of cognition and affect suggests additional techniques for the analysis of AAI discourse (see Chapter 4). These additional techniques expand Main and Goldwyn's classificatory procedures by clarifying and augmenting them rather than being in conflict with them. In addition, they provide a starting point for the exploration of new classifications. Finally, a DMM approach focuses attention directly on the roles of danger and sexuality in organizing thought and behavior, particularly in disturbed individuals. This approach holds the potential to facilitate study of the meaningful function (both currently and in childhood) of apparently maladaptive behavior and, with appropriate modification of the interview, of other adult attachment relationships (e.g., with spouses, children, and aging parents). The outcome could be better understanding of

- the developmental processes that lead to dysfunction (thus, promoting prevention efforts);
- the mental processes that maintain maladaptive behavior (thus, promoting new perspectives on the nature of psychological treatment); and
- normative developmental processes.

A particular contribution of the DMM method of discourse analysis is the focus on the nature of mental processes in cases of disturbance and psychopathology. Put another way, rather than assigning most of these transcripts to a "Cannot Classify" category, an attempt has been made to understand how information is transformed and how these transformations function when speakers have been exposed to self-threatening danger.

Chapter 3

Information Processing

In this chapter we focus on the contributions of cognitive psychology and the cognitive neurosciences to the discourse analysis used in the Dynamic-Maturational Model (DMM) method. In essence, we provide a guide to the relation between brain/mind and the Adult Attachment Interview (AAI), as an assessment of mental representations. That is, the brain is conceptualized as a meaning-generating organ, one that uses input to generate self-relevant meanings, particularly with regard to danger and sexual opportunity. The basic notion to be presented here is that the brain functions as a branching network of distributed parallel processing, in which each different neurological pathway transforms the input signal differently. The input to this network is initially sensory stimulation, generated from within the self and from outside the self, and, as processing continues, also from self-generated transformations that reflect attempts to bring coherence to the set of representations.

The first split in the branching network responds to two different attributes of sensory stimulation: temporal order and intensity. Thereafter, different areas of the brain receive the transformed output and transform it further before passing it forward, again in parallel branches, to other parts of the brain for further analysis and imputation of meaning. At each step, the neurological pathway constitutes a representation

of the relation of self to context, with each representation being differently processed as compared to the others. When coherence among the representations is achieved, dispositions to act are clarified.

The various transformations reflect both the advantages of each pathway through particular parts of the brain and also the limitations and distortions associated with that pathway. Further, each representation reflects a disposition to respond in some manner (Damasio, 1994). Hence, the representations are called "dispositional representations." The culmination of this process occurs at the cortical level where the multiple dispositional representations can be brought together for a final analysis, integration, and construction of a best-fitting and most inclusive dispositional representation. The discussion of this process of generating self-relevant meanings is divided into five sections: (1) transformations of sensory stimuli to predictive cognitive and affective information, (2) seven transformations of cognition and affect, (3) memory systems and dispositional representational models, (4) integration and reflective integration, and (5) encoding, remembering/forgetting, and retrieval.

TRANSFORMATIONS OF SENSORY STIMULI

Based on a congruence of theory and empirical evidence regarding brain evolution and function, Crittenden proposed two basic transformations of sensory stimulation to information that is predictive of danger or sexual opportunity (Crittenden, 1995, 1997c, 2002). One is a "cognitive" transformation based on the temporal ordering of stimuli and the implicit attribution of causation to the relation between preceding and subsequent events. The word "cognitive" is being used in a very precise and limited manner to mean temporally ordered information from which attributions regarding causality can be drawn. The cognitive transformation provides information regarding *when* in the sequence of one's behavior there might be danger or opportunity for sexual activity. In the terms of attachment theory, organization of behavior and thought on the basis of cognitive information is the basis for Type A functioning.

The other transformation is an "affective" transformation based on the intensity of the stimulation, that is, the number of neurons responding to the stimulus and the rate of firing of these neurons. The variations of intensity of the stimuli are treated as an indicator of how the

context has changed. The affective transformation provides information regarding *where,* relative to oneself, there might be danger or opportunity for sexual activity. Affect, negative affect in particular, is the basis of Type C functioning.

Together, cognition and affect provide information regarding when and where danger is to be expected and when and where sexual contact may be made. In attachment terms, the balanced use of both forms of information yields Type B functioning. These two basic transformations constitute the basis for further transformation.

Cognitive Information

The ability to make temporally based transformations is tied to the functioning of the brain stem and cerebellum (Green, Irvy, & Woodruff-Pak, 1999); thus, this is a relatively early evolving and primitive transformation. On the other hand, it requires relatively few synaptic connections and is, therefore, a rapid transformation. Speed can be crucial when danger is imminent.

Cognitive information is described by the principles of behavioral learning theory (Steinmetz, 1998; Thompson et al., 1997). That is, the consequences of behavior, the things that happen after one has acted, determine the meanings that can be attributed to one's behavior and, therefore, the probability that the behavior will be repeated in the future. Actions with desirable outcomes are likely to be repeated; those with undesirable outcomes are less likely to be repeated. Danger is the most undesirable outcome whereas sexual contact is one of the most pleasing outcomes.

Cognitive information can lead to inhibition of behavior that has been followed by dangerous (or unpleasant) outcomes and to more frequent display of behavior that preceded desired outcomes. Compelled behavior is particularly likely when danger was expected and failed to occur. Under this condition, an attribution of causality may be made between whatever one was doing just before the expected danger didn't occur and the absence of the danger. This behavior, in other words, will come to be defined as a protective behavior and may be displayed whenever danger is expected.

The cognitive transformation is usually the result of repeated experience with the same temporal order, but it can be made on the basis of a single trial. Single trial learning is most likely when the outcome was very dangerous (Gustavson, Garcia, Hankins, & Rusiniak, 1974). Under

such conditions, individuals endeavor to see that the dangerous sequence never recurs. They do this by controlling their own initiating behavior. However, single trial learning is very vulnerable to erroneous attributions of causality when the temporal sequence was coincidental and not causal. Because single trial learning occurs most frequently under dangerous conditions, exposure to danger is very vulnerable to superstitious cognitive attributions (Tracy, Ghose, Strecher, McFall, & Steinmetz, 1999). These effects can become the basis for disorders of inhibition and compulsion.

Cognitive information is inherently linear. It requires the mind to parse sequences into initiating events and their consequences. Type A speakers tend to identify their own acts as eliciting attachment figures' responses whereas Type C speakers tend to see themselves as acted upon by others, that is, they are the victims of the consequences of others' behavior. Neither perspective is fully accurate; both distort the dynamic, multidirectional and multicausal complexity of reality.

Affective Information

The ability to make the affective transformation is tied to the evolution of the limbic system, a more recent phenomenon associated only with mammalian species. The affective transformation is based on the relative intensity of stimulation, with rapid and unexpected changes in intensity precipitating processing through the limbic structures. Thus, intensely high and low levels of stimulation (that are unexpected) initiate a cascade of neurological responses that change the physiological state of individuals in ways that prepare them to fight, flee, or freeze (Perry, 1994; Selye, 1976). Accompanying these changes is a generalized state of anxious arousal, an anticipatory state (Le Doux, 1995; MacLean, 1990). The arousing stimulation can be perceived through any of the five senses such that very loud noise or extreme silence, intense brightness or absolute darkness, strong or barely discernible tastes, overpowering or faint odors, and painful or feather-light touches evoke arousal and physiological preparation for self-defense. Moreover, although none of these sensory states is dangerous in and of themselves, all are associated with higher than usual probabilities of danger (cf. Zhong, Bohns, & Gino, 2010; Zimbardo, 1969). Among the five senses, smell and touch hold particular significance as being the best sources of information about distal and proximal danger, respectively. Taste is special as a marker of the distinction between self and nonself (Rozin &

Fallon, 1987; Schedlowski & Pacheco-López, 2010). Distasteful substances are ejected from the body. Indeed, extremely distasteful substances are treated as poisonous, that is, antithetical to the self. (For a discussion of taste, disgust, and self-identity, see Crittenden, 1994.)

Somatic arousal is the outcome of changes in physiological state that produce sensory stimulation that in turn is processed through the limbic structures. These physiological changes adapt the body to its context and include physiological changes that prepare the body to flight, flee, or freeze. Thus, it is information about the state of the self and is highly relevant to knowing what the individual is disposed to do. Consequently, somatic images are of particular importance.

It should be noted that when the sensory information signals danger and one knows procedurally how to protect the self, there will be little or no change in arousal. Instead, one does what needs to be done and is safe. This may be relevant to the "cool/cold" demeanor of some very dangerous people.

Based on experience, unfocused anxiety can be differentiated into at least three distinct feeling states: anger, fear, and desire for comfort. Whereas unfocused anxiety leads to generalized arousal and increased sensory vigilance, desire for comfort, anger, and fear are focused affective states. That is, desire for comfort motivates approach with affection, anger motivates approach with aggression, and fear motivates withdrawal. The opposite of intense stimuli are moderate stimuli that are relatively similar to preceding levels of stimulation; such stimuli elicit feelings of comfort. Comfort serves as an affective signal of lower than usual probability of danger.

Other stimuli elicit feelings of sexual desire in postpubertal humans. Sexual desire is an anticipatory state that is experienced in ways that overlap with the experience of anxiety whereas sexual arousal is a very intense state that can even override the feelings of anxiety, anger, fear, and desire for comfort. Indeed, it is such an arousing state that it can diminish feelings of pain (which itself is the most arousing nonsexual state). Sexual satisfaction, on the other hand, is similar to comfort.

Affective information can be expanded by associative learning such that the sensory aspects of experienced dangerous and safe contexts become directly associated with danger or safety. Similarly sexual success and failure become associated with experienced sensory information. As with cognitive information, the prediction of danger/safety and sexuality can be in error and exposure to danger increases the probability that learned associations will be made rapidly and errone-

ously. This can lead, in extreme cases, to anxiety disorders, including sexualized attempts to regulate anxiety (Crittenden, 1997a, 2002).

The capacity to make the affective transformation, being later evolved than the cognitive transformation, has three advantages. First, it has innate perceptual biases for predicting higher probabilities of danger (or sexual opportunity); cognition only generates predictions on the basis of experienced threat. Second, affect, through arousal of the autonomic nervous system, is inherently self-relevant. Third, after being experienced, display of affect produces consequences; these lead to cognitive understanding of the meaning of displays of affect.

SEVEN TRANSFORMATIONS OF COGNITION AND AFFECT

As described in the previous section, the brain transforms sensory stimulation to improve prediction. That is, the neurological activity of the brain does not function so as to produce accurate representations of the past. Instead, it is organized to predict the need to protect the self and to identify potential reproductive partners. This creates risk of error, that is, of either over- or underidentifying future danger and possibility of sex. In general, overattribution of danger and of sexual opportunity is more likely than underattribution; functionally, this reduces risk of failing to attend to danger or to find sexual partners. Seven types of transformation seem logically possible (Crittenden, 1997d); each of these can be identified in the discourse used in AAIs.

True and Erroneous Information

Both cognitive and affective transformations can be truly predictive of danger and safety or erroneously predictive. When they are truly predictive, danger or opportunity for sex is correctly identified and appropriate self-protective or sexual action can be taken. When they are erroneously predictive, an association is made on the basis of temporal order or context, but the association is spurious because there is no predictive relation between the conditions. In such cases, either cognitive beliefs are held that are irrational, but which, nevertheless, regulate behavior, or affect is mistakenly associated with contexts that are not dangerous or protective or with people who are not appropriate for sexual contact. Actions taken on the basis of erroneous information will usually be maladaptive. Thus, there can be *true* and *erroneous* transformations of cognitive and affective information.

Distorted Information

In addition, both cognition and affect can be distorted. Cognition is distorted when one aspect of a complex causal relation is emphasized to the exclusion of other aspects of the relation. In general, this means overstating a causal relation that, in fact, is only partly or sometimes true. For example, emphasizing the good qualities of a sometimes angry and hostile parent may increase a child's willingness to comply with parental demands and, thus, reduce the probability of self-endangering protest. In the DMM method for analyzing AAIs, these distortions are called idealization, exoneration, and self-responsibility (typical of speakers using a Type A strategy) and passive semantic thought, reductionist blaming thought, and rationalization (typical of speakers using a Type C strategy).

Affect is distorted when one feeling in a set of complex mixed feelings is exaggerated to the exclusion of the other feelings. For example, when an individual who feels angry, fearful, and desirous of comfort focuses only on the anger, the probability that the individual will attack and fight fearlessly is increased and the probability of flight or affection is decreased.

Splitting is the mental process that makes distortion possible, by omitting some of the information from processing. For Type A speakers, the splitting is between good and bad cognitions and tends to be static. For Type C speakers, the splitting is within negative affect (i.e., among desire for comfort, anger, and fear) and tends to be alternated, contingently upon the behavior of the other person. To conclude, there can be *distorted* transformations of cognition and affect and splitting underlies the process of distorting information.

Omitted Information

When one or the other sort of information proves not to be predictive or to be dangerous, the information may be discarded from further mental processing. This is *omitted* affect or cognition. For example, Type A individuals often discard their own feelings of anxiety, desire for comfort, anger, or fear and positive cognitions about themselves as danger-eliciting. Type C individuals often discard information about

causal relations and predictable outcomes, thus, failing to discern complexly organized causal relations or their own contributions to unpleasant consequences.

False Information

Some information predicts the opposite of the apparent prediction. For example, some smiles cover anger and some statements of intention are lies. In these cases, the information is *false* and misleading. Some Type A speakers falsify negative affect, displaying, instead, false positive affect. Some Type C speakers falsify temporal predictions, thus misleading others about their future behavior.

Denied Information

Self-relevant information that speakers fear might be true (and which, if true, would require drastic reorganization of the speakers' representational process) can be *denied*. The information is perceived as threatening because it would force a reevaluation of the basic strategy, thus both undoing its strategic effectiveness and also causing emotional distress. Some Type A speakers deny all negative affect up to and including physical pain. Some Type C speakers deny their own role in causing dangerous outcomes. In both cases, denial is associated with extreme levels of endangerment (both physical and psychological and both aggressively abusive and abandoningly neglectful).

Delusional Information

The gaps left by information that is denied in high-numbered A and C strategies create discrepancies. When perceived, these either initiate corrective or *delusional* processes. Delusions are internally generated representations, the source of which is the self. However, they are not recognized as self-generated and, instead, are treated as real. The effect is to resolve the discrepancy elicited by denied information. Some Type A speakers construct delusional beliefs of being protected in the context of claiming to deserve punishment and denying responsibility of the other for harming the self. Affectively, they deny pain and delusionally claim pleasure that allows them to feel safe instead. This process is enhanced if sexual arousal accompanies the painful arousal and if they "invite" the inevitable. Some Type C speakers construct delusional

affective representations that treat one set of feelings as absolute while the other is denied, for example, absolute anger and invulnerability in the context of denied fear and vulnerability. Cognitively, they deny participation of self to causality, which allows delusional plots of threat and revenge.

The seven transformations of cognition and affect lead to 14 forms of information about danger/safety and sexual possibility: true, erroneous, omitted, distorted, false, denied, and delusional affect and cognition. The DMM method of analyzing the AAI identifies all of these transformations in discourse. Further, it is proposed that compulsive Type A and obsessive Type C speakers use a greater variety of transformations and more extreme transformations than speakers using lower-numbered Ainsworth strategies. Such transformations are usually associated both with the experience of danger in early childhood and also risk for psychopathology in adulthood. In addition, it is proposed that different clinical disorders might display different patterns of transformation. Although some supporting data are offered in Chapter 15, the strength of the DMM approach lies in the specification of testable hypotheses.

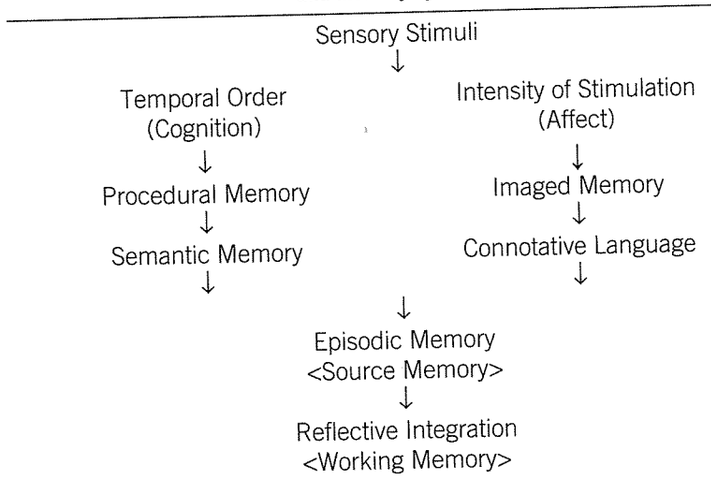
MEMORY SYSTEMS AND DISPOSITIONAL REPRESENTATIONS

Recent work in cognition suggests that there are (at least) five memory systems that are crucial to how people resolve threats to safety: procedural memory, imaged (or perceptual) memory, semantic memory, episodic memory, and reflective integration memory (Tulving, 1995; see Figure 3.1). Each has both experimental and neurological support. A sixth memory system, connotative language, is proposed here.

Of these memory systems, procedural and imaged memory are similar in that they consist of implicit knowledge, do not require language, and are functional from birth on. Semantic memory and connotative language are similar in that they are verbal and have both implicit (i.e., preconscious) and explicit (i.e., consciously regulated) forms. Episodic memory is a verbal, occasion-based integration of temporal sequences, images, semantic understandings, and the language that brings the episode to life.

Working memory differs from the memory systems in not being a type of transformation, but rather the cortical process of integrating in-

Figure 3.1. Transformations of information: The organization of information and memory systems.



formation generated by other parts of the brain (Baddeley, 2009). Current understanding of the neurological processing that underlies memory suggests that only three to five bits of information can be held active at one time (Cowan, 2010) and that these, including representations of the self-in-context-now, determine which representation will be enacted (Klingberg, 2009). Working memory (and thus representation) is an active process in which past and present neural networks are joined to create dispositional representations (Damasio, 1994) that reflect neither past nor present experience with veridical accuracy. Such representations reflect our best predictions of the likely relation of self to context in the future. Working memory stands apart from the other systems as being entirely a process that is dependent upon the output of the other memory systems.

Procedural memory and imaged memory were not described by Bowlby. Nevertheless, because they function in the first months of life, they operate preconsciously and involve very rapid processing and are particularly relevant to cases of severe or self-threatening danger. Therefore, including them may be critical to the analysis of AAI transcripts of individuals who have experienced risk, especially risk occurring early in life. In constructing guidelines for employing these memory systems, aspects of the Main and Goldwyn (1984, 1994) method

that reflect these systems have been assigned to them. For example, involving speech to the interviewer is discussed as an aspect of procedural memory. Each memory system is discussed in detail below. They are divided into two groups: implicit and explicit memory systems.

Implicit Memory Systems

The brain systems that support implicit memory are in place and functioning before those necessary for explicit memory. This is an advantage in that important aspects of experience can be learned from birth on and processing at all ages can occur far more rapidly than for explicit forms of knowledge. The drawback is that it can be very difficult to become aware of what one has learned implicitly, to predict how it will influence one's behavior, and to regulate that influence.

Procedural Memory

Procedural memory (Tulving, 1995) consists of preconscious, reflexive, and learned sensorimotor patterns of behavior, that is, schemata (Piaget, 1952). In Bruner's terms, it is "knowing how" (Bruner, 1972). In this method, it is described as implicit cognitive information. Procedures reflect what children and adults have learned to do to stay safe or what adults do to attract potential sexual partners. Most human behavior is procedural with only small bits becoming the focus of conscious thought and problem solving. As a consequence, procedures both reflect the predominant past experience of individuals and also their most probable future behavior. When conditions have been dangerous in predictable ways, children can develop procedural inhibitions or compulsions that function to increase safety. For example, when display of negative affect is punished, it may be inhibited; when it is rewarded, it is likely to occur more frequently. Rewarded affect may occur in three ways: (1) predictable reinforcement display of true feelings is associated with Type B classification; (2) predictable reinforcement of false positive affect is associated with the compulsive strategies (Types A4–6); and (3) intermittent, unpredictable positive reinforcement of distorted negative affect is associated with the coercive strategies (Type C).

Three sorts of procedures are of interest in discourse analysis of the AAI. Although the AAI was not constructed by George, Kaplan, and Main (1996) with the notion of eliciting procedural memory, in fact, it

does so quite effectively in the form of patterns of managing discourse, spontaneous expression of affect during the AAI, and patterns of interactive behavior that are used with the interviewer (cf. the transference, Szajnberg & Crittenden, 1997).

IMAGED MEMORY

Imaged memory consists of perceptual images of past experiences (Schacter & Tulving, 1994), for example, the shrill sound of angry voices, the soothing rhythm of close holding and rocking. Recalled images often reflect contexts of safety or danger (e.g., a warm, soft bed or a dark, cold basement). Somatic images are bodily states associated with anxious arousal (e.g., lightheadedness, nausea, shortness of breath), or with comfort (e.g., a cuddly grandma). Images tend to reflect contextual information about conditions with higher than usual probability of danger/safety or sexual opportunity.

Images, particularly somatic images, function to make past events seem real, present, and immediate; thus, they create in the individual a tendency to respond to the (prior) situation associated with the image. They also have the effect of eliciting arousal, which itself feeds back into the limbic system, thus increasing arousal. Animated images (i.e., images that are acted out through dialogues or gestures) are even more effective at increasing speakers' arousal. Delusional images appear to function specifically to help speakers enter an affective state that they feel is essential to their own physical or psychological safety. That is, delusional images appear to be imagined (as opposed to recalled) images, which are presented in an arousing or animated way that activates neurological pathways in the same manner as experienced and recalled images. The difference is that, although the source of the information is the self, the image is erroneously identified as coming from outside of the self (see below for source memory). Images are particularly relevant to exposure to danger.

Explicit Memory Systems

SEMANTIC MEMORY

Both procedural memory and imaged memory are functional in infancy whereas semantic memory first develops in the second year of life. Semantic memory can be conceptualized as a generalized verbal understanding of the contingencies implied by procedural knowledge, that is, a verbal transformation of cognitive information. The prototypical form of semantic information is a when/then temporal statement transformed into an if/then causal statement where "if" refers to the preceding condition and "then" to the subsequent event, the consequence. Sometimes, however, abbreviated forms are used. For example, "You are a good boy" implies the causal relation "Because you are a good boy, you will do only good things." Such statements, of course, distort reality. The accurate conditional statement would be something like "Usually you are a good boy and I will praise and reward you, although sometimes you don't do as I expect, and you may be punished for that."

In addition, descriptive semantic statements are easily transformed into prescriptive semantic statements. In prescriptive statements, a "should," "ought to," or "must" verb form is used. For example, "*You shouldn't run into the street*"; "*You ought to clean up your room*"; or "*You must not lie.*" Prescriptive statements are often used by parents, teachers, and other authority figures.

Preschool children are particularly vulnerable to distortions of semantic information because they are not yet able to comprehend more accurate and complex statements, and they cannot differentiate descriptive from prescriptive statements. Further, although older children are able to deduce their own semantic generalizations, preschool-aged children are not. Instead their generalizations are "borrowed" from their parents. When parents' statements do not reflect children's experience or when the statements are inaccurate (usually because the parent wants the child to believe something), children's emerging semantic representations of reality will be incongruent with their procedural and imaged understanding.

When children can articulate the discrepancy and when parents respond with empathy and assistance in resolving children's confusion, this maturational limitation becomes a pathway to growth. But frightened children do not ask such questions and some parents do not take children seriously or answer the questions honestly. This can result in semantic distortions that may both interfere with children's understanding and also affect the way they organize their behavior. In some cases, it results in idealization or exoneration (i.e., components of Type A functioning). A particular concern occurs when parents distort "descriptive" semantic statements about how things are into "prescriptive" semantic statements about how things ought to be, should be, or

must be. When such prescriptions are applied to children as if they were descriptions, children almost always fail to meet the standard and find themselves to be bad (as opposed to recognizing that something they did was bad).

In other cases, children give up, considering semantic statements to be useless (because they are not sufficiently predictive). These children omit semantic information from further processing; in Main and Goldwyn's (1984, 1994) terms, they use "passive (semantic) thought." In some deceptively dangerous circumstances, children learn that true relations are often the opposite of what is stated verbally; they learn that semantic information can be false. Under the most threatening conditions, children cannot discern a connection between their own behavior and danger to themselves. This can lead to complete denial of cognitive information and possible substitution of the missing information with delusional information.

Connotative Language

Connotative language refers to the use of words to elicit affective states in listeners. Preschool-aged children are exposed to connotative language in the form of stories, songs, and rhymes, but they are not able to generate such language meaningfully until the school years and adolescence. Although connotative language has not been identified by cognitive psychologists as a memory system, it functions in parallel with semantic memory as the verbalized form of an implicit memory system, in this case imaged memory.

Connotative language typified by artificial or intellectualized discourse functions to down-regulate arousal by removing the self and feelings from the narration. This usage accentuates the denotative function of language and keeps both speaker and listener emotionally distant from the story being told. It is typical of Type A speakers.

Connotative language typified by evocative words and phrases, instead, generates feelings in listeners, through the use of onomatopoeia, juxtaposition, rhythm (particularly lulling rhythms and sharp stops), alliteration, metaphors, etc. This language lets the reader share the speaker's affective state. This usage is typical of Type C speakers.

Type B speakers combine denotative and evocative language into discourse that is able to convey both semantic meaning and emotional depth. The connotative qualities of language are used to clarify feeling without overcoming the cognitive/semantic meanings. The result is an

efficient means to achieve the common goal that speaker and interviewer have negotiated: a clear story conveying personal meanings to an interested listener.

Episodic Memory

Episodes consist of an integration of cognitive information about sequences of events with affective information about the context and affective/somatic responses of the participants. Such integration requires that considerable information, generated through disparate parts of the brain (such as the sensory cortices, cerebellum, and limbic system), be held active at one moment in time with neural connections that converge, first, in the hippocampus where relational organization is constructed and, finally, in the prefrontal cortex where action potentials are evaluated (see Crittenden, 1997c for a full set of citations). It should be noted that an episode is a transient construction that contains not only reactivation of neural networks that were active during the event itself, but also networks that represent the state of the self in the present. The latter influences the activation of the former, thus making episodic recall inaccurate for the past but maximally relevant to the self in the present. The ability to construct episodes is not functional until about 3 years of age and even then it requires guidance by an attachment figure. Where such guidance is not available, episodic recall may be impaired.

Fully rendered episodes that integrate both temporal order and imaged information are typical of Type B speakers. Sequential episodes that are "dry" of images and evocative language (i.e., that are more like scripts) are typical of A1 and A2 individuals, whereas affectively rousing and vivid episode fragments (perceptual images) are typical of Type C speakers.

Source Memory

Source memory is a particular form of episodic memory, one that is essential for integration of the memory systems. It is recall of the precise source of information (Schacter, 1996). It tags all types of information with a code for the occasion when this information came to be one's own. Without this memory system, it can be difficult to evaluate the validity of information. Is this what I think now—or what I thought when I was younger? Was it your conclusion or mine? Did I read it in a

scholarly book or a tabloid newspaper? Did it really happen or did I just think about doing it? Source memory permits information to be reconsidered and evaluated in terms of current conditions and implications for the self. Without source information, one basis for doubt and certainty is removed.

The implications of this are profound. Without sufficient doubt, too much is accepted as true. Without the confidence of certainty, nothing can be known to be true. Differentiating doubt and certainty is central to mental and behavioral organization. If one cannot distinguish authentically generated semantic conclusions from borrowed conclusions, that is, those learned from others, one loses one's own perspective. Knowing the source of semantic conclusions both permits assignment of information to others' perspectives (thus encouraging one to evaluate explicitly its relevance to the self) and also permits one to compare past conclusions and prior self-relevance with current understanding and desires or needs. If one cannot tell whose feelings are whose, it becomes impossible to do what is in one's own best interest and to organize one's behavior affectively. Similarly, being unable to recall time and place information in episodes prevents one from differentiating daydreams, imagined actions, wished-for or feared actions, and actual experiences. This makes delusional thought possible (Schacter, 1996).

Source memory is processed through the frontal lobes, which also manage temporal ordering. This more sophisticated form of cognitive information is not functional early in life and is applied only to explicitly known information. Its absence in preschool-aged children accounts for their susceptibility to false recall and acceptance of the statements of others as being truths for themselves. It is not until adolescence that source memory is fully functional. This makes children particularly vulnerable to distortions passed to them by trusted adults (see discussion in Schacter, 1996, pp. 123–129). As compared to the other memory systems, source memory is particularly vulnerable to distortion and error, particularly errors tied to truth and delusion (or confabulation, to use a less pejorative term) and to self-relevance. This, together with its late development, gives it the potential to be a prime contributor to severe psychopathology. That is, the inability to differentiate fantasy from reality and to establish self-awareness, self-identity, and self-relevance are key indicators of psychopathology.

Understanding the role of source memory in adults may require understanding something about their development in the school years. In school-aged children, the central concerns are (a) that adults not pass

their own perspectives, biases, and experiences to children without clearly labeling their source as being outside the child and (b) that private inner sources that are not "true" in the outer world of behavior be accurately identified as dreams, daydreams, and wishes. It is noteworthy that children who talk out loud are more likely to identify themselves as the source than children who keep their thoughts in their minds (Giles, Gopnik and Heyman, 2002). Developmentally, it is important to note that preschool-aged children do not understand that their minds are private, that is, that others cannot know what they are thinking, and that this awareness is only beginning in young school-aged children. Given that troubled children are often isolated from both peers and trusted, supportive adults, that they may sleep or daydream more than other children, and that their wishes and fears are often of greater intensity and more discrepant with their experience than those of other children, there are particular risks that they will not be able to identify properly self-generated information as such. If misunderstandings are not corrected, there may be greater vulnerability to excessively rule-bound thinking or delusional thinking in adulthood.

INTEGRATION AND REFLECTIVE INTEGRATION

Making Meaning

The mind is a meaning-making organ. It seeks coherence, both internally and in relation to the context. Perception of discrepancy initiates integrative processing, with the end goal of reducing or eliminating discrepancy. Although many sorts of meaning can be generated, meanings associated with danger and sexual opportunity are critical to survival. That is, integration is not a luxury; it is a life-preserving process.

Reflective functioning is a type of integration that involves conscious thought without immediate action. It is often initiated by perception of discrepancy. In most cases, the reflective process reduces discrepancy by correcting errors in representation. Often this involves constructing a more complex and inclusive representation.

Processes versus Models

Attachment theory has tended to treat internal representational models as "things" that a person "has" and that "contain" information. Current neurophysiology conceptualizes representational models more

nearly as *processes*. In Damasio's terms, each processing pathway in the brain generates information that implies a disposition for action or lack of action (Damasio, 1994). If processing were aborted before completion, the "strongest" dispositional representation active at that moment would regulate behavior. This representation could be procedural, imaged, semantic, connotative, or episodic. However, because semantic, connotative, and episodic representation require more extensive processing (and therefore more time), early termination of processing will result in a bias toward enactment of procedural and imaged dispositional representations.

Fully completed processing, on the other hand, permits conscious construction of carefully evaluated representations. These are likely to result in better adapted behavior. Sensory stimuli are repeatedly transformed in a branching network of parallel processing in which each pathway modifies the signal in a manner that clarifies some things, but at the same time generates bias or error with regard to other things (for example, the cognitive and affective transformations result in different sorts of information from the same sensory stimuli). Cortical integration refers to the process of analyzing inputs, attributing meanings, and organizing responses from the multiple transformations reaching the cortex (Schacter & Tulving, 1994).

Working integrative memory, on the other hand, is the live, on-line process of integrating information. It is real-time functioning, as opposed to recall of past integrative processes and their outcomes. In the terms of the AAI, it is metacognitive thought or active reflective functioning. The distinction between integrated conclusions and metacognitive thinking is crucial to differentiating unintegrated speakers who parrot back wise and integrated thoughts from integrated speakers who actively engaged in the lifelong process of drawing meaning from experience.

Association and Disassociation

Current thinking about cortical (integrative) processing suggests that it consists of two opposite functions. The prefrontal cortex holds information discretely, such that it can be compared and contrasted; that is, the prefrontal cortex focuses the mind. Part of the means by which this is accomplished is through inhibition of extraneous, tangential, or competing thought processes. The posterior cortex, on the other hand, performs the associative function, that is, connecting information to expand or generate meanings. The posterior cortex opens the mind to interactive interconnectivity, to an increase in the range of associated and eliciting cues and meanings. Part of the process by which this is accomplished is through disinhibition of thought. Together, these processes permit information to be classified, that is, to be clumped and separated, for efficient and productive access. Put another way, these opposing processes permit information, and the behavior derived from it, to be organized. Although both processes are essential, they must be coordinated strategically in order not to lead to chaos, to disorganization.

Together, the prefrontal and posterior cortexes promote both recognition of discrepancies in dispositional representations resulting from different processing pathways and also the generation of complex understandings and solutions based on associated and relevant information. In general, the longer the individual delays action (or the faster he or she processes information) and the more information he or she is able to keep neurologically active at once, the greater will be the extent of integration. More errors will be identified and more information will be available to correct the error and construct alternate hypotheses. The outcome will be an integrative, consciously considered, hierarchical, and conditional meta-model (Crittenden, 1990) of how to interpret and respond to current conditions. The outcome, in other words, will be a metacognition resulting from the mind's consideration of its own output. For example, making implicit procedural rules explicit in semantic memory requires the reflective "rational-emotive" process identified by Ellis (1973). Understanding the limits of this rule (and the conditions under which the limits pertain) is metacognitive.

The Effects of Exposure to Danger on Integration

Integration takes time. But, under dangerous circumstances, taking time can increase the danger. A rapid response is often needed. This creates a very basic cost/benefit problem. Rapid reflexive responses are self-protective but sometimes misguided; reflective responses are more accurate but may come too late to protect the self. This situation helps to explain the particular sorts of information-processing problems, and consequent behavior, observed in adults who have experienced danger, especially early and recurrent danger.

In some cases, however, even with sufficient time for reflection, the more accurate representation is terrorizing or beyond the intellectual

capacity of the individual to accomplish. Especially for children, terrorizing representations (such as *"Your mother really hates you and wishes you were dead"*) need to be avoided to make daily life possible. In this case, the meaning-making function of the mind may "correct" the errors identified by discrepancy by denying accurate information and constructing delusions to cover the gap in reality.

ENCODING, REMEMBERING/FORGETTING, AND RETRIEVAL

Knowing is not as simple as having information and remembering is not as simple as accessing known information. This concluding section on information processing provides a quick overview of three processes that are essential to making use of experience.

Encoding

There are two forms of encoding. The first occurs in working memory and it functions to increase the probability that the neurological pathway activated by an event will be reactivated in the future (i.e., that it will be retained for future recall). It should be stated very clearly that information is not retained as a discrete unit (a memory), like a card in a file drawer or a book in a library. To the contrary, the central nervous system retains only probabilities of the sequential firing of neurons within a distributed neural network. When these probabilities increase, information is more available for future recall. When they decrease, information may be forgotten. Change in probability of future firing occurs at the synapse and consists of the enhanced or diminished release of neurotransmitters. This depends upon the intensity of the stimulation reaching the brain, that is, the emotional saliency of the event. Such long-term potentiation (LPT) constitutes a process-based form of encoding.

The second form of encoding uses protein synthesis to generate additional synapses; this is a structurally based, more enduring form of memory consolidation. The generation of new synaptic contacts requires information to be elaborated. This can occur by simple repetition, by strategic effort, or by association. The elaborative process includes classifying the event categorically, associating it with other long-term memories, and assigning personal relevance to it. Elaborative encoding creates the advantages of greater efficiency of recall,

greater meaning attribution (both in quantity and accuracy), and greater influence on future behavior. These, however, are also disadvantages. Greater efficiency means that new or competing approaches are less likely to be implemented. Greater meaning attribution tends to tie mental interpretations to fewer base experiences that are elicited by a wider range of cues. Greater influence on behavior means that some events will have disproportionate effects on individual functioning. When the event is recurrent and the elaboration is mature and balanced, this is an advantage. When the event is unlikely to recur or the elaboration immature, incomplete, or distorted, this may bias the individual toward maladaptive behavior. For example, "preventive" retelling of endangering experiences that are unlikely to recur may actually promote, rather than prevent, posttraumatic stress disorder (i.e., post-disaster retelling of experiences could cause iatrogenic disorder, Kenardy, 2000).

On the other hand, if information is not elaborated, it is recalled less frequently and with less detail. Further, fewer cues will elicit it. Type A speakers, in other words, may both recall information less easily than other speakers and also actually have fewer memories than other speakers.

To summarize, encoding consists of two processes. One is a relatively transient, passive, stimulus-dependent, and chemically mediated process of synapse enhancement, whereas the other is a structurally enduring, elaborative, strategic, and reflective process of synapse generation.

Remembering and Forgetting

Remembering and forgetting are complementary processes. Together, they impose order on the environment (Edelman, 1987). Forgetting irrelevant information is as necessary to thought as remembering relevant information. Forgetting is a form of mental pruning that deletes unneeded information to make space for new information, thus making mental functioning more efficient. Because failure to use synapses weakens them, forgetting occurs in direct relation to experienced need to know. This is obviously advantageous—except when important information is not activated through an inhibitory process. Under these conditions, information may be lost altogether as infrequently used synapses wither away and dendritic structures are adapted to other pathways. Without periodic firing, the probability of future firing (i.e., future recall), the range of cues that can elicit recall, and the wealth of recalled associations will be reduced or eliminated. In other words, not

everything is remembered and not everything that is remembered is infinitely recoverable. Memories are reconstructed from their elaborations (Schacter, 1996). Without these, there is no recall. With a paucity of these, memory will be limited.

Retrieval

Retrieval is a temporary constellation of activity in different parts of the brain that join to create a representation, one that will never be precisely duplicated again. It is an emergent entity; that is, the past is not recalled. On the contrary, recall is a process of activating disparate neural networks. Some represent current states of activation (the state of self in the present); others are activated by a retrieval cue. The retrieval cue, however, is tied to encoding cues (Tulving, 1995). Retrieval cues activate pathways that have been activated in the past, that is, aspects of the remembered event, connecting them with presently active pathways to create the memory, as it is recalled on this specific occasion. This incomplete mixture of past and present is what the network "remembers." Thus, all recall is currently self-relevant. This process also implies that the manner of encoding determines what sorts of cues can elicit recall.

There are two types of retrieval: associative retrieval (automatic, state-dependent retrieval) and strategic retrieval (in which one deliberately searches through categories and logical associations). The retrieval environment, including interviewer or therapist, greatly affects which cues are presented, whether they tend to be strategic or associative, and whether they are matched, in terms of generality versus specificity, to the prior encoding and elaborative process that generated the potential to recall. This fluid, emergent quality of memory is both adaptive and distorting.

A potentially misleading aspect of the experience of remembering is the individual's certainty of recall. Confidence in one's memory is totally unrelated to actual veracity.

CONCLUSION

The AAI uses five aspects of information processing (cognitive and affective aspects of sensory stimuli, seven types of transformation, memory systems, integration, and encoding and retrieval) to guide both

interviewing and the analysis of the interview. In the AAI, the speaker's history is co-constructed with an interviewer. The interviewer systematically probes each of the memory systems, using very general cues, cues of moderate specificity, and unique person-specific follow-up questions to maximize the possibility that the speaker will have access to relevant information. The coder of the interview examines the transcribed discourse, seeking (a) evidence of preferential reliance on cognitive or affective information, (b) distortions of information, (c) conflict in the content of representations drawn from different memory systems, and (d) evidence of the ability and willingness of the speaker to use the "on-line" relationship with the interviewer to examine self-relevant information. In the chapters to follow, these ideas are expanded to create a method of discourse analysis for the AAI.