback protocol is the Peniston protocol with the Scott and Kaiser modifications (Bodenhamer-Davis & Callaway, 2004; Callaway & Bodenhamer-Davis, 2008; Scott et al., 2005; Sokhadze et al., 2008). Several slightly different versions of this protocol exist.

### A Neurofeedback Protocol for the Treatment of SUDs

This protocol is based on the Peniston protocol with the Scott and Kaiser modifications. It is one of the many variants of it that exist.

After the completion of detoxification (i.e. at least a month after attaining stable and complete abstinence), and when all diagnostic conclusions are reached, the patients have several (at least two) sessions with the neurofeedback therapist in which the following subjects are discussed:

- General information about neurofeedback.
- What the patient can and cannot expect from neurofeedback treatment.
- The necessity of psychotherapy next to neurofeedback (neurofeedback *is not an alternative for* psychotherapy. Neurofeedback and psychotherapy are complementary treatment modalities).
- What is expected from the patient (total abstinence during treatment, attending all sessions, reporting adverse effects, reporting relapse, etc.).

- What the neurofeedback training sessions are like.
- The expected number of sessions, the planning of the sessions during the week, and the time-span of the complete neurofeedback treatment.
- Any questions the patient may have.
- How to use the symptom and craving self report diary.

During neurofeedback treatment, the patients keep a self report diary in which subjective progress in terms of symptoms and craving is monitored. It is generally considered useful to employ rating scales to quantify subjective symptoms and craving.

Before starting the neurofeedback treatment, the therapist and the patient write three to five so-called vignettes. These vignettes are short patient-personalized stories about successfully rejecting alcohol and/or drugs.

When all preparations are completed, the neurofeedback sessions will start. The applied treatment protocol is a standard neurofeedback protocol, so no qEEG is required. The protocol comprises two phases:

### **Phase 1**

In phase one, fifteen to twenty sessions of Sensory Motor Rhythm (SMR) and Theta training will take place. In these sessions, the augmentation of the production of SMR (12-15 Hz activity) on the Cz location (one channel) or C3 and C4 locations (two channels) is rewarded. Simultaneously, the decrease of the production of Theta (4-8 Hz activity) at Cz or C3 and C4 is also rewarded. The designated scalp locations are in accordance with the International 10-20 system of electrode application.

### **Phase 2**

In phase two, twenty sessions of Alpha-Theta training is administered. The patient is rewarded when the power of Theta (4-8 Hz activity) exceeds that of Alpha (8-12 Hz activity) at the scalp locations Pz (one channel) or P3 and P4 (two channels). Immediately before starting the training, one of the vignettes is read to the patient by the therapist. The patient is instructed to imagine the vignette as vividly as possible.

## **VIGNETTES**

Vignettes are written according to the following criteria:

- Vignettes are short. They take no longer than one minute to be read.
- The vignettes describe situations that are common risk situations in the patient's daily life.
- The vignettes are written in the patient's own words.

- The type of alcoholic beverage the patient typically drinks and/or drug the patient is addicted to is explicated. These substances are referred to using the names the patient uses for them.
- The vignettes have the following basic structure: 1: the description of the risk situation, 2: the description of the experience of temptation and craving, 3: the overcoming of the temptation and the craving, and 4: the experience of positive emotions as a result of overcoming the situation.

## SOME EXAMPLES OF VIGNETTES

### Vignette “Yesterday’s Friends”

Imagine yourself walking down a street in your neighborhood. Suddenly you see a couple of old friends you used to drink/do drugs with (specify the drug the patient is addicted to). You have a very nice talk with them, reviving old memories of the good old “wild” times.

One of your old friends then says he knows about a great party taking place tonight. It’s just the kind of party you used to go to and enjoy together with your old friends. The idea is born to meet up at this old friend’s house, have a drink and a .....(specify drug) first, and then go to the party. Everybody is very enthusiastic about the idea. You know you do have the money to go to this party. You really feel the temptation to go.

Then suddenly you start getting second thoughts about going to the party. Of course you like seeing your old friends again. Of course you would like to party again. Of course you would like to have a drink/use some.....(specify drug) again. You feel your heart is racing. You feel the craving again!

But then you start thinking about your addiction. You realize that going to this party is a very risky thing. This party could mean total relapse. You start thinking about your addiction and about all the problems it has brought you in your life. You start thinking about how unhappy your addiction has made you feel.

Then you hear the voice of your conscience. It sounds a lot louder and convincing than usual. It’s a warm and friendly voice that tells you to imagine how happy you would be without the alcohol/.....(specify drug). You start thinking about all the things you could do without the addiction holding you back. You feel that your craving for the alcohol/.....(specify drug) is getting less and less, until it goes away completely. You start feeling calm, happy and confident!

You tell your old friends that you are not going to the party this evening and you explain to them why. You are not affected in any way by their protests and objections. You don’t mind being called a party crasher or a wet blanket. You don’t care if they say you will miss out on an awesome night. You don’t care that they say that they won’t have so much fun without you....you don’t feel guilty about it.

You walk away feeling happy and proud of yourself. You feel like a winner!

### **Vignette “The Liquor Store”**

On a Saturday afternoon you walk past a liquor store. You can't help noticing an advertisement-board in the window. Your favorite drink is on sale! This week only, you can buy two whole bottles of .....(specify product, brand and type/variant) for the price of one. You look at the big full color picture of the .....(specify). It looks tempting and delicious! You really feel like entering the liquor store and buy your .....(specify).

Your heart is racing. You can taste the .....(specify) in your mouth. You really feel the craving for the .....(specify).

Then you hear the voice of your conscience. It sounds a lot louder and convincing than usual. It's a warm and friendly voice that tells you to imagine how happy you would be without the alcohol/.....(specify). You start thinking about all the things you could do without the addiction holding you back. You feel that your craving for the alcohol/.....(specify) is getting less and less, until it goes away completely. You start feeling calm, happy and confident!

You decide not to go in and by any alcohol. You feel strong and confident. You think of all the things you can do without your addiction to alcohol.

You walk away feeling happy and proud of yourself. You feel like a winner!

### **Vignette “In the Bar”**

You know it probably wasn't a very good idea, but you agreed to go to a bar with some friends. You may even have thought that this was a good opportunity to prove to yourself and to your friends that you could stay off the booze even in very tempting situations.

You enter the bar and you see a lot of old friends you used to have good times with. You engage in very nice conversations with them and you drink only Coca Cola or mineral water. You feel proud that you haven't given in to the temptation to drink alcohol.

It's getting later and later, and you are getting a bit tired. Everybody else is clearly having a lot of fun. Everybody is drinking alcohol, some people obviously quite a lot! You are starting to feel a little lonesome. You are considering going home, but you feel bad to go home before your friends do. They are having a lot of fun. You feel you don't fit in the party.

Before you know it, you begin saying things to yourself like “Well, one drink won't hurt”. Or “I have been sober for months, having one drink doesn't mean I'll relapse”.

Then you hear the voice of your conscience. It sounds a lot louder and convincing than usual. It's a warm and friendly voice that tells you to imagine how happy you would be without the alcohol. You start thinking about all the things you could do without the addiction holding you back. You feel that your craving for the alcohol is getting less and less, until it goes away completely. You start feeling calm, happy and confident!

You decide to call it a night and to go home. You feel strong and confident. You think of all the things you can do without your addiction to alcohol.

You walk away feeling happy and proud of yourself. You feel like a winner!

### Vignette “Home Alone”

You are home alone. You feel very bored, you have nothing to do. Actually, you don't really feel like doing anything. There is no one you can call or meet up with. You watch some television and make some coffee. You walk a bit about the house, you feel very, very bored. This feeling of emptiness is really getting to you.

Your old medicine for these kind of situations was having a .....(specify drink or drug). This really made you feel better, more relaxed, more energetic, more self-confident. That empty feeling used to go away after having a .....(specify). Life seemed a lot more fun when having a .....(specify) was still OK.

You can't get your mind off having a .....(specify). Your heart starts racing. You really feel the craving for a .....(specify).

Then you hear the voice of your conscience. It sounds a lot louder and convincing than usual. It's a warm and friendly voice that tells you to imagine how happy you would be without the .....(specify). You start thinking about all the things you could do without the addiction holding you back. You feel that your craving for the .....(specify) is getting less and less, until it goes away completely. You start feeling calm, happy and confident!

You decide not to have a .....(specify) but to call an old friend or family member instead. You feel strong and confident. You think of all the things you can do without your addiction to .....(specify).

You feel happy and proud of yourself. You feel like a winner!

### Vignette “Quarrel with the Wife/Husband”

Again you had a fight with your wife/husband/boyfriend/girlfriend. The fights are always about the same problems that just seem unsolvable. These problems, and fights, just keep coming back.

You are very angry with your wife/husband/boyfriend/girlfriend. You feel that he/she isn't doing enough to make your relationship better. Sometimes you get the impression that he/she doesn't really care anymore. Maybe his/her love for you is ebbing away, maybe he/she doesn't love you anymore. You're feeling angry and sad at the same time. Sometimes you even feel desperate and powerless. You just don't know what to do anymore.

You feel consumed by all these bad feelings and want to get away from it all. You really want to have a .....(specify drink or drug). After all, who cares anymore? Having a .....(specify) now seems the only way out of all this. You may even feel you have the right to have a .....(specify) because of the way your wife/husband/boyfriend/girlfriend makes you feel.

Then you hear the voice of your conscience. It sounds a lot louder and convincing than usual. It's a warm and friendly voice that tells you to imagine how happy you would be without the .....(specify). You start thinking about all the things you could do without the addiction holding you back. You feel that your craving for the .....(specify) is getting less and less, until it goes away completely. You start feeling calm, happy and confident!

You decide not to have a .....(specify) but to call a good friend or a family member to talk about the problems in your relationship. Maybe you'll get some good advice about what to do. You feel strong and confident. You think of all the things you can do without your addiction to .....(specify). You feel happy and proud of yourself. You feel like a winner!

### **Completion of the Neurofeedback Treatment**

When phases one and two are completed, the neurofeedback treatment is completed. The treatment is evaluated as to its results and further treatment is discussed with the patient.

## **ATTENTIONAL BIAS IN SUDS**

### **What is Attentional Bias in General?**

Attentional bias is a phenomenon wherein an individual focuses more of his/her attention toward a specific stimulus or a sensory cue. Often, this leads to a poor sense of judgment or an incomplete recollection of a certain event or memory. Attentional biases can also lead to poor decision-making, as the individual already has a bias towards one stimulus and may more likely base his/her decision on that preference.

Various experts believe that humans already have a tendency to show attentional bias in some situations due to the evolution of human intelligence and the need to survive. For this reason, individuals usually give more of their attention to stimuli that pose a threat to them. This enhanced attention, or hyperattention, is usually associated with sensory responses such as a tunnel vision, in which the frightened person temporarily loses his peripheral vision and focuses on the threatening object. It frequently sets off a set of physiological responses such as an adrenaline rush and an increased heart rate, and also several neurological reactions that allows the person to respond more rapidly to whatever occurs as the situation evolves.

Certain forms of attentional bias in some situations may be innate in humans and may be appropriate for their survival and well-being. But several other types of attentional bias, the same types of it in other situations, or an exaggerated degree of it in the appropriate situations, may be symptoms or results of a psychological disorder. For instance, being focused constantly on signs of impending danger may be adequate while exploring deep into an unknown jungle, but is clearly dysfunctional when lying safely in bed at home.

When individuals make decisions, they sometimes become so focused on particular aspects of the situation they are in that they tend to ignore other relevant information. This type of attentional bias can have a major impact on the decision-making process, and strongly influence the choices that are ultimately made.

One approach to measuring attentional bias is the Stroop task. In this test, color-pertaining words are written out in different colors. For example, the word "red" is written out in the color green. The individual is then asked to say out loud the *color* of the word, not the word itself. In this example, the correct answer would be "green" and not "red". A person with a high level of attentional bias may take longer to answer correctly. In some case studies,

it was shown that patients who had severe anxieties and phobias had a difficult time saying the color of some suggestive words such as “spider” or “blood,” as their inclination to focus on the word itself gets in the way of getting the main task done. The Stroop task is considered to measure selective attention, cognitive flexibility and processing speed, and it is used as a tool in the evaluation of executive functions. An increased interference effect is found in disorders such as brain damage, dementias and other neurodegenerative diseases, ADHD, or a variety of mental disorders such as schizophrenia, addictions, and depression. There are different test variants commonly used in clinical settings, with differences between them in the number of subtasks, type and number of stimulus, times for the task, or scoring procedures.

### **What is Attentional Bias in SUDS?**

Attentional bias has been studied not only in relation to phobias and other forms of psychopathology, but also in the context of alcoholism and substance abuse. In separate experiments, participants (drug users and alcoholics), exhibited more delayed responses in the Stroop task to words that implied drugs or alcohol (or the consumption of them) than members of control groups who were not addicted (Cane et al., 2009; Carpenter et al., 2006; Drobles et al., 2006; Field & Cos, 2008; Field et al., 2009; Hester et al., 2006; Marhe, 2013; Streeter et al., 2007; Waters et al., 2012).

Attentional bias often seen in eye tracking movements is thought to be an underlying issue of addiction. Smokers linger on smoking cues compared with neutral cues. Researchers found higher activation in the insular cortex, the orbitofrontal cortex and the amygdala when presented with smoking cues (Janes et al., 2012; Kang et al., 2012; Luijten et al., 2011; Stippekohl et al., 2012). Similar activation patterns are observed in subjects who are addicted to other substances (Euser, 2013). The orbitofrontal cortex is known to be associated with drug-seeking behavior and the insular cortex and amygdala are involved in the autonomic and emotional state of an individual. Neural activity is also shown to decrease upon the beginning of smoking, causing the smoker to focus his attention on his next cigarette. Therefore, when smoking cues are nearby it is harder for a smoker to concentrate on other tasks. This is seen in the activation of the dorsal anterior cingulate cortex, known for focusing attention on relevant stimuli (Janes et al., 2012; Kang et al., 2012; Luijten et al., 2011; Stippekohl et al., 2012). Again, similar activation patterns are observed in subjects who are addicted to other substances (Euser, 2013).

These studies not only illustrate the importance of attentional bias in addiction and cravings, they also influence the way we look at addiction from a scientific point of view. The behavioral and emotional aspects of addiction and craving are extensively covered. However, the perceptual and neurological aspects of attentional bias and the role they play in SUDs is supported by recent research to be significant.

The intervention method that is presented below makes use of the phenomenon of attentional bias in SUDs.

## **RELAPSE EARLY WARNING AND RESPONSE SYSTEM (REWARS)**

The Relapse Early Warning And Response System (REWARS) is a set of relapse prevention techniques that is applied *immediately before* the risk of relapse is at its highest. It is an additional tool for (forensic) SUDs treatment. It is neither an alternative nor a substitute for other evidence based offender treatment or SUDs treatment methods. REWARS is suitable only for patients who are motivated to stay abstinent. It is not recommended to use REWARS with patients who are (still) ambivalent towards substance use and abstinence. In these cases, motivation techniques should be used first. REWARS can be used in both inpatient and outpatient treatment settings. It is typically used for the first six months of abstinence after the detoxification phase of treatment is fully completed.

The basic philosophy of REWARS is that relapse prevention techniques are the most powerful when applied shortly before acute cravings start. Therefore, it is of crucial importance to be able to identify these particular windows of time. Waters & Li (2008), Waters et al., (2012) and Marhe (2013) demonstrated that acute cravings and subsequent relapse are preceded by a relatively short period of time (twelve to twenty-four hours) in which the addicted subject exhibits strong substance related attentional bias. During this period of time, the subject is still able to think clearly and is not yet profoundly affected in his/her decision-making by the experience of craving for the substance. So, relapse prevention interventions can be expected to be the most effective during this “early warning phase” before actual relapse.

### **The Addiction Stroop Task (AST)**

A key instrument for detecting these “early warning phases” of relapse is the *Addiction Stroop Task (AST)*. This is a variant of the standard Stroop task. The AST is a neuropsychological test used to measure a person’s reaction time for recognizing the color of alcohol-related or drug-related words compared to neutral words that appear on a computer or PDA (Personal Digital Assistant) screen. A computerized response box with colored buttons is used to indicate the color of each word. Each individual word appears in the middle of the screen. The objective is to click the correct colored button without thinking about the word. The time is measured in milliseconds.

When at a certain point in time the patient’s AST reaction times on alcohol-related or drug-related words are sufficiently elevated (above a preset cut off score) it is indicative for the fact that the patient is highly at risk of relapsing during the next twelve to twenty four hours.

The words to be used in the AST must be specific to the substance the patient is addicted to, and also to the country, the culture, the subculture, and the age of the patient. The alcohol or drug words should be as descriptive and concrete as possible. Equal numbers of neutral control words should be matched in as many ways as possible (complexity of words, including word length, number of syllables per word, and how common they are); words associated with colors should be avoided (e.g., sky, tomato). The neutral words and alcohol/drug-related words should be intermingled randomly.

Examples of neutral words: Was, Window, Invite, Lamp, Key, Shoe, House, Carpet, Floor, Boots, Bulb, Read, Table, Card, Building, Telephone, Cape, Box, Chain, Watch.

Examples of marijuana-related words: Baked, Bamboo, Bong, Bored, Bud, Burn, Chronic, Cough, Food, Herb, Hydro, Joint, Music, Papers, Pot, Rolling, Skunk, Trees, Weed, Blunt.

Examples of cocaine-related words: Stem, Pipe, Rock, Lighter, Crack, Coke, Blast, Baking Soda, Dime, Escape, Lonely, More, Numb, Paranoid, Screen, Crash, Glass, Razor, Ye-yo, Eightball.

Examples of heroin-related words: Dope, Sick, Needle, Nod, Cooker, Blood, Spoon, Works, Cotton, Sleep, Copping, Calm, Medicine, Ties, Bitter, Bundle, Dee, Energy, Jail, Sad.

Examples of mixed drugs-related words: Money, High, Sex, Relax, Bags, Straw, Pain, Smoke, Hit, Happy, Powder, Sniff, Snort, Pleasure, Nickle, Death, Hate, Fun, Rush, Anger, Pill.

Examples of alcohol-related words: Drink, Glass, Drunk, Bottle, Bar, Juiced, Tipsy, Liquor, Faced, Booze, Shot, Beer, Loaded, Thirst, Cheers, Sourced, Gin, Tanked.

The equipment that is needed for the AST is: a personal computer/laptop or a PDA (many modern telephones are also suitable), a response box that measures the patient's response to the computer program in milliseconds, and statistical software that can perform an Analysis of Variance (ANOVA) test on reaction time data.

Several companies have developed the measurement software needed to conduct the AST and other variants of the Stroop task. The AST can be website-based, for instance as a part of an e-health program, or it can be installed on the PDA or telephone.

More detailed information on the Stroop task and the AST is found in Carpenter et al. (2006), Cox et al. (2006), Golden (1976), Waters & Li (2008), and Waters et al. (2012).

## **The Basic Structure of REWARS**

REWARS is a 24-hour relapse prevention program that has the following structure:

- 1 Fifteen to thirty minutes after waking up in the morning, the patient completes the AST.
- 2 If no elevated risk of relapse is indicated by the AST, the patient will carry on with his/her daily life without undertaking any special action.
- 3 If an elevated risk of relapse is indicated by the AST, a message (an e-mail or a text message) will be sent automatically to the patient's therapist and, if possible, to other people who can offer positive support to the patient. The therapist will then contact the patient and arrange for an extra appointment on that day. The therapist and the patient will also call each other several times during the day to further minimize the risk of relapse. Relevant others will support the patient during that day in accordance to whatever is agreed upon with the patient and the therapist.
- 4 If an elevated risk of relapse is indicated by the AST, the patient will follow an "emergency protocol" during the next twenty-four hours. This protocol is a personalized set of rules about what to do and what not to do during high-risk days. It is designed by the patient and therapist together.

The “emergency protocol” will have (at least) the following elements:

- 1 *Today’s no-go areas*: these are the places where the patient is not allowed to go to on high-risk days. These are the places where temptations are most present.
- 2 *Today’s no-see persons*: these are the persons the patient is not allowed to have contact with on high-risk days. These are people that may tempt the patient to drink alcohol or use drugs.
- 3 *Today’s safety areas*: these are the places where temptations are absent and where the patient is safe from relapse-provoking stimuli and people. These are the places where the patient is recommended to be for as long as possible during high-risk days.
- 4 *Today’s safety people*: these are the people who can and will support the patient in his/her struggle against relapse. It is recommended that the patient will be in the company of these people for as long as possible during high-risk days.
- 5 *Today’s safety actions*: this is a set of things the patient *must* do during high-risk days in order to reduce the probability of relapse. These actions can include taking medication, employing stress reduction and relaxation techniques, doing physical exercise, etc.

The patient will keep a diary in order to be able to evaluate the effectiveness of this protocol over time together with the therapist. The protocol should be adjusted until the best results are reached. The AST software will record relevant data of every completion of the AST in order to monitor treatment compliance.

REWARS is not suitable for the following categories of patients:

- Patients with an IQ lower than 80.
- Psychotic patients (with manifest symptoms of psychosis).
- Patients suffering from advanced Korsakoff’s syndrome.
- Patients without stable housing conditions.
- Patients with seriously impaired eyesight (who are unable to complete the AST).
- Patients who are unable to use a computer or a PDA.
- Patients who have severe difficulties in adhering to a daily task (as is the case in patients with severe ADHD).

The availability of supportive persons (either professionals or non-professionals) is of the utmost importance for the success of the REWARS system. The recruitment of a social support network for the patient, therefore, should be an integral component of the total SUDs treatment program.

## CONCLUSION

The two methods that are presented in this chapter are both new and require more empirical testing and further development. Presently, neurofeedback comes forward in the literature as a promising addition to various forms of offender treatment. It is stressed here that neurofeedback is still a relatively new subject of empirical research. Much more research,

especially of the randomized controlled trial design, is needed to establish its value for the field of offender treatment more precisely. REWARDS is also in its beginning stages of development. Recent discoveries and insights concerning attentional bias in SUDs may yield more practical applications that may prove valuable in the reduction of antisocial behavior in addicted patients. Audacity, inventiveness and creativity are needed for further progress in offender treatment.

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