Infant Mental Health Journal, Vol. 3 No. 4, Winter 1982

Toward a Synactive Theory of Development: Promise for the Assessment and Support of Infant Individuality

Heidelise Als, PhD

ABSTRACT: A theoretical model to understand and assess the individual infant is presented. Its focus is on the dynamic, continuous interplay of various subsystems within the organism: the autonomic system, the motor system, the state organizational system, the attentional-interactive system, and the self-regulatory system. The organism forges ahead negotiating emerging developmental agenda while simultaneously seeking to attain a new level of modulated, functional competence. Developmentally salient aspects of the environment are actively sought as fuel in this process. This synactive model of development promises to be helpful in identifying specific ingredients of the early developmental process and in structuring specific supports for preventive and ameliorative work when difficulties in differentiation and regulation are identified. An assessment procedure to systematically identify difficult areas of modulation integration is briefly described and examples of environmental structuring are given.

Clinical work with infants necessitates a theory from which to understand the individual organism and his/her development. While research is the process of identifying and quantifying regularities and patterns, the tension of clinical work lies in the task of identifying the individuality and specificity with which a particular small infant negotiates this common developmental process. Much work over the last decade has increased our knowledge about the infant's remarkable sensory, cognitive, and social capacities. Now we are at the threshold of developing methods to document how an individual infant integrates these capacities and negotiates his/her unique and specific develop-

Heidelise Als is Assistant Professor of Pediatrics (Psychology) at the Harvard Medical School and Director of Clinical Research at the Child Development Unit, Children's Hospital Medical Center, 300 Longwood Avenue, Boston, MA 02115. Reprint requests should be directed to Dr. Als at that address.

This work was supported by grants HD 10889 from the National Institute of Mental Health and by grant 3122 from the Grant Foundation, New York. Part of this work was executed at the facilities of the Mental Retardation Research Center, Children's Hospital Medical Center, Boston, Massachusetts.

The author wishes to acknowledge her indebtedness to Dr. T. B. Brazelton, Chief of the Child Development Unit at Children's Hospital Medical Center, to her colleagues, Drs. B. M. Lester and M. Yogman, co-investigators on a project of preterm infant development, and to Dr. F. H. Duffy for his continued guidance from a neurologist's perspective. Special thanks go to the infants and their families who make our observations and studies possible, and who have contributed so generously to our understanding of the early developmental process.

0613-9641/82/1600-0229$02.75

ment by bringing the capacities to bear on the surrounding environment. We shall discuss a process-oriented theory of development and a recently developed, behavioral assessment of newborn organization based on this formulation. We shall draw inferences as to the clinical care possible in support of optimal development.

A SYNACTIVE FORMULATION OF INFANT DEVELOPMENT

The conceptualization of development presented here focuses on how the individual infant appears to handle the experience of the world around him/her. The infant's functioning is seen in a model of continuous intra-organism, subsystem interaction and the organism, in turn, is seen in continuous interaction with the environment. We have termed this view of development synactive, since at each stage in development and each moment of functioning, the various subsystems of functioning are existing side by side, often truly interactive, but often in a relative holding pattern, as if providing a steady substratum for one of the system's differentiation process. The systems we are speaking of include the autonomic system, the motor system, the state-organizational system, the attention and interaction system, and a self-regulatory, balancing system. The functioning of all these systems is reliably observable without technical instrumentation.

The autonomic system is observable via the pattern of respiration, color changes, tremulousness, and visceral signals such as bowel movements, gagging, hiccoughing, etc. The motor system is observable in the posture, tone and movements of the organism. The state-organizational system is observable in the kind and range of states of consciousness available to the organism, from asleep to aroused states, and in the pattern of state transitions exhibited. The attention and interaction system is exemplified in the organism's ability to come to an alert, attentive state and to utilize this state to take in cognitive and social-emotional information from the environment and in turn elicit and modify the inputs from the environment. The regulatory system is exemplified in the observable strategies the organism utilizes to maintain a balanced, relatively stable and relaxed state of subsystem integration or to return to such a state of balance and relaxation. If the infant's regulatory capacity is exceeded and the infant is unable to return to an integrated, balanced subsystem state, another parameter of functioning is identifiable in the kind and amount of facilitation from the environment that is necessary to aid the infant's return to balance.

The questions posed about the organism in this synactive model of development always are: How well differentiated, and how well modulated, are the various subsystems, given varying demands placed on the organism and given the varying developmental tasks the organism attempts to master from his/her intrinsic motivation? Where are the thresholds of functioning beyond which smoothness and balance become stressed coping behaviors, and eventually costly, bare subsistence protections or even counterproductive maladaptations?

Which subsystem is differentially vulnerable at which level of environmental and endogenous demand? How severe is its infringement on, and kindling of, other systems' imbalance by virtue of its own current disorganization? How much or how little does it take in terms of environmental modification to induce the reinstitution of a more balanced, integrated state?

THE DEVELOPMENTAL TASK OF THE HUMAN ORGANISM

From our work with healthy fullterm newborns examined with the *Brazelton Neonatal Behavioral Assessment Scale*,[1] and in direct observation of newborns with their mothers over the first 3 months,[2,3] we learned that the differentiation of the attentional-interactive system is the most rapidly changing, apparently newly emerging, salient agendum of the human organism.[4,5] Autonomic stability in terms of, for instance, respiratory control, temperature regulation, and digestive visceral functioning, is relatively quickly restabilized after the birth process, as are smoothness of movements and adaptation of well regulated, smooth balance between flexor and extensor posture.[6] The same holds true for state organization in terms of the range of states available and their transitions.[7,8] Most healthy full-term newborns have no difficulty achieving a robust crying state and can return to a sleep state quite readily. The issue most newborns seem to attempt to get under control in the first weeks after birth is the increasing stabilization of the alert state in their movement from sleep to aroused crying states and back to sleep state. While in the two-day-old infant the alert periods are still much more difficult to come by and are embedded in long stretches of sleep and episodes of crying, by two and three weeks these periods of alertness have become increasingly reliable and solidified. By one month to six weeks many infants spend an hour or more in an alert, socially and cognitively available state.

THE SOCIAL ENVIRONMENT OF THE HUMAN NEWBORN

It appears that the newborn is not the only one grappling to solidify these periods of alert availability. The infant's social partners, from the first post-natal contact with the baby tend to be sensitive in aiding the newborn in stabilizing these periods. On the first contact mothers and, presumably, fathers will prod their newborn in both vocal and tactile ways to open his/her eyes, even at the cost of eliciting crying. Once the newborn opens at least one eye, the parent will typically acknowledge this initial connection and mutual recognition by an affectively positive, heightened vocal pattern, accompanied by an animated facial expression, praising the newborn for the accomplishment: "Hi! There you are—that's right—I knew you were in there. . . . Hi!" The parent may say it over and over again in a drawn out loving manner.[9] The parent's behavior in turn, appears to facilitate and

support the infant's alertness. From a brief initial glance, the infant may go to widen his/her eyes, raise the eyebrows, soften and raise the cheeks, and shape the mouth into an "ooh" configuration. The partners mutually support and drive each other to prolong this episode. One of them will then reset or break the intensity. For instance, the infant may avert his/her gaze and move into a yawn or a sneeze, thus resetting the intensity of the interaction at a lower level by utilizing subtle attentional regulation strategies. Or the infant may avert and move into a fussy, crying or drowsy state, thus utilizing state shifts to reset the interaction. The baby may not avert but may stay locked on the parents' face, become tense and perhaps spit up or move into hiccoughs or gags or even the strain of bowel movement, thus reacting at an autonomic visceral level in resetting the interaction. The baby may begin to extend or even flail his/her arms and start to squirm, thus utilizing motoric shifts in the resetting of the interaction. If the infant is able to sustain alertness for a substantial period, keeping respective subsystems of functioning in balance, the parent may be the one resetting the intensity of the interaction by pulling the baby close and nuzzling and kissing the baby, or by stroking and patting, thus changing the cyclical attentional interchange.

It is curious that such emphasis appears to be placed on these early attentional episodes of the infant embedded in affectively supportive and highly positive inputs from the parent, given that later this alertness will be much more easily available. From a species evolutionary perspective, this early valuing of the attentional interactive connection gains an added dimension. It appears that it is uniquely human, and it takes on significance as we identify a correlation between an increasingly complex and simultaneously flexible social system with an increasingly complex affective communication system in the order primate from the nocturnal prosimians via the old and new world monkeys to the great apes and man.[10,11,12,13] The essence of humanness, and in fact of survival of the human species, appears to be in man's enormously complex social and emotional interaction capacity that is the prerequisite for the super systems of material culture technology that we have constructed and are dependent on for survival. Highly differentiated capacities for collaboration and cooperation of species members are necessary to make complex adaptation workable. It appears that from the beginning of extrauterine life the newborn is specifically launched onto the species specific, collaborative, communicative track and is in turn supported and affectively rewarded by caregivers as a social interactor. The attentional interactive capacity of the newborn and young infant becomes a salient parameter of newborn functioning. It appears to be in current ascendancy and is highly valued and supported by those around the baby.

THE NEWBORN'S ATTENTIONAL INTERACTIVE CAPACITY AND THE FUNCTIONING OF OTHER SYSTEMS

Not all newborns are equally able to increasingly build up this interactive attentional capacity. For some, this is a difficult task that impinges on the

infant's other functional subsystems. For example, in a study of thin-for-height newborns[14] these infants showed great reluctance to come into alertness, moving into hypertonic, flexed high-guard arm position with fisted hands, while becoming pale, showing tachypneic and irregular respiration and pained and drawn facial expressions. Eventually, with calm support they would gradually open their eyes, but then the hypertonic high-guard-fisted-defended-ness shifted abruptly into motoric flaccidity and tuning out, the color paled further, and breathing became slow and irregular. The mustered attention was of a glassy-eyed, barely focused kind that came at great cost to the autonomic and motoric regulation.

The identification of this pattern of relatively poor subsystem differentiation, where as one system attempts to accomplish a task, the other systems are drawn into the reaction exemplifying the relative cost to the total system, is one avenue toward understanding the current standing of the infant in terms of subsystem differentiation.

ASSESSING THE INFANT'S FUNCTIONING FROM A SYNACTIVE PERSPECTIVE

On the basis of our observations of this subsystem synaction, we have formulated the following parameters to be identified when assessing an individual infant's functioning:

1. the infant's currently emerging developmental agendum and a situation to test the degree of ascendency of this agendum;
2. the infant's current level of subsystem balance and smooth integrated subsystem functioning, regardless of the agendum identified as in acendency;
3. the threshold of disorganization indicated in behaviors of defense and avoidance, at varying subsystem levels of functioning as the developmental agendum in ascendency is tested;
4. the degree of relative modulation and regulation of the various subsystems in accomplishing the new task;
5. the degree of differentiation and effectiveness in rebalancing the subsystems in the accomplishment of the task;
6. the degree of environmental structuring and support necessary to bring about optimal implementation of the new task; and
7. the degree of environmental structuring and support necessary to bring about return to smooth, well-integrated, baseline functioning.

This approach to assessment is thought to be appropriate throughout the life span of the organism. At each stage of development, newly salient agenda are being negotiated on the backdrop of previously accomplished subsystem differentiation and modulation. Figure 1 is a schematic attempt to visualize the conceptualization of the synactive perspective of development, applied to the fetal and neonatal stages.

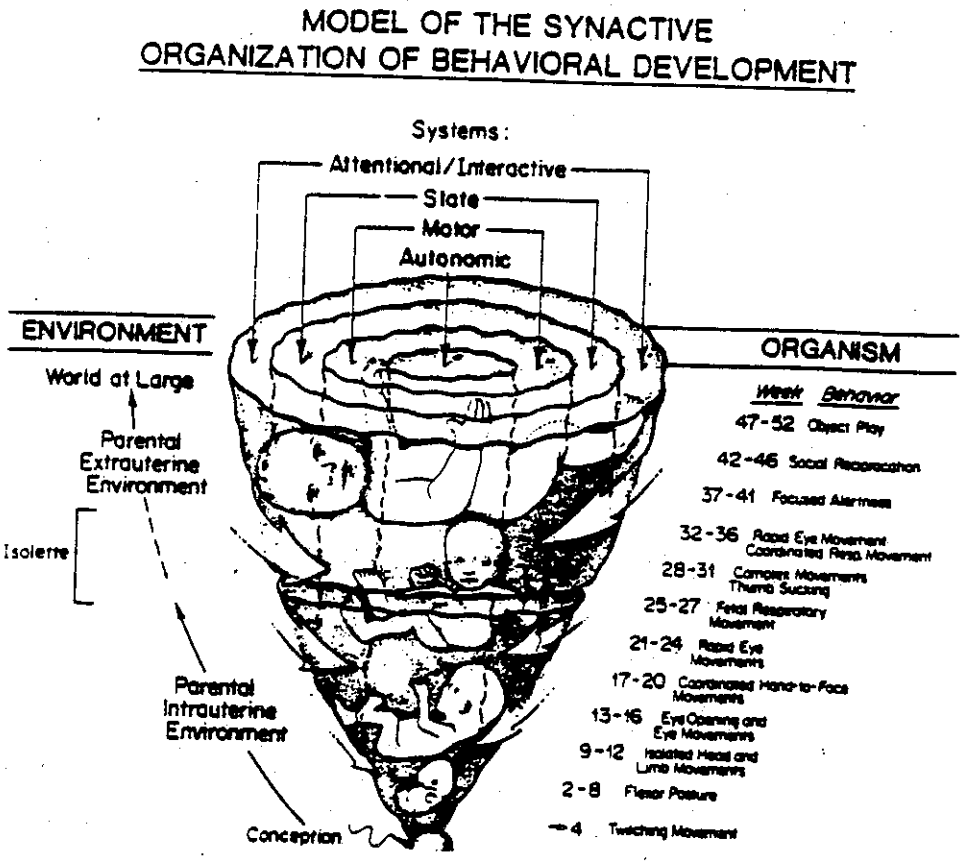

Figure 1

Looked at from above, four concentric cones are seen, representing from the innermost going outward, first the autonomic system in its basic position suring up the organism's baseline functioning. Around it, is the motor system, unfolding from early embryonic stages with recognizable flexor posture, limb and trunk movements, and becoming increasingly differentiated in its explication. Around it, as a third cone, lies the state-organizational system, the unfolding of distinct states of consciousness from a diffuse quasi-sleep to increasingly differentiated sleep, wake, and aroused bands of consciousness. Around this cone lies the gradual differentiation of the awake state into more elaborated, subtly branched and finely tuned nuances of affective and cognitive receptivity and activity, shaping the social and inanimate world and in turn negotiating one's developmental progression in the process. These cones are continuously in simultaneous contiguity if not interaction with one another, influencing and supporting one another or infringing on one another's relative stability. The within-subsystem differentiation each system is pushing for depends on the other subsystems' support and relative intactness. The

organism with its intraorganism subsystem synaction is at all stages embedded in an environment it has evolved to expect for its species appropriate ontogenesis. It is shaping and selecting from this environment as it is also challenged and impinged upon by this environment at all times.[15,16]

THE PRETERM ORGANISM SEEN IN A SYNACTIVE DEVELOPMENTAL PERSPECTIVE

We shall use the preterm organism as an example to further explain this synactive formulation of development. From 24-27 weeks postconceptual-age on, the human fetus can be kept alive in an extrauterine environment due to the advances of medical technology. The infant is biologically expecting 13-16 more weeks of in-utero existence, with respiratory, cardiac, digestive, and temperature control aided by the maternal bloodflow and placental functioning. Total cutaneous somasthetic input from the amniotic fluid is expected. Kinesthetic input from the contingently reactive amniotic sac, prevents full extensor patterns and assures flexor inhibition and maintenance for the typical head-trunk extremity adjustments and movements of soft modulated limbs, trunk, and head movement, so vividly described by Milani Comparetti[17] and Birnholz.[18] Maternal diurnal rhythms presumably entraining the infant's own gradually differentiating states of consciousness are expected. The infant is expecting presumably muted sensory inputs to the primary senses of vision and audition, readying him/her for the experience of the extrauterine world. The preterm infant is not an inadequate fullterm organism, but a well-equipped, competently adapted organism appropriately functioning at his/her stage and in a particular environment. Suddenly, the infant is in a vastly different environment, the passage to which has irreversibly triggered subsystem functioning in an environment only poorly matched to the infant's expectations. Instead of the maternal organism, medical technology attempts to take care of respiratory, cardiac, digestive, and temperature control functions. The motor system, the state-organizational system and sensory functioning intimately dependent on an adaptive environment are largely left to their own devices. The center in our schematic model of Figure 1, the autonomic functioning, is currently the primary focus of medical care. As the preterm organism reactivates after a period of "shut down" and "holding," trying to get back on track with his earlier accomplished developmental differentiation, we need to ask with what supports and in what situations is the infant already able to bring about smooth and balanced functioning which will be critical for realization of new pathways. The freeing up of the strands of the next developmental agenda in the offing must occur on the background of well integrated functioning in order to set and maintain the path of development in a positive direction. This is necessary to avoid the unwitting reinforcement of the disturbing, defense behaviors that are

concomitants of the discrepant organism-environment fit and that can easily lead to a vicious cycle of increasing distortion and disorganization.[19] From this perspective, it is not surprising that the number of autistic children and children with organizational, impulsivity, and attention deficits[20] is made up of a disproportionately high number of prematurely born infants.

The developmental agendum that we have identified for the fullterm newborn, namely to increasingly free up the ability to maintain an alert state, may not yet be the appropriate issue for the preterm infant. The mutual regulation of autonomic functioning with motoric balance and equilibrium, in a well-defined sleep state may be the salient agendum for a while, before further state differentiation becomes possible.

DESCRIPTION OF THE ASSESSMENT OF PRETERM INFANTS' BEHAVIOR (A.P.I.B.)

In an attempt to systematically identify the infant's relative standing in terms of differentiation and modulation of behavioral subsystems, we have formulated over the last eight years the *Assessment of Preterm Infants' Behavior* (A.P.I.B.).[21] The instrument is appropriate not only for preterm, but also for otherwise at risk infants and for well fullterm infants. It is a substantial refinement and extension of the *Brazelton Neonatal Behavioral Assessment Scale* (B.N.B.A.S.),[2] in that it provides an integrated subsystem profile of the infant's current levels of smooth, well-balanced functioning in the face of varying developmental demands. Toward this goal, in the A.P.I.B., the maneuvers of the B.N.B.A.S. are used as graded sequences of increasingly vigorous environmental inputs, moving from distal stimulation presented during sleep to mild tactile stimulation, to medium tactile stimulation paired with vestibular stimulation, to more massive tactile stimulation paired with vestibular stimulation. The social-interactive-attentional package is administered in the course of the examination whenever the infant's behavioral organization indicates the infant's availability for this sequence. It receives priority in the examiner's attempts to facilitate the infant's organization. The systems sheet of the assessment permits one to read off which tasks are handled with ease by the infant in terms of maintaining well regulated, balanced functioning of all subsystems; which tasks begin to stress the infant and trespass the balance and modulation of various subsystems yet can be handled with enough environmental facilitation; and which tasks are clearly inappropriate for the infant at this time. In this fashion, developmentally appropriate goals can be established for the individual infant and facilitations can be instituted in the infant's care so that the infant is not overtaxed or, less likely, underchallenged.

Aside from the systems sheet, the A.P.I.B. provides detailed information on each individual item presented, as is the case in the B.N.B.A.S., yet the scales are expanded to document the behavior of the immature, as well as the mature

Table 1

Stress Reactions of the Organism by Subsystem

1. Autonomic and Visceral stress signals include, among others:

   a. seizures
   b. respiratory pauses, tachypneic respiration
   c. color changes to mottled, webbed, cyanotic, grey, flushed
   d. gagging, gasping
   e. spitting up
   f. hiccoughing
   g. straining as if or actually producing a bowel movement
   h. tremoring and startling; twitching
   i. coughing
   j. sneezing
   k. yawning
   l. sighing

2. Motoric stress signals include:

   a. motoric flaccidity or "tuning out"
      1) trunkal flaccidity
      2) extremities flaccidity
      3) facial flaccidity (gape face)

   b. motoric hypertonicity
      1) with hyperextensions:
         of legs (sitting on air; leg bracing)
         of arms (airplaning; salutes)
         of trunk (arching; opisthotonus)
         fingersplays
         facial grimacing
         tongue extensions
         protective maneuvers such as hand on face maneuver, high guard arm position, and fisting

      2) with hyperflexions:
         of trunk and extremities (fetal tuck)

   c. frantic, diffuse activity

3. State-related stress signals include:

   a. diffuse sleep or awake states with whimpering sounds, facial twitches and discharge smiling
   b. eye floating
   c. strained fussing or crying
   d. staring
   e. active averting
   f. panicked or worried alertness
   g. glassy-eyed, strained alertness
   h. rapid state oscillations
   i. irritability and diffuse arousal
   j. crying

Table 2

Self-Regulatory Behaviors of the Organism by Subsystem

1. Autonomic stability is evidenced by:

   a. smooth respiration
   b. good, stable color
   c. stable digestion

2. Motoric stability is evidenced by:

   a. smooth, well modulated posture and well regulated tone
   b. synchronous smooth movements with efficient motoric strategies such as

      1) hand clasping
      2) foot clasping
      3) finger folding
      4) hand-to-mouth maneuvers
      5) grasping
      6) suck searching and sucking
      7) handholding
      8) tucking

3. State stability and attentional regulation are evidenced by:

   a. clear, robust sleep states
   b. rhythmical robust crying
   c. good self quieting and/or consolability
   d. robust, focused, shiny-eyed alertness with intent and/or animated facial expression, e.g.

      1) frowning
      2) cheek softening
      3) mouth pursing to "ooh" face
      4) cooing
      5) attentional smiling

fullterm, organism. Moreover, particular attention has been given to the reliably readable body language of the developing organism and a catalogue of specific regulation behaviors has been established that can be helpful in understanding the infant's current functioning. The signals of stress and signals of stability can be grouped into autonomic/visceral stress signals, motoric stress signals, and state-related stress signals on the one hand and signals of autonomic/visceral stability, signals of motoric stability, and signals of state-organizational stability, on the other hand. The conceptualization underlying this approach is that stimulation if inappropriately timed or inappropriate in quality and intensity will cause the organism to move away from it and protect itself. Stimulation if appropriately timed or appropriate in quality and intensity will cause the organism to seek it out and move towards

it, while maintaining a balanced level.[22,23,24,25] Table 1 catalogues stress behaviors by varying levels of defense reaction, from the autonomic level to the motoric and state organizational level. Table 2 catalogues self regulatory behaviors of the organism by various subsystems. All these behaviors are readily and reliably identifiable in the observation of infants. The formulation of this dual antagonist integration of avoidance and approach as applied to the newborn infant[1,26,27,28] can be helpful in identifying the infant's current thresholds of balanced, well-modulated functioning and can facilitate the individualization of caregiving and interaction with an infant.

IMPLICATIONS FOR CAREGIVING

On the basis of this synactive approach to development, individualized environmental structuring to maintain maximal development and to reduce developmental defense and sparsity becomes possible. Using the preterm infant as an example, various treatment modifications are suggested depending on the baby's current sensitivities. It must be kept in mind that these are as yet suggestions and their efficacy must be systematically tested. Many others may be apparent as we become more attuned and creative in the understanding of the preterm organism. For some babies, complete elimination of nearly all stimulation may be necessary and strict stress precautions may be appropriate, depending on the infant's level of sensitivity and fragility of current subsystem integration. This would include elimination of touching and handling, as much as procedures to ensure physiological survival permit, while assuring maximal postural containment and complete sensory shielding. This might be provided ideally by a parent or other caregiver softly encasing head, trunk, and extremities of the infant in the isolette or crib in an ongoing fashion. Such containment presumably has an advantage over physical containment via blanket rolls, etc., in that it can be continuously and assuringly reactive and adjusting as the infant increasingly stabilizes him- or herself autonomously. For most preterm infants a protected location for the baby's incubator remains important for extended periods. Auditory inputs can be significantly reduced by felt stripping on drawers and pails; decrease in ambient conversation and laughter, elimination of radios, and modelling of quiet behavior for others in the area are possible. Visual inputs can be individualized. Bright overhead light can be shielded through a blanket hood over the isolette ceiling or a bassinette hood for an open crib. Stable visual patterning without clutter can be achieved on the incubator walls through stationary decal on porthole doors and one distinct facial configuration. Thus, a visual stimulus within the baby's visual field is ensured without being overwhelming. Olfactory inputs can be controlled. Pungent smells can be eliminated whenever possible. Low concentration of the mother's perfume can be used on a gauze pad in the infant's isolette or crib, or a gauze pad saturated with maternal breast milk can

be used for a pleasing olfactory experience. Change in environmental stimuli, e.g., gentle music, mobile, change in visual stimuli should be introduced only when the infant is changing into a more alert state. Sleep state should not be interrupted for the sake of changing these stimulations. Should certain stimuli prove stressful or counterproductive, they would be eliminated or postponed. Quiet protected contained time is of great importance.

The direct caregiving procedures to the infant can also be individually modified to reduce the stress signals of the baby and increase the stability signals whenever possible. Vital sign taking, including taking the baby's temperature, blood pressure, respiratory and cardiac rates, can be timed to the baby's state transition from quiet sleep to higher states. The caregiver can delay these activities when the baby is soundly asleep or quietly alert. When the infant is drowsy or aroused, the caregiver can first position the baby so that autonomic and motoric stress signals are at a minimum. This can be done for instance by helping the infant into a more flexed position and stabilizing respirations by holding the infant's hands and feet and encasing the baby with the caregiver's arm. While talking softly in a reassuring voice, the caregiving ministrations can be performed by giving the baby enough facilitation and rest during the process so that the infant can return to a relatively stable baseline. When the vital sign taking is complete the caregiver can make sure that the infant is positioned in such a way that motor arousal and autonomic reactivity are contained and stabilized as much as possible. The goal of this intervention is to decrease the stress of these manipulations and increase the infant's positive functional strategies. The same approach can be taken when the more intrusive special procedures such as postural drainage, suctioning, and chest vibration are being performed. The goal is always to reduce stress signals and enhance stabilization signals.

This goal also applies for feeding procedures. The baby should not be interrupted when in deep sleep or when quietly alert. Babies on the respirator who are gavage fed can be facilitated in a flexed position by diaper rolls for better hip flexion and knee, shoulder and elbow flexion if the containment by the caregiver is not possible. Containment can then be provided along the back of the trunk and against the soles of the feet with diaper rolls. A soft, graspable terrycloth roll for both hands can facilitate the sucking and trunkal-flexion configuration. Yet the parent's or nurse's finger may be placed in the baby's hands and may accomplish this even more effectively. As soon as possible, a pacifier to suck during gavage feeding can be gently offered when the baby is relaxed facially. After gavage feeding, a reorganization period for stabilization, as described above, can be ensured.

After discontinuation of the respirator babies can also be fed when the state is appropriate for feeding. The baby can be cradled in the parent's or caregiver's arm with the baby's face about eight inches from the caregiver's face. The caregiver should sit in a relaxed position in a rocking chair with feet on a footstool to provide a comfortable cradle with his/her lap. The baby should be facing away from a direct light source and the ambient noise and light level

need to be subdued. When appropriate, the caregiver could talk softly to the baby to encourage a quiet, modulated, alert state with a relaxed face. He/She would hold onto the baby's hand and allow the infant's feet to tuck into the crook of the caregiver's other arm to inhibit unnecessary motor arousal. In this supported flexor position, the nipple could be introduced. For babies who are gavage fed, a pacifier can be used in association with the feed. Burping can be done gently with the baby against the nurse's shoulder to promote flexion, cuddling, and visual alertness. Resting periods should be interspersed as necessary and extraneous interruptions should be avoided as much as possible. Depending on the baby's robustness, soft talking may be added to looking at the baby and smiling. Overload must be carefully avoided. For some babies, it may be necessary to avert one's gaze during feeding while the infant is sucking and only look at the infant during sucking pauses, if at all. The baby's signals should be used to titer the complexity of the input. It may be inappropriate for some babies to be taken out of the isolette for feedings. They may do better gently supported in the isolette, without additional tactile and sensory input.

Diaper changing and cleaning need to be timed to the baby's state transition. Being placed in supine can be stressful for many preterm babies. Therefore, diaper changing and cleaning should be accomplished as much as possible in a prone and side position. Stabilization should be assured and then during the procedure flexion can be facilitated by letting the baby hold onto the nurse's finger, by letting the baby suck if necessary, and by aiding postural and autonomic restabilization after the procedure. Calm, soothing talk can accompany the procedure for some infants. For others this may be too much input.

All social interaction must be in keeping with the baby's state transitions. The baby should not be interrupted if in quiet sleep. Once in a quiet alert state, social interaction can proceed in a graded fashion, first from a distance and with soft gentle talking and lowkeyed animation. If the baby responds well the complexity of talking and facial expression can be gradually increased; animation in the baby's face is the goal, with reciprocation of social signals on the baby's part.

The baby should be continuously monitored for autonomic and motoric stress signals during these interactive sequences. The interaction will be reduced in complexity or terminated as necessary, if the baby shows stress. An aroused or otherwise stressed baby always needs to be stabilized and reorganized before the caregiver leaves the baby.

IMPLICATIONS FOR PARENT SUPPORT

Parents are vital participants in the baby's development. As our model in Figure 1 indicates, they are temporarily subsidized by the isolette and medical technology in facilitating the premature transition from in-utero to extra-utero parenting. That this is a temporary subsidy only must be kept in mind by all professional personnel. The parents are the key facilitators of the infant's

development and need to be seen in their critical role of appropriate stimulus barrier between the infant and the world at large. The infant's behavioral organization in the synactive formulation outlined here is often intuitively obvious to the parent. Yet often the parents do not dare trust their intuition and the infant's signals of communication. They defer to the professional to whom they abruptly and totally had to relinquish their child, and they gather that the legitimacy of questions and discussion is now established by the professional. Discussion tends to revolve around blood gasses, oxygen levels, equipment, etc. The parent often becomes good at verbal intercourse on this level. Yet he or she wonders how the infant is feeling; whether the baby is in pain; and whether the baby is panicked, overwhelmed, desperate. The baby is seen by the parent communicating all those messages quite clearly. This is an opportunity to assure the parents of the significance of the baby's communication, of the accuracy of their understanding of these communications, and of their importance in responding to these communications. When the parents can recapture the baby as theirs and in need of their protection and their growing trust in the infant's integrity and autonomy, then the clinician has done the job well of supporting infant and parents in this mutual development task.

SUMMARY

We have outlined a formulation of development that identifies five subsystems of functioning in continuous contiguity and interaction: the autonomic system, the motor system, the state-organizational system, the attentional-interactive system, and the self-regulatory-balancing system. The organism negotiates the integration and continuous differentiation of these systems in continuous interplay with the environment. Assessment of the organism's functioning therefore lies in the identification of the currently salient and emerging developmental task and its relative support by, or disruption of, the other subsystems in their balance and modulation. Signals of stress and signals of self regulation can be detected at each system level in the identification of the organism's current degree of smooth, well-regulated functioning. This kind of assessment of the infant's current level of organization seems important for our preventive and supportive structuring of the environment and for the identification of an infant's individual progression. This permits us to provide opportunities for the parents and others working with the infant to take pleasure in the infant's competence and their own competence, no matter how difficult or different the infant may be.

REFERENCES

1. Brazelton TB: The neonatal behavioral assessment scale. *Clinics in Developmental Medicine 50.* London, William Heinemann, 1973.
2. Als H: The newborn communicates. *J Commun 27*:66-73, 1977.
3. Als H: Autonomous state control: The first stage in successful negotiation of parent-infant interaction.

Presented at the Meetings of the American Academy of Child Psychiatry, Toronto, 1976.
4. Als H: Social interaction: Dynamic matrix for developing behavioral organization. In IC Uzgiris (Ed), *New Directions for Child Development, Vol. 4*. San Francisco, Jossey Bass, 1979.
5. Als H: Assessing an assessment: Conceptual considerations, methodological issues, and a perspective on the future of the neonatal behavioral assessment scale. In AJ Sameroff (Ed), Organization and stability of newborn behavior: A commentary on the Brazelton Neonatal Behavioral Assessment Scale. *Monographs of the Society for Research in Child Development 43*, No. 5-6, 1978.
6. Casaer P: Postural behavior in newborn infants. *Clin Dev Med 72*, London, William Heinemann and Philadelphia, JB Lippincott, 1979.
7. Sander, LW: Issues in early mother-child interaction. *J Am Acad Child Psychiatry 1*:141-166, 1962.
8. Sander LW: Adaptive relationships in early mother-child interaction. *J Am Acad Child Psychiatry 3*:232-264, 1964.
9. Als H: The human newborn and his mother: An ethological study of their interaction. Doctoral Dissertation, University of Pennsylvania, 1975.
10. Huber E: *Evolution of Facial Musculature and Facial Expression*. Baltimore, Johns Hopkins Press, 1931.
11. Bolwig N: A study of the behavior of the chacma baboon, Papio Ursinus. *Behavior 14*:136-163, 1959a.
12. Bolwig N: Observations and thoughts on the evolution of facial mimic. *Koedoe 2*:60-69, 1959b.
13. Buettner-Janusch J: *Origins of Man*. New York, John Wiley, 1966.
14. Als H, Tronick E, Adamson L, Brazelton TB: The behavior of the fullterm yet underweight newborn infant. *Dev Med Child Neurol 18*:590-602, 1976.
15. Hunt JM: *Intelligence and Experience*. New York, Ronald Press, 1961.
16. Piaget J: *The Origins of Intelligence in Children*. New York, WW Norton & Co, 1963.
17. Milani-Comparetti A: Fetal movement. First E. Zausmer Lecture, Children's Hospital Medical Center, Boston, 1980.
18. Birnholz JC, Stephens, JC, Faria H: Fetal movement patterns: A possible means of defining neurologic developmental milestones in utero. *Am J Roentgenology 130*:536-540, 1978.
19. Herzog JM: Attachment, attunement, and abuse, and occurrence in certain premature infant-parent dyads and triads. Presented at the American Academy of Child Psychiatry Meetings, Atlanta, 1979.
20. Denckla MB: Minimal brain dysfunction. In *Education and the Brain. 77th Yearbook of the National Society for the Study of Education*:223-268. Chicago, University of Chicago Press, 1978.
21. Als H, Lester BM, Tronick EC, Brazelton TB: *Manual for the Assessment of Preterm Infants' Behavior (APIB)*. Appendix to Als H, Lester BM, Tronick EC, Brazelton TB: Towards a research instrument for the assessment of preterm infants' behavior (APIB). In HE Fitzgerald, BM Lester, MW Yogman (Eds), *Theory and Research in Behavioral Pediatrics, Vol 1*, New York, Plenum Publishers, in press.
22. Schneirla TC: An evolutionary and developmental theory of biphasic processes underlying approach and withdrawal. In MR Jones (Ed), *Nebraska Symposium on Motivation*:1-42. Lincoln, University of Nebraska Press, 1959.
23. Schneirla TC: Aspects of stimulation and organization in approach/withdrawal processes underlying vertebrate behavioral development. *Advances in the Study of Science 1*:1-74, 1965.
24. Denny-Brown D: *The Basal Ganglia and their Relation to Disorders of Movement*. Oxford, Oxford University Press, 1972.
25. Denny-Brown D: *The Cerebral Control of Movement*. Springfield, Charles Thomas, 1966.
26. Als H: Infant individuality: Assessing patterns of very early development. In J Call, E Galenson (Eds), *Frontiers of Infant Psychiatry*, New York, Basic Books, in press.
27. Als H, Duffy FH: The behavior of the premature infant: A theoretical framework for a systematic assessment. In TB Brazelton, BM Lester (Eds), *Toward Plasticity and Intervention*. Elsevier, North Holland, in press.
28. Als H, Brazelton TB: A new model of assessing the behavioral organization in preterm and fullterm infants: Two case studies. *J Am Acad Child Psychiatry 20*:239-263, 1981.