Interactive Cognitive Motor Interweaves During EMDR

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A new interweave technique is described for when patients are slow to desensitize or when they are emotionally overwhelmed during EMDR (Eye Movement Desensitization and Reprocessing) treatment. The interweave is comprised of two parallel components: a finger-touching go/no-go tracking task and a semantic priming task. The theoretical rationale for the finger-touching task is explained relative to neuroimaging studies of the anterior cingulate cortex and other areas. The rationale for the semantic priming task is explained relative to research about dopaminergic activation projecting from the ventral tegmentum as well as novelty-generated orienting responses. A two-stage model is proposed for constructing effective EMDR stimulation techniques.

When Francine Shapiro initially published her EMDR protocol for treating Post-Traumatic Stress Disorder (PTSD) in 1989, eye movements were hypothesized to be the catalytic ingredient to stimulate accelerated information processing. Since that time, many EMDR trainers and consultants have used *alternating bilateral stimulation* (ABS) as a more liberal interpretation of the catalytic stimulus. The use of numerous forms of ABS (e.g. auditory tones, vibrations, hand taps, etc.) is now widely accepted by EMDR clinicians. It is assumed that they all are effective forms of sensory stimulation because they bilaterally alternate. What is lost in this evolution is that the EMDR eye movement procedure is a visual-tracking task in the context of a performance expectation. It demands effortful divided attention. The patient is required to synchronize his or her gaze on a moving target while concurrently thinking about the target memory. In addition, the therapist's obvious scrutiny of the patient's gaze and the therapist's periodic verbal encouragement "paint" the patient's efforts with a sense of importance. All of these factors have neurological effects.

From the standpoint of psychophysiology, such a performance task is a very different phenomenon than the passive reception of non-task-related sensations. By emphasizing eye movements and bilateral stimulation, the proponents of EMDR have drawn attention away from the informational dimensions of the methods used. Task relevance, novelty, ambiguity, complexity of stimulus information, social context, public exposure, relevance to the targeted memory, and load demand on short-term memory are just a few of the informational dimensions that may make one method of stimulation functionally nonequivalent to another.

Shapiro (2001) describes using cognitive interweaves to help the patient overcome processing blocks. This paper proposes a new interactive cognitive motor (ICM) interweave to be added to the extensive array of EMDR tools. It is meant to be a supplement, and not a replacement, for either the standard EMDR visual-tracking task or the usual cognitive interweaves involving issues of responsibility, safety, and choice. When EMDR processing is laboriously slow and "looping" prevails, the proposed interweave procedure can be helpful. Perhaps even more important is that the theoretical basis for the proposed interweave might promote effective procedures that are not easily conceived from the current emphasis on physical sensation and eye movement.

The proposed ICM interweave is a combination of two tasks being performed simultaneously: One task is verbal, the other is visual motor. The two parallel tasks are designed to interact and reinforce their catalytic effect on information processing. Because of its complexity, the theoretical rationale for ICM interweaves will be deferred until the reader can first visualize the procedure.

The ICM Interweave Procedure

Patient Preparation

Before the desensitization phase of EMDR is started, the patient will need to be shown how to perform the ICM interweave with the therapist. For this, the patient should be seated in the usual "ships passing" position relative to the therapist. The ICM interweave procedure is explained to be a combination of verbal and motor tasks that will stimulate the nervous system to operate more flexibly with the patient's disturbing memory. The patient is told that there are two parts to the ICM interweave procedure: a part A and a part B.

Preparatory Instructions for Part A (Semantic Priming):

As we go through the free association phase of EMDR, I will sometimes ask you to think back on some of the things you have thought and said while free associating. I will then ask you the following question:

"***Since the last time we visited your disturbing experience, what is the most important personal meaning, to you, of everything you have said?"***

In other words, I will ask you to think back over the last 5 to 10 minutes and then summarize what you think has been your most important personal meaning in all that you have said during that time. I will ask you to summarize that meaning in one sentence. (Therapist asks for questions and clarifies at this point.)

Now, once you have told me your sentence, I will ask you to take that sentence and condense it further into a short phrase of only two to three words… to act as a symbol for the sentence…no more than three words. For example, if the sentence were "I wish I had felt more safe as a child," then the phrase or symbol might be "Unsafe Child" or it might be "Want More Safety." Whatever it is, let it be your personal meaning and no one else's. (Therapist asks for questions and clarifies at this point.)

As we go along in the EMDR procedure, I will occasionally ask you to give me one sentence summaries of your personal meaning. I will also be collecting your two- and three-word phrases. I will then make a list of these phrases because they will be used later to ask you some very interesting questions. Next, I will show you how we will combine these questions with a motor task that you will do with your hands.

Preparatory Instructions for Part B (Finger-Touching Task):

The motor part of the ICM interweave is kind of like playing patty cake only a bit more complex. First, you put your hands on your chest, like this, with your hands open and your fingers on your chest. (The therapist puts his hands on his chest to demonstrate.) **Now, this is home base. This is where you usually are except when you have to respond. This is where you come back to after you have responded. Good! Now, imagine that there is a large clock-face circle between us.**

(The therapist draws a large imaginary circle in the air between himself and the patient.)

H**ere's three o'clock** (therapist points), **nine o'clock** (therapist points), **twelve o'clock** (therapist points), and **six o'clock** (therapist points). **I am going to put one of my hands out around the circle at any point except for twelve o'clock and six o'clock because that is where you are. Here, watch this.**

(The therapist alternates putting his right hand to the patient's left side and his left hand to the patient's right side. The exact position of the target hand positions will vary around the imaginary clock face except for the twelve o'clock and six o'clock positions. Each time that one of the therapist's hands is extended, it is made into a fist, except for the index finger which is extended forward.)

Now, your job is to take your hand on the same side as my hand and reach out and touch my finger. Go ahead and do it now. (The therapist corrects and guides until the patient does it correctly.) **Good! Now you have to get your hand back to home base after you touch mine.** (Therapist gestures with his own hands on his chest.) **That's right! OK. Let's practice a little bit. Ready? Here goes.**

(The therapist alternates putting his left hand, then right hand around the imaginary clock face in different locations while the patient reaches out and touches the therapist's finger. The pace is kept easily obtainable: approximately once every two seconds. This only needs to be done for about 30 to 40 seconds)

Great! Now that you know how to do it, we are going to make it a little bit more complicated. From here on out, whenever I stick out my hand I will extend either one finger or two fingers. When you see one finger, reach out and touch it with your fingertip. But when you see two fingers, try not to move at all. In other words, reach and touch with one but try to INHIBIT and do nothing with two. Understand? (The therapist answers any questions.) **OK, let's practice a bit.**

(The therapist and patient practice for about one minute. The pace is gradually increased to the point that the patient can still perform the task but must concentrate fairly well to make the discriminations.)

OK. Good! You've got it. Now there is one more piece to the interweave. When we finally do it in the context of working with your disturbing memory, I will give you some interesting questions to repeat. While I am putting my hands out, I will be taking your meaningful phrases and posing them into interesting questions. Your job is merely to repeat the questions out loud. You do not have to answer them, just repeat them. (For the next part of the explanation, the therapist gestures as if he's putting out his one- or two-fingered hand targets) **For example, if you had given me the phrases "I wanted freedom" or "Not enough safety," I might ask you the questions: "Would it have been safe to have wanted freedom?" or "Am I now free enough to seek more safety?" Do you understand?** (The therapist answers any questions.) **OK, let's practice a bit.** (The therapist and patient practice for about one minute.)

<u>Obtaining Semantic Cues</u>

During the desensitization phase and at the end of each associative channel, the therapist and patient derive a semantic cue that is strongly associated with each channel. This is done before returning to the target memory. When the patient has completed his or her last response for the particular channel, the therapist derives the cue as follows:

OK. Now, think back over all that you have said since the last time we visited your disturbing experience and try to find the MOST IMPORTANT PERSONAL MEANING of everything you have said since then. Then take that meaning and put it into a sentence…only one sentence. What would that sentence be? (Therapist waits until patient responds, clarifying if necessary.)

Good. Now condense that sentence down to two or three words. No more than three words that symbolize what is most important in that sentence. (Therapist waits until patient responds, clarifying if necessary)

The Interweave

The ICM interweave is not started unless the patient is not processing well with the normal ABS procedure. Before it is implemented, at least three to four semantic cues must have been previously obtained from the patient. The interweave is employed after the patient has completed processing an associative channel and has again revisited his or her target memory.

OK, now we are going to do the interactive exercise I showed you. Put your hands on your chest like this. (The therapist models with his hands splayed on his chest.) **Now I am going to ask you to touch on "one" but not on "two." Got it? … Good. Now remember to repeat each question after I say it. OK? Ready?**

The therapist starts placing his hands around the imaginary clock face, extending either one or two fingers approximately two seconds between extensions. When extending to the patient's right side, the therapist uses his or her left hand and vice versa on the patient's left side. The therapist should randomly choose on which side of the patient to present the target. Sometimes the patient will be required to interpret two or three consecutive targets on the same side. This prevents the patient from being able to anticipate which side will require his or her response. The ratio of "go" responses (touch) should be approximately 2-to-1 with "no-go" responses (inhibit) occurring about one-third of the time.

While the therapist is presenting his hands for "go" or "no-go" targets, he starts posing questions for the patient to repeat out loud. The questions are all improvised by the therapist and utilize the list of semantic cues (phrases) that the patient has previously provided. It is best to have this list of semantic cues printed in large bold letters and placed on a clipboard within easy viewing distance of the therapist. The reason for this is that the improvising process requires intense creative thinking and it is not a good time for the therapist to be struggling with memory issues. Questions should be posed in the first person when possible and in the third person when it is not. The ideal use of the semantic cues is to combine them into inferred potential relationships by using two at a time within each question. For example, the semantic cues of "Never enough" and "He was preferred" could be used to generate the following questions: "Would I have been preferred if I were more than enough?" or "Could he have felt that his preferences were never enough?" It is important to use key words from the patient's own semantic cues. The questions will imply unfamiliar perspectives to the patient and are not necessarily meant to lead the patient in a particular direction. There purpose is mainly to stimulate processing for semantic priming. Too much focus on making the questions directive will likely stop the therapist from being sufficiently creative in the moment. This exercise taxes the limit on both the therapist's and the patient's cognitive flexibility.

An illustration of the semantic priming process is shown in Figure 1.

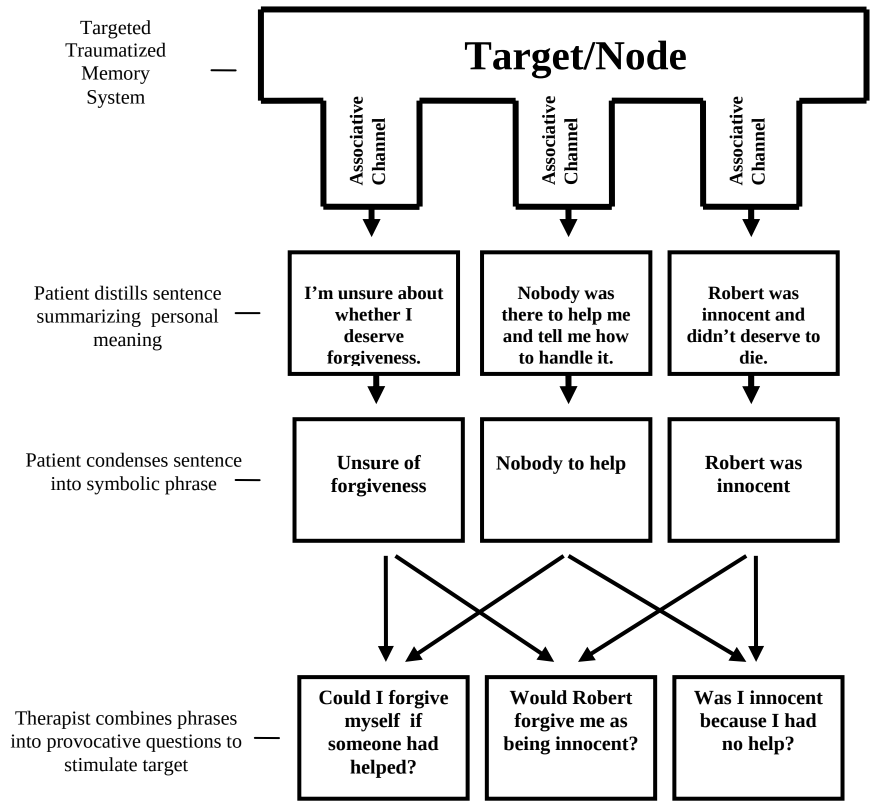

FIGURE 1. Illustrated process for deriving priming questions.

When conducting the ICM interweave, the therapist should pose approximately six to eight questions while presenting the one-or two-fingered targets to the patient. After the last question, the therapist asks the patient to think about the posed questions relative to his or her disturbing experience while their go and no-go hand responding continues for another 30 seconds:

Now think about those questions relative to your disturbing experience while we continue this for awhile.

After the therapist stops the ICM interweave, he asks the patient to stop and take a deep breath, and then he asks for first associations that come. Conventional EMDR processing continues with interspersed eye movement sets for whatever new channel of associations has been stimulated. At the end of each channel, the therapist continues to derive new semantic cues with the already described procedure.

When shifting to a new ICM interweave, an important feature is to reverse polarity of action on the hand targets. While the first interweave should involve touch on "one" and not on "two," the second time an ICM interweave is used, the patient should be told to touch on “two” and not on “one.” By reversing the direction each time, the patient is prevented from automatizing the task into procedural memory. This variation guarantees that a fair amount of conscious effort and working memory will always be required for the task. It also ensures that activation of the upper anterior cingulate will not be reduced through a practice effect. This last point will be explained later in the discussion.

Development of the ICM Interweave Strategy

A simplified explanation for the strategy for using ICM interweaves is that two processes are being stimulated at the same time. The first process is a “go/no-go” task that is employed to simultaneously stimulate cognitive flexibility and temporarily reduce the patient’s experience of negative affect. Supportive background research for these hypothesized effects will be presented. The second process is the priming of working memory so that the first task does not reciprocally deactivate the targeted traumatic material. This potential deactivation of the target memory is a very real problem when using any arousing sensory-motor task for ABS. This problem will be illustrated in the following discussion about the author’s early pilot work.

One of the main contenders for explaining the efficacy of EMDR has been the orienting reflex (Denny, 1995; Armstrong & Vaughan, 1996; MacCulloch & Feldman, 1996). While exploring the orienting reflex relative to EMDR over a period of several years, the current author monitored the real-time GSR (galvanic skin resistance) for patients while undergoing EMDR desensitization. GSR has been found to be a reliable indicator of sympathetic arousal resulting from orienting reflexes (Barry, 1990a,b). Electrodes were placed on the patients’ feet so that GSR could be monitored while the patients retained free use of their hands. This allowed for exploration of different methods of sensory motor hand-tasking for alternate bilateral stimulation.

Several very interesting observations came out of this pilot work. The first observation was that EMDR desensitization appeared to be a very dynamic process. The sympathetic arousal indicated by GSR did not decline in a straight linear fashion. While there was a slight general trend toward lower sympathetic arousal as each session progressed, most EMDR sessions involved several transient episodes of increased sympathetic arousal when new material emerged. The observed episodes of arousal were consistent with the description of novelty-driven phasic OR’s (short-term orienting reflexes) previously described by Maltzman, Sokolov, and others (Maltzman, 1971, 1979; Maltzman & Mandell, 1968; Maltzman et al., 1970; Sokolov, 1963, 1965, 1972). What was most interesting was that there appeared to be a correlation between frequency of short-term phasic novelty orienting (as indicated by GSR during a session) and the speed with which a patient would desensitize. In other words, more quickly desensitizing patients generally had more GSR variability that was attributable to internal processing. Patients who did not show much GSR variability or only a steady decline in sympathetic arousal did not desensitize as well.

These observations were very much in line with Rossi’s (2002) description of creative psychobiological cycles as well as Maltzman’s earlier work correlating OR’s with efficient learning. The observations suggested that EMDR desensitization involves much more of a quantum process of neural reorganization instead of a smooth and steady rate of transformation. The observed correlation of auto-generated OR’s and speed of desensitization is also consistent with Rossi’s description of the “novelty-numinosum-neurogenesis effect.” This effect takes place when novelty or surprise switches on immediate early genes such as c-fos, c-jun, and zif-268 that mediate neurogenesis. If EMDR results in new neural connections, as strongly suggested by the neuroimaging work of van der Kolk et al. (1997), then it is reasonable to surmise that the emergence of surprising new memories or perspectives during EMDR might also be switching on immediate early genes for neurogenesis. It was hypothesized that the observed phasic episodes of sympathetic arousal during EMDR desensitization might be revealing this process.

To illustrate the dynamic fluctuation of sympathetic arousal during many of the pilot EMDR sessions, a GSR recording of such a session is shown in Figure 2. The patient was a 34-year-old intelligent female executive who had been sexually enmeshed with her father. He had engaged her in oral sex from the age of 5 to 16 and her chief complaint was that she could never refuse sexual advances by males, even those she considered undesirable. This problem required numerous desensitization sessions on various memory targets around the issues of enmeshment and sexual abuse. Her chief complaint was resolved within 5 months when she was able to demonstrate that she could effectively set limits with males. The patient was then referred to another therapist for further consolidation work. When interpreting the following graph, it should be noted that a decrease in GSR means an increase in sympathetic arousal. In other words, sympathetic arousal is inversely related to GSR level.

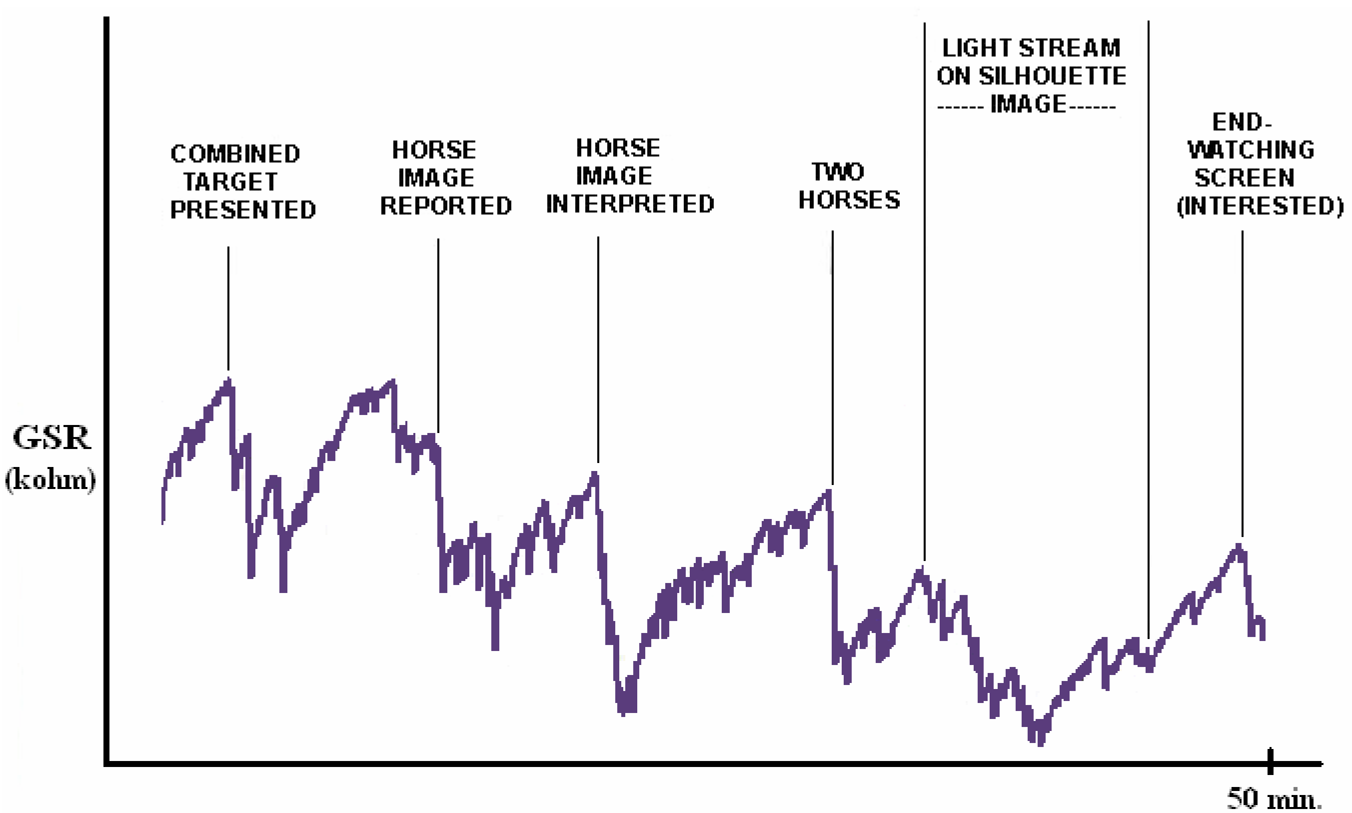

Figure 2. GSR recording of an EMDR session with a sexual abuse survivor

Explanation of events for Figure 2:

Combined Target Presented - The combination of target images, negative cognition and somatic associations are elicited together. Target is of fantasy or memory of patient first refusing father's advances followed by father's rejection. The patient shows some tension as several stimulation and association sets follow.

Horse Image Reported - The patient reports association to an image of a horse with no elaboration. Monitor shows dramatic GSR drop. No obvious external reactions by patient.

Horse Image Interpreted - After associations processed to point of positive affect, patient was then asked to re-visualize her earlier image of the horse. After visualizing for 15 seconds, patient is then asked for "an intuitive interpretation" of what the image might mean to her. Patient reports her interpretation and GSR drops again. Much affect is evident.

Two Horses - New image of two horses running emerges in associations. One horse is brown (like before), but the other horse is white. Trembling jaw observed. Patient subsequently associates to a "light" feeling over most of her head but some pain in her head behind her right eye. Regular sets on pain and the "lightness" in rest of head result in no change.

Light Stream on Silhouette Image - The "light" feeling is rated as positive but the pain behind right eye is not. Patient is asked to associate a shape for the pain and a silhouette comes to mind. No other features. Light stream technique results in patient eventually identifying the silhouette as her father. Subsequent eye movement sets results in absence of pain behind eye and patient's whole body feeling light "as if about to float from chair."

End of Session – Watching Screen (Interested) - Patient reports feeling very positive. Becomes engrossed with her GSR reactions on computer screen.

When observing real-time GSR during the pilot EMDR sessions, it was intriguing to see patients with the most auto-generated OR's desensitize more quickly. This observation seemed to imply that Armstrong & Vaughan's (1996) proposal might be correct: that one could use other procedures to induce OR's, inhibit the negative affect of the target memory, and thereby obtain effective desensitization. The current author decided to explore this hypothesis by creating a highly engaging ABS task to possibly induce faster desensitization via arousing ABS. The patients were instructed to drum an innovative pattern of their own on a set of four acoustical drum pads laid out on a board in their lap. The two pads on the right of the board would produce different tones in a speaker to their right. The two pads on the left of the board would similarly produce different tones in a speaker to their left. The patients were given a target tone that alternated between the speaker to their left and the speaker to their right. Instructions were given for patients to drum a beat using both hands that would track the moving target tone. In other words, they would try to roughly lateralize their drumming sounds to correspond with whatever side the acoustical target tone would occupy.

Unfortunately, a simple implementation of Armstrong & Vaughan's hypothesis did not work as had been hoped. While highly arousing and apparently enjoyable for many of the patients, the desensitization effect of the drumming was very poor. Merely stimulating intense OR's in the presence of a trauma-related cortical set did not produce the effective desensitization that those authors had proposed. Instead, it appeared that the procedure's requirement for quick movement and its heavy utilization of working memory were too distracting. It was interpreted that the high task demand, through coordinative inhibition (Anokhin, 1974), was deactivating the target memory so that neural remapping of the target could not take place. Therefore, it was decided to add a priming element to the procedure. On a sensory level, priming reduces activation thresholds. It induces preliminary potential into the networks to be later used in sensory processing (Posner et al. 1997, Posner & Fan 2003). However, the type of priming chosen for the current procedure was more cognitive/emotional in nature than the simple sensory cues referenced by Posner et al. It was decided to use emotionally laden semantic cues that were relevant to the patient's own traumatic experience. It was also decided to structure these priming cues in novel configurations so as to stimulate novelty-driven orienting responses. It was reasoned that intense curiosity about these cues might catalyze activity into the traumatized memory system and thereby prevent it from being suppressed. In other words, it was assumed that working memory demands of highly interactive ABS needed to be balanced by more stimulation of the traumatic memory. This reasoning led to the current method of semantic priming in the ICM protocol.

At the time that the semantic priming element was added, the current author was applying EMDR with 12 patients who were targeting mostly attachment-related “small T” traumas. Many of these patients were dealing with numerous “feeder memories,” as well as additional enmeshment/individuation issues. For these reasons, as well as the fact that each session lasted only 50 minutes, desensitization could be expected to be much slower than with adult onset single trauma targets in 90-minute sessions. However, with the high intensity drumming ABS without semantic priming, desensitization was even slower than expected.

When semantic priming was then added to the ABS for all 12 patients, improvement was immediate and dramatic. Because the improved desensitization was so evident, the author retrospectively assembled data to measure this effect. To accomplish this, the author attempted a rough post hoc time-series comparison of before versus after the addition of semantic priming. The chosen dependent variable was the amount of decrement in the initial SUD level (subjective unit of disturbance) from one session to the next. For the aforementioned 12 patients, when the drumming ABS was used without semantic priming, SUD decrements averaged only one unit between sessions. When semantic priming was added with the same patients on the same target memories, SUD decrements immediately tripled to an average of three. This finding was considered a powerful affirmation for the strategy of balancing highly interactive ABS with periodic target memory priming.

Some interesting observations were made during sessions with the drumming ABS semantic priming combination. For most patients, the combination produced immediate sympathetic arousal. However, for some patients the arousal lasted for long periods of time. It was evident that the ABS combination had sparked a novelty-driven tonic OR involving prolonged curiosity. These patients showed good desensitization and many later described their curiosity about the priming questions. GSR and plethysmograph recordings are shown for one of these patients in Figure 3. This particular patient was a highly intelligent biochemical research scientist who demonstrated enormous OR responses during sessions. He desensitized relatively quickly with most targets. With the onset of ICM interweaves, his GSR would drop precipitously while the capillaries in his toes would contract as shown. A second measure of blood flow in his superficial temporal artery (not shown) simultaneously showed increased blood flow to the head. This reaction is described by Sokolov (2002) for strong orienting responses when increased brain metabolism demands more energy resources.

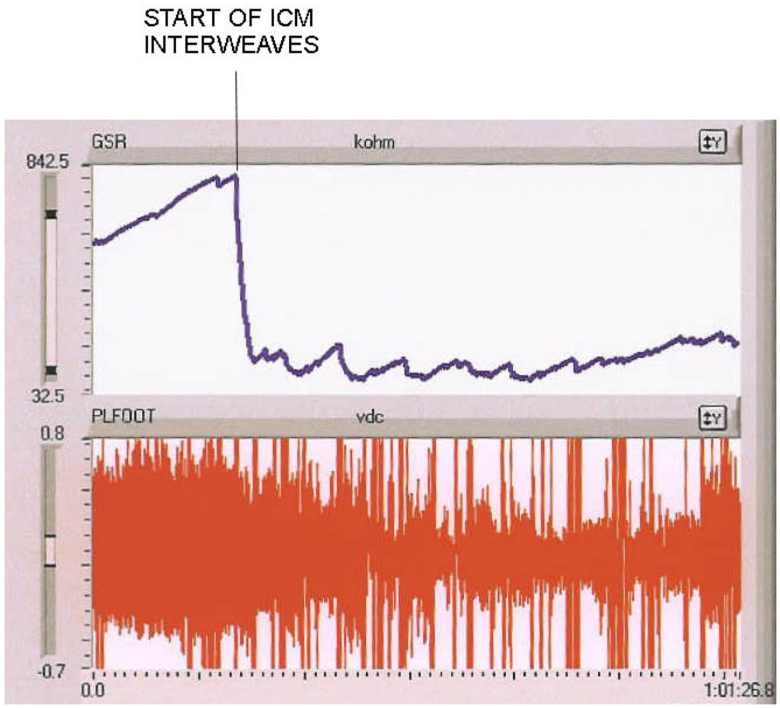

FIGURE 3. GSR and toe plethysmograph responses to ICM interweave.
(Large longitudinal lines on plethysmograph are movement artifacts to be ignored.)

Since the finding of improved desensitization via semantic priming, the highly interactive ABS technique has evolved further. In order to reduce coordinative inhibition caused by a large amount of movement, the drumming ABS method was replaced by the finger-touching procedure described earlier in this article. It was hypothesized that less emphasis on movement and more emphasis on cognitive response conflict would give better results. Initially, this rationale was based on findings from earlier research on the orienting response. Sokolov (1963, 2002) describes how powerful orienting responses usually occur when there is a conflict between execution versus inhibition of responding. However, there was a more compelling rationale to consider inducing such a response conflict in the ABS method. This rationale is based on neuroimaging research involving the executive control functioning of the anterior cingulate cortex (ACC) and the dorsolateral prefrontal cortex (DLPC). To introduce the reasoning behind this procedure, some background research will be discussed.

<u>The Cingulate Connection</u>

Bessel van der Kolk has contributed much to the understanding and treatment of PTSD. In their 1997 article, van der Kolk et al. summarize research implicating dysfunction of the hippocampus under extreme stress and the failure of the nervous system to synthesize sensations related to the traumatic memory into an integrated semantic memory. Van der Kolk et al. hypothesize that this disorganization interferes with the evaluation, classification, and contextualizing of the traumatic experience. However, these authors make another point in this article that is perhaps even more important to the evolution of EMDR. They report on pilot imagery work on the aftereffects of successful EMDR treatment. After such treatment, van der Kolk et al. found increased activation of the ACC bilaterally as well as a suggestion of increased activation of the right prefrontal cortex. The authors hypothesize that improvement of PTSD symptoms may be mediated by increased activation in these areas which help the patient to better discriminate context. This hypothesis is highly consistent with other imaging studies involving the ACC and prefrontal cortex. If van der Kolk et al.'s hypothesis is correct, then it would be reasonable to infer that strategic manipulations to activate these areas during EMDR may hold promise for improving EMDR's effectiveness. The hypothesis, if true, may also help explain why the eye-finger-tracking ABS procedure facilitates processing of traumatic memory.

Fernandez-Duque et al. (2000) explain how the ACC and DLPC are key components of an executive system that carries out metacognitive control of lower level cognitive processes. Other areas involved in this system are the orbitofrontal cortex, portions of the basal ganglia, and the thalamus. According to these authors, the function of this system is to add flexibility to cognitive processes and make them less dependent on external cues. Consistent with this idea, Lu and Pederson (in press) summarize research showing the ACC to mediate at least three processes in action regulation: (1) Monitoring expectancy (context) violations, (2) Monitoring of response relative to context, and (3) Evaluating the affective consequence of any expectancy violations. According to Lu and Pederson, the ACC adapts behavior to context in a circuit also including the amygdala and other components.

Much imaging research with the ACC and prefrontal cortex has been performed using various conflict-inducing tasks such as the color-word Stroop where the subject must discriminate and selectively respond to the name of a color that is printed in an incongruent color (e.g. "green" typed in red letters). Another frequently used method is the flanker task in which the incongruent (conflict) stimulus is a target arrow pointing in one direction while flanking arrows point in the opposite direction. Of direct relevance to the current ICM protocol, the creation of a go/no-go conflict requiring discrimination of context is yet another way of activating the ACC (Nieuwenhuis et al., 2003). This strategy was adopted in constructing the current ICM protocol's finger-touching task. The general picture that emerges from much of this response conflict research is that the ACC helps monitor conditions under which errors are likely to occur (response competition) and not the errors themselves (Carter et al., 1998). The role of the DLPC seems to be to hold in mind the relevant information for the particular task (Posner & Fan, 2003).

While response conflict has been a frequent research method for activating the ACC, other conditions have also been found to involve ACC activation. Intense negative emotional states have been found to involve activation of the pregenual portion of the ACC (Drevets & Raichle, 1998). Corbetta et al. (1991) found that both the ACC and the DLPC activate during divided attention, but not with selective attention that involved other structures. Perhaps this latter finding is relevant to the eye-finger-tracking procedure used in Shapiro's original EMDR protocol. Considering the research already discussed, at least two dimensions of the tracking can plausibly activate the ACC. First, the eye-finger-tracking task involves dividing attention between the processed topic and the tracking. Second, the tracking task may evoke some error monitoring. This latter process may be helped by the fact that the therapist usually reinforces this monitoring by offering verbal encouragement about performance.

Other findings about ACC activity can be summarized as follows:

- Different conflict tasks have been shown to activate the ACC and the left DLPC but each task involves a somewhat different location on the ACC. This finding supports the idea that either there are distinct networks for each conflict task or a single network that monitors conflict with different sites used to resolve the conflict (Posner & Fan, 2003).

- ACC activity can be stimulated by instructions long before a stimulus is presented (Bush et al., 2000). This finding is potentially very relevant to clinical practice. The implication is that manipulations to activate the ACC may have relatively enduring effects on subsequent cognitive processing. If ACC activation only occurs during stimulus presentation, then clinical applications would be impractical because the effects would be too transitory. A state of ACC activation needs to endure long enough between stimulus presentations so as to allow practical clinical work. The implications of the Bush et al. research are that ACC activation can be maintained between manipulations merely by the anticipation and vigilance involved in response conflict.

- ACC activity has been shown to decline with practice and automatization of task skills by the nervous system (Bush et al., 1998). For this very reason, the current ICM protocol regularly reverses polarity of "go" versus "no-go" between the two hand signals. Automatization is thereby prevented and ACC activity is hypothetically maintained at a relatively high level.

- Higher activity in the ACC during response conflict and error trials has been found to be associated with greater subsequent behavioral adjustment at later points in time (Kerns et al., 2004). In this study, the higher ACC activity was also predictive of later increased activity in the right DLPC in subsequent trials. The central feature of this piece of research was the demonstration that increased ACC activity projected benefits of improved control across time. This finding is relevant to the fact that van der Kolk's pilot research with post-EMDR subjects found increased activation of the ACC and right DLPC regions following successful EMDR treatment.

- Different regions of the ACC activate for emotional processing versus cognitive processing (Drevets & Raichle, 1998). Cognitive processing involves activation of the upper anterior region, whereas emotional processing involves activation of the lower anterior region (See Figure 4). It should be noted that only negative (not positive) emotion was involved in all of these studies cited by Drevets & Raichle.

- There are important interactions between emotion and cognition involving the ACC and the dorsolateral prefrontal cortices. Drevets and Raichle (1998) summarize a number of these studies. The pattern is that some areas showing increased blood flow while performing attention demanding cognitive tasks (upper ACC and dorsolateral prefrontal cortices) will also show <u>decreased</u> blood flow during experimentally induced and pathological negative emotional states. Conversely, attention demanding tasks have been found to decrease activation in the same regions that typically activate during intense (negative) emotional processing (amygdala, posteromedial orbital cortex, and the ventral ACC). Based on these findings, Drevets and Raichle propose a reciprocal suppression model involving a neural substrate where competition between mental operations may occur. They also propose that this model may more specifically define the mechanisms by which extreme fear or severe depression may interfere with cognitive performance.

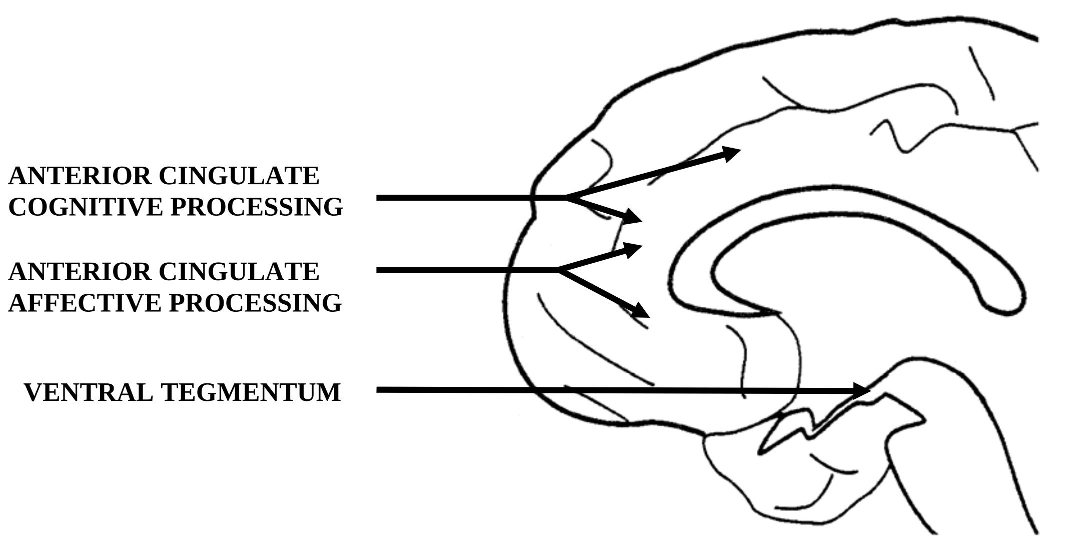

FIGURE 4. ACC processing areas
(adapted from Bush et al., 1998, and Fernandez-Duque et al., 2000).

Mayberg et al. (1999) also demonstrated similar reciprocal effects to those summarized by Drevets and Raichle. In the Mayberg study, sadness was found to increase activation in the lower ACC and decrease activity in the right DLPC. These findings of reciprocal suppression between affect and cognition in the ACC are extremely important. They may offer the potential for evolving EMDR treatment by facilitating the development of new treatment techniques to manipulate the cognitive/emotional neurological interface.

<u>Affect, Dopamine, Novelty, and the Anterior Cingulate</u>

While van der Kolk offers an elegant model for how post-traumatic memories originally become un-integrated, the pressing question for treatment is how to integrate. Van der Kolk's model of PTSD genesis does not necessarily show us the way. Why don't these shattered memories quickly meld together with contextual information when they are revisited in talk therapy? The current author proposes that the answer to this question may be severe reciprocal suppression involving the ACC. If the ventral ACC is sufficiently "hot" from negative affect, then cognitive processing in the dorsal ACC may be so strongly suppressed that new contextual information may not be allowed to enter the system. Strong associations would then be expected to perseverate. The appropriate metaphor is that of a self-tightening knot. While some researchers have sought mechanisms that account for hyper-association during EMDR, they may not be accurately framing the task. It may be more appropriate instead to search for ways to reduce under-association. In other words, we need to find ways to "loosen the knot." One logical method would be to utilize the reciprocal suppression effect in the ACC. By stimulating upper ACC activation with tasks that evoke error-monitoring and/or divided attention, a "hot" lower ACC during traumatic memory recall might be cooled down. Theoretically, this reduced activation could allow new contextual information to enter the system as long as the tasks are not too distracting. This latter point will be discussed later in more detail.

Another important study was performed by Rainville et al. (1997) who demonstrated that pain is encoded in the ACC and not the somatosensory cortex. Hypnotic suggestion was used to alter the unpleasantness of noxious stimuli without changing perceived stimulus intensity. PET (Positron

Emission Tomography) scans revealed significant resulting changes only in the ACC. Furthermore, the resulting changes closely correlated with reduction in the perceived unpleasantness of the stimuli. The reason this study is so important is that it shows that affective distress can be dissociated from a previously associated network, and it very strongly suggests that the ACC may be a critical mediator of this effect. There is also another possible implication from the study: If affective distress can be dissociation from painful sensation, then perhaps it can also be dissociation from painful memory. If this can happen, then cognitive processing might be opened up on the traumatic material by reversing reciprocal suppression. This possible effect would assume that the traumatic memory is not completely deactivated as affective distress goes down. Early Soviet research on dominant foci (areas of brain activation) are consistent with this assumption. There is appreciable momentum for a dominant focus to endure until it is inhibited by a new competing focus of activation (Ukhtomski, 1926, Rusinov, 1973, Anokhin, 1974). Even after losing its primacy of dominance, a focus of activation may remain as a "latent dominant." To the extent that affective distress can be dissociated from a traumatic memory in the ACC, then the momentum of the traumatic memory's dominant focus might allow remaining time to cognitively reprocess its context.

In addition to the phenomenon of reciprocal suppression, there is yet another possible influence in the ACC that might facilitate traumatic memory processing. Positive affect may also play a role. In EMDR, positive resource consolidation plays a role in facilitating treatment effectiveness (Korn & Leeds, 2002). While the underlying mechanism for this phenomenon is not known, research on positive affect relative to cognitive flexibility may be relevant. Ashby et al. (1999) present a theory for how cognitive flexibility and the selection of perspective may be facilitated by dopamine in the ACC. These authors summarize a large number of experiments showing that randomly assigned positive affect enhances one's ability to see alternative cognitive perspectives. It is not their contention that positive affect actually causes cognitive flexibility. Instead, they propose that positive affect via dopamine release in the nucleus accumbens often accompanies activation of ventral tegmental area's (VTA) dopamine projections to the ACC and the prefrontal cortex (See Figure 4). It is known that these dopamine receptors are richly expressed in layer five of the cingulate (Posner & Fan, 2003). Ashby et al. cite other research that dopamine projections from the VTA into the ACC facilitate the cognitive selection process and that dopamine projections from the substantia nigra into the striatum facilitate the actual switching. Ashby et al. predict that any pathological condition that is associated with reductions in brain dopamine levels might be temporarily relieved by positive affect.

Consistent with Ashby et al.'s model, the current author proposes that events that evoke positive affect such as "resource installation" may also reverse the suppression of the VTA dopaminergic projection system. There is already evidence that the VTA dopamine system can be suppressed by a series of reactions initiated by serotonin-based projections from the raphe nuclei (Nieuwenhuys, 1985; Cloninger, 1991). In his article, Cloninger describes the latter serotonin-based system as a major personality mechanism for behavioral inhibition. He proposes that the serotonin-based inhibition system opposes the VTA dopamine-based activation system that drives pursuit of novelty and hedonic pleasure. In 2001, Suhara et al. provided strong evidence for the dopamine side of this theory. In a hypothesis driven study, these researchers measured the dopamine-bonding factor in the right insular cortex and then correlated it with the novelty-seeking trait score on Cloninger's Temperament and Character Inventory. The resulting correlation ($r = -.67$) is very powerful evidence that the dopaminergic system is a central mediator of a broad array of novelty-seeking behaviors. In his article, Cloninger describes how repeated frustration and other events can result in inhibition of the VTA dopamine-based system. Cloninger's description of this process is strikingly similar to Nathanson's (1992) description for the generation of shame. The current author also proposes that traumatic installation of "learned helplessness" (Seligman, 1973, 1983) may involve the same system of behavioral inhibition. It is plausible that all of these phenomena are involved in the inherently shameful and disempowering characteristics of traumatic memory. If so, then VTA activating experiences may improve flexibility of cognitive switching via the ACC as proposed by Ashby et al. This is one plausible explanation for how resource installation facilitates EMDR.

If cognitive flexibility can be improved through VTA activation of dopamine in the ACC, there may be other possible dopamine activating EMDR manipulations besides resource installation. Considering the research of Cloninger and Suhara et al., evocation of a novelty-seeking state may also be effective for activating VTA dopamine projections. MacCulloch & Feldman (1996) hypothesize that the visceral components of an investigatory state may be activated by eye movement in EMDR. Although this author would disagree that eye movements alone are likely to evoke an investigatory state, the dopamine-affect hypothesis would suggest that an investigatory state can help facilitate processing during EMDR. In the current ICM protocol, semantic priming is used to create such a state. Emotionally significant concepts, previously generated from the patient's own material, are woven together into intriguing questions. The questions are provided fairly rapidly, in the context of divided attention, and the patient is given no opportunity to answer them. Because of this, the patient is unable to quickly bring closure to any of the questions posed. Uncertainty and novelty are thereby "woven" into the patient's ongoing processing. It is this author's interpretation that this manipulation provokes aggressive internal searching for information to resolve the generated uncertainty. Subsequent to an ICM interweave, signs of curiosity, wonder, and mild confusion are frequently observed along with lower GSR. During the following free-association episodes, patients often shift to a stronger emphasis in tonality as if answering some of the questions that they have been covertly pondering.

Earlier in this article, the current author discussed an apparent correlation between the degree of auto-generated phasic OR's during EMDR and the rate of desensitization. It should now be mentioned that this is probably true only for novelty-generated OR's. By the late 1970s, most researchers had come to the conclusion that the orienting reflex construct was not unitary but covered a class of related and not identical phenomena. Emotional significance, task relevance, signal value, and other attributes of a stimulus will not necessarily evoke the same physiological responses as will novelty. They may evoke sympathetic arousal but affective tone and other visceral components can be quite divergent (Barry, 1990b). Novelty-generated OR's originate via novelty detectors in the hippocampus relatively early in the detection process (Sokolov, 1990). Vinogradova (1975) discovered novelty-activated neurons and sameness-activated neurons in the hippocampus that service the activation and inhibitory functions respectively. The novelty neurons were found to stimulate the reticular activating system, whereas sameness neurons feed into the synchronizing system. As previously stated, this system works rather quickly (approximately 80 to 100 ms.). Sokolov explains that emotional significance requires longer to process in the cortex before it makes its contribution to sympathetic arousal (at around 300 ms.). In addition to these psychophysiological differences, novelty and significance can evoke very different affects. For example, the anxiety about performing poorly on a visual-motor task would be much less positive than the arousal of considering surprisingly novel questions. For these considerations, our present discussion of OR manipulations will only involve novelty-generated orienting.

Major points will now be summarized from all of the previous discussion. Relevance to EMDR will be drawn for each point.

- Van der Kolk has found increased activation in the ACC and right prefrontal cortex following successful EMDR treatment of PTSD. Neuroimaging research has strongly implicated the ACC and right dorsolateral prefrontal cortex as mediating the override of previously conditioned reflexes.

- Traumatic memory is difficult to change with normal recall and reflection. Neuroimaging research strongly supports the concept of reciprocal suppression whereby sufficiently strong affective processing in the lower ACC can suppress cognitive processing in the upper ACC.

- EMDR traditionally uses a dual attention task in its ABS eye-to-finger tracking procedure. Dual attention has been shown to activate the dorsal ACC along with the DLPF where cognitive processing is mediated.

- In EMDR, its dual attention tracking task can mitigate some of the distress from traumatic memory recall. Dual attention tasks have been shown to activate the cognitive processing areas in the ACC and deactivate the affective processing areas.

- Affective distress can be dissociated from physical pain via hypnosis. ACC affective processing areas deactivate during this phenomenon while still leaving somatosensory areas active in the brain.

- There is research to support that positive affect facilitates cognitive flexibility. There is also research to support that the VTA dopaminergic projection system is associated with this phenomenon. The ACC is a major dopaminergic recipient for projections from the VTA. EMDR is facilitated by the use of positive "resources" associated with positive affect.

- A very strong correlation has been found between novelty-seeking in personality and post-synaptic sensitivity in the dopaminergic projection system. Therefore, it is hypothesized that novelty may be a stimulus dimension for activating dopamine release in the ACC for eliciting cognitive flexibility.

There are many coincidences between the EMDR eye-finger-tracking procedure and the way that the ACC and DLPC react to different dimensions of information. Van der Kolk's 1997 article states that these structures are probably central to the down-regulation of traumatic memory. In the next section, a theoretical model will be presented to explain the ICM protocol. Arousal, affect, novelty, and distraction/absorption will be discussed as related but also interacting variables.

<u>A Two-Stage Multi-dimensional Model Incorporating Balance</u>

Various researchers have proposed models to account for the therapeutic effect of eye movements during EMDR. Denny (1995) proposes an external inhibition model whereby an orienting reflex suppresses the pain and distress of traumatic memory. Armstrong & Vaughan (1996) propose a fairly straightforward extinction model whereby an orienting reflex catalyzes a new appraisal and changes in the neuronal model of the UCS. Andrade et al. (1997) propose a model whereby eye movements interfere with the vividness of traumatic material in the visual-spatial sketchpad of working memory. Stickgold (2002) suggests that the orienting of eye movements may activate REM-like PGO (spell out) waves along with hyper-association. MacCulloch and Feldman (1996) propose that eye moments in EMDR evoke a "reassurance reflex" via positive visceral components of an investigatory OR response. Consistent with this concept, Barrowcliff et al. (2003) demonstrated psychophysiological de-arousal effects of eye movement following arousing stimulation.

The current author agrees with MacCulloch and Feldman that investigatory reflex is probably involved during EMDR. However, instead of attributing the investigatory OR to eye movements themselves, the current author proposes a two-stage process. The first stage involves reciprocal suppression of affective processing in the lower ACC due to error-monitoring in the eye-finger-tracking task. This first stage may "loosen the knot" so that dorsal ACC cognitive processing may proceed. The second stage involves novelty-evoked investigatory OR's from the patient's own newly emerging contextual information. This two-stage model is consistent with MacCulloch and Feldman's model, but without the assumption that eye movements actually stimulate the investigatory reflex. The error-monitoring in the eye-finger-tracking task may merely allow it.

The current ICM interweave procedure is built on the previously described two-stage model. The finger-touching task is a powerful stimulus method for evoking error-monitoring. It is proposed that it activates the upper cognitive processing areas of the ACC along with suppression of the lower ACC affective processing. With the upper ACC no longer blocking cognitive processing, novelty orienting can then proceed with the patient's own emerging material. In this favorable environment, the semantic priming component of the ICM interweave is a powerful stimulus for evoking novelty from the patient's own material. Instead of waiting for novel information to emerge as in the usual ABS procedure, the ICM interweave constructs novelty from the patient's material in an attempt to "kick start" the investigatory OR. Once an investigatory OR is underway, then multiple layers of processing are accelerated as indicated by classical OR research (Sokolov, 1963, 2002) and immediate early genes are switched on for neurogenesis (Rossi, 2002). In addition, some positive affect from the investigatory reflex may accompany dopaminergic activation in the ACC thereby increasing cognitive flexibility (Ashby & Turken, 1999).

There are two other psychophysiological dimensions that need to be incorporated before the model is complete. The dimensions of sympathetic arousal and distraction have often been of central focus in EMDR research. The problem with these dimensions is that in real life they are terribly confounded with other processes. For example, tasks that lead to distraction may deactivate affective processing in the lower ACC. However, they may also deactivate non-affective relevant components of the target memory through coordinative inhibition. The current author hypothesizes that this is the reason he obtained such poor desensitization with a highly interactive drumming task. It is hypothesized that the addition of semantic priming reduced this distraction effect and, thereby, increased the task's effectiveness. In the current ICM interweave procedure, semantic priming also serves this function by preventing a similar distraction effect (coordinative inhibition).

The other highly confounded dimension is arousal. Many researchers have abandoned this construct as a useful unitary process since its popularization by Yerkes and Dodson (1908). However, there is still some utility in using the construct in a very general way. The inverted-U relationship of performance to arousal has been found in many applications. It is generally assumed that very high arousal increases the salience of well-established associations over weaker associations. This dominance of strong associations can lead to cognitive inflexibility and decreased performance. Litt (2005) proposes a two-dimensional model for optimizing ABS within EMDR. In Litt's model, the inverted-U function of performance is plotted against the variables of sympathetic arousal and absorption. This latter variable of absorption refers to how much the patient is focusing on past memory versus the present situation. Patients in the middle of an abreaction would be considered in high absorption. Patients totally focused on a highly interactive ABS task would be in low absorption. According to Litt, optimal desensitization occurs when ABS stimulates the patient into a zone of moderate absorption, as well as moderate sympathetic arousal.

The current author believes the Litt model to be accurate, but with the limitation that it does not account for different forms of arousal. It is proposed that the type of arousal, as well as the origin of the generated arousal, will greatly affect the effective range of the familiar U-shaped function. There are two reasons for making this statement. First, there are problems with assuming that arousal is a unitary construct (Lacey, 1967; Neiss, 1990). Dienstbier (1989) summarizes a number of studies that distinguish between two types of arousal. Pituitary-adrenal-cortical arousal is typified by a heightened and prolonged cortisol response to lack of available instrumental coping responses. In contrast, SNS-adrenal-medullary arousal is typified by increased catcholamine levels when effective instrumental coping responses are available. Dienstbier proposes that practicing this latter form of arousal can even "toughen" physiological and mental processes against quick catecholamine depletion in stressful situations. The author's second concern about arousal is that it rarely occurs in the real world without affective tone. In the Litt two-dimensional model, arousal is heavily confounded with negative affect from the traumatic memory. This is consistent with factor analytic findings that emotional responses to stimuli can be described along three dimensions with the dimensions of affect and arousal carrying the most variance (Russel & Mehrabian, 1977). In an arousing situation, affective tone can vary greatly depending upon the type of arousal being elicited. For example, Apter (2001) distinguishes between a "telic," means-ends goal-focused state, versus a "paratelic," here-and-now focused state. In the former, arousal is accompanied by a negative hedonic tone (anxiety). The latter usually involves positive affect such as excitement and joy. It is reasonable to assume that novel situations that generate emotions of awe, fascination, curiosity, and wonder will generate a positive hedonic tone along with sympathetic arousal. For this reason, it is proposed that Litt's model needs to consider that effective desensitization may take place at higher arousal levels during novelty orienting than when arousal stems from trauma-related memory.

Due to the heavy confounding of arousal, affect, absorption, and distraction when designing any ABS technique, the following model is proposed. It is suggested that there is a need for balancing the trade-offs among several variables. These hypotheses are as follows:

1) Consistent with the Litt model, desensitization effectiveness is generally an inverted two-dimensional U-shaped function of sympathetic arousal and absorption.

2) ABS tasks that are known to activate the upper ACC (e.g. error-monitoring, execution vs. inhibition conflict) will generally improve desensitization, but with trade-offs due to any distraction effects. These distraction effects may be multi-dimensional, involving reduced attentional resources as well as coordinative inhibition of the target material in implicit memory. When upper ACC activation is maximized and distraction effects are kept low, desensitization will be optimal. This means that a balance will usually need to be struck between the two conflicting factors. The result of these trade-offs is that moderate levels of absorption will usually be the "sweet spot" for good desensitization.

3) Novelty generated sympathetic arousal will allow effective desensitization at higher levels of arousal than other forms of arousal involving more negative affect. It is proposed that novelty-generated orienting acts as a "resource" via dopaminergic activation in the ACC with improved cognitive flexibility. However, this may be true only if the novelty ORs are in some

way directed at the target memory material and not away from it. Novelty ORs to irrelevant material may lead to greater distraction and decreased desensitization.

The ICM interweave procedure attempts to strike a balance of trade-offs among confounded dimensions. Upper ACC activation is elicited with a go/no-go task and novelty is stimulated by unusual combinations of emotionally charged cues related to the target memory. The semantic priming is designed to minimize distraction effects attributable to the heavy load placed on working memory during the go/no-go task. The technique is designed to strike a balance among competing considerations. Even so, it is best to use it as an interweave and not as a replacement for the eye-finger-tracking task. The current author believes that the latter's light demand on working memory makes it ideal for dual-attention free association. The ICM interweave is best used as a temporary alternative ABS only when the patient gets "stuck" or is emotionally overwhelmed.

One of the best ways to use this interweave is when patients are beginning to dissociate or are being overwhelmed by abreaction. In these instances, an initial full ICM interweave with combined semantic priming and finger touching can be followed by several subsequent sets using the finger-touching task alone. When the patient is no longer overwhelmed, then regular eye-finger-tracking can resume. It is theorized that the go/no-go finger-touching task evokes strong reciprocal suppression of affect processing in the lower ACC. When patients are being overwhelmed by affect, this suppression is most useful. When the patients are less overwhelmed, then the less distracting eye-finger-tracking is preferred. Knipe (2002) suggests a task of playing "catch" with a ball of wadded up tissue when a patient starts to dissociate. This suggested task is likely another method of evoking reciprocal suppression in the ACC via intense error-monitoring. However, the ICM interweave probably allows more retention of the target memory material due to its semantic priming and lesser distraction. It also allows continuity of pacing with the alternating ABS and verbal report. It is very easy to shift from eye-finger-tracking to go/no-go finger touching to the full ICM interweave or between any of these modalities in accordance with what the patient needs at the moment.

Suggestions for Future Research

If the current author's two-stage model is correct, then several lines of research may prove productive:

1) Future imaging research on post-EMDR effects should examine deactivation in addition to activation of different regions. Also, more specificity of location is needed since there is evidence of reciprocal suppression functions between the upper and lower ACC areas.

2) Research is suggested for correlating rate of EMDR desensitization with frequency of novelty-driven OR's stimulated by the patient's own material. This author predicts a positive relationship based upon his pilot observations of real-time GSR responding. Such findings would be consistent with Maltzman's previous research on OR's being predictive of learning and conditioning. They would also be consistent with Rossi's (2002) description of a naturally occurring four-stage creative psychobiological cycle.

3) Research is suggested for examining individual differences in both novelty-OR responding and rates of desensitization. If VTA dopaminergic activation of the ACC plays an important part during desensitization, then individual differences should be salient. Post-synaptic sensitivity

of the VTA dopamine projection system can be correlated to personality as demonstrated by the Suhara et al. study. Therefore, it is predicted that patients scoring high on Novelty Seeking measured by Cloninger's TCI inventory will generally desensitize faster than those scoring lower. It is also predicted that individuals holding the 7-repeat allele version of the DRD4 gene will generally desensitize faster than those holding the 4-repeat version. The DRD4 gene effects dopamine sensitivity and the 7-repeat version of the gene has been found to correlate with greater novelty seeking (Cloninger, 2004).

4) Research on the effectiveness of ICM interweaves will be difficult to perform in a controlled manner. Since the technique is recommended as an alternative back-up and is only used intermittently under certain circumstances, its contribution will likely be masked by other treatment factors. Clinical observation will more likely determine the fate of the technique. The current author has frequently observed signs of emerging curiosity and intense processing following ICM interweaves. If other clinicians observe the same, then the technique may survive the natural selection process of evolving psychotherapy. Newly emerging technology may help individual clinicians to explore these types of techniques. Good real-time GSR equipment has historically cost thousands of dollars. At the time that this article is being written, new technology is bringing the cost down to a fraction of that price. One internet vendor offers a video game software package that trains meditation using two biofeedback measures. Along with its real-time graphic package, the equipment allows real-time GSR observation at a very nominal fee. Using this type of technology, individual clinicians can virtually "see" their patients' sympathetic responding when novel contextual information emerges into consciousness and gets processed.

Conclusion

The ICM interweave is offered as an additional tool to supplement the existing array of EMDR techniques. It is an unusual technique because it has been modeled from a new perspective. Based on neuroimaging and earlier research on cognitive and emotional processing, a new model for EMDR desensitization is proposed. This two- stage model emphasizes the role of reciprocal suppression in executive processing along with the role of disinhibited investigatory OR reflexes. In addition, trade-offs need to be balanced between gains in desired reflex phenomena versus distraction in working memory and inhibition of implicit memory. To use a metaphor, we are no longer working with a black box. However, the box is still appreciably grey. The proposed model (may not be accurate—you may want to delete this so as not to discredit your theory in closing) but it attempts to integrate a fit with a broad scope of psychophysiological research. It represents a more diligent approach than arbitrarily labeling a tracking task as "eye movements" or "alternating bilateral stimulation." These latter externalizing labels ignore the contextual meaning of the sensory stimulation and ignore that the sensory information is utilized to perform a specific task. The result is that passive ABS techniques can be equated with the original eye-finger-tracking task. This author's last metaphorical indulgence is that we now have oranges labeled as apples in the EMDR orchard.

References

Andrade, J., Kavanagh, D. & Baddeley, A. (1997). Eye-movements and visual imagery: A working memory approach to the treatment of post-traumatic stress disorder. *British Journal of Clinical Psychology*, *36*, 209–223.

Anokhin, P. A. (1974) *Biology and Neurophysiology of the Conditioned Reflex and its Role in Adaptive Behavior*. New York: Pergamon Press.

Apter, M. (2001) *Motivational Styles in Everyday Life.* Washington, DC: American Psychological Association.

Armstrong, M. S. & Vaughan, K. (1996). An orienting response model of eye movement desensitization. *Journal of Behavior Therapy & Experimental Psychiatry*, *27*, 21–32.

Ashby, F., Isen, A., & Turken, A. (1999) A neuropsychological theory of positive affect and its influence on cognition. *Psychological Review*, *106*, 525–550.

Barrowcliff, A., Gray, N., MacCulloch, S., Freeman, T., & MacCulloch, M. (2003). Horizontal rhythmical eye movements consistently diminish the arousal provoked by auditory stimuli. *British Journal of Clinical Psychology, 42*, 289–302.

Barry, R. J. (1990). Scoring criteria for response latency and habituation in electrodermal research: A study in the context of the orienting response. *Psychophysiology, 27*(1) , 94–100.

Barry, R. J. (1990). The orienting response: Stimulus factors and response measures. *Pavlovian Journal of Biological Science, 25*, 931–03.

Bush, G., Luu, P., & Posner, M. (2000). Cognitive and emotional influences in the ACC gyrus. *Trends in Cognitive Sciences*, *4*(6), 2152–22.

Bush, G., Whalen, P., Rosen, B., Jenike, M., McInerney, S., & Rausch, L. (1998). The counting Stroop: An interference task specialized for functional neuroimaging—Validation study with functional MRI. *Human Brain Mapping*, *6*, 270–282.

Carter, C., Braver, T., Deanna, M., Mathew, M., Noll, D., Cohen, J. (1998). ACC cortex, error detection, and the online monitoring of performance. *Science*, *280*(5364). (page numbers missing?)

Cloninger, C. R. (1991). Brain networks underlying personality development. In B. J. Carroll & J. E. Barrett (eds.) *Psychopathology and the Brain.* New York, New York: Raven Press; pp.183–208.

Cloninger, C. (2004). *Feeling Good: The Science of Well-Being.* New York: Oxford University Press.

Corbetta, M., Miezin, F., Dobmeyer, S., Shulman, G., & Petersen, S. (1991) Selective and divided attention during visual discriminations of shape, color, and speed: functional anatomy by positron emission tomography. *The Journal of Neuroscience*, *11*(8), 2383–2402.

Denny, N. (1995). An orienting reflex/external inhibition model of EMDR and Thought Field Therapy. *Tramatology, 1*(1). (pages?)

Dienstbier, R. (1989). Arousal and physiological toughness: Implications for mental and physical health. *Psychological Review, 96(1)*, 84–100.

Drevets, W. C. & Raichle, M. E. (1998) Reciprocal suppression of regional cerebral blood flow during emotional versus higher cognitive processes: implications for interactions between emotion and cognition. *Cognition Emotion*, *12*, 353–385.

Fernandez-Duque, D., Baird, J., & Posner, M. (2000). Executive Attention and Metacognitive Regulation. *Consciousness and Cognition*, *9*, 288–307.

Kerns, J., Cohen, J., MacDonald, A., Cho, R., Stenger, V. , & Carter, C. (2004). ACC conflict monitoring and adjustments in control. *Science*, *13*, 969–970.

Knipe, J. (2002) A tool for working with dissociative clients. *The EMDRIA Newsletter, 7*(2), 14–16.

Korn, D. & Leeds, A. (2002). Preliminary evidence of efficacy for EMDR resource development and installation in the stabilization phase of treatment of complex posttraumatic stress disorder. *Journal of Clinical Psychology*, *58*(12), 1465–1487.

Lacey, J. I. (1967) Somatic response patterning and stress: some revisions of activation theory. In: Psychological Stress: Issues in Research (Eds. M. H. Appley and R. Trunbull). Appleton-Century-Crofts, New York, pp. 14–42.

Litt, B. (2005). EMDR in couples therapy. *Presentation at EMDR International Association Annual Conference,* Seattle, WA.

MacCulloch, M. J. & Feldman, P. (1996). Eye movement treatment utilizes the positive visceral element of the investigatory reflex to inhibit the memories of post-traumatic stress disorder: A theoretical analysis. *British Journal of Psychiatry, 169,* 571–579.

Maltzman, I. (1971). The orienting reflex and thinking as determiners of conditioning and generalization to words. (missing information? Journal title, volume, pages)

Maltzman, I. (1979). Orienting reflexes and classical conditioning in humans. In H. D. Kimmel, E. H. Olst & J. F. Orlebeke (Eds.) *The Orienting Reflex in Humans*. Hillsdale, N. J.: Lawrence Erlbaum Associates.

Maltzman, I., Langdon, B., & Feeney, D. (1970). Semantic generalization without prior conditioning. *Journal of Experimental Psychology*, *83*, 73–75.

Maltzman, I. & Mandell, M. P. (1968) The orienting reflex as a predictor of learning and performance. *Journal of Experimental Research in Personality, 3*, 99–106.

Mayberg, H., Liotti, M., Brannan, S., McGinnis, S., Mahurin, R., Jerabek, P., Silva, J., Tekell, J., Martin, C., Lancaster, J., & Fox, P. (1999). Reciprocal limbic-cortical function and negative mood:

converging PET findings in depression and normal sadness. *American Journal of Psychiatry, 156*(5), 675–682.

Nathanson, D. (1992). *Shame and Pride: Affect, Sex, and the Birth of the Self.* New York: W. W. Norton & Co.

Neiss, R. (1990). Ending arousal's reign of error: a reply to Anderson. *Psychological Bulletin*, *107*(1), 101–105.

Nieuwenhuis, S., Yeung, N., Van Den Wildenbert, W. & Ridderinkhof, R. (2003). Electrophysiological correlates of anterior cingulated function in a go/no-go task: Effects of response conflict and trial type frequency. *Cognitive, Affective, & Behavioral Neuroscience, 3(1), 17-26.*

Nieuwenhuys, R. (1985). *Chemoarchitecture of the Brain.* Berlin: Springer-Verlag.

Posner, M., DiGirolamo, G. & Fernandez-Duque, D. (1997). Brain mechanisms of cognitive skills. *Consciousness and Cognition*, *6*, 267–290.

Posner, M. I. & Fan, J. (2003). Attention as an organ system. In J. Pomerantz (Ed.) *Neurobiology of perception and communication. IVth De Lange Conference.*

Rainville, P., Duncan, G., Price, D., Carrier, B., & Bushness, M. (1997). Pain affect encoded in human anterior cingulated but not somatosensory cortex. *Science*, *277*, 968–970.

Rossi, E. (2002). *The Psychobiology of Gene Expression.* New York: W.W.Norton & Co.

Rusinov, V. S. (1973). *The Dominant Focus: Electrophysiological Investigations.* New York: Consultants Bureau.

Russell, J. and Mehrabian, A. (1977). Evidence of a three-factor theory of emotions. *Journal of Research in Personality, 11*, 273–294.

Seligman, M. (1973). Fall into helplessness. *Psychology Today*, June 7, 43–48.

Seligman, M. (1983). Learned helplessness. In E. Levitt, B. Lubin, & J. Brooks (Eds.), *Depression: Concepts, Controversies, and Some New Facts* (2nd ed.). Hillsdale, N.J.: Lawrence Erlbaum Associates.

Shapiro, F. (1989). Eye movement desensitization: A new treatment for post-traumatic stress disorder. *Journal of Behavior Therapy and Experimental Psychiatry*, *20*, 211–217.

Shapiro, F. (2001). *Eye Movement Desensitization and Reprocessing: Basic Principles, Protocols, and Procedures.* New York: Guilford.

Sokolov, E. N. (1963). *Perception and the Conditioned Reflex.* Oxford: Pergamon Press.

Sokolov, E. N. (1975). The neuronal mechanisms of the orienting reflex. In E. N. Sokolov & O. S. Vinogradova (Eds.) *Neuronal Mechanisms of the Orienting Reflex.* Hillsdale, N.J.: Erlbaum Associates.

Sokolov, E. N. (1990). The orienting response, and future directions of its development. *Pavlovian Journal of Biological Science*, *25*, 142–150.

Sokolov, E.N. (2002). *The Orienting Response in Information Processing.* Mahwah, N. J.: Erlbaum Associates.

Stickgold, R. (2002). EMDR: A putative neurobiological mechanism of action. *Journal of Clinical Psychology*, *58*, 61–75.

Suhara, Tetsuya; Yasuno, F.; Sudo, Y.; Yamamoto, M.; Inoue, M.; Okubo, Y. and Suzuki, K. (2001). Dopamine D2 receptors in the insular cortex and the personality trait of novelty seeking. *Neuroimage*, *13*, 891–895.

Ukhtomski, A. A. (1926). Concerning the condition of excitation in dominance. *Novoev Refleksologii I Fiziol. Nervoi Sistemy* **2**, 3–15. Abstr. in *Psychol. Abstr. 1927* No. 2388. (182)

van der Kolk, B., Burbridge, J., & Suzuki, J. (1997). The psychobiology of traumatic memory: clinical implications of neuroimaging studies. *Annals New York Academy of Sciences*, *8*(21), 99–113.

Vinogradova, O. S. (1975). The hippocampus and the orienting reflex. In E. N. Sokolov & O. S. Vinogradova (Eds.) *Neuronal Mechanisms of the Orienting Reflex.* Hillsdale, N.J.: Erlbaum Associates.

Yerkes, R. & Dodson, J. (1908) The relation of strength of stimulus to rapidity of habit-formation. *Journal of Comparative Neurological Psychology*, *18*, 459–582.