A Model of Infant Mood States

Long Lasting Organizing Affective States

and

Emotional Representational Processes

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Introduction

Despite parents’ attribution of moods to their infant (“He was just out of sorts all day. I stood on my head but nothing pleased him.”), there has been little or no research on the establishment of infant moods or the mechanisms underlying them. Researchers like myself have not tackled this problem of long lasting affective states but rather have almost exclusively focused on specific short-lived affective expressions. Pragmatically short lived expressions were easier to study and have been used either as measures of the ‘meaning’ of an event to the infant (e.g., the sad and negative reaction to the still-faced mother), or as communicative signals that regulate interactions (e.g., infant smiles signal the mother to “continue what she is doing”) (Tronick, Als, Adamson, Wise, & Brazelton, 1978; Tronick, 1980; Weinberg et al., 1994). But there are conceptual challenges to the study of moods that go beyond pragmatics. One reason may be related to the recency of the idea that infants have affects at all and that they are organized and not disruptive. A greater difficulty is having to adjust our thinking to the more radical idea that emotions are organizing processes that structure behavior (Tronick, 1989; Beebe & Stern, 1977; Fogel, Diamond,
Langhorst, & Demos, 1983; Weinberg & Tronick, 1994). However, if these challenges to our thinking are difficult, it may be an even greater mind stretch to entertain the idea there are affective processes in infants that have a long lasting organizing continuous effects. Yet, it is this possibility that I want to consider. I want to some thinking on what moods are, how they are created and what some of their functions are. Thus I want to present a model of moods.

My model of moods is that infants have long lasting (e.g., hours, days and even longer) mood states. Mood states are dynamically changing yet distinct assemblages of affective behaviors and their control processes are modified by affective input from others. Mood states function to organize behavior and experience over time and they critically serve an anticipatory representational function by providing directionality to the infant’s behavior as he ‘moves’ into the future. Moods states are also implicitly and often explicitly known to the infant’s caregivers/partners and as a consequence function to give them a sense of what the infant will be like in the present and in the future. Importantly, I also believe that moods are co-created by the interplay of active self-organized bio-rhythmic affective control processes in the infant and the effect of the emotions expressed by others during routine social-emotional exchanges on mood control processes. Thus while we attribute moods to the individual – the infant is in a mood and the mood is in her – I will argue that moods are co-created by the infant interacting with others and that they function to organize the infant and to communicate that
In this paper I would like to present my model of moods recognizing that much of the thinking was developed in my work with the Change Process Study Group of Boston (see Stern, Sander, Nahum, Harrison, Lyons-Ruth, Morgan, Brushweiler Stern, & Tronick, 1998; Tronick, Brushweiller-Stern, Harrison, Lysons-Ruth, Morgan, Nahum, Sander, Stern 1998; Change Process Study Group of Boston, 2001). First, I present Sander’s ideas and research on sleep-wake states as the basis for my thinking about moods. Second, I will present my model of moods and how they come to be established and modified. Third, although examples of moods will be presented throughout the paper, I will present an extended example, “The Mood in Morning”, to illustrate how moods are established and dynamically changed. Last, I will discuss some of the developmental and clinical implications of the model of moods.

**Sander’s Sleep Research As A Basis for Thinking About Moods**

The theory of moods that I am presenting is derived from on Sander’s pioneering thinking and research on the organization of sleep and wake cycles in newborns and how they come to be organized by caretaking input ((Sander, 1976, 1977a,b). Thus when Sander (Sander, in this issue) asks where is the field of parent-infant research going he left out a possibility that I have seized – the possibility of looking back to his own work as a way of moving forward. Clearly moods are not sleep cycles. However, both are phenomena that
organize behavior and experience over time. I believe that by seeing the relations between sleep states and mood states we can begin to understand what mood states are and how they come about. Indeed, in recognition of the central importance to Sander’s thinking to my thinking about moods, I have named one of the critical mood control processes the Sanderian Activation Wave (SAW).

Sander investigated how sleep states came to be organized in order to understand how the biological was transformed into the psychological. He found and argued that although there were critical self-organizing processes that controlled sleep, that the organization of sleep was not simply a maturational phenomenon. To the contrary, it was powerfully influenced by the temporal and social-emotional features of caretaking. Sander carried out a series of foundational studies on the effects of caretaking on the organization of behavioral states during the newborn period. He found that infants had ongoing self-(infant)-generated bio-rhythmically organized patterns of sleep and awake states, but critically he also found that many features of sleep and awake states were modified by the quality and timing of caretaking. His interpretation was that sleep organization was the outcome of an interaction of endogenous and exogenous processes. Sleep organization was not just “in” the infant, it was “in” the interaction of the infant and the other.

The actual experiment was complex (see Sander 1976, 1977a,b for a
complete description), but its most important ‘experimental manipulation’ was that there was one nursery caretaking routine for newborns that was contingent on state behaviors (e.g., crying, eyes open), and another routine that was on a fixed schedule that went on regardless of the infants’ state. Sander’s hypothesis was that the different caretaking routines would modify the temporal organization of the infants’ behavioral states. This hypothesis was strongly supported.

Initially the sleep-wake activity cycles of the infants were monitored. It was found that each infant had an endogenous ‘diurnal’ organization of awake, REM and nonREM sleep states. Although the diurnal organization was still immature (e.g., nonREM and REM sleep states had varying durations, transitions among state were irregular), Sander found that there were individual differences and each infant had its own self-organized ‘pattern.’ Most important, Sander demonstrated that the coherence of the organization of the different states and their diurnal cycling was much more rapidly established by the state contingent caretaking routine than by non-contingently scheduled caretaking routine.

This finding was stunning. Sleep organization did not just mature. Its organization (its maturation) was modified by the temporal quality of the caretaking the infant received in relation to the self-organized state cycles of the infant. The finding is fundamental because it demonstrated that the organization neither came exclusively from the inside nor from the outside. Rather that there were two processes, one in the infant and the other in the environment, which in
their interaction over time led to the emergence of a more coherent state organization. State organization was no longer an internal maturational process but a mutually regulated process. Thus Sander’s thinking on sleep was not a one person but a two person model of a dynamic social exchange process co-creating organization. At the time, and still today this was a profound insight about the organization and development of human behavior.

Several other findings from this study are also interesting in the current context. Sander, found that female and male infants reacted differently with a suggestion that female infants established diurnal cycles more quickly. This difference speaks to differences in the self-organizational capacities of male and female infants, and more broadly to the pervasiveness of individual differences in endogenous organization and receptivity to the environment (Weinberg, Tronick, Cohn & Olson, 1998). He also found that two different caretakers carrying out the same contingent regime nonetheless were differentially successful in establishing diurnal rhythmicity in their infants. This finding emphasizes that the process of establishing the sleep rhythmicity is a mutually regulated process affected and modulated by both of the participants. Unfortunately, he was not able to specify what it was that the two caretakers did differently nor how those differences were regulated by the different caretakers and infants. Nonetheless the finding demonstrates the specific fittedness that takes place between the caretaker(s) and the infant(s). Sander also showed that if infants were shifted
from one routine to the other their sleep cycles persisted for a while in the face of the new routine, but after several days they shifted in response to the new routine. Critically, he also found that a perturbation of the normal behavior of the caretaker, having the caretaker wear a mask during a feeding, disrupted the subsequent cycling of the infant. This masking experiment demonstrates the receptivity of the cycles to specific inputs, their mutability and the active process of exchange that takes place between the infant and the caretaker.

Despite the differences between moods and sleep states, I see them as related because both are long lasting states, one behavioral, the other affective. Thus Sander’s work on sleep has scaffolded my thinking about moods. But what are moods?

The Question of Moods

I believe that understanding the establishment of moods is central to our understanding of infant as well as adult functioning. Spitz believed that affective processes (e.g., the social smile, stranger anxiety) were the organizers of the psychic life of the infant (Spitz, 1965). Emde has argued that infants develop an affective core, which provides continuity for the self over the lifespan (Emde, 1983). Certainly clinicians believe that affects are central to the adult’s psychic life and have a continuity from infancy. Like Spitz and Emde, I too believe that moods provide continuity to infants’ experiential life and that they are organized and organizing processes of infants’ affective and social behavior. Furthermore,
I believe that an affective organization for understanding the continuity and ‘expectancy” of behavior can stand in stark contrast to cognitive and information processing models of infant functioning. These models overestimate infant cognitive abilities and underestimate infant’s affective capacities and the adaptive possibilities and functions of affects. For example, I hypothesize that moods fulfill the Janus principle of bringing the past into the future for the infant but as a non-cognitive/symbolic/linguistic – that is purely affective – memorial process. It is typical for parents to note with much of affect of their own that “He was angry yesterday when we didn’t go out and he is still that way.” I also believe that consideration of the development of moods opens the way for thinking about dynamic conflictual processes in infants (Anni Bergman, personal communication). Again parents implicitly know this too when they observe that “Now he is always upset with her since she made him cry by leaving, though they were having such fun together.” And of course, while I will stay for the most part focused on infants, I hope that thinking about infant moods provokes thoughts about therapist-patient interactions ("Is he going to be in that mood again in this session?"), and about the interactive basis for the development of psychopathology.

But what is a mood? Though there is no accepted definition of mood and the concept of mood is vague and murky, parents have lots of knowledge about moods. Papousek would call this a form of intuitive knowledge (Papousek &
Papousek, 1983). For example, a mother and father in my laboratory were discussing their 4 month old infant in response to my question, “What is he like and how was he today?” We ask this question to find out if anything unusual was going on for the infant. The mother responded: “He was in a tough mood this morning when he got up. I tried everything but nothing worked. Well, when I gave him his mobile he seemed okay but after a few minutes he was really unhappy again. He wouldn’t even look at me. But we got through it and I finally got him to nap around 11. And after his nap he was in a great mood even though I was pretty tired and flat. Its funny because a month ago he used to wake up in a great mood, but hated his nap and got really cranky after it. But I figured out that if I just crooned for 20 minutes him he would calm down and after a while he got up like now, in a better mood.” The father added with concern and caring, “I thought he would always be tough in the morning. He really was tough on her, but now it seems to have switched around. She figured out this crooning thing and it changed him. She was just great. In lots of ways I think he is easier than he used to be. My sister had a baby who made you nervous because she would suddenly fuss and cry for no reason at all. Drove her crazy. He is really wonderful.”

What are some of the characteristics of mood states that these intuitive observations point toward? Like the distinct states of sleep and wakefulness (REM, nonREM, Alert, and Distress), mood states are a set of mutually exclusive
states made up of a distinct set (assemblage) of affective behaviors (Prechtl, 1974). In our research, we have found that during social interactions infants are most often in one of four highly organized short-lived affective states (Weinberg et al., 1994; Tronick, Beeghly, Fetters, & Weinberg, 1991). One is a Sad/withdrawn configuration which assembles a sad facial expression, looking away, slumping, and whimpering. Whereas a second is Social Engagement a distinctly different assemblage of a smile face, looking toward the partner, open handed gestures and positive vocalizations. A third is an Angry configuration and the fourth is an Interested/Curious configuration. But mood states are not just fleeting affective states. Again, like behavioral states of sleep and awake, moods last over time with critical temporal features such as stickiness, momentum, and ebb and flow.

What do I mean by stickiness? Stickiness is that once an infant (and likely for adults as well) is in a mood, it is hard to move the infant out it, and when the infant does get out of it, she readily fall back into it. “She woke up in a cranky mood and she just wouldn’t get out of it, even when she smiled to her teddy, she just went back to fussing”. As we shall see, moods are sticky because of the self-organizing processes in the CNS and the body that generate moods. Acting synergistically with these self-organizing processes, receptive processes function to bias the infant’s response to affective input even when the mood itself is not fully manifest. “She looked ok, not really happy, and then bang she was
screaming. I had no clue why. I sang her favorite song and it even made her worse. Everything annoyed her.” The biasing of affective input by receptive mood processes makes one or another mood more likely to occur as well as more stable. However, the dominance of a mood is not fixed and another mood may replace it, although the changeover to another mood may occur only slowly. “So I just took her as she came and little by little with a lot of cuddling she slowly came out of it.”

Mood states also evidence what I call momentum because they continue to be manifest even after the triggering event has ended. “She smiled to the rabbit and then just kept on smiling even when it was gone. Playing with it just put her into a great mood.” Momentum is also generated by self-organizing internal processes. As a consequence of these processes, even though affective input is critical to initially generating a mood, affective input may paradoxically have little role in maintaining a mood state. Mood states may simply “go on-and-on” on their own momentum. Moods also have other short and long term temporal qualities. In the short run, moods ebb and flow over the course of the day, often with a predictable regularity, though sometimes without any apparent regularity. “She was really fussy for a while, but then she was better, but when it came back it was with a vengeance.” Over longer time spans, they seem to be present for some period of time (e.g., a month or so) and then dissipate. “She used to be so cranky after her nap but now she is just a joy.” The wave like bio-
rhythmic ebb and flow is a self-organized process that organizes affective states over time and into the future.

Moods are different than what might be thought of as temperament. Moods grow out of the recurrence of the infants’ affective experience, whereas temperament is an organismic characteristic. However, organismic features of an infant may predispose an infant toward establishing one or another mood. “You could see she was easily overstimulated as a newborn and now too much of even good things get to her.” Most important, the long duration of moods, their flow, stickiness, and momentum make them different than fleeting affects which are briefly present and then dissipate. Yet because both are affective states, many of their behavioral components and likely CNS and physiologic components are shared.

One of the shared features of mood states and shorter-lived affective states is that different affective states are receptive (have specific fittedness) to specific emotional input during social exchanges that exceeds an activation threshold. We have found specific contingencies between infant affective expressions and maternal expressed affect (Cohn & Tronick, 1988; Cohn & Tronick, 1989). For example, we have found high correlations and contingencies between sad maternal affective expressions and infant sadness, and between maternal positive emotional expressions and infant social engagement. Again as with states of sleep and wakefulness where the infant is in one or another state
but not both, we see little if any “cross-talk” among affective states (i.e., the infant is in one or another of these states). “He just shifted between being happy and being upset.” Although, specific receptiveness to specific affective input may be adequate for understanding the triggering of brief affective states it is inadequate for understanding the generation of a mood. Such a situation would a simple stimulus-response model in which affective states would be activated in the presence a specific affective stimulus that exceeds a threshold and absent when the stimulus was below threshold or absent. As a consequence, Infants would be at the mercy of stimulus input and their affective states would be under stimulus control. Obviously, such a model fails to account for a mood’s chronicity, stickiness and momentum, their organizing of behavior over time, or the infant’s self-organized activity.

To overcome these problems in my model of moods I hypothesize 1) that moods are controlled in part by self-organized affective control processes, and 2) that affective input induces as well as stabilizes changes in the settings of the affective control processes. Thus like the variation induced by caretaking input in the temporal flow of sleep and awake states and the establishment of an infant’s diurnal cycle, moods arise out of the interaction of external affective input from others and the infant’s internal self-organized affective processes (Sander, 1977a), but then have their own stability. In this model of moods the infant is neither void of affective processes and simply under the control of external
regulators nor completely under the internal control of self-generated emotional processes independent of input. Indeed, I will attempt to show, that the introduction of an interaction between other's affective input and the infant's self organized processes as a source of variation of the control parameters of mood states helps account for the development and establishment of moods. Moreover, with variation of control parameters as a key element of this model of moods, the explanation for the continuity of infant experience remains within the affective domain without having to introduce cognitive processes as a kind of deus ex machina.

**Mood Control Processes: Sanderian Activation Waves**

What might the internal self-organized processes look like which regulate the activation of moods? Let me begin with a caveat. The goal in presenting this model of moods is to provoke thinking about how affective control processes might operate. The model should not be reified, but only used to challenge our usual (often cognitive) models about moods. Given this caveat, let’s focus on how the sensitivity for activating a mood state is set. Again, following from the work on behavioral states of sleep and wakefulness, it is my hypothesis that self-organizing CNS and bodily processes (e.g., biological clocks) generate a bio-rhythmic wave-like pattern of the sensitivity of the mood to activating affective input over time. I refer to this sensitivity or activation curve, as a Sanderian Activation Wave (SAW).

The amplitude of the SAW at any one moment in time specifies the likelihood (the sensitivity) that affective input will activate a mood state at that
point in time. When the amplitude is high the likelihood of activation is high whereas when the amplitude is low the sensitivity is low. The wave like ebb and flow over time (e.g., over hours) of the amplitude of a SAW specifies the change of a mood state’s likelihood of activation. For example, the effect of the variation in the SAW can be seen when affective input from a partner (e.g., a lolling voice) that can trigger an infant affective state (e.g., a big smile and gesture) at one point in time when the SAW’s amplitude is high will be ineffective at another point in time when the amplitude has ebbed and is low. Thus a mood state is not activated by stimulation alone or by stimulation mis-timed or at the ‘wrong’ place on the SAW. Activation is dependent on the interaction of the self-organized amplitude features of the SAW and the occurrence of input in relation to the parameters of the SAW. With the introduction of the SAW, the infant is no longer simply under stimulus control. Internal processes in relation to external events have an effect on the infant’s affective state. For example, the variation of the SAW in relation to affective input is one mechanism that would underlie the waxing and waning of moods. When the SAW associated with a positive affective state (posSAW) is high the infant is more likely to be in a positive mood but as the amplitude of the SAW decreases the positive mood is likely to wane.

Clearly, to understand moods it is critical to understand how the sensitivity of the self-organized affective control processes of the SAW are set or modified? Most of the changes are associated with affective input. Affective input that
exceeds the threshold of activation has two effects. First, when affective input exceeds the threshold of the SAW it triggers an affective state. Second, it also transiently increases the sensitivity (i.e., raises the amplitude) of the SAW. For example, a smile from the caretaker that triggers a positive state in the infant also will increment the sensitivity (raises the amplitude) of the infant’s posSAW. This increment in sensitivity has the effect of increasing the likelihood that the infant will be in a positive mood because even if the caretaker’s next smile is less intense than the first smile it is more likely to exceed the posSAW’s threshold. As a consequence of this modifiability of the SAW, affective input can increase (or the absence of affective input can decrease) the likelihood that a mood state is triggered by affective input and the likelihood of a mood state becoming established.

The size of the increment of in the sensitivity of the SAW and its duration (rate of dissipation) are unknown. However, I can suggest several factors that affect the size of the increment and its duration. More intense and longer duration affective input will produce a larger and more lasting increment of sensitivity than less intense or short duration emotional input. Indeed, very powerful singular traumatic events (e.g., violent anger) will have a larger, possibly even a permanent effect on the sensitivity of a SAW. Furthermore, rapidly repeated affective events will have a bigger effect on a SAW’s sensitivity than events which occur more slowly. This effect is the result of self-
amplification. Self-amplification occurs when the prior increment in sensitivity associated with a single affective event has not yet dissipated at the time the next input occurs. As a consequence, the changes in sensitivity begin to ‘pile up one on top of the other’ and there is an accumulation -- self-amplification -- of the increase in sensitivity of the SAW. I also expect that a SAW is more likely to be shifted by chronically recurrent events, especially ones that occur at the same point in time (i.e., at the same place on the SAW). For example, the excitement an infant begins to experience around the time when his father usually comes home from work. The effect of chronically recurrent “well” timed events is based on the assumption that the SAW, like other bio-rhythmic processes (e.g., sleep and awake states), is both open to input from the environment and has a stable temporal (e.g., ultradian and diurnal) organization which can function to anticipate the event that is yet to happen.

**The Mood in the Morning**

Let me present an example of how my model describes how mood states and SAWs generate and establishes long lasting affective states with stickiness, momentum, ebb and flow, and other temporal features. The example is called, the Mood in the Morning. The example begins with a transient event during one morning. I will then elaborate it to illustrate the effects of repeated and chronic affective events over many mornings. The example will also be limited to two moods, positive and negative, and the effects of affective events on their SAWs
(negSAW and posSAW). And though the example seems to focus on the negative affective state and the negSAW for expository purposes, the model of mood applies equally well to positive affects and posSAW. The example will also permit the elaboration of other features of SAWs.

As the infant awakens, she is in a somewhat neutral mood and the amplitudes of her negSAW and posSAW are close to, but still below their activation thresholds (i.e., their sensitivity to triggering affective input is about the same). The mother approaches, doesn’t smile and comments angrily on the messy diaper and sheets. The occurrence of this negative affective input increases the amplitude of the negSAW. It goes above the activation threshold and the infant goes into a negative affective state. She has a pouty facial expression, whimpers, turns her head into the bedding, and starts to suck on her thumb. Within moments, more negative affective elements are recruited to this negative affective state. She starts to wail. The mother shifts her behavior and starts to comfort her. However despite this change in the mother’s affective behavior, the infant stays in her negative state. But the mother persists and the negative mood starts to weaken. The amplitude of the negSAW has begun to dissipate because it is not receptive to (activated by) soothing input. Simultaneously the soothing input raises the amplitude of the posSAW above its activation threshold and the infant moves into a positive affective state. She looks at the mother with big wide eyes, smiles, reaches up to her to be picked up.
But the mother gets distracted and looks away, lost in thought. The baby almost immediately goes back into her negative affective state in response to this “still-face” by her mother, and she is mostly in a negative mood for much of the morning until her nap. The mother says to her husband, “Boy, was she in a mood this morning. *Nothing* I tried seemed to make a difference.”

How did she get into this mood on this morning? Given the amplitude of the infant’s negSAW when she first wakes up her mother’s negative affect activates the negative affective state. One can imagine that had the amplitude been lower, or the mother’s input had been less intense, the threshold may not have been exceeded. But the amplitude was high enough and the input was intense enough. The effect was to trigger a negative affective state (i.e., a large number of negative behaviors were assembled). But why was wailing added to the state after a few moments? This adding on is one of the most interesting features of moods. Mood states self-amplify; they feed on themselves. Being in a state further raises its amplitude and leads to the recruitment of additional related behaviors. The recruitment is a self-organized process that does not require external input, but is in a sense (self-) triggered by the infant’s own negative affective behavior. But why does the infant stay in the negative state despite the mother’s soothing? States are sticky and not fully controlled by input. With the activation of the state there is a cascade of affective processes. The amplitude of the negSAW was raised. Less intense and even internal events can
now activate the state. It is more coherently organized. Effectively there is an
on-going self-amplification of these changes which generates the moods
momentum and it keeps on going on its own.

But why doesn’t the infant simply only stay in the negative affective state
for the whole morning? The infant shifts from a negative to a positive affective
state because the soothing no longer activates the negative state and its
sensitivity dissipates below threshold. Simultaneously the soothing input
activates the positive affective state. But then why does the mother’s looking
away trigger the negative affective state again? Such triggering is a critical
feature of moods, as opposed to more fleeting affects. It is also related to the
dissipation of the SAW. In this case, although the amplitude of the negSAW has
dissipated below the activation threshold, it has not returned to its earlier, lower
level. It remains at a heightened level close to the threshold. Now less intense
input is able to activate it, even though the input would not be a sufficient trigger
at other times. By considering this movement between the negative mood state
and positive affects we can see that other briefer affects can be manifest as the
negative mood’s threshold is crossed or as the SAW dissipates. However, these
affects are vulnerable to preemption by the coherently organized negative mood
lurking just below the surface. Thus over the course of morning other affective
states come and go in relation to the waxing and waning of infant’s mood. But
they have short durations because the negative mood is so readily activated by
external affect input or even internal processes. Of course there is likely to be a reciprocal effect on the mother. Her positive affective state is likely to dissipate in the face of her frustration dealing with her baby’s mood. Perhaps she thinks to herself, “I just got more and more frustrated. I couldn’t figure what pleased her.” Her reactions become part of an external social amplification of the infants own internal self-amplification processes.

But how could this one-day morning mood become a stable affective state that lasts for days for this baby? As Sander has argued, the key to understanding how psychological processes become established is the recurrence of events, and establishing mood – an affective state that may last for days -- also takes recurrence (Sander, 1983; Sander, 1980). Let me extend the example to a longer period of time, such as a month. The mother of our 4 month old recurrently, rather than just occasionally, greets her in the morning with a negative affective display – lack of eye contact, flat or angry facial expressions, veiled but hostile vocal tone, and delayed comforting. At first the baby moves into a negative affective state, but she often can be comforted. However, after few days of this recurrent pattern she will become affectively negative when the mother does even a slight behavior that expresses negative affect. For example, if the mother’s voice is flat, the baby will go into a negative affective state, though ‘flat-voiced mother’ was not initially able to trigger her negative affective state. The infant is sensitized to the mother’s negative affective displays. The duration
of the state increases, even in the face of the most comforting of input from her mother. Everyone comments on how “tough she is to deal with in the mornings,” and the mother begins to feel that “she doesn't know her anymore.” Social amplification becomes more likely and regular.

How did the baby become so tough? Again, as in the one-day morning mood the central events are the self-organizing and self-amplifying processes of affective states as they are repeatedly triggered. Essentially, with the daily recurrence of the daughter-mother negative interaction at waking, the increments in the sensitivity induced in the SAW are preserved over days. The ultradian and diurnal organizations of the negSAW are modified. Stabilization of these ultradian and diurnal changes is especially likely to occur when the recurrent event occurs at about the same time every day (i.e., it chronically occurs around the time every day, that is at the same place on the SAW). As a consequence, the SAW of the elicited mood is shifted upwards, and the amplitude(s) of unelicited moods are shifted downward. To further stabilize the changes, a self-reinforcing cascade of processes amplifies the shifts. In the example, with chronic exposure to the mother’s negative affective state, the infant wakes up in the morning with the negSAW already approaching threshold. It is now very easily provoked. Moreover, the amplitude of her posSAW is low because it has recurrently not been elicited. It is has become difficult to provoke. As a consequence there is an increase in the likelihood that the negative state is
activated, which further induces and self-amplifies incremental changes in the sensitivity of the negSAW. These modifications in turn increase the likelihood that the negative state will occur tomorrow. The Mood in the Morning is established. All of these processes are further amplified by the mother’s social-affective behavior. Indeed, moods come to characterize, and be embodied in the co-created patterns of interpersonal relationships.

**Moods and Polymorphic Representations**

What are some of the implications of this model of moods. I expect, or should I better say “feel”, that we can now see how the characteristics of moods and the underlying SAW process fulfill the Janus principle. The Janus principle states that we use the past to anticipate the future; that we look backward in order to look forward. Looking back requires that there is some form of representation that carries the past into the present and the future in a meaningful way to guide thought and action, and emotions. Edleman (1986) refers to an internal mapping process of an unlabeled world that can organize action. Though typically our first thoughts are to think of representations as cognitive, in fact for adults representations take on many forms: linguistic, symbolic, imagic, motoric, olfactory, visual, bodily, and others. Any of these forms of representations may be in awareness or out of awareness, conscious or unconscious, explicit or implicit. Given these polymorphs, it is critical to realize that representations do not have to be a 1:1 mapping to the object, event or
experience, and they do not have to correspond in a 1:1 fashion to each other. A linguistic representation of an object is hardly the object and it is hardly the same as an imagic representation. The transformation rules from the 'real' event to its representation may be complex, but that complexity in no way diminishes that the past has been mapped into the present.

To explore this complexity let me present an imprecise but revealing example. It is the idea that the 'representation' manifest in our riding movements when riding a bicycle does not correspond to the bicycle itself. Instead it captures the interaction between the rider, the object and the riding environment. More specifically, the dynamic form of our body movements when riding a bicycle is an isomorphic 'representation' of the bicycle, just as much as the word 'bicycle' is a representation of the bicycle. Certainly, one would be hard pressed to figure out what a bicycle actually looked like simply by looking at riding movements. Riding movements have a self-generated and constrained organization that is modified by the forces acting on the body and the brain as they engage the bicycle and it engages the features of the terrain. The transformation functions of these constraints and forces to what movements are actually made are complex. Nonetheless the movements are fitted to the shape of the bicycle in unique ways. They would not be confused with the movements associated with riding a scooter or rowing a boat. Thus the movements isomorphically represent the bicycle, just as does a picture or a blueprint. Importantly once this bodily
representation is established, once the bicycle and terrain become mapped into
the body and the brain, these movements will shape movements in the future. If
the bicycle is changed the movements initially will be like the ones made on the
original bicycle. However, over time the movements will change and take on a
form unique to the new bicycle. Thus the movements as representations are
open and modifiable by input. If they weren’t we would always deploy tricycle
riding movements with bicycles, a past we would not want to maintain into the
present and the future.

I believe moods are another member of this polymorphic set of
representational forms, but one with a special centrality in infancy. Moods and
the interplay among them are representations of the emotional experience,
especially the chronic emotional experience of the infant. Mood processes and
the parameters of these processes, such as the level and temporal flow of their
SAW are affected by affective input. The induced changes in the control
processes bias how new affective input is processed and which affective
behaviors will be assembled and activated. Thus the settings of these
parameters encode the history of the infant’s affective experience. Were the
experience different the settings would be different. In turn, the affective state’s
stickiness serves to organize the infant’s social-affective behavior in the present
moment. Its momentum moves that social affective behavior into the future. In
the example of the infant with the Mood in the Morning, she awakens in a mood
that organizes a negative affective state and negatively biases how she will react to her mother’s affective input. Her mood is sticky and it has momentum. It got that way because her recurrent negative experience with her mother at waking was isomorphically mapped into her mood. Her Mood in the Morning is stable (though changeable). For now it organizes her actions in the present, the immediate future, and even tomorrow’s future. The ebb and flow of the mood’s SAW, as a representation, allows her to anticipate what she ‘expects’ to happen and organizes her response. However, while her mood is a mapping, a representation that functions as a memorial anticipatory process, it has no schemes, language, or symbols. It is purely affective.

**Moods and Affective Disturbances**

Moods are normal affective processes but the same processes that generate them can produce affective disturbances in the infant. Such disturbances are associated with a limitation or even a failure of the mood state to be affected by input. In the Mood in the Morning example, after a month of negative maternal greetings with their repeated activation of her negative affective state things “get worse.” In this context, getting worse means that the infant wakes up in a negative affective state. Her SAW has a flow but the whole SAW has been elevated and acutely entrained to her waking in the morning. Thus she doesn’t look at her mother when she enters, but rather looks at an object, fusses, sucks on her thumb, and cries without reaching up to her mother.
to get picked-up. Whatever the mother does makes no difference. Indeed even some soothing actions just intensify the state (i.e., the negSAW is so sensitive the soothing is experienced as intrusive). She is in a negative mood pretty much regardless of what the mother is doing. The Mom says, “She just wakes up in a bad mood.”

What has occurred is that the reiterated activations of her negative affective state around the same time each day, have led to a self-organized and stable level of her negative affect state’s SAW such that it can be above its activation threshold “on its own”. It has become independent of input. Or if independent is too strong a word, the negative state can be activated by an extremely wide variety of very low intensity internal or external stimuli. Much of the SAW’s specific fittedness to affective input is lost. The mood is, or at least seems to be activated for no apparent reason. It is very sticky, it has a lot of momentum and it is amplified and stabilized by the infant’s self-organizing processes. In a sense, it is ‘disconnected’ from reality. Indeed the infant now engages in coping behaviors, such as looking away, that exacerbate this disconnection. These coping behaviors, which normally operate to limit the disruptive effect of negative events, are now deployed in anticipation of affective events. However, since these events may not be forthcoming they are in some ways defensive (i.e., affective actions deployed in anticipation of events that may not occur but which preclude processing the ‘real’ event; Gianino & Tronick,
1988). Thus the infant’s self-organizing affective processes and self-regulatory processes conspire with each other to increasingly detach the infant from reality. The infant’s mood, functioning as an affective representation of the past, distorts the future. The infant has developed an affective problem.

I don’t know if such an affective problem can be thought of as an affective disorder or if we could reify it into a diagnosis. At times I am tempted to do so and it is in fact a diagnosis in clinical infant work. One time is when I think about infants exposed to traumatic events. These events may drive the threshold so high that the affective state is always activated. This is especially likely because the traumatic event almost always occurs in the context of recurrent chronic stress and distortion. Another time is when infants’ use internal coping processes in an attempt to segregate the trauma induced affective state from other affective states and experiences. This affective segregation of one affective state from other states may be analogous to cognitive dissociation or splitting. For example, the infant who interacts positively with her mother but is unable to express any anger toward her mother even though her mother has left her repeatedly in stressful situations. The infants reaction may be seen as adaptive but it does not integrate her positive and negative affective states in relation to her mother. The negative affect is split off. This segregation is an affective process, not a cognitive process. In fact, given my experience it seems to me almost unimaginable for the young infant to have any sort of cognitive processes
(e.g., working models) that would be capable of splitting off experience. By contrast, affective and regulatory processes would seem quite able to isolate affective states and split them off from other states and distort the infants’ functioning. Of course we have not identified such phenomena in infants, but we also have not looked them. However, I believe they exist and this thinking would help us to observe and identify them.

Another situation that tempts me to think in terms of affective disorders are cases when infants’ are chronically exposed to low levels of negative input. For example, we have found that maternal depressed affect is extremely stable and unchanging over the first year of life even if the mother fails to meet diagnostic criteria (Beeghly, Weinberg, Olson, Kernan, Riley, & Tronick, 2001). In these situations, though the exposure to negative affect is ‘constant’ it is not intense enough to always generate a negative affective state. This low intensity affective input, a kind of low-level affective radioactivity, nonetheless insidiously raises the sensitivity of the negative affective state. Over time the infant is ‘forced’ to deploy self-directed coping behaviors to restrict the experience of this chronically oppressive state. As a consequence, the infant’s affective experience is dramatically compressed and shifted toward an aberrant pathway of development. But whether or not we use terms like disorders or even diagnostic terms, my hypothesis is that these sorts of chronic affective problems are signaled by the dominance of a single affect, a restricted range of affect (e.g., no
heightened positive or heightened negative emotions), an anticipatory deployment of self-directed coping behaviors that produce a detachment from people and things, and expressions of affect that are not connected to affective reality. Unfortunately, because we do not know the range and variation of affective states in "normal" infants, it is difficult to identify what a restricted range or dominance of a single affect might look like. Of course we can identify the extreme cases, but we must also be concerned for those infants in these low level chronic situations who are experiencing affective problems that are currently completely unrecognized. Cases that I refer to as the ‘Oh, don’t worry, he will grow out of it’ cases, which are not grown out of but grown into.

**Moods As A Two Person Model of Co-creation**

This discussion of affective problems -- of moods deployed independently of ongoing input -- raises a conceptual danger of thinking about this model of moods as locating mood processes only “in” the infant. But the affective processes that generate moods are not simply located in the infant. The model is not a one-person model. It is a model of two (or more) persons engaging in affective regulation. It is a two sided model. On the infant side, the model neither sees the infant as void of organized processes nor passive in the face of affective infant. Infants have self-organizing processes that generate affective states that have short and long run temporal features. The model also sees the infant as self-regulating their affective states with coping behaviors (e.g., self-
comforting, looking away, disengaging). In the Mood in the Morning example, had the infant initially been able to self-comfort herself by sucking on her thumb and turning away from the mother when she first came into the room, her SAW may have stayed below threshold and allowed for a better morning. Thus in no sense are the infants simply at the mercy of input.

As I have argued in my Model of Mutual Regulation (MRM) (Gianino et al., 1988; Tronick, 1989; see also Hofer, 1994; Beebe, Jaffe, & Lachmann, 1992, Stern, 1976) and others Fogel et al., 1983; Cramer & Stern, 1988; Field, 1995), despite infants’ affective and self-regulatory capacities, the affective and regulatory input from the caregiver affects the infant’s affective states and regulatory success. The underlying processes of mood are open to input and they change as the affective input from another person interacts with these processes. Thus others (other persons) are external regulators (Hofer, 1994) of the infant’s affective state making affective processes dyadic, not monadic. In the Mood in the Morning example it is clear how the mother’s affective state affects the infant’s state. It is also clear how her regulatory actions scaffold the infant’s own regulatory actions (e.g., the mother’s persistent soothing of the infant in the face of her upset). Thus affective regulation is a not only within the infant, or only within the caretaker. It is dyadic. From my perspective as a consequence of these dyadic processes, the infant and the caregiver co-create infant moods. An hypothesis about an individual's mood being co-created may
seem odd, but I do not see how it could be otherwise. (see Tronick, 2001b for an elaboration of this perspective)

**Representational Infusions and Intergenerational Transfer**

Given this view of the mutuality of the processes that create moods, it is important to at least briefly consider the mother’s (caretaker’s) role in this process. My hypothesis is that mutual regulatory processes make possible the transfer of maternal moods to the infant. Once the infant detects the mother’s expressed affect (and if infants are anything they are mood detectors), the infant actively processes the mother’s affect to generate his or her own affective start. It is not simply a passive mirroring by the infant. Moreover, as a mutually regulated process the caretaker’s affective state is affected by the infant’s affective state.

In the Mood in the Morning example, the mother’s mood becomes more negative as the infant becomes more and more distressed. Thus the infant and the mother create their moods together. But because there is an asymmetry in the dyad, what the infant and mother carry into this creative process is different.

A mother’s mood states are more complexly, or perhaps it is better to say differently governed than are the processes governing infant moods. In particular mothers have dynamic representational processes (Fraiberg, Adelson, & Shapiro, 1975; Seligman, 1994). The mother may have said to the father that she ‘Just wakes up in a bad mood’, but she may have consciously, or more likely unconsciously thought that “the baby is just like my mother. I couldn’t ‘t please
The mother’s affective state is not simply a ‘pure’ affective state (a state connected only to the moment), or a mood ‘only’ based on her emotional experience with her infant (which is more likely to characterize infants’ affective states). Rather, the mother’s affective state is in part determined by dynamic representations (representations the infant has not yet developed). These representational processes, typically (but not always) unconsciously affect the mother’s affective state. The effect of maternal dynamic representations is to bring unconscious meanings and memories of the mother’s past into her present affective state. Thus infants have to process an affective state that contains unconscious and implicit meanings, what I refer to as representational infusions.

There is evidence that infant’s are affected by these representational infusions. Clinical cases in which infants take on the symptom of the mother (e.g., the infant of a once but no longer anorexic mother who fails to thrive) as well as the therapeutic research on how changing maternal representations changes her engagement with her infant, and in turn her infant’s state (Cramer, 1997; Stern, 1985; Bruschweiler-Stern & Stern, 1989; Seligman, 1999). The more difficult question is to understand how representational infusions, which are largely unconscious, could be conveyed in ways that affect the infant. One way they might is that they might “add” something specific to the mothers' behavioral and affective displays. For a toddler or a child one might think about how words
are used, or the concordance of words and actions. The mother might use sweet words with a hostile voice and gesture. Another possibility is that the mother’s affective infusions affect how she responds to her infant’s affective displays in ways that are distorted. For example, the mother responds with affective displays that don’t match the infant’s affective state (e.g., maternal sadness or anger to infant positive affective displays, or maternal turning away from infant solicitations of eye-to-eye contact). Massie (1982), Stern (1976) and others have described the profoundly derailing developmental effects affective mis-matching has on infants who chronically experience them. They have also shown how the mis-matching is founded on and generated by unconscious representational infusions.

Yet another possibility is that maternal affective processes are distorted by representational infusions in particular contexts such that they distort specific infant emotional and behavioral processes. For example, anorexic mothers disrupt the feeding of their infants (A. Stein, personal communication). The disruption is not so much in their feeding technique, but is more related to the affective states they express during feeding. These states result in a lack of pleasure in feeding for the infant, and as a consequence feeding related problems develop in the infant, including failure-to-thrive. Such context specific disruptions hold out the possibility of generating distortions of infants’ affect and behavior that are specifically related to the maternal representations. But
whatever the process I do not think that this process is (yet) one in which the infant is generating cognitive models (e.g., working models) of their own. Rather I think we need to seek out an explanation in how representational infusions affect the affective processes of the mother-infant dyad and in turn the infant’s mood states.

**Neurophysiologic Mechanisms**

I have not addressed the question of what underlying neurophysiologic processes might account for the establishment of moods and processes such as the SAW. There are several reasons for this omission. First, though we are ‘infatuated’ with the brain some of the processes may not be in the brain. I think they may be in the body. Downing (2001) has suggested that we need to think about the infant developing implicit motor procedures that go along with moods. These bodily processes would be stable ways of being in a mood and expressing it. They would be ways in which we as well as others come to know our moods. Given that we are talking primarily of infants I think our disregard of the body is at the very least damaging to our attempt to understand affect and moods. Second, I don’t want to tie the model to a particular model of the brain or a particular set of functions in the brain. Nonetheless there are a number of neurophysiologic processes that are compatible with this model of moods. One is that there might be chronic changes in the brain’s neurotransmitters. I like this idea because one can think of neurotransmitters as a soup that affects brain processes. Think of a
pea soup. Adding one carrot sends waves of flavor through the soup but if it is the only carrot then its effect dissipates over time. But adding a lot of carrots may permanently change the soup’s flavor. Indeed enough carrots may change it into a carrot soup. Affective input may change the neurotransmitter soup in similar ways. The neurotransmitter soup may be to generate a sad mood but with enough positive input there could be a dynamic shift into another state such as joy. There are other processes, such as the stabilization of neural nets, electrophysiologic changes analogous to kindling, changes in attractor states of brain processes, shifting central timing mechanisms, modifying the synchronicities among different regions of the brain, and neuronal selection (Edleman, 1986; Schore, 1994a,b). All of these processes and others have been linked to affective states and are modifiable by input. Choosing among them, despite my preference for the soup idea, is not possible at the current time, and it is not necessary for understanding moods.

Some Future Issues

There are a number of other issues have might be pursued further. One is how moods may modify infant-parent therapeutic work. This is a critical issue and requires fuller treatment. This issue will have to be taken up elsewhere. I would only note that moods are dissipative states that change slowly. Getting them to shift will require the induction of chronic changes in the affective experience of the infant. Moreover, the work must be dyadic and it must work with the dyad’s
creative processes. Another issue to pursue is that the model is not restricted to infants. I think it applies to children and adults as well. Thus it has implications for the role of moods in adult mental states and psychopathology and for adult therapeutic work. In my work with the The Change Process Study Group of Boston we have not talked much about moods, but rather about the processes of moving along and relational moves (affective moves) that provoke change (Change Process Study Group, 2001). I believe that when mood states are an issue for a patient, as they often are, that relational affective processes in the therapeutic setting will be critical for inducing change. This is not to deny the importance of other dynamic processes such as insight or analyzing the transference. My point is simply that moods are likely to be more open and ‘shiftable’ through affective input than through cognitive processes, because as implicit isomorphic representational processes they are not readily transformed into a narrative structure (Fosha, 2000; Emde, 1983; Schore, 1994b; Beebe, Jaffe, & Lachmann, 1992; Tronick, 1998; Fonagy, & Target, 1998; Tronick, 2001a).

Lastly, there has been little elaboration of the interplay among moods. Their interplay is a complex process. But one of the possibilities is that by seeing mood states as central to the organization of the infant, one can begin to consider that they come into dynamic conflict with one another (also see Seligman, 1999 for a related discussion). For example when one mood is
manifest, but another mood is moving toward activation the infant may find itself in a dynamic internal conflict. This kind of dynamic conflict would not be a conflict of unconscious adult-like representational processes (which once again the infant does not yet have) but a conflict of implicit affective representational processes. It is interesting to think, following Downing (2001), that the conflict may be felt most keenly in the body. Another case where there would likely be dynamic conflict is when there is a segregating off of an affective state from other affective states. Thus thinking about affective dynamics might provide a deeper understanding of the disregulation and disorganization seen in infants, and even in adults. But this and other issues will be pursued in other papers.

Allow me one last thought. If infant moods have even some of the centrality I have argued they have, why haven’t we attended to them more than we have. I believe that this may be the case because we (researchers and clinicians) want to deny that infants have moods. Were we to accept the phenomenon of infant moods it would shatter our oft-times romanticized images of infants as affectively curious and happy and emotionally flexible (Tronick, 1989). But if we did bring the mood idea into consciousness, we would have to examine the possibility that “infants-with-moods” might also experience affective problems and disorders. Such a possibility is a very painful and disquieting thought but it has unexplored implications for our research and clinical work with children and adults.
References


Bowlby, J. (1951). *Maternal Care and Mental Health*. World Health Organization, Monograph Series No.2,


Research in Child Development.


