

Adaptive Information Processing and a Systemic Biopsychosocial Model

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Shapiro's (2001) adaptive information processing (AIP) model portrays an innate healing system hypothesized to be composed of neurophysiological mechanisms of action causally related to the resolution of disturbing life experiences. The author expands the model to include psychosocial mechanisms and suggests that a model of a biopsychosocial system can best depict causal properties related to positive outcomes of eye movement desensitization and reprocessing (EMDR). Teleofunctionalist and evolutionary perspectives are applied: the first, to explain the inclusion of the psychological and social features highlighted in the updated model; the second, to support the hypothesis that AIP is a goal of the human attachment system. It is posited that bonding, following a disturbing life experience, facilitates the access of information related to previous states, thus allowing an update of self/world models. These interactions are analogous to psychotherapeutic encounters, with multiple levels of information processing at subpersonal, personal, and interpersonal levels. Analysis of the causal properties of personal and interpersonal levels supports a broader understanding of AIP's scope in conceptualizing psychopathology and informing treatment applications and research.

Keywords: EMDR; adaptive information processing; biopsychosocial; teleofunctionalism; internal working models

Originally conceived to describe well-documented treatment effects of eye movement desensitization and reprocessing (EMDR) in the treatment of post-traumatic stress disorder (PTSD), Shapiro's (2001) adaptive information processing (AIP) model has been described as a "working hypothesis" intended to start the model building process (p. 30). The model is based on "neurophysiological" structures comprising an "innate healing system" (Shapiro, 2001, p. 30). Imbalances in the system are considered to be caused by traumatic memories and contribute to symptoms of psychopathology (Shapiro, 2001). Processed memory networks are seen as the basis for health (Shapiro, 2001, p. 32).

This article recommends enhancing the model by including imbalances in personal and interpersonal processes as additional effects of disturbing life experiences and viewing their restoration as additional signs of well-being. Imbalances are conceptualized as problems in personal and interpersonal communication and representation. This emphasis views the biopsychosocial context as a source of both trauma and healing. Consequently, the enhancement of

communication and representation on all levels is presented as causally involved in AIP at the subpersonal level and therefore critical to effective EMDR.

Information Processing Models and Systems

A communication theory perspective on memory and psychopathology was speculated by the American mathematician Norbert Wiener (1948). The founder of "cybernetics," Wiener considered the role that information plays in both machines and natural systems. He noted that psychopathology was likely caused by the functional impairments resulting from structural problems in the nervous system. He conjectured that the challenge for the treatment of psychopathology would be to surmount the fact that unlike with machines, memory in humans becomes permanent throughout the "systems" life and therefore the system cannot be "reset." He observed that clinical applications of a model focused on memory and psychopathology at the time of his writing included frontal lobotomies (to remove the memory physically) and

electroshock therapy (to jar the circuits into new patterns of firing). Such linear interventions seem to belie the model they were built on. Cybernetics brought to light the causal properties related to information processing and feedback mechanisms that do not rely on forces alone to determine the course of the system.

Central to the discourse of information processing models is defining the system and determining its boundaries. The author's experience in the clinical application of EMDR and systemic family therapy is the basis and main inspiration for broadening the boundaries to include psychological and social components.

The biopsychosocial AIP model is conceptualized as a "nearly decomposable system" (Simon, as cited in Juarrero, 1999) which means that each level maintains a distinct separation from the next while all are connected via feedback loops. It can also be considered a "hierarchical dynamics system" where top levels constrain the lower (Juarrero). These attributes of complex systems contribute to the proposed causal relationship between higher (personal and interpersonal) and lower (subpersonal) levels.

The physical flow of information between component parts makes the biopsychosocial AIP system an "informational system" (Juarrero, 1999). Seen from this perspective, the pathogenic nature of disturbing life experiences lies in their capacity to disrupt communication and representation at any level. Information flowing within and between levels makes the system "vulnerable to noise and sensitive to context" (Juarrero, p. 114). The open and relatively unequivocal exchange of information between and within levels of biopsychosocial AIP enhances the accumulation of past states of adaptive actions that have led to mutually beneficial outcomes for person and environment. System complexity is seen as enhanced behavioral flexibility.

The authors suggest that there is ample evidence in the literature on EMDR, trauma, philosophy of mind, and attachment to build a model of such a system. In EMDR, the AIP system is thought to allow for links to neural networks that promote life-preserving responses to stress that become integrated into an adaptive emotional and cognitive schema (Shapiro, 2001). The incorporation of adaptively processed memories into a positive schema of the self/world is thought to be an outcome of effective EMDR in addition to the amelioration of PTSD symptoms (Shapiro, 2001). Thus, the survival value of using social engagement to deal with stress (Porges, as cited in Ogden, Minton, & Pain, 2006) amplifies the salience of having sophisticated resources for social cognition in coping responses to disturbing life experiences.

A biopsychosocial AIP model provides explanatory strength to EMDR case conceptualization and

treatment planning by including the social context of the client, the therapist, and the therapy. The location of the information processing system within and without the client assists in conceptualizing relevant relational aspects of psychotherapy as well as the social environment within which treatment takes place. Such a model may be able to systematically account for many of the various factors thought to be involved in successful psychotherapy as described by Norcross (2007). As with the behavior of all complex natural systems, treatment response is understood in retrospect (Juarrero, 1999) with a caution against definitive prediction, instead favoring probabilistic assertions prone to change as this multilevel complex informational system organizes and reorganizes (Juarrero). Each client's story provides the necessary context for treatment planning while chance "natural occurrences" may also play a critical role in treatment outcome. Expanding the scope of the AIP system emphasizes the critical role that the availability of adaptive information within the system at large plays in the efficacy of EMDR treatment.

Internal Working Models of Self

Empirical evidence for a biopsychosocial AIP system is found in the role that memory appears to play in behavioral integration and social cognition. The construction of internal working models of self (IWMs; Bowlby, 1969) organized to control behavior involves autobiographical memory and personal and social information processing. For humans, the internalization of our social history involves the brain, the mind, and the relationships (Panksepp, 1998; Siegel, 1999). The development of autobiographical memory systems gave humans the capacity to retrieve past states and bring them forward in time. The resulting "autonoetic consciousness" (Tulving, 2000) or "extended consciousness" (Damasio, 1999) allows us to experience ourselves in time. We can direct attention to past, present, and anticipated future states and mentally simulate possible selves and possible worlds as well as possible relationships between them (Metzinger, 2003). Of particular importance to AIP is the internalization of examples of communicating with caregivers and constructing adaptive stories of how to deal with stressful situations encountered across all behavioral systems.

In other words, IWMs constrain the attention and behavior of both caregiver and child. The capacity for intrapersonal attunement (Siegel, 2007) of the caregiver and interpersonal attunement with the child is "passed down." The child can then establish the capacity to form an open personal and interpersonal communication channel, relatively free from "noise";

this facilitates the entrainment of adaptive memory useful for the maintenance of the self/world boundary that will be necessary to integrate disturbing life experiences in the future.

The author proposes that these early relationships with caregivers can be understood as “context-sensitive constraints” (Juarrero, 1999) that have causal properties that structure the experiences of the child, thus making some outcomes more likely than others. These outcomes include integration of memory into a healthy IWM or segregation of memory into disintegrated IWMs (Liotti, 2006).

When unconscious IWMs underlie a healthy self-concept, they can be consciously invoked to further shape the more fixed subpersonal patterns of behavior and to promote self-regulation and behavioral coherence. When an IWM supports “mutual feedback” (Juarrero, 1999) between the internal model, somatosensory systems, and other people, intrapersonal and interpersonal attunement is effective, and the individual learns appropriate self-regulation and behavioral integration that is coherent with their social environment.

Possible Mechanisms of Action in EMDR

Based on clinical experience, Shapiro (2001) has attributed neurophysiological mechanisms of action to the AIP model. Most research on EMDR’s mechanisms of action has investigated the biological and psychological elements involved in procedural steps (e.g., eye movements) related to the resolution of traumatic memory (Maxfield, 2008). Various related theories have been proposed. These include the role of working memory in memory desensitization (e.g., Maxfield, Melnyk, & Hyman, 2008) and interhemispheric integration enhancing memory recall (e.g., Propper & Christman, 2008). Neurobiological hypotheses have been advanced, for example, Bergmann (2008) hypothesized that alternating bilateral stimulation stimulates and repairs thalamic activity and fosters neurobiological integration.

Mechanisms of Action From Information Processing Perspectives

Information processing models that are seen as relevant to Shapiro’s (2001) AIP model include the transfer-appropriate processing model, the cortical reinstatement model, the parallel distributed/connectionistic model, and the thalamocortical-temporal binding model (EMDR International Association, 2009). The transfer-appropriate processing model considers the conditions present at the time of encoding and retrieval relevant to the encoding of memory and that memory performance

is enhanced when recollection occurs in the context within which the content was encoded (Tulving, 2000). The cortical reinstatement model suggests that the neurological correlates of episodic memory retrieval differ according to the type of information contained in the recollected episode. The retrieval of a particular type of memory content will “reinstates” the mental state present at the time of encoding (Johnson & Rugg, 2007). The parallel distributed processing (PDP) model describes the representation of information as distributed throughout the brain; memory and knowledge are not stored explicitly but between many “units,” and learning can occur with gradual changes in connection strength with experience (Rumelhart & McClelland, 1986). The PDP model stresses that many units process information through sending and receiving excitatory and inhibitory signals in a particular environment that promotes such communication between units (Rumelhart & McClelland). Finally, the thalamocortical-temporal binding model posits that an integrative hippocampal formation process links together various neuronal assemblies established at the time an event was perceived via the 40-Hz gamma band activity of the thalamus (Bergmann, 2008).

To understand how EMDR facilitates AIP, a synthesis of observations related to the interaction of neurobiological and psychological levels of processing provides the clearest picture. AIP seems to facilitate communication in such a way that autobiographical memory can be adaptively represented and integrated. Structures involving basic components of a communications system including a channel, distributed data structures (sources of information), and an optimal environment for the transmission and representation of information seem salient to AIP. The biopsychosocial model suggests such structures exist on personal and interpersonal levels as well and have a causal relationship to each level and ultimately on the resolution of disturbing life experiences in EMDR treatment.

A Historical, Contextual, and Temporal Biopsychosocial AIP System

Dynamical systems theory as applied to complex living systems can help the EMDR clinician and researcher understand how psychological and social processes can be causally related to AIP. To this end, the author has reviewed some relevant concepts to begin the integration of dynamical systems theory with AIP.

Causality

The first concept is that of causality. The exploration of the inanimate physical world has led to productive notions of “what causes things to happen.” However,

natural systems seem to operate under different rules. In the inanimate world, it is logical to consider separate entities exerting a force on one another. In that world, the history of the entity is irrelevant to its course.

When considering living systems, context and time must be brought into the scientific exploration of causality (Juarrero, 1999). EMDR clinicians conceptualizing a case in AIP terms are presented with excellent examples of natural systems adapting to their environments over time. To understand why natural living wholes do what they do, we need to consider the initial conditions of a system, what goal it is organized around, and how its history has shaped its course over time.

Clients are living systems embedded in their environments and they exchange information with it. The concept of nonlinear causality posits that a living system is its own cause because it uses its history to determine the set of possible actions at any particular moment in time (Juarrero, 1999). In contrast to force, context-sensitive constraint is understood to be the way that history shapes behavior.

In a closed system where information is not shared between parts, one part "causes" another to do something, and the history of the latter is inconsequential because the system is governed by an overarching physical law (Juarrero, 1999), in which change does not occur; the trajectory of a near equilibrium system is fixed. This type of system moves toward entropy, and its trajectory can be explained by traditional thermodynamic laws. Natural systems, however, are systems that characteristically reside at states far from equilibrium. Such "nonlinear" systems are dynamic and particularly sensitive to the initial conditions present at the time of their formation. Although initial conditions are not causes, or forces acting on the system, they can have substantial effects on the system's trajectory over time (Murphy & Brown, 2007). Clients bring both their genetic and autobiographical history forward in time to shape behavior in a dynamic interaction of their past, present, and potential future states with their environment. The current environment's evocation of memory constrains behavior leading to states of increased or decreased complexity in relationship to the present moment (Juarrero).

Dynamic and Mutualistic

Each individual is an extraordinarily sophisticated system of systems (complex system) that uses self-representation to exploit autobiographical history to its fullest. This complexity can be described as dynamic and mutualistic. A biopsychosocial information processing model describes how communication between the

brain, mind, and world allows individuals to manipulate memory to create the experience of a self, world, a self in a world, and the present moment (Metzinger, 2003). This capacity for complex information processing provides the ability to simulate past, present, and anticipated future experiences, making behaviorally relevant information about self and world unconsciously and consciously available (Metzinger, 2003).

EMDR clinicians have witnessed and documented how the adaptive resolution of autobiographical memory relates to overall behavioral integration beyond the alleviation of PTSD symptoms (Shapiro, 2001). The author believes an outcome of effective EMDR treatment is the enhancement of biopsychosocial communication and representation that allows for the simulation of a phenomenal first person perspective and supports optimal behavioral integration within a social context when confronted with a stressor. An informational system's physical operations are organized around the exchange of information between parts and levels (Juarrero, 1999). EMDR therapists have been in a unique position to observe such information exchange at multiple levels and within social groups.

Memory and Moving Around in Time and Space

Consciousness and Behavioral Integration

It is well understood that individuals use memory to make their way through the spatiotemporal world. The author believes that adaptively processed memories seem to enhance functioning in systems related to the sophisticated way humans intentionally move through space and time. Expanded level of consciousness make intentional movement possible (Metzinger, 2003, p. 60) via autobiographical memory that allows for the experience of self as a historical persona. Dworkin (2005) has described resources necessary for successful EMDR treatment: attunement, mindfulness, and response flexibility. Adaptively processed autobiographical memories are intimately linked to these metacognitive properties. They provide functions necessary to organize behavior in a spatiotemporal phenomenological world. Objects of attentional processing and cognition (which include memory) are always also constituents of behavioral space (Metzinger, 2003).

Autonoetic consciousness or "mental time travel" is a temporal process that organizes experience and differentiates between what has happened, is happening, and may happen. Response flexibility refers to the ability to intentionally delay action. Together these capacities allow for a more sophisticated consideration

of possible adaptive actions. In a neurobiologically integrative climate, memories can be processed similarly to external objects and become part of conscious experience (Damasio, 1999). EMDR may be conceptualized as a type of coregulated mental simulation that involves accessing memory to internalize a variety of adaptive ways we can move in the spaces we occupy.

Establishing Reliable Biopsychosocial Communication

Embedded but Separate: A Need to Make Contact

The individual's capacity to experience self as separate from an environment in which she is deeply embedded promotes behavioral flexibility. This phenomenally experienced boundary between the body and the environment emerges from the communication between the brain, mind, and relationships (Metzinger, 2003; Siegel, 1999). However, not all of this communication and representing is available in everyday conscious experience. In fact, the self and world directly experienced by the individual are themselves representations based on estimations. Individuals are ironically unable to directly experience "ourselves" or the "external" world. This places a premium on the nervous system's ability to transmit (communicate) and manipulate (represent) information from sensory and memory systems.

Referred to as "autoepistemic closure" by philosophy of mind philosopher Metzinger (2003), humans are in a predicament he describes as a "structurally anchored deficit in the capacity to gain knowledge about oneself" (p. 32). The process of representing self in the world takes place at the subpersonal level and is not generally available for conscious reflection (Metzinger, 2003). While client and therapist might take such phenomenological experience for granted, it would be impossible to carry out the EMDR protocol without the experience of a personal boundary for the client.

Subpersonal Communication and Representation

Communication in the brain involves an exchange between particular structures of the brain and an external or internal stimulus. Gallistel and King (2009) developed the following model to explain this process. To make contact with an external stimulus, there is an interaction with sensory receptors that provide information about what is happening outside of the brain. Acting as an extremely complex subpersonal processing center, the brain relies on extracting meaning from a wide variety of signals. This process

of extracting meaning from information is called representation. In order for communication to take place at this level, a neurobiological channel is needed to carry the "spikes," which are transmuted external signals produced by sensory receptors. A "spike train" comprises the subpersonal channel and includes neurons, which facilitates the transmission of information and allows the brain to extract information from these signals. Information removed may be used to inform present behavior or contained for later use to influence future actions. Such a channel provides the necessary organizational structure a system needs to effectively communicate, and therefore, represent.

Personal and Interpersonal Communication and Representation in AIP

When phenomenal experience is possible, client and therapist are in a position to reflect on representations of memory networks containing related to the presenting complaints. The author believes that intrapersonal attunement (Siegel, 2007) is the communication channel operating at the personal and interpersonal levels through which this process occurs. It has the function of ensuring the relatively unequivocal transmission of information rising up from the subpersonal level. Through introspection, the client can become attuned to his or her biopsychosocial state and the pair's capacity to guide their attention maximizes information extraction relevant to representing dysfunctional networks as directed in the EMDR protocol.

Trauma and Noise Reduction

There is a vulnerability to noise within any complex system. Noise is anything that interferes with information-carrying signals reaching their intended receiver (Gallistel & King, 2009; Juarrero, 1999; Shannon, 1948). Based on the current EMDR literature and information theory, trauma may be conceptualized from an informational theoretic perspective as noise that disrupts communication at all levels of AIP. The manner in which trauma disrupts communication between episodic and semantic memory systems in rapid eye movement (REM) stages of sleep would be a subpersonal example of "trauma as noise." The loss of communication between body and mind in somatoform dissociation (Nijenhuis, 2004) would be an example on the personal level, and keeping secrets about abuse in a family would be an example on the interpersonal level. In these examples, trauma becomes defined more by the lack of resources for attunement and communication rather than by the nature of the stimuli as emphasized by Freud and Reik (Reik, 1945).

The assumption that AIP at higher levels of functioning is causally related to the subpersonal level leads to two propositions of this article. One is that the reduction of noise and relatively unequivocal communication between elements of the system at all levels is critical to adaptive processing. The second proposition is that structures related to interpersonal and personal information processing are component parts of the AIP system to the extent to which they reduce noise and allow for reflection on mental content relevant to the subpersonal memory networks being targeted. This makes the biopsychosocial AIP system an integrated set of multilayered structural isomorphies built on the subpersonal level of processing and organized around communication and representation.

The Subjectivity of Information Processing

Shannon's (1948) information theory suggests that the extent to which a receiver has narrowed down a broad range of possible values for a stimulus is the extent to which the receiver has had an "informative experience" (Gallistel & King, 2009, p. 6). This situation highlights the subjective nature of information. The availability of possible states of self and world in autobiographical memory allows one to distinguish between potentially infinite amounts of online sensory input. This makes the accumulation of memory important not only for constructing adaptive mental models that promote attunement but also for fine-tuned perception of differentiated states of self and world.

A dynamic model of self that allows for an ever expanding IWM will therefore increase a client's capacity for accurate simulations of reality. Likewise, an expansive and expanding IWM of the clinician is also valuable. From an information theoretical perspective, the clinician's prior knowledge of the client's biopsychosocial state increases the probability that client's messages will be information-bearing messages. A clinician will be unable to assist the client in distinguishing the meaning of his or her various state to his or her biopsychosocial situation if the clinician has no prior awareness that a given possible state of the world might exist.

Social Attunement

Because of the presumed causal properties of social states, the author expanded the concepts of intrapersonal and interpersonal attunement (Siegel, 2007) to include social states. Each client exists at any given historical moment within a particular social context that shapes his or her phenomenal experience. The social

state of the client is a condition that is causally related to AIP by promoting or thwarting attunement. At the interpersonal level, social attunement is critical to positive outcomes in psychotherapy. For instance, clinical experience with EMDR suggests that the clinician's awareness of the particular clinical issues facing the client (e.g., age, family history, sexism, racism) is critical to successful EMDR treatment (Shapiro, 2001).

The author believes that when biopsychosocial attunement is attained, the "state of co-regulation" (Dworkin, 2005) maintained is the physical realization of a channel of interpersonal communication. This allows the representation of information and construction of representations of the self and world that assist the therapist in directing attention to relevant aspects of the biopsychosocial experience of the client that allow for the targeting of salient subpersonal networks of memory.

Representational Structures That Structure the AIP System

Mental Models and States of Mind as Context Sensitive Constraints

Shapiro (2006) describes the AIP system as an "innate healing system forged over millions of years" (p. 5). As implied previously along with biological structures, temporal, and social structures are among the evolutionary tools humans have obtained to maximize the adaptive behavioral responses to self/world situations. "Mental states possess causal properties, which, in a certain group of persons or under the selective pressure of a particular biological environment, can be more or less adequate" (Metzinger, 2003, p. 26).

The existence of any biological tool implies a functional relationship between the tool and the system/organism using it (Metzinger, 2003). States of mind and their corresponding self-models have been optimized through their causal relationship to neurobiological structures over time. The presence of sophisticated and complex mental content found in representational systems seem to be the most plausible explanation for the capacity of social cognition that allows us to pay attention to the concepts, behaviors, and mental models of others (Metzinger, 2003). The author believes that mental states that facilitate AIP are those that allow an individual to reflect on his or her self/world models making himself or herself, his or her concepts, and his or her behaviors the object of his or her own attention and the attention of a trusted other. In this way, these become context-sensitive constraints related to AIP.

Reliable biopsychosocial communication establishes a context within which mental models in need of further updating can be identified via corresponding states of mind reflected on in a trusting relationship. This ability to represent self to enhance self-organization emerges in the context of relationship. This inherency of the social in the personal is logical for an organism that thrives in attuned interpersonal relationships and it is emphasized in the model of AIP.

Safety, Responsibility, and Choices: Meaning Structures of a Biopsychosocial AIP System

The "engine" of a biopsychosocial AIP system is those structures that promote the relatively unequivocal transmission of messages on both the sending and receiving end. The author believes that the EMDR tradition has identified a triad of phenomenal content found in IWMs that aids in structuring the biopsychosocial AIP system. Positive cognitions related to safety, responsibility, and choice have long been documented in the EMDR literature (Shapiro, 2001) as emergent phenomenal content indicative of the presence of adaptively processed autobiographical memory. In their negative form, they indicate the presence of unprocessed memory. For example, the negative cognitions associated with targeted memories in EMDR have been distilled down to "I'm not safe," "I'm to blame," and/or "I'm helpless." It is postulated that the inability to incorporate an experience into a healthy self-concept seem to be related processes associated with threat to life, experiencing toxic shame, and/or feeling trapped. All of these experiences make the individual vulnerable to affect dysregulation and distortions of time, place, and person.

Fear, shame, and rage are innate stimulus bound affective responses to such situations (Panksepp, 1998). Extreme levels of these emotions can inhibit information processing in the moment on the subpersonal, personal, and interpersonal levels (e.g., the role of shame in dissociative responses). Examples from psychotherapy of how a lack of safety, undue responsibility, and/or lack of choice affect communication, and therefore, adaptive representations of experience that facilitate information processing have been described by Dworkin (2005). Fear, shame, and helplessness can emerge as a result of intersubjective interactions during psychotherapy and can stifle AIP. When the EMDR therapist pays attention to these emotional states in the client and facilitates a return to a state of "co-regulation," AIP can resume. Dworkin has suggested that repairing the rupture of such states is imperative to successful EMDR treatment.

The author supports Dworkin's (2005) assertion and hypothesizes that when such a rupture is interpersonally processed in a session as described in the "relational interweave" (p.39) intervention, the biopsychosocial AIP system itself is strengthened. In other words, the actual relationship and the updated IWMs structure the bio-psycho-social AIP system and are thought to be causally related to the adaptive resolution of the target memory network. When therapist and client create a context within which it is acceptable to feel safe and focus on the target experience/memory, acceptable to own the experience/memory, and acceptable to use the experience/memory for current and future simulations, AIP is strengthened.

"Optimal" Internal Working Models and a Healthy Self-Concept

Self-directed attunement and introspection depend on the individual's ability to direct his own attention. This capacity is called attentional agency (Juarrero, 1999; Metzinger, 2009). IWMs containing a robust set of prior probabilities suggesting that the individual is safe, can own experiences, and has more choice will support the regulation of fear, shame, and rage allowing for attentional agency and ongoing communication and representation of what is happening. The author hypothesizes that "optimal internal working models of self and world" promote a feeling of safety by allowing the individual to own the disturbing experience and to problem solve how to represent and remedy it, in a manner that benefits self and environment. In other words, this process is accomplished in part through the maintenance of a self/world boundary. The specific self-conceptual triad related to safety, responsibility, and choices would be considered linguistic representations of such models hypothesized to be prevalent among individuals with a secure/autonomous attachment status.

Goals of the Biopsychosocial AIP System

The use of both fixed action patterns and learned behaviors is prevalent among more complex species (Murphy & Brown, 2007). Behavioral flexibility is maximized via optimal IWMs. Bowlby's (1969) "environment of evolutionary adaptedness" describes the emergence of innate "stimulus bound" unreflective behaviors shaped by evolution that prepare an organism for life in a specific setting. There are also characteristic behavioral responses genetically encoded within the central nervous system of humans and other mammals related to the absence of certain environmental stimuli that are salient to survival (Bowlby, 1969; Panksepp, 1998). The author believes that an attuned

interpersonal relationship is the environment to which an infant's fixed patterns of attachment behavior are designed to anticipate and respond. Furthermore, the guarantee that the infant will consistently seek and find attunement is hypothesized to be found in the capacity to develop IWMs that selectively entrain attention and memories that maximize attunement. Thereby ensuring attentional agency and adaptive behavioral integration will occur via the construction of accurate representations of self and world.

How a Biopsychosocial AIP System Is Organized and Maintained

The author hypothesizes that the presence of attunement in the environment acts as the initial condition that an AIP system organizes around. Furthermore, IWMs can be seen as data structures containing information useful to depict what dynamic systems theorists call attractors. An attractor is an abstract shape that delineates the state space over time within which any given system resides (Juarrero, 1999, p. 152; Murphy & Brown, 2007, pp. 75–76). They represent the multitude of context-sensitive constraints that endure and influence the probability that a system will behave with predictable patterns (Juarrero). An attractor also represents the space a system will return to if perturbed outside of its typical pattern of behavior. For instance, the conceptualization of human behavior as resulting from a system's predictable trajectory through state space has been used by Putnam (1997) to describe dissociative disorders.

The author believes that IWMs act as attractors that shape an individual's trajectory toward the development of an AIP system. In addition, the establishment of a biopsychosocial AIP system may be the apex of the attachment system in a secure autonomous individual. He has found the conceptualization of IWMs as data structures containing information useful in describing salient attractors of a biopsychosocial AIP system as a useful diagnostic tool in determining the overall tendency for an individual to respond with attunement in any given stressful situation. By extension, the assessment of the capacity for intrapersonal and interpersonal attunement has also been useful in the author's clinical work to assess the robustness of the biopsychosocial AIP system itself.

Discussion

A phylogenetic perspective of AIP suggests that emergent properties of a complex natural system that uses its history to promote behavioral flexibility are caus-

ally related to adaptive processing of autobiographical memory. The author presents the theoretical perspective of a biopsychosocial AIP system to capture the way that personal and interpersonal processes (mental and social states) may be causally related to the adaptive resolution of disturbing life experience. In particular, advances in the understanding of complex natural systems and their capacity for subjectivity and intentional actions have offered important insights that can be integrated with the existing neurophysiological model of AIP.

In addition, current trends in EMDR have focused on relational aspects of AIP (Dworkin, 2005; Dworkin & Erbe, 2010) as clinicians and researchers adapt the protocol to treat more complex psychiatric conditions. These adaptations have often led to the integration of EMDR and attachment theory. This article has moved the discussion from the clinical integration of EMDR and attachment theory to the theoretical integration of the two. Focusing merely on traumatic memory in a linear fashion as if it were a "germ" that "causes like a force," betrays the deeper understandings of how disturbing life experiences and the state of a biopsychosocial AIP system relate to one another in determining the trajectory of psychopathology where memory is concerned.

What happens when an infant develops in an environment where attunement is not prevalent or possible? Informational closure (Juarrero, 1999) describes the tenacity with which a system maintains its integrity despite exchanges with the environment. The author suggests that a systemic understanding of AIP is necessary to avoid clinical errors and frustration in the therapeutic alliance when an individual does not have the capacity for attentional agency required to process disturbing experiences with EMDR. The biopsychosocial AIP model offers methodological insights derived from considering the dynamics of such a system. Space limitations of this article and its focus on theory require a follow-up paper to adequately address these insights.

One insight is the value of the model in identifying the extent to which a client is embedded in an AIP system. If adaptively processed memories function within a system to bring information forward in time, to optimize the simulation and actualization of behavior that maximize the fit among an individual and his or her environment, then the use of such adaptive memories ought to be inferred from coherent behavioral functioning. Likewise, the absence of adaptive processing ought to be inferred from disorganized behavioral repertoires. It would also be sound to consider that the more AIP "like" a system is, the "more

conscious” the individual will be and the more he or she will behave more “intentionally.”

The biopsychosocial AIP model can enhance treatment planning in the following ways: The client’s maladaptive attractors can be described and identified by the range of negative cognitions and affects associated with recent triggers and past touchstone memories. These representations of IWMs can be plotted on a chart with a corresponding differential list of associated reflexive behaviors targeted for change. Such an exploration will yield the generic elements of situations likely to move the system into the closed state. Because behaviors of complex natural systems are multiply realizable, this approach to treatment planning can assist in making sense of how the array of maladaptive behaviors in the client profile are organized around specific self/world interactions. A list of adaptive self-representations and reflective actions tailored to specific client situations can also be identified early in treatment to highlight where skill building needs to take place as updates to IWMs are made.

Finally, the author believes that a biopsychosocial model supports the long-held adage of Francine Shapiro, (2009) that EMDR begins when the client walks in the door. Beginning with step one in the protocol, the pair construct macro representations of memory networks by maintaining biopsychosocial attunement and recording information related to areas of inhibition to growth. These representations, whether verbal or written, guide the pair’s attention. The use of the EMDR self-report scales and body scans also constrain the personal and subpersonal levels of the client. In fact, the personal and subpersonal experiences of the therapist become constrained as well, and if there is minimal noise interfering with the therapist’s intrapersonal attunement, the dyad will maintain a state of coregulation necessary for AIP. The author hypothesizes that these are examples of how interpersonal AIP is an emergent property of the biopsychosocial AIP system.

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