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# Thinking Differently

## Principles of Process in Living Systems and the Specificity of Being Known

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As a way of integrating emerging knowledge of biological systems, developmental process, and therapeutic process, we identify principles in the process of exchange between organism and its context of life support that are present at all levels of complexity in living systems, from the cellular to the organization of consciousness. These principles range from specificity, rhythmicity, recurrence, and pattern to coherence, wholeness, and a relative unity in the organization of component parts. By proposing that these principles are also governing the exchange between mother and infant as they negotiate a sequence of essential tasks of adaptation, or "fitting-together" between them over the first years of life, the author suggests that the biological level becomes integrated with the developmental. A sequence of adaptive tasks extends from specificity of recognition in the newborn state, to recognition of inner awareness, purpose, and intention—shaping conscious organization. The bridge to the therapeutic level is constructed as therapist and patient build increasingly inclusive and coherent moments of recognition between themselves at the level of conscious organization, which act as corrective experiences, bringing the patient's own senses of "true self" and of "agency-to-initiate" to new levels of validity and competence.

AT FIRST GLANCE AT THE TITLE SELECTED FOR THIS SYMPOSIUM SUGGESTS that its goal must be to stimulate each of us to try to "put it all together." But as soon as we address the meanings and levels of meaning that can be given to each of the words of the title—Early Development, Biological Systems, and Therapeutic Process—

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we confront the necessity to acknowledge the diversity of meanings we can give to these words, at least a diversity of ways each of us might think about how one could go about such a task of integration. The limits of a brief essay allow me only to sketch one idea of the way it might be done.

As I see it, even to begin the task, one must begin with the broadest possible perspective, one that could include each of these five domains from the outset. The challenge of integration, then, would be to work out how each relates to the other within that perspective. For me, that broadest of perspectives would be the actuality of life itself, each of us sustained by it in order even to think about it—something we, for the most part, take totally for granted, but something that remains a mystery to all of us. Furthermore, immediately we begin to think about life and life process, we are confronted with paradox, and not only one paradox, but many. In what follows, we will be searching for principles in life process that govern the moves toward resolving some of its enigmas. If we find that such principles apply at each of the different levels that our symposium title includes:—the biological level, the developmental level, and the level of the organization of consciousness, that is, the level at which therapeutic process operates—we, already will have begun the process of integration we are seeking. It should be evident that, by choosing to begin within the broad perspective of principles governing life as process, we will be beginning at the level of biology. But this is the same level at which our thinking about developmental process must also begin. Then, if we find that the same principles operate at the psychological level, the way will be open to integrate our thinking about the level of therapeutic process. "Emerging knowledge" in each of the several domains included in the title can give the necessary new meaning to the way the word integration can be applied in bringing these diverse domains together.

Each person's life has its own pattern, which is one reason why so many efforts have been made to find a language that allows us to communicate across our diversities. My effort here is to draw on a spectrum of sciences to select powerful terms that can facilitate translation. For example, I have come to rely on the term coherence to describe the wholeness in the organization of the complexity of component parts that exists at a heirarchy of levels in the life of the organism and is essential for its continuity. The state of coherence, or wholeness, can be thought of as a goal, or motivating force, for the



achievement of what regulation means—at the level both of the individual organism and of the organism within its ecology of life support. This would imply an underlying direction between infant and its surround that makes a widening connectedness possible in their engagement together as the developmental process increases its complexity of functioning.

The experience of specificity in interaction and engagement at the level of consciousness is what I have called "recognition process." I propose this process as a bridge, at the human level, connecting basic principles of biological process with developmental process—through the negotiation of a sequence of increasingly complex tasks of adaptation, or "fitting together," between the infant and its caregiving environment over the first years of life. This is a sequence of negotiations of connectedness in the interactions between infant and mother that constructs the bridge to organization at the psychological level. By "organization" at the psychological level, the level of consciousness, I am thinking of the spectrum of ways we experience our own self-awareness within our awareness of our surround. The ever-developing brain, through the infant's experiential engagement with its world, as a self-initiating agent, is now understood as functioning to bring together new levels of integration in the adaptive process (see Freeman, 1995). An example of a new level of integration would be increasing coherence in the experience of sense of "self" within one's context of life support.

The sequence of adaptive tasks we propose as a perspective on early development illustrates the way "the experience of recognition" that is, the specificity of a moment of one's knowing that one is "known"by an "other," gradually expands as the infant moves to increasingly complex levels of function. In the healthy environment, expansion of the experience of recognition allows the infant's spontaneity of initiative to emerge through the way the infant's adaptive strategies construct relative harmony in its engagement with both its surround and its significant "other." On the other hand, given the spectrum of healthy-to-unhealthy infant–caregiver systems (in which "fitting-together" becomes increasingly difficult), there would be a spectrum of exchanges that could move from facilitation to inhibition.

In like manner, the goal of the therapeutic process can be thought of as the facilitation of increasing coherence in one's organization of consciousness through the experience of an expanding specificity of recognition, co-constructed between patient and therapisr, that

changes awareness of one's sense of self-as-agent within the awareness of what one is doing in the therapeutic interaction and in the world around.

## Life Process and Paradox

Immediately we begin to think about life and the mystery of life process, we begin to confront paradox, actually a list of paradoxes. For example, we cannot think of any organism, down to the smallest microbe, that lives without having to think of an environment within which it must be in an ever-ongoing interaction. Thus, if we begin with life, we begin not with the living organism itself, but with a "system"—the organism and its environment. But, if we begin with a system—the organism always within an ever-ongoing exchange with its surround—we are thinking of process, a continuing process with many levels of complexity occurring together. A process with many levels of complexity occurring together immediately becomes paradoxical since life process requires both ongoing continuity and ongoing change. What appears to have the stability of the material structure of the body is found to be, itself, within a flow of change. The molecules that make up the body today are not the same molecules that constructed it a month ago. This flow of change, paradoxically, must maintain the organized wholeness of the organism, while its components move through disorganization, removal, and replacement, all the while maintaining the vital coherence of the organism, essential for the continuity of its life. How can all this be done? How can continuity, discontinuity, and wholeness go on together? What we have been accustomed to thinking of as having the permanence of "structure" we now seek to understand as an ongoing process, a process "organizing complexity." Later we will come to a way of thinking about this by taking a glimpse at chaos (or complexity) theory, but first let us return to paradox—that, by thinking of life as process, we must think of the organism actively and continuously engaged with its ecology at a complex heirarchy of levels—that is, we must think of the functioning of a system, not of life as the property of the organism alone.

Let us start with the meaning Webster gives to the word *system*: an assemblage of objects united by some form of regular interaction or interdependance or "a group of diverse units so combined as to form



an integral whole." For life to continue over time, the combining of diverse units to form an "integral whole" also must be continuous over time. If a coherently organized wholeness stops, life begins to fail; if process stops, life stops. We know that in living systems life does stop, but we know also that the new keeps appearing. Thus we must think of process as a flow of input and output in the system through an ever-moving, overarching, organizing process that, through ongoing interaction between organism and surround, is constantly achieving continuity in the face of discontinuity—rather than thinking of the continuity of life as having a kind of given permanence. It is process at all levels of complexity, from the molecular to our ecology within our solar system, that is required to keep the almost unimaginable diversity of parts combining to achieve the "integral whole" that the living system represents.[1]

## General Systems Theory: A Perspective on the Problem of Life

Those familiar with my work will recall that I began my search for principles of process in living systems as part of an effort to bring together the first three years of empirical observational data of infants and their families in the Boston University Longitudinal Study of Early Personality Development, begun in 1954. I turned then to the writings of the biologist who launched General Systems Theory some 70 years ago, Von Bertalanffy (1952). He proposed two principles essential for life: "organization" and "primary activity." By organization he referred to Webster's "integral whole"—the holding together, or coherence, among the enormously complex diversity of parts that make up the

[1] Beebe and Lachmann (1996) have been on a similar search for principles of process in living systems at the human level, coming up with their "three principles of salience": Regulation, Disruption and Repair, and Heightened Affective Moments. The experience of "heightened affective moments" provides the essential positive affects in our experiencing that accompany being "together-with" another. At the psychological level, then, events that generate the experiencing of positive affects become the source of the essential motivating impetus that pushes us to restore connection when it has become disrupted. Without something of this positive dimension as part of our framework of expectancy, we become vulnerable to a lapse into the dis-organization of depression or illness.

living organism. It is because of the diverse ways we can think of the word "organization" that the title of my paper begins with the words "thinking differently." The meaning I give to the word organization as it applies to living systems, includes concepts of an ongoing process—a flow of energy—that, in the healthy systems, brings the astounding complexity of the organism to a coherence, wholeness, or, unity among its interacting components that stems from an essential specificity in the connections between them

By "primary activity" von Bertalanffy was referring to an organisms's inner, or endogenous, origin of the initiatives for action necessary to achieve and maintain integration of such complexity. Coherence in the organization of the living organism comes from the inside; it is not imposed from the outside. Each living system—each organism—thus is seen as self-organizing, self-regulating, and self-correcting within its surround, its environment. A first step in our way to integrate the biological, the developmental, and the therapeutic would be to see how principles such as "organization" and "primary activity," essential at the biological level, might be applied to each of the higher levels. For example, we now refer to the initiation of self-organizing, self-regulating, self-correcting moves as reflecting the agency of the individual. Achieving a coherent sense of "self-as-agent"—differentiated, valid, and competent within one's context of life support—brings us to a key goal of both the developmental and the therapeutic processes. I suggest that the process of achieving a coherent sense of self-as-agent is an example of the way "principles of process in living systems" can be applied to the task of integrating biological, developmental, and therapeutic levels we have been assigned.

## The Nonlinear Dynamic System

To go a step further, the living system is described now as a nonlinear dynamic system, a system far from equilibrium (to use Prigogine's, 1997, term) having the features of sensitivity to initial conditions, the uncertainty of potential bifurcations, and an open endedness of its trajectory. The nonlinear dynamic system perspective allows us to understand the way both the new and the creative, as well as the disorganizing and the destructive, can be potentials of the same system. Within such a framework, self-organizing, self-regulatory processes must be continuous at a hierarchy of levels of complexity to maintain the essential unity, or coherent wholeness, of the organism that is



necessary for life to continue. Even today, as biologist Paul Weiss (1970) pointed out some 30 years ago, biology still has not clarified how the principle of wholeness, unity, or coherence, which the word organization represents, as essential as it is, is accomplished or maintained through "self-organization." How the principle of wholeness, or coherence, operates remains one of the mysteries of the life process, which, for the most part we resist confronting—or of which we remain totally unaware—taking it for granted, without thinking. It is to be hoped that this principle will be clarified as the human genome project progresses in its comprehension of the way the ongoing flow of exchange between genes and environment brings about this essential requirement for life. But it is a parameter involved at every level of complexity in living systems, and, as we shall see, of special relevance at the psychological level—the level of the organization of consciousness, the level at which the therapeutic process takes place. But let us begin with a look at what can be seen of organization—the "integral whole"—at the cellular level.

### *Coherence at the Cellular Level*

Recently Ingber (1998) introduced the concept of "tensegrity" to capture the way the structural wholeness of a cell is maintained when it is exposed to the pressures of a changing dynamic of forces. Although Ingber is referring to the architecture, the mechanical structure, of the living cell, I would suggest that "tensegrity" might serve as a useful metaphor for conceptualizing the elusive property of coherence at the level of psychological organization. Let us take a moment to see the way Ingber describes tensegrity as a principle of process in the living system.

Ingber (1998) writes:

> Life is the ultimate example of complexity at work. That nature applies common assembly rules is implied by the recurrence—at scales from the molecular to the macroscopic—of certain patterns. These patterns appear in structures ranging from highly regular crystals to relatively irregular proteins and in organisms as diverse as viruses, plankton and humans. This phenomenon, in which components join together to form larger, stable structures having new properties that could not have been predicted from the characterisics of their individual parts, is known as self-assembly. It is observed at many scales in nature. In the human body, for

example, large molecules self-assemble into cellular components known as organelles, which self-assemble into cells, which self-assemble into tissues, which self-assemble into organs. The result is a body organized hierarchically as tiers of systems within systems. Thus, if we are to understand fully the way living creatures form and function, we need to uncover these basic principles that guide biological organization.

An astoundingly wide variety of natural systems, including carbon atoms, water molecules, proteins, viruses, cells, tissues and even humans and other living creatures, are constructed using a common form of architecture known as "tensegrity." The term refers to a system that stabilizes itself mechanically because of the way in which tensional and compressive forces are distributed and balanced within the structure. Since the molecules and cells that form our tissues are continually removed and replaced, it is the maintenance of pattern and architecture—I reason—that we call life. Tensegrity structures are mechanically stable, not because of the strength of individual members, but because of the way the entire structure contains and manages to distribute and balance-stresses. Tension is continuously transmitted across all structural members. These counteracting forces which equilibrate throughout the structure, are what enable it to stabilize itself [pp. 48–49].

I suggest that Ingber's conceptualization provides a bridge, a metaphor for our thinking, namely, that a principle of equilibration of counteracting forces within the hierarchical complexity of psychological organization might describe the way a degree of relative order or disorder in the coherence of organization or wholeness of function in the personality of a given individual would be brought about. For example (although not to say how it is done), it is not a great leap to think that an interplay of counteracting forces is required to maintain coherence in one's sense of identity. This would be particularly true as one engages the unpredictability of conflict between opposing forces in one's dynamic system of life support. As Weiss (1970) pointed out at the biological level, we have yet to define at the psychological level the way the strength of coherence in our sense of identity operates and is mediated.

But coherence in one's sense of identity brings us to the next, most difficult, paradox with which thinking of process in the living system



confronts us. How can we, as unique self-organizing individuals, remain "distinct from" an "other" at the same time that we must be "together-with" that "other" in order for our "system"—which is sustaining life for us—to maintain its essential coherence and wholeness? (Benjamin, 1995, Seligman and Shanok, 1995).

## Two Additional Principles: Specificity and Rhythmicity

Two additional principles in biological systems—specificity and rhythmicity—provide essential clues to the way life process resolves this difficult paradox: the way the complexity, generated by the uniqueness of self-organizing individuals, still permits the necessesary wholeness or coherence of organization of the larger system of which each is a part to be attained and maintained.

### Specificity

The first of these principles, specificity, was introduced to me by the work of the biologist Paul Weiss (1947) at the time I was getting acquainted also with the work of Von Bertalanffy (1952). Weiss emphasized the critical significance of what he called "the device of specficity" in establishing and maintaining those connections on which the mysterious coherence or unity of living organization rests. He pointed out that the determining quality of specificity is a principle, universally used in the living world. It is essential for communication, recognition, affinity relations, selectivity, and so on. Weiss (1970) described the basic principle as one of matched specificities—"a sort of resonance between two systems attuned to each other by corresponding properties" (p. 162)—and gave several illustrations of the way a principle of specificity operates in the living system, from the level of embryology and the immune system, to the functions of hearing and seeing.

### Observing the "Device of Specificity"

Can we see the way specificity functions to connect components as essential coherence is being constructed at the systems level? The

mysterious way Weiss's "device of specificity" operates to construct "organization," or wholeness, in the living system at its most complex level was brought home to me powerfully decades ago, when Dan Stern offered me the opportunity to review some of the movies of newborn infants that we had taken in our longitudinal study, using his frame-by-frame projector. The scene was drawn from some three minutes of movie film taken of our research team out on the lawn during a home visit with one of our new neonatal subjects on the eighth postdelivery day. (In those days [1958], that was three days after mother and new baby had returned from the hospital.) One of the team was standing on the lawn talking with the father. Mother was sitting nearby holding her new baby and talking with the leader of the team. The baby became increasingly fussy and mother tried to quiet her but was unsuccessful. Mother became a bit embarrassed in the presence of the leader and decided it was time to bring out refreshments. So she gave the baby to the father, who was standing talking nearby, and went into the house. The next two or three minutes of film show the father standing on the lawn, holding the baby in his left arm, continuing to talk to the researcher, during which time the baby simply fell asleep and the two went on talking. Run at normal film speed of 30 frames per second, this is all one sees.

Over the same few minutes, now run frame-by-frame, one sees the father glance down momentarily at the baby's face. Strangely enough, in the same frames, the infant looks up at the father's face. Then the infant's left arm, which had been hanging down over the father's left arm, begins to move upward. Miraculously, in the same frame, the father's right arm, which had been hanging down at his right side, begins to move upward. Frame by frame by frame, the baby's hand and the father's hand move upward simultaneously. Finally, just as they meet over the baby's tummy, the baby's left hand grasps the little finger of the father's right hand. At that moment, the infant's eyes close and she falls asleep, while father continues talking, apparently totally unaware of the little miracle of specificity in time, place, and movement that had taken place in his arms.

How do we account for such specificity of connection between father and baby? Was there a "representation" of the father's little finger in the newborn's brain? Did she know "where" it was, to grasp it? As father's hand came over the infant's body, father extended his little finger, separating it from his other fingers; otherwise the baby could not have grasped it. How did he know the baby wished to grasp it? How could the movements of father and baby fit so precisely in time



and in place, eight days after the baby had been born? Are we looking at some principle of wholeness,—that is, building on an underlying principle of specificity in time, place, and movement that joins directionalities between component subsystems—a joining that is necessary to construct coherent wholeness in a "system" that can be said to "live"? Would "tensegrity" be one illustration of this principle of wholeness? Might this same principle of joining directionality also underly Stern's (1985a) "attunement" or Trevarthen's (1979) "brain-to-brain" communication—or our increasingly employed concept of "intersubjectivity"?

## Self-Assembly at the Psychological Level

When we extend the concept of specificity to the interactions between two people, we begin to have a bridge from the principles of process at the level of molecules to principles of process at the level of persons. How people find and link with one another has become a current interest in the psychoanalytic world. Thus we can turn our search for principles of process in the organization of coherence or wholeness in living systems to the level of the organization of consciousness.

In Tronick's (1998) "Diadically Expanded States of Consciousness and the Process of Therapeutic Change," drawn from his research in infancy and using the "still-face" paradigm, we find exactly the same principles as Ingber described. Tronick writes:

> Each individual is a self-organizing system that creates its own states of consciousness—states of brain organization—which can be expanded into more coherent and complex states in collaboration with another self-organizing system. When the [specificity of] collaboration between two brains is successful, each fulfills the systems principle of inceasing its coherence and complexity—the infant becoming capable of performing actions in the dyadic system that the infant would not be capable of performing alone [p. 296].

Tronick's example thus illustrates the way a principle of process in living systems, such as Ingber's self-assembly, can be applied at the highest level of human complexity—that of human consciousness. As we shall see, the principle of specificity of connection, required for the self-assembly of components into larger wholes at the level of awareness, is basic to what we refer to as "recognition process"—a

process that brings two states of consciousness together in a moment of fittedness.

However, a paradox remains. Specificity of connection must emerge from the resolution of stresses between opposing forces generated by the ongoing flow of change in time, place, and movement both within and among the components that make up the organism's hierarchical levels of complexity. Are there other mechanisms by which specificity of connection can be accomplished? The answer, I suggest at this point, would draw from and extend Weiss's (1947) expression of a "device of specificity." We propose that it is through a second additional principle, the "device of rhythmicity," that this is accomplished. Let us see how rhythmicity contributes to expanding connections between the infant and its world.

## Rhythmicity

Relatively stable but resilient "holding together" of the complexity of the biological system is brought about by the entrainment and synchrony of biological rhythms. The living system is a symphony of biorhythmic systems within systems. A simple metaphor in the language of complexity, or chaos theory, gives an overview of the process of consruction of rhythm in the nonlinear dynamic system: "When a flow of energy enters a matrix of sufficient complexity that is under constraint by certain parameters, it will emerge as a flow of recurrent pattern, each recurrence of pattern having features, both of self-similarity and of singularity." That is, each recurrence of pattern both resembles previous patterns but is unique in its own way. The creative potential of such a flow of energy might be illustrated in the world of mathematics by the repeated iterations of a simple formula in fractal geometry that constructs the beauty and complexity of the display known as the Mandelbrot set (Mandelbrot, 1982).

Self-similarity in recurrent patterns brings us at once to rhythmicity—and, in the biological system, to biorhythmicity, a fundamental feature of living systems at all levels of complexity from the dinoflagellate to the human. It is a feature in nature that facilitates resolution of one of life's underlying paradoxes—the way a complexity of self-organizing components "distinct-from" each other can reach a coherence or unity in being "together-with" each other.



### *Observing Rhythmicity*

To illustrate this elusive point, I would like to turn to my own (Sander, 1975) research encounter with biological systems that began with a 24-hour bassinet monitor. With pressure-sensitive pads on which newborn infants lay in their bassinets, it was possible to record heart rate, respiratory rate, and movement patterns continuously as they occcurred in real time around the clock. From this record it was possible to determine sleep and awake states and the transitions between them. The monitor also recorded automatically the timing of caregiver presence or absence at the cribside, infant crying, infant time in and time out of the bassinet, and so forth. With this systems monitor it was possible to compare the role of the biorhythmicity of 24-hour neonatal state organization within different newborn–caregiver interactional systems. The data illustrate the ways the neonatal infants' sleep–awake rhythms of relatively short duration (one to four hours) synchronized (or connected with) the longer, 24-hour day–night circadian rhythms of the infants' caregiver systems over the first days of life. The data indicated that the achievement of synchrony depended on the role played by the agency of a neonate to self-organize its own sleep–awake rhythmicity within the larger system in which it is embedded. The larger system, in turn, self-organizes its action to recognize the specificity of cues of state change in the newborn infant and then to connect with the specificity in timing now introduced by the timing of the newborn's readiness as agent to initiate feeding.

For example, we compared samples of neonates fed on "infant-demand" with samples of neonates fed over the first 10 days of life every four hours by the clock, regardless of their state. The usual rhythm of the neonate brings an awakening roughly every four hours around the clock. However, the demand-fed sample began to show the emergence, in days three or four, of one or two longer sleep periods per 24 hours. Between the fourth and sixth day of postnatal life, the longer sleep episodes of the demand-fed infants spontaneously began to occur more frequently in the nightly 12 hours and the shorter episodes more frequently in the daytime 12 hours. In other words, the sleep–awake rhythms of the neonates in the demand-fed sample now began to synchronize with the diurnal 24-hour day of the caregiver. Thus a quality of coherence in the new infant–caregiver system emerged as the timing of the caregivers' initiative to feed began to

synchronize with the timing of the infants' rhythm of state and hunger, a specificity that constructed coherence in a new and more inclusive system.

The neonates fed every four hours around the clock regardless of their state, however, showed no such change; they did not develop a new day–night organization but remained awake and crying as often and as long in the nightly 12 hours as in the daytime 12 hours.

We can see here the role of infant "agency" to self-regulate in the resolution of the dynamc tension between neonate and caregiver by the joining of directionality between them, that is, the caregiver's specificity in timing of intervention in relation to the availability of the neonate's agency in the awake state to initiate feeding. The appearance of a new and continuing 24-hour circadian rhythmicity in the demand-fed infant–caregiver system can be seen as an emergent property of a system in a state of stable regulation, an example of Ingber's (1998) self-assembly of a new and more inclusive system. The infant becomes a system within a larger system, held together by the capability of biorhythms to phase-shift, increase or decrease period length, moving in or out of synchrony with other rhythms.

The relation between the rhythmicities of infant and of caregiver allows the emergence of recurring patterns of connection and disconnection between them; rhythms of recurring engagement and disengagement become established. Elsewhere, I (Sander, 1991, 1997) have described rhythms of recurring engagement as a flow of "moments of meeting" within the rhythm of times of being together-with and times of being apart and distinct from the other. Research on infant–mother face-to-face interaction (Tronick et al., 1978) shows the solution for the paradoxical tension of being together with while at the same time being distinct from in the rhythmicity of looking and looking away. In such an engagement infant and mother can be both together with and distinct from at the same time, something played out later in great detail in the game of peek-a-boo. As we will see in the clinical vignette to be described, the recurring rhythmic flow of events becomes basic to the brain's construction of expectancy even as early as the first days of life.

### *The Wider Role of Rhythmicity*

But let us go a bit further with rhythmicity as part of the basic machinery of self-assembly by which coherence of organization is



achieved in the living system. The rhythms of oscillating systems bcome coupled when they share a common signal. Coupling amplifies the signal, increasing the inclusiveness and strength of coherence in the community of oscillators. The flow of energy is enhanced. This is one reason the construction of a new specificity of connection that expands the inclusiveness of two states of consciousness as they become engaged together can be thought of as motivational. A simple illustration is the nightly onset of flashing rhythms in communities of fireflies (Strogatz and Mirollo, cited in Peterson, 1991). The rhythm becomes increasingly inclusive as the night deepens, until the whole community is flashing synchronously.

A fascinating recent discovery is Young's (1998) finding that there are biological clocks in each of the components of a fruitfly's body:—thorax, proboscis, antennae—so that phase-shifting and phase-synchrony of endogenous rhythms may be found to be central to the modifiability needed for its adaptability, as well as for its coherence as a fruitfly. Essential to the coupling between rhythmically oscillating systems is the specificity of the shared signal, that is the timing and configuration of the entraining cue. In jet lag, for instance, we experience the break in coupling with the disorganization that goes with temporal asynchrony between our internal rhythm and that of our surround. Phase-shifting of rhythm is necessary to reconstruct the specificities of connection that are required to restore our sense of coherent organization within the timing of the new environment. Within a principle of rhythmicity governing both interacting partners, continuity is preserved, because disengagement does not mean disconnection.

A still more provocative perspective on the role of rhythmicity in biological organization is the way each brain puts together unified scenes and meanings from its own widely distributed areas of sensory processing. Gray, Singer, and others (cited in Bower, 1998) propose that synchronized rhythms of neural firing spark the anatomical connection and chemical processes necessary for perception, memory, language, and even consciousness. Rhythmic electric output among far-flung neuronal groupings lies at the heart of visual perception and perhaps of other aspects of thought, all of which brings us to a key bridge in the integration of the biological, the developmental, and the psychological—the brain.

## The Brain and Developmental Process

### Early Experience and the Brain's Developing Morphology

One of the important bridges extending our integration of emerging knowledge of biological processes to newer perspectives on developmental process is our changing understanding of the way the brain functions. Of special significance is the interplay between an infant's experiencing and the developing morphology of the infant brain. For example, we are learning that the early experiencing of the infant shapes and modifies the morphology of the baby's brain. Thus is opened the door to new understanding, both of long-term effects of certain negative features in an infant's early experiencing, such as trauma and recurrent pathogenic encounters, and, on the positive side, amplifying the development of the brain's potentials.

From his work on the olfactory bulb of the rabbit, Freeman (1995) describes the brain as constantly functioning to bring all experience, all training, all learning up to the present moment, which he calls the "Now Moment," in anticipation of, and in organizing for, the next move it is to initiate. Thus we have a brain that is constantly "putting it all together"—constructing the present moment that we experience—from everything we have experienced in the past. Just how the brain accomplishes this integration is the subject of much contemporary interest for the neurosciences; it is referred to as the"binding problem." Freeman has called the brain a "meaning-making machine," suggesting that such terms as purpose, intention, and meaning construct the "direction" that is essential for this integrative function of the brain as it joins with its context of life support in organizing the initiation of its next act.

Looking at what the fundamental biological process of adaptation means, we can see at once that such a function would be an essential evolutionary requirement for survival of an organism in its process of "fitting-together" with the ever-changing flow of time, place, and movement in its engagement with its life supporting environment. The idea of life as "process" is that life is generated through such an ongoing "flow" over time of exchanges that achieve the necessary specificity of connectedness between organism and environment. In other words, although there are powerful moments of experiencing, they are couched within a context of previous moments and subsequent



moments, which construct a flow of sequence and consequence that allows direction and meaning to be added to the experiencing of the "moment." Hence it is the concurrence between organism and environment in the directionality of that flow that must be an essential parameter of the "fitting together" that the word adaptation means. But, before we describe the way we have studied how the increasing complexity of the adaptive process in early development begins to include the function of an inner awareness that is necessary for the specificity of connection that I have referred to as "recognition process," we must go a bit further with the role the brain plays in making it possible.

### The Brain and Perception

One of the most basic, but, to me, most incredible of recent findings is that, in its function of perception, the brain first deconstructs its sensory input into the bits and pieces that make up the perception. It places each sensory component of the input into a category—line, color, depth, contour, movement—which the brain then processes, each category in a different brain area. The map of this widely distributed process is then brought back together to construct the whole of the percept, including relevant affective, or emotional, categories, (its limbic system values, as Edelman, 1992, has termed them), and from these, the meaning of the percept is constructed for the perceiver.) Perceptual function includes perceiving "direction" in one's interactional exchanges. As part of this process, the infant's repertoire of actual behavioral strategies governing how to "be with" significant "others"—mother, father, and the like within the idiosyncracies of its particular caregiving system is being constructed (see, e.g., Stern, 1985b).

The brain's integrative function in putting together the whole of a percept from the complexity of its input can be seen as a function that provides fundamental motivation for each of us in our flow of engagement with our context to "put it all together" each in our own way. The brain's integrative function not only enables each one to carry out idiosyncratic tasks of basic adaptation, but also is an organizing force at the most complex levels of human experiencing—the goal of this symposium (e.g., Freeman, 1999). One has only to look at the flood of new books that are appearing from the disciplines of physics and mathematics to experience the way researchers in these

fields also have been trying to "put it all together" in new integrations stemming from new theories of cosmology, chaos, complexity and nonlinear dynamic systems.[2]

## Gestalt Perception

As mentioned, an example of the way the brain integrates a heirarchy of subsystems to form an "integral whole" can be seen in its powerful but often unrealized wizardry of "gestalt perception." Those familiar with infant research know about Heinz Prechtl's (1990) use of this gestalt function to assess the intactness of a newborn infant's nervous system. His variables focus on the quality of spontaneous movement of the newborn's whole body. He writes, "It is not surprising that only terms such as complexity, fluency, or elegance capture the characteristics of normal general movement, or, that their absence or reduction indicates an abnormality" (p. 154). He finds interobserver agreement in rating such qualities, of newborn movement as actual variables, to be at the $r = 0.90$ level and the accuracy of this method in assessing neurological intactness to be far greater than can be obtained using elicited movement or any combination of quantitative measures. He defines this powerful instrument for the brain's analysis of the infant's spontaneous movement as a gestalt perception and quotes from Konrad Lorenz's (1971) famous paper, "Gestalt Perception as a Source of Scientific Knowledge": "Gestalt perception is able to take into account a greater number of individual details and more relationships between these than in any rational calculation" (p. 154).

As we trace the increasing complexity, as development proceeds, of what is involved in what I have termed " recognition process," it is just this integrative capacity that provides the bridge that connects the biological, the developmental, and the psychological levels in the adaptive process of interaction and exchange between the infant or

[2] For example, David Layzer (1990) takes the reader from the big bang to the organization of consciousness. See also Stuart Kaufman (1995), of the Santa Fe Institute; Nobel Laureate Murray Gell-Mann (1994); Ilya Prigogine (1997), who seeks to bring together linear, Newtonian deterministic physics, and the creative, open-ended, probabilistic, nonlinear world of quantum mechanics; and the most recent, Wilson (1999). These references illustrate a strategy of integration in human thought that can take us from a background of the broadest of perspectives to a foreground of detail that exemplifies a particular principle and vice versa.



child and its caregivers. The importance of bringing this functioning capacity of the brain to the fore at this point is its relationship to the role of expectancy in this process of "fitting-together," or adaptation. As noted in the discussion of the "Device of Rhythmicity," recurrence in the engagement between infant and caregiver four to six times per day plays a powerful role in the organization of the exchanges between them. By the same token, recurrence plays a powerful role in shaping the expectancy that prepares the mind for its next act, for what will be the next thing to happen. Long before language and words are available, adaptive, interactive, and interpersonal strategies become organized: "ways of being with the other" (Stern, 1985b) and "implicit relational knowing" (Lyons-Ruth, 1999).

## Expectancy: A Gestalt of Recurring Organization in the System

The principle of the brain's gestalt construction of expectancy and its role in the fitting together of the adaptive process that combines background and foreground in the flow of interactional sequencing can be illustrated by an observation I made some 25 years ago in what I called a "masking experiment" carried out on the seventh postnatal day of a baby's life in St. Mary's Hospital, Paddington, London. This experiment took place back in the days when the usual lying-in stay of mother and infant in the hospital was one week. We had been recording infant states and caregiver interaction around the clock from the delivery room onward with our bassinet monitor, using healthy, natural mothers rooming-in with their healthy new babies.

On the morning of the seventh day, as the infant first showed signs of transition to the awake state, we asked the mother to put on a mask, an ordinary ski mask, but otherwise to carry out her caregiving in every way exactly as she customarily had been doing. At the appropriate moment, she picked up the infant and began her usual sequence of changing the baby's diapers and gown, holding the baby while getting and preparing the bottle for feeding, and, finally, sitting down in the feeding chair. During the preparatory procedures the infant had looked in the direction of the mother's face repeatedly without the slightest evidence of a change of state. The mother found her comfortable position in the chair, with her infant in her left arm. Only at the moment she brought the nipple of the bottle to the infant's lips

did the looking directly at the mother's face transform the infant in a dramatic surprise reaction. Although its lips were now open, there was not the slightest interest in the nipple that the mother was moving gently in and out to try to get the baby to start sucking. The baby continued staring at the mask and looked at it from different angles as it moved its head from side to side. It was almost a minute and a half before the infant finally took the nipple and began sucking. But the feeding was not as customary, with the infant gradually becoming drowsier and terminating the feeding by falling asleep as in the days previously. Its state now was one of arousal throughout, with feeding interruptions, spitting up, choking, followed by a long transition from this state of arousal to sleep, requiring almost an hour after the mother had returned the infant to the bassinet.

I think we can see here that by the seventh day the infant had assimilated the background of a time frame for the awakening and the flow of sequence and directionality in the kinesics and events of the feeding that had become familiar. We could call this a gestalt of organization in the system—a recurring flow of context that could set the stage for the profound reaction to the violation of the infant's expectancy for the familiar configuration of the mother's face. But it was only at a specific point in the gestalt of the sequence—the moment of initiating its new act, the moment of accepting the nipple for the onset of sucking—that violation of expectancy for the mother's face was experienced so profoundly. The observation illustrates the neonate's most sensitive dependence, for its self-organizing initiative, on the stability of a pattern of recurrence in the configuration that frames the flow of interaction that it is experiencing.[3]

In other words, achieving stability in initial state regulation in the infant–mother system sets up a stability in the recurrent pattern of interactional events that organizes the gestalt of infant expectancy and frames the organization of its next move.[4]

[3] These observations were confirmed in a sample of 30 newborns by Cassell and Sander (1975).

[4] But, as mentioned, and as this vignette illustrates, the developmental process also involves disruptions of expectancy that then need repair through coconstruction of recurrence in new adaptive strategies—new probabilities in expectancy for recurrence in the flow of sequence and consequence, strategies that will be newly unique for that particular system but will maintain the needed coordination in that system with a better predictability.



## Early Development and a Sequence of Tasks of Adaptation Between Infant and Mother

We have tried to capture something of this creative interactive process by conceptualizing the infant and caregiver system as being engaged in a process of negotiating a chronologic sequence of tasks of fitting together over the first three years of life. We have used the process of negotiating a sequence of adaptive tasks as a method of comparing early developmental process in different infant-caregiver systems in terms of new infant functions that arise over this span of time (see Table 1). Each new function triggers an adjustment in the infant's engagement with its larger system. Each task of adjustment presents an issue for a given system—whether or not, or how, the two will reach the specificity required to attain reasonably stable regulation in relation to that new infant function. As can be seen from Table 1, the sequence moves from regulation of basic states of sleep, wakefulness, hunger, distress in the newborn, to tasks in the second 18 months of life that depend on the infant's emerging awareness of its own inner state and intention as well as the mother's widening perception of her infant's changing inner states, intentions, meanings, and so on. The emerging and widening awareness in each, of both the sense of one's own inner state and of that being experienced by the "other," are drawn on and refined as they encounter the tensions required of each to bring their interaction to a new specificity of connection, or fit. We use the term recognition process as the conveyor of this widening specificity in the gestalt perception of each.

## Recognition Process and the Increasing Complexity of Interactions in Early Development

The idea of recognition as a process provides a bridge over which the increasing complexity and diversity in the development of different systems can be integrated with biologic processes, and both with the developing organization of infant consciousness, to provide continuity in the necessary specificity of connection that is essential for the construction of coherence in systems as they gain increasing inclusiveness. To illustrate what I mean by recognition process in the construction of coherence in systems as they gain increasing

**Table 1.** Adaptive Issues Negotiated in Interaction between Infant and Caretaker

| Issue | Title | Span of months | Prominent infant behavior that became coordinate with maternal activities |
|---|---|---|---|
| I | Initial regulation | Months 1–3 | Basic infant activities concerned with biological processes related to feeding, sleeping, elimination, postural maintenance, etc., including stimulus needs for quieting and arousal. |
| II | Reciprocal exchange | Months 4–6 | Smiling behavior that extends to full motor and vocal involvement in sequences of affectively spontaneous back-and-forth exchanges. Activities of spoon feeding, dressing, etc., become reciprocally coordinated. |
| III | Initiative | Months 7–9 | Activities initiated by infant to secure a reciprocal social exchange with mother or to manipulate environment on his own selection. |
| IV | Focalization | Months 10–13 | Activities by which infant determines the availability of mother on his specific initiative. Tends to focalize need-meeting demands on the mother, |
| V | Self-assertion | Months 14–20 | Activities in which infant widens the determination of his own behavior, often in the face of maternal opposition. |
| VI | Recognition | Months 18–36 | Activities (including language) that express perceptions of own state, intentions, and thought content. |
| VII | Continuity (conservation of self as active organizer) | Months 18–36 | Activities rupturing and restoring coordination on an intentional level. (Intended and directed aggressive behavior in equilibrium with directed initiations aimed at facilitating restoration of interactional concordance.) |

Source: Anthony (1975), p. 136.



inclusiveness, we must turn to a more detailed description of increasing complexity of adaptation in early development and how it gradually expands what it means to "recognize," or give to one the experience of being known by, an "other."

## A Moment of Recognition at the Newborn Level

As a bridge of specificity providing the essential connections that construct and preserve coherence in the system as a whole, reognition must serve bidirectionally in the interaction between the partners from infant to mother and from mother to infant. The specificity experienced by the mother in her infant's behavior can, in turn, confirm the mother's experience of coherence in her sense of personal identity within the caregiving context.

The following illustration is drawn from the very beginnings of our longitudinal study in the mid-1950s. This was a time when there were many myths about which functions a newborn infant possessed. One such myth was that a newborn actually could not see, that visual focus had not yet matured.

I was beginning an interview with one of our new mothers some weeks after the delivery of her first baby. Things seemed not to be going too well. The mother, unsure of herself with the baby, felt that she was not doing the right thing, that the baby was not eating as well as it should, that it seemed fussy and was difficult to quiet, and that she just didn't know how to manage it.

As we sat down in the interviewing room, I had taken the baby from her to hold, and, as we were talking, I had placed it supine on my lap where I could make visual contact with it as the interview proceeded. After a few minutes of my glancing at the baby's eyes, the baby's eyes suddenly met mine. At this instant the baby kicked out with its legs, threw out its arms, and broke into a wide and engaging smile. The mother gasped in astonishment: "He can see!" she exclaimed. "Oh, yes," I said, "indeed he can see." "Oh," she replied with an excited tone. "Now I know he will know who is being good to him!"

The mother now realized that she was known by her infant, and, sure enough, at the next visit she and the infant had their act together. The difficulties had vanished, and things were going well. Here was specificity at two levels: a level of simplicity—the meeting of my eyes, the eyes of a perfect stranger, with the eyes of the infant; and a level

of complexity—the specific meaning to the mother of being seen by her infant as being "known" by him. Here the experience of knowing herself as mother could come together with the specificity of her infant's behavior in a new coherence of relationship.

By this example, I am suggesting how the subtlties of the experience of being "known" by a significant "other" describe a moment of recognition and how the experiencing of such moments provides an organizing principle in the developmental process. Although in this example we see the effect on the mother's experiencing, in the infant's developmental trajectory such moments move in increasing complexity from the level of state, to the level of affect, to the initiation of action, to goal organization, and so on. As "togetherness" is experienced in these moments, coherence in the system moves toward a greater inclusiveness of complexity. One can see, then, that such moments of recognition could be applied to a similar integrative process at the intersubjective level in the therapeutic interaction.

In the example just given we have an application of Ingber's (1998) principle of "self-assembly" in the living system at the psychological level—the joining together of two states of conscious organization in a new inclusiveness of coherent wholeness.[5]

## Uniqueness and the Recognition Process

Whereas we have sought in research for norms and means and generalizable rules that can be derived from different samples of different subjects, uniqueness is a kind of complicated difficulty that has always seemed a hindrance to our understanding. But in dealing with ongoing processes in any given living system, we become confronted by the necessity to deal with the unavoidable actuality of uniqueness. This is a uniqueness that will configure whatever the principle of "coherence of organization" will require for its realization through the organizing process in that particular system. Given the

[5] If our integration is to begin at the level of the broadest of perspectives, we find that human social culture has, from its historical beginnings, identified a principle of recognition, and the experience of being "known," as essential to the vitalizing human experience of a moment of joining with a larger, more inclusive whole. To quote from the 139th psalm, "Oh, Lord, thou has searched me and known me. Thou knowest my downsitting and my uprising, and art acquainted with all my ways. . . . For there is not a word on my tongue but thou knowest it altogether."



uniqueness of each of us as individuals, in no two infant–caregiver systems will "process" be alike either.

By beginning with the idea of "thinking differently," I am also asking, "Why not begin with uniqueness as a central principle in the organization of a living system?" I suggest, further, that specificity of recognition of that uniqueness—in an interactive system—is key to an organizing process based on constructing the essential specificity of connection between components that is necessary to achieve the coherence or wholeness of the system required for continuity of its life. The same principle of specificity of connection that is essential for Ingber's (1998) self-assembly at the biological level is also essential at the psychological level. "Hospitalism," as described by Spitz (1945), illustrates what happens in systems in which such specificity is lacking in early development. At the level to which the complexity of human consciousness brings us, the uniqueness of each of us in the organization of our attention and awareness seems obvious.

## Recognition and "State"

Where do we begin, then, in the increasing complexity of recognition of uniqueness? We began our task of integration with Webster's definition of "system"as an "integral whole" and with Von Bertalanffy's principle of "organization" as essential descriptors of systems that can be said to live. The route that gives us operational access (or observational access) to the recognition of the "integral whole" of organism within its system is through the concept of state. "State" has a very specific, empirically valid definition as a descriptor of the complexity yet the unity of a living system. It is defined as that configuration of the values of a set of variables that characterize the functioning of the system as a whole at a particular moment in time, a configuration that recurs and that can be recognized whenever that same configuration recurs again. An example at the newborn level would be the range of states on the sleep–awake continuum, observable with a high degree of reliability. At a slightly later point in the developmental process, there is the range of emotional states that express feeling, namely, the affects. Affects are observable states, specificity of recognition of which becomes key to regulation, to adaptation, to communication. It is fascinating to realize that the essential role in the adaptive process made possible by one's ability to perceive the state of an "other" depends on the brain's capacity for

nonlinear dynamic system they are constructing, that is, moving each partner to seek the positive affective accompaniment of being "together-with" the other. It is a small step here to move , in terms of a common basic principle, from Ingber's (1998) many examples of self-assembly at the biological level to "self-assembly" at the psychological level—two unique brain organizations of mother and infant self-assembling into a larger, more inclusive coherence of conscious organization—as in "doing things together." With specificity of connection, the flow of energy expands as states of brain organization in the two partners expand their complexity into new and more inclusive states of coherent organization, enabling the infant to do what it would not be able to do alone. (Again, we are at Tronick et al.'s [1998] dyadic expansion of consciousness hypothesis.

## The Level of Psychotherapeutic Process

We began with the challenge of integrating emerging knowledge at the biological, developmental, and psychotherapeutic levels and chose to see if a way to do this might be to find basic principles of process in living systems that would apply at each of these levels. In turning now to the psychotherapeutic level, especially "within the psychoanalytic framework," we can think of the therapeutic process essentially as a process bringing change to the organization of consciousness, that is changing the way we are aware of ourselves in the context of what is going on around us, which allows us to put together a new and more inclusive coherence of ourselves within our own particular environment of life support. In the foreground detail of the progression of interactional events that construct the flow of process at the biological and early developmental levels, the question becomes, what do these principles look like at the therapeutic level? In the integration of the biological with the developmental, we translated from "organization" to "wholeness" to "state," beginning our list of adaptive tasks in early development with the regulation of the flow of state change in the infant within the 24-hour day–night cycle.

A current example of the use of specificity in recognition of state within the psychoanalytic framework is the work of Schwaber in her description of "Psychoanalytic Listening." She applies her sensitivity in perceiving the flow of state and state change, both in her patient



and within herself, as the therapeutic hour progresses. Each point of change provides her the opportunity for a moment of inquiry, an opportunity to bring her awareness of change to the patient's awareness of change in the flow of the interaction between them, an opportunity to reach a new moment of meeting as the "direction" and the "intention" of each become clarified.

The adaptive tasks just described above, leading from the recognition of state change to the recognition of the process of disembedding of "self" from "other," illustrate the increasing complexity of what specificity of recognition involves as development proceeds. How the experience of specificity of being known or recognized is conveyed obviously is at the heart of what the effective interpretation accomplishes—bringing patient and therapist into new "moments of meeting"—the inclusiveness of new, expanded states of conscious connection.

I would like to conclude with a clinical moment that Lyons-Ruth (2000) describes. She relates a brief exchange with a self-destructively acting-out adolescent during the early alliance-forming months of treatment. In this session the adolescent was angrily listing her disappointments in all her adjunct treatment providers. Lyons-Ruth writes, "The patient finally looked at me with a hard querying look and fell silent. I asked what she was thinking that made her lapse into silence. She said, 'You never know what these people are thinking. I mean they're human. They're probably thinking about the errands they need to do, you know, go to the cleaners and things'" (pp. 92–93).

The author notes that the patient's feeling of being unseen by important others had already been a part of the dialogue, so that making a comment about her feeling unseen within the therapy felt sterile and abstract. The therapist reflected briefly on her own experience of feeling attacked and depleted by the patient during these early months of therapy. Then she said, "Would you like to know what I've been thinking about as I was listening to you?" The patient nodded and the therapist continued, "I was thinking what a difficult adversary you are to yourself. You're very thoughtful and disciplined and insightful (all obvious traits in this excellent student) and right now all those strengths are being used against you rather than in the service of furthering your life" (p. 93). At this point, for the first time, the patient began to talk at a very meaningful level about her inner experience of feeling like an abused wife who could not separate from

an abusive husband, the "husband" who was embodied in her self-destructive behavior, because she feared he was the only one who could love her.

The author uses this exchange to point to the multilayered levels of communication that are inherent in such a clinical exchange:

> My understanding of what had transpired between us had more in common with a theory of complementary fitted action and recognition process than a theory of interpretation. She had brought a central 'way of being with' into the treatment room that involved angry opposition to the 'unseeing others.' But in this instance, it was an opposition in the course of her development that had become directed away from the important others in her life and towards herself. I was improvising as best I could to recognize implicitly a number of levels of her communication to me in a way that opened new avenues for collaboration, without overpowering her defenses or undermining her self-esteem. Over the course of this exchange, a deepening of her willingness to share her inner world with me occurred that was perceptible to us both. However, we did not verbally acknowledge our shared perception of the moment until many sessions later [p. 93].

It was a "moment," but one not forgotten.

This example illustrates the specificity of fittedness in therapeutic moments of recognition, in which a complex configuration of interactive elements must become well-enough aligned between patient and therapist at a specific point in time to open up new possibilities for what they can do together.

## Conclusion

The elements of the "recognition process" model, with its simple core and culmination in the idea of a structure of meetings centered about the experience of specificity in moments of shared awareness, underlie and simplify the complexity of the domains of biological organization, developmental process, and therapeutic process. The central idea is a very simple one that describes a key moment of specificity of



connection that occurs within a framework of recurrent meeting—becoming a "now " moment that changes organizatiion. It is the now moment of "knowing and being known" in the governing of a heirarchical self-organizing systems process that brings coherence or wholeness to a dyadic system in the process of increasing its inclusiveness of complexity. This is a moment central to regulation, to adaptation, to integration—to the experience of oneself and the relation of this experience to one's experience of the other.

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