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THE INFANT

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A View from Psychoanalysis  
& Developmental Psychology

DANIEL N. STERN

NEW INTRODUCTION BY THE AUTHOR



period of each of the subsequent domains of sense of self. The later uses of self to emerge are products of the organizing process. They are true, encompassing perspectives about the self—about the physical, emotional self, about the subjective self, about the verbal self. The process of forming each of these perspectives, the creative act concerning the nature of self and others, is the process that gives rise to the sense of an emergent self, which will be experienced in the process of forming each of the other senses of the self, to which it can now turn.

## Chapter 4

# The Sense of a Core Self:

## I. Self versus Other

AT THE AGE of two to three months, infants begin to give the impression of being quite different persons. When engaged in social interaction, they appear to be more wholly integrated. It is as if their actions, plans, affects, perceptions, and cognitions can now all be brought into play and focused, for a while, on an interpersonal situation. They are not simply more social, or more regulated, or more attentive, or smarter. They seem to approach interpersonal relatedness with an organizing perspective that makes it feel as if there is now an integrated sense of themselves as distinct and coherent bodies, with control over their own actions, ownership of their own affectivity, a sense of continuity, and a sense of other people as distinct and separate interactants. And the world now begins to treat them as if they are complete persons and do possess an integrated sense of themselves.

In spite of this very distinctive impression, the prevailing views of clinical developmental theory do not reflect the image of an infant with an integrated sense of self. Instead, it is widely held that infants go through an extended period of self/other undifferentiation and that only very slowly, sometime towards the end of the first year of life, do they differentiate a sense of self and other. Some psychoanalytic

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## II / THE FOUR SENSES OF SELF

developmental theories, of which Mahler provides the most influential example, propose that during the undifferentiated phase infants experience a state of fusion or "dual-unity" with mother. This is the phase of "normal symbiosis," lasting roughly from the second to the seventh or ninth month. This state of dual-unity is proposed as the background from which the infant gradually separates and individuates to arrive at a sense of self and of other. Academic theories have not differed basically from the psychoanalytic theories in the sense that both propose a slow emergence of self after a long period of undifferentiation.

Recent findings about infants challenge these generally accepted timetables and sequences and are more in accord with the impression of a changed infant, capable of having—in fact, likely to have—an integrated sense of self and of others. These new findings support the view that the infant's first order of business, in creating an interpersonal world, is to form the sense of a core self and core others. The evidence also supports the notion that this task is largely accomplished during the period between two and seven months. Further, it suggests that the capacity to have merger- or fusion-like experiences as described in psychoanalysis is secondary to and dependent upon an already existing sense of self and other. The newly suggested timetable pushes the emergence of the self earlier in time dramatically and reverses the sequencing of developmental tasks. First comes the formation of self and other, and only then is the sense of merger-like experiences possible.

Before examining the new evidence, we must ask, what kind of a sense of self is the infant likely to discover or create, beyond the sense of an emergent self that appeared in the first two months?

### *The Nature of an Organized Sense of Self*

The first organizing subjective perspective about the self must be at a fairly basic level.<sup>1</sup> A tentative list of the experiences available to the infant, and needed to form an organized sense of a core self

1. This discussion will generally concern sense of self. The sense of other is most often the opposite side of the same coin and is implied.

## THE SENSE OF A CORE SELF: I.

includes (1) self-agency, in the sense of authorship of one's own actions and nonauthorship of the actions of others: having volition, having control over self-generated action (your arm moves when you want it to), and expecting consequences of one's actions (when you shut your eyes it gets dark); (2) self-coherence, having a sense of being a nonfragmented, physical whole with boundaries and a locus of integrated action, both while moving (behaving) and when still; (3) self-affectivity, experiencing patterned inner qualities of feeling (affects) that belong with other experiences of self; and (4) self-history, having the sense of enduring, of a continuity with one's own past so that one "goes on being" and can even change while remaining the same. The infant notes regularities in the flow of events.

These four self-experiences, taken together, constitute a sense of a core self. This sense of a core self is thus an experiential sense of events. It is normally taken completely for granted and operates outside of awareness. A crucial term here is "sense of," as distinct from "concept of" or "knowledge of" or "awareness of" a self or other. The emphasis is on the palpable experiential realities of substance, action, sensation, affect, and time. Sense of self is not a cognitive construct. It is an experiential integration. This sense of a core self will be the foundation for all the more elaborate senses of the self to be added later.<sup>2</sup>

These four basic self-experiences seem to be reasonable choices from a clinical point of view as well as from a developmental point of view, in that they are necessary for adult psychological health. It is only in major psychosis that we see a significant absence of any of these four self-experiences. Absence of agency can be manifest in catatonia, hysterical paralysis, derealization, and some paranoid states in which authorship of action is taken over. Absence of coherence can be manifest in depersonalization, fragmentation, and psychotic ~~breaks~~ experiences of merger or fusion. Absence of affectivity can be seen in the anhedonia of some schizophrenias, and absence of continuity can be seen in fugue and other disassociative states.

A sense of a core self results from the integration of these four basic self-experiences into a social subjective perspective. Each of these self-experiences can be seen as self-invariant. An invariant is that which does not change in the face of all the things that do

2. It is reasonable to believe that many higher nonhuman animals form such a sense of a core self. That in no way diminishes this achievement.



change. To be persuaded that a sense of a core self is likely to form during the first half year of life as a primary social task, one would want to be assured that the infant has the appropriate opportunities to find the necessary self-invariants (agency, coherence, and so on) in daily social life, the capacities to identify these self-invariants, and the ability to integrate all of these self-invariants into a single subjective perspective. Let us begin with the opportunities.

*The Natural Opportunities for Identifying Self-Invariants*

The period roughly from two to six months is perhaps the most exclusively social period of life. By two or three months the social smile is in place, vocalizations directed at others have come in, mutual gaze is sought more avidly, pre-designed preferences for the human face and voice are operating fully, and the infant undergoes that biobehavioral transformation resulting in a highly social partner (Spitz 1965; Emde et al. 1976). Before these changes at two months, the infant is relatively more engaged with social behaviors directly bearing on the regulation of physiological needs—sleep and hunger. And after six months the infant changes again and becomes fascinated by, and proficient in, manipulating external objects; coordination of limbs and hand-to-eye have improved rapidly, and an interest in inanimate objects sweeps the field. When in physiological and affective equilibrium, the infant becomes relatively more engaged with things than with people. So it is in between these two shifts at two and six months of age that the infant is relatively more socially oriented. This short period of intense and almost exclusive sociability results both from default and design.

Given this honeymoon period of intense sociability, how are the interpersonal interactions mutually constructed so that the infant is in a position to identify the invariants (“islands of consistency”) that will come to specify a core self and a core other? This has been discussed in greater detail elsewhere (Stern 1977), but the highlights for our purposes are as follows:

First, the caregivers’ social behaviors elicited by the infant are generally exaggerated and moderately stereotypic. “Baby talk,” the

example par excellence, is marked by raised pitch, simplified syntax, reduced rate, and exaggerated pitch contours (Ferguson 1964; Snow 1972; Fernald 1982; Stern, Spieker, and MacKain 1983). “Baby faces” (the often odd but effective faces made automatically by adults towards infants) are marked by exaggeration in fullness of display, longer duration, and slower composition and decomposition of the display (Stern 1977). Similarly, gaze behaviors are exaggerated, and adults tend to “work in closer” to proximate positions best suited for the infant to focus on and attend exclusively to the adult’s behavior. The social presence of an infant elicits variations in adult behavior that are best suited to the infant’s innate perceptual biases; for example, infants prefer sounds of a higher pitch, such as are achieved in “baby talk.” The result is that the adult’s behavior is maximally attended by the infant.

Ultimately, it is these same caregiver behaviors that are the stimuli from which the infant must pick out the many invariants that specify an other. The matching of caregiver behavioral variations and infant predilections gives the infant the optimal opportunity to perceive those behavioral invariants that identify self or other.

Caregivers typically perform these exaggerated behaviors in a theme and variation format. An example of this format in verbal behavior might go something like this:

Hey, honey... Yeah, honey... Hi, honey... Watcha doing, honey?...  
 Yeah, watcha doing?... what are ya doing?... what are ya doing there?  
 ... ya doing nothing?

There are two themes, “honey” and “ya doing.” Each theme is restated several times, with minor variations in language or para-language.

The same kind of theme and variations format is also the rule for repetitious facial displays or body-touching games. For example, the general game “I’m going to get you,” when played in the tickle form of “walking fingers,” consists of repeated finger marches up the infant’s legs and torso, ending up with a neck or chin tickle as the punch line. It is played over and over, but each finger march is distinctly different from the previous one in speed, in suspense, in vocal accompaniment, or in some other way. The longer the caregiver can introduce an optimal amount of novelty into the



performance of each successive round, the longer the infant will stay entranced.

There are two reasons why caregivers engage in this kind of varied repetitiveness (though they generally are not conscious of their reasons). First, if the caregiver did the exact same thing at each repeat, the infant would habituate and lose interest. Infants rapidly determine if a stimulus is the same as those seen or heard immediately before; if it is, they soon stop responding to it. So the caregiver who wishes to maintain a steady high level of interest must constantly change the stimulus presentation a little bit to prevent the baby from habituating. The caregiver's behavior must keep changing, to keep the baby in the same place; it cannot be exact repeats. But then why not do something completely different each time? Why use variations on a theme? This leads to the second reason, the importance of order and repetitiveness.

One of the central tendencies of mind that infants readily display is the tendency to order the world by seeking invariants. A format in which each successive variation is both familiar (the part that is repeated) and novel (the part that is new) is ideally suited to teach infants to identify interpersonal invariants. They get to see a complex behavior and observe which parts of it, so to speak, can be deleted and which parts must remain for it to be the same. They are getting lessons in identifying the invariant features of interpersonal behavior.

The use of exaggerated infant-elicited behaviors and their organization into a theme-and-variation format are not done by caregivers to teach the infant about interpersonal invariants. That is a by-product. They are done to help regulate the infant's level of arousal and excitement within a tolerable range (and to keep the parents from getting bored).

Each infant has an optimal level of excitation that is pleasurable. Beyond that level of excitation the experience becomes unpleasurable, and below a certain level the experience becomes uninteresting and stops being pleasurable. The optimal level is actually a range. Both partners adjust to keep the infant within it. On the one side, the caregiver regulates the level of activity in facial and vocal expressions, gestures, and body movements—the stimulus events that determine the infant's level of excitation. Corresponding to each infant's optimal range of excitation is an optimal range of stimulation. By sensitively gearing the level of such behaviors as the extent of

exaggeration and the amount of variation to the infant's current level of excitation and the direction of its predictable drift, the caregiver achieves the optimal range of stimulation.

On the other side, the infant also regulates the level of excitation, using gaze aversion to cut out stimulation that has risen above the optimal range and gaze and facial behaviors to seek out and invite new or higher levels of stimulation when the level of excitation has fallen too low (Brazelton et al. 1974; Stern 1974a, 1975; Fogel 1982). When one watches infants play their role in these mutual regulations, it is difficult not to conclude that they sense the presence of a separate other and sense their capacity to alter the behavior of the other as well as their own experience.

With this kind of mutual regulation, infants in effect get extensive experience with self-regulation of their own level of excitation and with regulation, through signals, of a responsive caregiver's level of stimulation. This amounts to an early coping function. Infants also get extensive experience with the caregiver as a regulator of their levels of excitation, that is, of being with an other who helps them self-regulate. All this can be best observed in the fairly stereotypic parent-infant games of this life period (Call and Marschak 1976; Fogel 1977; Schaffer 1977; Stern et al. 1977; Tronick et al. 1977; Field 1978; Kaye 1982).

It is important to note that during this period of life, these social interactions are in no way purely cognitive events. They mainly involve the regulation of affect and excitation. Perceptual, cognitive, and memorial events play a considerable role in these regulatory events, but they are all about affect and excitement. It must also be recalled that during this period, when face-to-face social interactions are one of the main forms of interpersonal engagement, the major emotional peaks and valleys of social life now occur during these encounters and not during activities such as feeding, when physiological regulation is uppermost. These social matters concern both the infant's cognitive and affective experience.

But how about the extreme affective states related to physiological and bodily needs—distress and crying because of hunger or discomfort, and contentment due to satiation? Do these present an entirely different social situation for the infant insofar as discovery of self and other are concerned? No. Parental behavior in these situations follows the same general rules that it does during social play. Behaviors are



exaggerated, repeated with appropriate variation, and stereotypic. Imagine an attempt to soothe a distressed baby. The facial, vocal, and tactile behaviors are greatly exaggerated and repeated with constant variations until success is achieved. Soothing, comforting, putting to sleep, and so on are rituals that follow a narrowly prescribed repertoire of themes and variations. (Unsuccessful soothing consists of a series of uncompleted, broken up, ineffective rituals, but it is ritual nonetheless.) And during these events the infant is of course experiencing affective changes that vary along with the parents' behavioral themes and variations.

These, then, are the daily life events that offer up the opportunities from which the infant must identify the invariants that specify a core self and, complementarily, those that specify a core other. We can now turn to the capacities the infant would need in order to be able to discover the basic invariants that will specify a core self and other.

*Motive to Own  
and Universe  
in primitive  
mental*

The Identification of Self-Invariants

First of all, the intrinsic motivation to order one's universe is an imperative of mental life. And the infant has the overall capacity to do so, in large part by identifying the invariants (the islands of consistency) that gradually provide organization to experience. In addition to this general motivation and capacity, the infant needs specific capacities to identify the invariants that seem most crucial in specifying a sense of a core self. Let us look closely at the four crucial invariants.

AGENCY

Agency, or authorship of action, can be broken down into three possible invariants of experience: (1) the sense of volition that precedes a motor act, (2) the proprioceptive feedback that does or does not occur during the act, and (3) the predictability of consequences that follow the act. What capacities does the infant have for identifying these features of agency?

The invariant of volition may be the most fundamental invariant

THE SENSE OF A CORE SELF: I.

of core self-experience. All movements of voluntary (striated) muscles that are organized at a level higher than the reflex are preceded by the elaboration of a motor plan, which is then executed by the muscle groups (Lashley 1951). Exactly how these motor plans are registered in sentience is not clear, but it is commonly accepted that there is some mental registration (usually out of awareness) of the existence of a motor plan prior to action. The existence of the plan can reach awareness quite readily when its execution is inhibited or when for some reason the motor execution misfires and fails to match the original plan (the thumb hits the cheek instead of going into the mouth, for example). We expect our eyes and hands and legs to do what we have planned for them. The presence of the motor plan as it exists in mind allows for the sense of volition or will. Even when we are unaware of the motor plan, the sense of volition makes our actions seem to belong to us and to be self-acts. Without it, an infant would feel what a puppet would "feel" like, as the nonauthor of its own immediate behavior.

One expects to find motor plans from the very beginning of life, at least as soon as voluntary motor skills become evident. And this, of course, occurs in the first month of life, with hand-to-mouth reaching for an object of a certain size will begin to shape finger position and degree of hand opening to fit the size of the object to be grasped (Bower et al. 1970). These hand adjustments are made en route to the object; they are accommodations to the size of the object as seen and not yet felt. What must be occurring is that the motor plan for the hand-shaping-during-reach is being formed on the basis of visual information.

One could argue that the achievement of a motor plan such as handshaping is simply a match/mismatch operation with goal-correcting feedback. But such arguments still do not address the initiating mental event that forms the motor plan. That is where volition resides. The execution of match/mismatch operations determines only the likelihood of the original plan being successful or not, or brought to awareness or not.

The reality and importance of motor plans as mental phenomena, particularly as these apply to skilled actions such as talking or playing the piano, were beautifully argued by Lashley. Recently, another illustration of this phenomenon was pointed out to me (Hadlke,



personal communication, 1983). If subjects are asked to write their signatures twice, first very small on a piece of paper and then in very large script on a blackboard, the two signatures will be remarkably alike when adjusted for size. What is interesting about this example is that entirely different muscle groups are used to render the two signatures. In the first signing, on paper, the elbow and shoulder are fixed and all action occurs in the fingers and wrist. In the second signing, on the blackboard, the fingers and wrist are fixed and all action occurs in the movements at the elbow and shoulder. The motor program for the signature thus in no way resides in the muscles required for the signing. It resides in the mind and is transferable from one set of muscles to a completely different set of muscles for its execution. Volition in the form of motor plans exists as a mental phenomenon that can be combined with a variety of different muscle groups for execution. This is what Piaget had in mind when he spoke of sensorimotor schemas and the ability of the infant to marshal different means to accomplish the same ends. These considerations lead to a clinical vignette.

Several years ago a pair of "Siamese twins" (Xiphophagus conjoint twins) were born at a hospital near the university where I teach. These were only the sixth set of twins of their kind reported in the world literature. They were connected on the ventral surface between the umbilicus and the bottom of the sternum, so that they always faced one another. They shared no organs, had separate nervous systems, and shared essentially no blood supply (Harper et al. 1980). It was noticed that very frequently one would end up sucking on the other's fingers and vice versa, and neither seemed to mind. About one week before they were to be surgically separated at four months of age (corrected for prematurity), Risa Harper, Director of the Neonatal Nursery, called me because of the potential psychological interest of this pair. Susan Baker, Roanne Barnett, and I had an opportunity to do a number of experiments before surgical separation. One experiment bears on volitional motor plans and the self. When twin A (Alice) was sucking on her own fingers, one of us placed one hand on her head and the other hand on the arm that she was sucking. We gently pulled the sucking arm away from her mouth and registered (in our own hands) whether her arm put up resistance to being moved from her mouth and/or whether her head strained forward to go after the retreating hand. In this situation, Alice's arm

resisted the interruption of sucking, but she did not give evidence of straining forward with her head. The same procedure was followed when Alice was sucking on her sister Betty's fingers rather than her own. When Betty's hand was gently pulled from Alice's mouth, Alice's arms showed no resistance or movement, and Betty's arm showed no resistance, but Alice's head did strain forward. Thus when her own hand was removed, the plan to maintain sucking was put into execution by the attempt to bring her arm back to the mouth, while when another person's hand was removed the plan to maintain sucking was put into execution with the movement of her head forward. Alice seemed, in this case, to have no confusion as to whose fingers belonged to whom and which motor plan would best reestablish sucking.

We were fortunate to come upon several occasions when Alice was sucking on Betty's fingers while Betty was sucking on Alice's fingers. The same interruption of sucking manipulation was performed, except doubly and simultaneously. The results indicated that each twin "knew" that one's own mouth sucking a finger and one's own finger being sucked do not make a coherent self. Two invariants are missing, volition (of the arm) as we have been talking about it, although this cannot be proved, and predictable consequences, which we shall address below.<sup>3</sup>

This aspect of agency, the sense of volition, must occur very early during the newborn period, since the infant's repertoire of action is not all reflexive even at birth. To the extent that the newborn's behaviors are to a considerable extent reflexive, the sense of volition will not be an invariant of movement. Sometimes it will be there, seen in such voluntary movements as some head-turns, some sucking, some gazing behaviors, and some kickings. Sometimes it will not be there, when a behavior is fired off reflexively; such behaviors include many arm movements (tonic neck reflexes), head movements (rooting), and so on. Until the proportion of all self-action that is reflexive becomes quite small, the sense of volition will be an "almost invariant" of self-action. By the second month of life, when core-relatedness begins, this is certainly the case.

The second invariant property specifying agency is proprioceptive feedback. This is a pervasive reality of self-action whether the action

3. This example is in part an unusual case of "single touch" versus "double touch." Double touch is when you touch yourself and the touched part in turn touches the touching part.

Infant core self (own arm & mouth) action plan  
volition  
predictable consequences  
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is initiated by self or passively manipulated by another. It is clear that infant motor acts are guided by proprioceptive feedback from the earliest days, and we have very reason to assume that proprioception is developmentally a constant invariant of self-agency, even when the infant is not acting but is holding any antigravity posture. The Papoušek (1979) have commented on this point, which was also central for Spitz (1957).

Given just these two invariants, volition and proprioception, it becomes clearer how the infant could sense three different combinations of these two invariants: self-willed action of self, (bringing thumb up towards own mouth), in which both volition and proprioception are experienced; other-willed action of other (mother bringing pacifier up towards infant's mouth), in which neither volition nor proprioception are experienced; or other-willed action on self (mother holds baby's wrists and plays "clap hands" or "pat-a-cake," at a point when the child does not yet know the game), in which proprioception but not volition will be experienced. It is in this way that the infant is in a position to identify those invariants that specify a core self, core other, and the various amalgams of these invariants that specify self-with-other. As we add more invariant interpersonal properties, the possibilities expand greatly.

The third invariant that potentially can specify agency is consequence of action—Self events generally have contingent relations very different from events with another. When you suck your finger, your finger gets sucked—and not just generally sucked, but with a sensory synchrony between the tongue and palate sensations and the complementary sensations of the sucked finger. When your eyes close, the world goes dark. When your head turns and eyes move, the visual sights change. And so on.

For virtually all self-initiated actions upon the self, there is a felt consequence. A constant schedule of reinforcement results. Conversely, acts of the self upon the other generally provide less certain consequences and result in a quite variable schedule of reinforcement. The infant's ability to sense contingent relations alone will be of no help in self/other differentiation. What will help, however, will be the infant's ability to tell one schedule of reinforcement from another, since only self-generated acts are constantly reinforced.

Recent experiments show that infants have considerable ability to

discriminate different schedules of reinforcement (Watson 1979, 1980). Using a paradigm in which infants must turn their heads against a pressurized pillow to get a mobile to turn, Watson has demonstrated that infants by the age of three months can distinguish between schedules of constant reinforcement (each head-turn is rewarded), a fixed ratio of reinforcement (every third head-turn, say, is reinforced) and a variable schedule (where head-turns are less predictably rewarded). The implications for self/other differentiation are clear. This discrimination provides the needed leverage for the problem at hand. Most classes of action by the self upon the self necessarily have a constant reinforcement schedule. (Arm motions always result in proprioceptive sensations. Vocalization always results in unique resonance phenomena from neck and chest and skull. And so on.)

By contrast, actions of the self upon others are usually variably rewarded. The variable and unpredictable nature of maternal responses to infant actions has been documented often (see Watson 1979). For instance, a three-month-old infant who vocalizes has a 100 percent likelihood of feeling the chest resonance of the sound but the likelihood of mother vocalizing back is only probabilistic (Stern et al. 1974; Strain and Vietze 1975; Schaffer et al. 1977). Similarly, if the three-and-one-half-month-old infant gazes toward mother, it is certain she will come into view, but the odds are only high, not certain, that she will look back (Stern 1974b; Messer and Vietze 1982).

In examining the basis of causal inference in infancy, Watson (1980) suggests that there are three features of causal structure available to the infants by three to four months of age: an appreciation of temporal relations between events; an appreciation of sensory relations, that is, the ability to correlate intensity or duration of a behavior and its effect; and an appreciation of spatial relations, the ability to take into account the spatial laws of a behavior and the laws of its effects. These three dimensions of information about causal structure, which we will examine in more detail in the next section, presumably act additively or interactively in providing the infant with rudimentary knowledge of different occasions or conditions of causality. This knowledge in turn should help to separate the world into self-caused and other-caused effects.



The sense of agency is certainly a major specifier of self versus other. But there is a parallel question of equal magnitude. Must the infant not have a sense of a coherent, dynamic physical entity to which the sense of agency can belong?

#### SELF-COHERENCE

What are the invariant properties of interpersonal experience that might specify that the self versus the other is a single, coherent, bounded physical entity? And what are the infant's capacities to identify them? Without a sense of self and other as coherent entities unto themselves, a sense of a core self or core other would not be possible, and agency would have no place of residence.

There are several features of experience that could help in establishing self-coherence:

Unity-of-locus. A coherent entity ought to be in one place at one time, and its various actions should emanate from one locus. It has long been known that infants visually orient to the source of a sound at birth (Worthheimer 1961; Butterworth and Castillo 1976; Mendelson and Haith 1976). Part of the problem of discovering unity of locus is thus already solved by predesign of the nervous system. By the age of three months, infants expect that the sound of a voice should come from the same direction as the visual location of the face.

Because infants' reflexes and expectations assure that they will be watching what they are listening to and vice versa (under most natural conditions), infants are in a good position to notice that the behaviors specific to an other occupy a separate locus of origin from the locus occupied by the behaviors specific to themselves. Real life interactions, however, confound this picture, and common locus of origin as an identifiable property of self versus other is often violated. For instance, at the close range of face-to-face interactions, the mother's mouth, face, and voice obey the invariant of common locus of origin, but her hands may be holding or tickling the baby. In that case the mother's hands are as far from her face as is the infant's body. Her hands violate the unity of locus of her facial behaviors just as much as any part of the baby's body might be seen to. Unity of locus certainly plays a role as an interpersonal invariant, but by itself it can take the infant only so far in specifying core self and

other. It is very helpful when mother is across the room, but of limited help at close range.

Coherence of motion. Things that move coherently in time belong together. Mother as an object seen moving across the room or against any stationary backdrop will be experienced as having coherence because all of her parts are moving relative to some background (Gibson 1969). Ruff (1980) argues that the continuous optical transformations of a moving object (mother) provide the infant with unique kinds of information to detect structural invariants. Because the mind can extract invariants from dynamic events, Ruff deals with the fact that both the infant and the object may be in motion and puts this fact to use. But the problems with motion as an invariant identifying mother as a core other entity are similar to those encountered for unity of locus. First, when she is quite close, the infant observes that parts of her are moving relatively faster than others. This generally means that parts of her become the background, relatively speaking, for other parts of her. When this occurs, and it occurs often, one arm might appear to be a different entity from the other arm, or from the body. The second problem is that infants experience greater coherence if all parts are moving as if associated by rigid connections (Spelke 1983). This is not often the case with a socially interacting mother. Her hand, head, mouth, and body movements may be far too fluidly related ever to give the impression that they all belong to the same whole.

Coherence of motion alone, then, as an invariant would be of limited value in detecting core entities. Happily, human actions have other properties that can serve as more reliable invariants.

Coherence of temporal structure. Time provides an organizing structure that helps identify different entities. The many behaviors that are invariably performed simultaneously by one person share a common temporal structure. Condon and Ogston (1966) have labeled this self-synchrony, not to be confused with interactional synchrony, which will be discussed later in this section. Self-synchrony refers to the fact that separate parts of the body such as limbs, torso, and face tend to move—in fact, must move—together synchronously to a split second, in the sense that starts, stops, and changes in direction or speed in one muscle group will occur synchronously with starts, stops, and changes in other muscle groups. This does not mean that the two arms must be doing the same thing at the same time, nor

Things that move coherently in time belong together. Mother as an object seen moving across the room or against any stationary backdrop will be experienced as having coherence because all of her parts are moving relative to some background (Gibson 1969). Ruff (1980) argues that the continuous optical transformations of a moving object (mother) provide the infant with unique kinds of information to detect structural invariants. Because the mind can extract invariants from dynamic events, Ruff deals with the fact that both the infant and the object may be in motion and puts this fact to use. But the problems with motion as an invariant identifying mother as a core other entity are similar to those encountered for unity of locus. First, when she is quite close, the infant observes that parts of her are moving relatively faster than others. This generally means that parts of her become the background, relatively speaking, for other parts of her. When this occurs, and it occurs often, one arm might appear to be a different entity from the other arm, or from the body. The second problem is that infants experience greater coherence if all parts are moving as if associated by rigid connections (Spelke 1983). This is not often the case with a socially interacting mother. Her hand, head, mouth, and body movements may be far too fluidly related ever to give the impression that they all belong to the same whole.



that the face and leg, for example, start and stop moving together. It permits each body part to trace its own pattern and to start and stop independently, so long as they all adhere to a basic temporal structure such that changes in one body part occur, if they are going to, only in synchrony with changes in other parts. In addition, these changes in movement occur synchronously with natural speech boundaries at the phonemic level, such that the temporal structure of self-synchronous behavior is like an orchestra, in which the body is the conductor and the voice the music. (Try to pat your head, rub your belly, and count all at the same time. Violating temporal coherence in this activity can be done, but only with great concentration.) In short, all of the stimuli (auditory, visual, tactile, proprioceptive) emanating from the self share a common temporal structure, while all of those emanating from an other share a different temporal structure. Furthermore, Stern (1977) has found that all features of maternal self-synchronous behavior are highlighted or exaggerated, and Beebe and Gerstman (1980) have observed that the "packaging" of maternal behaviors into synchronous bursts or units is especially tight. Both of these observations suggest that mothers act to make the temporal structure of their behavior especially obvious.

There is a potential problem with all of this. Condon and Sander (1974) have suggested that in addition to self-synchrony, there also exists between mother and baby "interactional synchrony," in which the infant's movements are in perfect synchrony with the mother's voice. If this were true, then each partner's behavior would not in fact have a separate and distinct temporal structure, because the timing of the behavior would be largely determined by that of the partner. Since the original publication, however, there have been several unsuccessful attempts to replicate the original demonstration of interactional synchrony. There have also been unsuccessful attempts to demonstrate the same phenomenon using other and more precise methods. In spite of the rapid and wide initial acceptance of the phenomenon of interactional synchrony—its appeal is obvious—it has not stood the test of time, and we do not need to consider it. Self-synchrony does seem to have stood up, and we are left with two persons who, most of the time, have different and distinct temporal patterns common to their individual behavior.

If the infant were equipped with the ability to perceive a common temporal structure in that which is seen and heard, the task of

differentiating self from other, and the task of differentiating this other from that other, would be greatly facilitated. Recent evidence strongly suggests that infants do indeed have such a capacity and that it is observable by four months of age, if not earlier.

Spelke (1976, 1979) has reported that infants are responsive to temporal congruity between auditory and visual stimuli, with a tendency to match events that are synchronous in time across sensory modality. She presented four-month-old infants with two animated cartoon films projected side by side, with the sound track appropriate (that is, synchronous) to only one of the films emanating from a speaker placed midway between the two images. The infants could tell which film was synchronous with the sound track and preferred to look at the sound-synchronous film. Through a variety of similar experiments, researchers have found that infants can recognize common temporal structure. It does not matter whether the two synchronous events are in the same modality (both visual) or in mixed modes (one auditory and one visual); infants will spot the two that share the same temporal structure (Spelke 1976; Lyons-Ruth 1977; Lawson 1980). Moreover, infants will notice a discrepancy of 400 milliseconds between a sight and sound that are expected to be paired, such as in lip reading (Dodd 1979).

This work suggests that temporal structure is a valuable invariant in identifying core entities. Infants act as though two events sharing the same temporal structure belong together. Taking the step from experimental stimuli to the stimuli provided by natural human behavior, it seems more than likely that infants should readily perceive that the sounds and sights (voice, movements, and expressions) that share a common temporal structure belong to an entity (self or other) that is distinct by virtue of its unique temporal organization (Spelke and Cortelyou 1981; Sullivan and Horowitz 1983). While there have as yet been no experiments that have extended these findings to the proprioceptive or tactile senses, the weight of evidence is increasing that infants inhabit a sensory world in which they integrate cross-modal experience, recognizing the patterns of sounds, sights, and touches that come from self and those that come from an other as separate phenomena, each with its own singular temporal structure.

If we assume that the infant can identify coherent entities (such as mother's behavior) that have a common temporal structure, will



the temporal structure that identifies her be destroyed or interfered with by the infant's own behavior? Will the performance by the infant of an arm movement or a vocalization get mixed up in the mother's temporal structure, or set up a competing temporal structure that obscures it? Can the infant exert selective auditory and visual attention to the temporal structure of the stimuli emanating from one member of the pair, without being distracted or having that structure disorganized by the behavior of the other member?

A recent experiment bears on this question. Walker et al. (1980) demonstrated the ability of four-month-old infants to be selectively inattentive to competing visual events with different time structures. The infants were placed in front of a rear projection screen. Two films of different events were projected on the same area of the screen, one superimposed upon the other. The sound track that was played was synchronous with only one of the films. The images of the two films were then gradually separated, so that they were seen side by side on the screen. After a moment's hesitation, the infants looked at the film that was not synchronous with the sound. They acted as though the film not accompanied by the sound track were a novel event, not noticed before; even though they had been watching it all along during the superimposition. The authors concluded that "perceptual selection is not accomplished through special mechanisms constructed in the course of cognitive development, but is a feature of the art of perceiving early on" (p. 9). The problem of one partner's disrupting the temporal structure of another partner's behavior and thus confusing the discrimination of a core self from a core other may be a theoretical problem for us, but it is not a practical problem for infants in real life.

*Coherence of intensity structure.* Another invariant identifying the behavior of a separate and distinct person is a common intensity structure. In the separate behaviors that emanate from one person, the modulations in the intensity gradient of one behavior or modality generally match the gradations in the intensity in another behavior. In an angry outburst, for example, the loudness of a vocalization is generally matched by the speed or forcefulness of an accompanying movement, not only absolutely but as the intensity of the behaviors is contoured during their performance. This match of intensity structure is true for the infant's own behavior and the infant's perception of that behavior. For example, as an infant's distress builds

and the cry builds in intensity (as an acoustic event), so do the proprioceptive sensations in the chest and vocal cords and the sight and proprioception of a forcefully flailing arm. In short, all the stimuli (auditory, visual, tactile, proprioceptive) emanating from the self (versus other) may share a common intensity structure.

Is it possible that the infant utilizes the perception of levels of intensity to discriminate self and others? Recent experimental work, already mentioned in chapter 3, provides a clue that infants may be able to perceive common intensity level across modalities, just as they can perceive common shape or temporal structure across modalities, and that they can use this information to determine the source (self versus other) of interpersonal events. Lewkowicz and Turkewitz (1980) showed that infants in a laboratory setting can match the intensity of a stimulus experienced in one modality (light) with the intensity of a stimulus experienced in another modality (sound). Intensity-matching across modalities (the seeking of cross-modal equivalence of intensity) is thus another way in which infants are aided in distinguishing self from other.<sup>4</sup>

*Coherence of form.* The form (or configuration) of the other is an obvious property that "belongs" to someone and can serve to identify that person as an enduring and coherent entity. Infants of two to three months of age have no trouble recognizing the particular facial configuration that belongs to still photographs of their own mothers. Two questions arise. What happens when a face changes expression? And what happens when a face or head changes its angle or position of presentation? First, how does the infant handle internal changes in form? Whenever a face changes its emotional expression, its configuration changes. Does the infant identify different expressional configurations as many different faces, resulting in a "happy mother," a "sad mother," a "surprised mother," and so on, each a separate and unrelated entity? Spieker has results suggesting that infants "know" that the same face showing happiness, surprise, or fear is

4. Several authors have recently stressed that gradient or dimensional information, as opposed to categorical information (brightness vs. pattern, or loudness vs. phonemic structure), has greater importance for the infant than for the adult (Runde 1980a; Stern et al. 1983). Given that young infants may be particularly attentive to the quantitative variations in stimulation, especially variations in intensity, in preference to qualitative variation, the ability to match intensities across modalities will be most helpful in discriminating whether a particular stimulus (such as the loudness of a vocalization or the speed of forcefulness of a movement) belongs to one or the other member of the dyad in which the infant is participating.



still the same face (1982). They conserve the identity of a particular face across the various transformations of that face in different facial expressions.<sup>5</sup>

The second question is, how do infants handle external changes in form? The boundary form of the face changes as the head is turned, so that the face is seen full on, in a three-quarter presentation, and in profile. Similarly, as a person comes forward or goes away, the size of the face changes, even though the configuration is not transformed. Is a "new" entity revealed to the infant with each of these changes? Are there small mothers, large mothers, full-faced mothers, profile mothers?

The infant's perceptual system (given some experience with the world) seems able to keep track of the identity of an object in spite of changes in its size or distance, its orientation or position of presentation, its degree of shading, and so on. While different theories abound as to how the infant can maintain the identity of inanimate objects across these kinds of changes (see, for example, Gibson 1969; Cohen and Salapatek 1975; Ruff 1980; and Bronson 1982). All agree that the infant can do it. These abilities certainly apply to human stimuli as well as inanimate ones. For example, Fagan finds that five- to seven-month-old infants can recognize the never-before-seen profile of a face after a short familiarization with the full face, or even better with the three-quarter view of the face (Fagan 1976, 1977).<sup>6</sup>

Sometimes these abilities may be enhanced by cues provided by the infant's abilities at cross-modal matching. Walker-Andrews and Lennon (1984) showed that when five-month-old infants were shown two movies side by side, one of a Volkswagen approaching and one of the same car receding, they would look at the approaching car if at the same time they heard the sound of a car getting

5. Spieker also found that when looking at strange faces an infant also conserves the identity of a given expression across different faces displaying that expression. While the infants could conserve both identity and expression, when dealing with strangers they acted as though the facial expression rather than the facial identity was more salient: "If you don't know them, you'd better know what their affect is, rather than who they are." When dealing with a very familiar face, we assume the reverse is the case: "It is still that person, but wearing a different expression."

6. Fagan found that infants extracted the most information about the invariants of configuration from a three-quarter face presentation, compared with a full or profile presentation. So do adults, according to police department experts in criminal identification.

### THE SENSE OF A CORE SELF: I.

progressively louder, and they would look at the receding car if the sound got progressively softer. The comings and goings of parents must provide innumerable similar examples.

The evidence thus suggests that distance and positional and expressional (internal) changes, which normally accompany the interactive behavior of an other, need not be seen as problematic for the infant. The infant recognizes that form survives these changes, and early in the infant's life, the invariant of form provides yet another means of discriminating one other from all others.

So far, we have discussed five different potential invariant properties that specify a coherent self entity. Many of these invariants are not truly invariant—that is, always nonvarying—but it is likely that their effect is cumulative in the task of discovering the separate organizations that constitute a core self and a core other. A remaining problem concerns whose organization belongs to whom. How, for instance, does the infant sense that a particular coherent organization of behaviors actually is his or her own, and not an other's? The most ready answer is to assume that only the infant's own organization is accompanied by the invariants of agency, especially volition and proprioception.

#### SELF-APPROPRIETY

By the age of two months or so, the infant has had innumerable experiences with many of the affects—joy, interest, and distress and perhaps surprise and anger. For each separate emotion, the infant comes to recognize and expect a characteristic constellation of things happening (invariant self-events): (1) the proprioceptive feedback from particular motor outflow patterns, to the face, respiration, and vocal apparatus; (2) internally patterned sensations of arousal or activation; and (3) emotion-specific qualities of feeling. These three self-invariants, taken together, become a higher-order invariant, a constellation of invariants belonging to the self and specifying one category of emotion.

Affects are excellent higher-order self-invariants because of their relative fixity: the organization and manifestation of each emotion is well fixed by innate design and changes little over development (Lizard 1977). The facial display (and therefore the proprioceptive feedback from the facial muscles) is invariant in configuration for



each discrete affect. If the preliminary evidence of Ekman et al. (1983) is confirmed, each discrete affect also has a specific profile of autonomic firing with its concomitant discrete constellation of internal feelings, at least in adults. And finally, the quality of subjective feeling is specific to each emotion. Therefore, with each separate emotion there occurs the invariant coordination of three discrete self-invariant events.

The self-invariant constellation belonging to each discrete emotion occurs, for any infant, in a number of contexts and usually with different persons. Mother's making faces, grandmother's tickling, father's throwing the infant in the air, the babysitter's making sounds, and uncle's making the puppet talk may all be experiences of joy. What is common to all five "joys" is the constellation of three kinds of feedback: from the infant's face, from the activation profile, and from the quality of subjective feeling. It is that constellation that remains invariant across the various contexts and interacting others. Affects belong to the self, not to the person who may elicit them.

While we have been concerned so far in this discussion only with the categorical affects, a similar case can be made for the vitality affects. The infant experiences a multitude of crescendos, for example, in diverse actions, perceptions, and affects. All of them trace a similar family of activation contours that create a familiar internal state despite the variety of eliciting events. The subjective quality of feeling remains as the self-invariant experience.

SELF-HISTORY (MEMORY)

A sense of a core self would be ephemeral if there were no continuity of experience. Continuity or historicity is the crucial ingredient that distinguishes an interaction from a relationship, with self as well as with an other (Hinde 1979). It is the ingredient that accounts for Winnicott's sense of "going on being" (1958). The infant capacity necessary for this form of continuity is memory. Is the infant's memory up to the task of maintaining a core self-history—a self continuous in time? Is the infant capable of remembering the three different kinds of experience that make up the other main core self-invariants—agency, coherence, and affect? Does an infant of the age of two to seven months have a "motor memory" for experiences of agency, a "perceptual memory" for the experiences

of coherence, and an "affect memory" for the affective experiences? The issues of agency mainly involve motor plans and acts and their consequences. It has long been assumed that infants must have excellent motor memories. Bruner (1969) has called such memory "memory without words." It refers to memories that reside in voluntary muscular patterns and their coordinations: how to ride a bicycle, throw a ball, suck your thumb. Motor memory is one of the more obvious features of infant maturation. Learning to sit, to perform hand-eye coordinations, and so on require some component of motor memory. Piaget implied exactly this (and more) in his concept of a sensorimotor schema.

It is now clear that there are recall memory "systems" that are not language-based and that operate very early (see Olson and Strauss 1984). Motor memory is one of them. Rovee-Collier and Fagen, and their colleagues have demonstrated long-term cued recall for motor memories in three-month-olds (Rovee-Collier et al. 1980; Rovee-Collier and Fagen 1981; Rovee-Collier and Lipsitt 1981). The infants were placed in a crib with an attractive overhead mobile. A string was tied connecting the infant's foot to the mobile, so that each time the infant kicked, the mobile would move. The infants quickly learned to kick to make the mobile move. Several days after the training session, the infants were placed in the same crib with an overhead mobile but without the attaching string. The context of room, personnel, crib, mobile, and so on recalled the motor act, and the infants began to kick at a high rate, even though there was no string and therefore no movement of the mobile. If a different mobile was used during the memory test session, the infant kicked less than with the original mobile; that is, it was a poorer cue for retrieving or recalling the motor act. Similarly, a change in the design of the crib guard, a peripheral visual attribute of the whole episode, altered

7. For the moment, the distinction between recognition memory (in the presence of the object to be remembered) and recall or evocative memory (in the absence of the object) will be overlooked. The dichotomy between recall and recognition memory has been overdrawn. There is probably no such thing as a memory that is spontaneously evoked (pure recall). Some association or cue, regardless of how farflung, must have triggered it. There is a continuum of recall cues, from farflung and slight, as occurs in some free association, to something fairly close to but not identical with the original, to the reappearance of the original itself, which brings us back to recognition memory (see also Nelson and Grendel 1981). The sharp distinction was partially due to the older assumption that recall memory systems had to be language- or symbol-based (Frawberg 1969).

*Handwritten notes:* Memory without words, Motor memory, Agency, Coherence, Affect, Recall, Recognition, Sensorimotor schema, Cued recall, Overhead mobile, String, Infant's foot, Mobile, Training session, Memory test session, Different mobile, Original mobile, Crib guard, Peripheral visual attribute, Whole episode, Altered.



the infant's cued recall (Rovee-Collier, personal communication, 1984).

One can argue that cued recall is neither truly evocative memory nor recognition memory. The cue is not the same as the original, nor is the memory spontaneously recalled in vacuo. But that is immaterial. The point is that cued recall for motor experiences can be experimentally demonstrated, as well as inferred from natural behavior, and that these motor memories assure self-continuity in time. They thus constitute another set of self-invariants, part of the "motor self."

The issue of coherence mainly involves the infant's perceptions and sensations. What evidence exists for the infant's capacity for remembering perceptions? It is well established that infants by five to seven months have extraordinary long-term recognition memory for visual perceptions. Fagan (1973) has shown that an infant who is shown the picture of a strange person's face for less than one minute will be able to recognize the same face more than one week later. How early does this perceptual memory begin? Perhaps in the womb. DeCasper and Fifer (1980) asked mothers to talk to their fetuses, that is, to direct speech to their pregnant bellies during the last trimester of pregnancy. He gave each a particular script to speak many times each day. The scripts used (for example, passages from stories by Dr. Seuss) had distinctive rhythmic and stress patterns. Shortly after birth the infants were "asked" (using sucking as the response) whether the passage they had heard in utero was more familiar than a control passage. The infants treated the passage they had been exposed to as familiar. In a similar vein, Lipsitt (personal communication, 1984) presented pure tones to fetuses just prior to a caesarian delivery. The tones were treated as familiar by the newly born infants. Thus, for some events, recognition memory appears to operate across the birth gap.

The recognition memory for the smell of the mother's milk and for the mother's face and voice has already been mentioned. It is clear that the infant has an enormous capacity for registering perceptual events in memory. Furthermore, whenever recognition memory of external events occurs, it is not only continuity of the external world that is affirmed, but also continuity of the mental percepts or schemas that permit recognition to begin with. The likelihood that recognition memory is experienced as self-affirming,

as well as world-affirming, is suggested by the well-known "smile of recognition," which may be more than pleasure at successful effortful assimilation. ("My mental representation works—that is, it applies to the real world—and that is pleasurable!") In this light, the act of memory itself can be seen as a self-invariant.

Finally, what evidence exists for the infant's capacity to recognize or recall affective experiences? Emde has recently spoken of an affective core to the prerepresentational self (1983): This is exactly what we mean by the continuity of affective experience, in the form of constellations of self-invariants, that contributes to the sense of continuity of self. Affects, as we have seen, are well suited to this task because after two months emotions as displayed and presumably felt change very little from day to day or from year to year. Of all human behavior, affects perhaps change the least over the life span.

The muscles that the two-month-old uses to smile or cry are the exact same ones that the adult uses. Accordingly, the proprioceptive feedback from smiling or crying remains the same from birth to death. For this reason, "our affective core guarantees our continuity of experience across development in spite of the many ways we change" (Emde 1983, p. 1). But this does not answer the question of whether the specific conditions that elicit particular affective experiences can be remembered at these ages.

To answer this question experimentally, Nachman (1982) and Nachman and Stern (1983) made six- to seven-month-old infants laugh with a hand puppet that moved, "spoke," and played peek-a-boo, disappearing and reappearing. When the infants were shown the puppet a week later, the sight of it made them smile.<sup>8</sup> This response is considered cued recall because the sight alone of the unmoving, silent puppet made them smile; in other words, it activated an affective experience. Moreover, they smiled at the puppet only after they had had the game experience. Cued recall memory for affective experience as well as motor experience thus seems not to have to await the development of linguistic encoding vehicles. A different form of encoding is involved. This should hardly be surprising to most psychoanalytic theorists, who have always assumed

8. This was not a smile of recognition, because another group of infants were shown unmoving puppets that did not make them smile. When this group returned one week later they recognized the test puppet in a paired comparison procedure, but they never smiled at it in spite of their recognition.



that affect memories were laid down from the first moments, or at least weeks, of life and have in fact described the first year of this process (McDevitt 1979).

Gunther describes an example of cued recall memory for an affective experience in the first days of life (1967). A newborn whose breathing is accidentally occluded by the breast during a feeding will be "breast shy" for the next several feedings. Clearly, the infant has the memorial capacities to register, recognize, and recall affective experiences so that continuity of the affective self is assured.

In short, the infant has the abilities to maintain an updated history for his "motor," "perceptual," and "affective" selves—that is, for his agency, coherence and affectivity.

### *Integrating the Self-Invariants*

How do agency, coherence, affectivity, and continuity all become integrated into one organizing subjective perspective? Memory may provide the answer to the extent that it is a system or process for integrating the diverse features of a lived experience. An experience as lived in real time does not have a completed structure until it is over. Its structure is then immediately reconstituted in memory. It is in this sense that the structure of experience as it is lived and as it is remembered may not be so different, and a closer look at what is called *episodic memory* is now crucial for understanding how the different self-invariants embedded in lived experience are integrated.

Episodic memory, as described by Tulving (1972), refers to the memory for real-life experiences occurring in real time. These episodes of lived experience range from the trivial—what happened at breakfast this morning, what I ate, in what order, where I was sitting—to the more psychologically meaningful—what I experienced when they told me my father had had a stroke. Episodic memory has the great advantage, for our purposes, of being able to include actions, perceptions, and affects as the main ingredients or attributes of a remembered episode. It is therefore the view on memory that is most relevant to our inquiry about infant experience. It attempts to render the daily personal events of a life in memorial and

representational terms (Nelson 1973, 1978; Shank and Abelson 1975, 1977; Nelson and Grendel 1979, 1981; Nelson and Ross 1980; Shank 1982).

The basic memorial unit is the episode, a small but coherent chunk of lived experiences. The exact dimensions of an episode cannot be specified here; they represent an ongoing problem in the field. There is agreement, however, that an episode is made of smaller elements or attributes. These attributes are sensations, perceptions, actions, thoughts, affects, and goals, which occur in some temporal, physical, and causal relationship so that they constitute a coherent episode of experience. Depending on how one defines episodes, there are no lived experiences that do not clump to form episodes, because there are rarely, if ever, perceptions or sensations without accompanying affects and cognitions and/or actions. There are never emotions without a perceptual context. There are never cognitions without some affect fluctuations, even if only of interest. An episode occurs within one single physical, motivational setting; events are processed in time and causality is inferred, or at least expectations are set up.

An episode appears to enter into memory as an indivisible unit. The different pieces, the attributes of experience that make up an episode, such as perceptions, affects, and actions, can be isolated from the entire episode of which they are attributes. But in general the episode stands as a whole. *Shank as a whole*

Let us say that an infant has experienced a specific episode once, an episode with the following attributes: being hungry, being positioned at the breast (with accompanying tactile, olfactory, and visual sensations and perceptions), rooting, opening mouth, beginning to suck, getting milk. Let us call that a "breast-milk" episode. The next time a similar "breast-milk" episode occurs, if the infant can recognize that most of the important attributes of the current "breast-milk" episode are similar to the past "breast-milk" episode, two specific "breast-milk" episodes will have occurred. Two may be enough, but surely if several more occur with detectable similarities and only minor differences, the infant will soon begin to form a generalized "breast-milk" episode. This generalized memory is an individualized, personal expectation of how things are likely to proceed on a moment-to-moment basis. The generalized breast-milk episode is not in itself a specific memory any more; it is an abstraction



of many specific memories, all inevitably slightly different, that produces one generalized memory structure. It is, so to speak, averaged experience made prototypic. (In this sense it is now potentially part of semantic memory.)

Now, suppose that the next time a specific breast-episode begins, a deviation from the generalized episode happens. For example, at the moment the infant takes the nipple, the infant's nose gets occluded by the breast. The infant cannot breathe, feels distress, flails, averts head from breast, and regains breath. This new specific episode ("breast-occlusion" episode) is similar to, yet importantly and recognizably different from, the anticipated generalized "breast-milk" episode. It becomes a remembered specific episode. Shank (1982) calls the memory of this specific "breast-occlusion" episode the result of a failed expectation. Memory is failure-driven in that the specific episode is only relevant and memorable as a piece of lived experience to the extent that it violates the expectations of the generalized episode.<sup>9</sup> An episode need not be so deviant as this to be memorable as a specific instance of the generalized episode, so long as it is distinctive enough to be discriminated from the prototype.

At this point, one of three things can happen. The "breast-occlusion" experience may never recur, in which case it will persist enshrined as a specific episodic memory. Gunther (1961) has reported that one episode of breast-occlusion appears to influence newborn behavior for several feedings afterwards. The episode then probably becomes part of long-term, cued recall memory. Or the breast-occlusion experience may recur again and again. In that case the specific episodes become generalized to form a new generalized episode, which we can call the generalized "breast-occlusion" episode. Once this has formed, specific instances of these episodes will be memorable as actual episodes only if they are detectably distinctive from the averaged generalized breast-occlusion episode.

Finally, after the first "breast-occlusion" experience, the infant may never again experience an actual specific instance of the generalized "breast-milk" episode. That is to say, there may continue to be feeding trouble, so that the mother has to switch to a bottle. In this case, the original "breast-milk" generalized episode will after a time no longer be a normal, expected part of daily living and may

9. The occlusion episode would be memorable for other reasons, too. But the concern here is mainly with the relations between relative events.

cease to be an active (even retrievable) memory structure.

There are several points to be made about generalized episodes. The generalized episode is not a specific memory. It does not describe an event that actually ever happened exactly that way. It contains multiple specific memories, but as a structure it is closer to an abstract representation, as that term is used clinically. It is a structure about the likely course of events, based on average experiences. Accordingly, it creates expectations of actions, of feelings, of sensations, and so on that can either be met or be violated.

Exactly what events make up these generalized episodes? Nelson and Grendel (1981), in their study of preschoolers, have focused on what might best be called external events (verbally reported as a rule) such as what happens at a birthday party. The actions that make up the episode are: decorate cake, greet guests, open presents, sing "Happy Birthday," blow candles, cut cake, eat cake. These actions occur predictably and in predictable temporal and causal sequence. Children as young as two years construct generalized episodes about these happenings. Nelson and Grendel have called these general schemes (with variable elements but structured wholes) Generalized Event Structures (GERS) and consider them to be basic building blocks of cognitive development as well as of autobiographical memory.

Our concern, in contrast, is with preverbal infants and with different happenings such as what happens when you are hungry and at the breast, or what happens when you and mom play an exciting game. Moreover, our interest concerns not only the actions but also the sensations and affects. What we are concerned with, then, are episodes that involve interpersonal interactions of different types. Further, we are concerned with the interactive experience, not just the interactive events. I am suggesting that these episodes are also averaged and represented preverbally. They are Representations of Interactions that have been Generalized (RIGs).

We do know that infants have some abilities to abstract, average, and represent information preverbally. A recent experiment on the formation of prototypes is instructive in describing the infant's capacities for the kind of process involved. Strauss (1979) showed ten-month-old infants a series of schematic face drawings. Each face was different in length of the nose or placement of the eyes or ears. After the whole series was shown, the infants were asked (in terms



