

TRAITS, BEHAVIORAL SYSTEMS, AND RELATIONSHIPS: THREE MODELS OF INFANT-ADULT ATTACHMENT

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Psychodynamic, social learning, and ethological approaches to infant behavior have each yielded important descriptive insights concerning infant-adult attachment. In many respects these insights appear to be complementary. But because of competition and conflict among theoretical systems, integration of descriptive insights has been difficult to achieve.

The pace at which new attachment research appears seems to have slackened. Recent critiques have suggested that everything implied by the notion of a bond between infant and adult can be captured by studying patterns of interactive behavior, without invoking the concept of attachment (Rosenthal 1973). Weinraub et al. (1977) have even wondered whether an attachment construct has any value at all from a logical and scientific point of view.

The goal of this chapter is to step outside the arena of cross-theoretical controversy and to examine models rather than theories of infant-adult attachment. My premise is that difficulties and discouragement have arisen in part because we have failed to look beyond differences of theoretical orientation to examine the models and types of constructs that we use in developing attachment theory and designing research. My primary concern is that the failure to consider various modes of model building has not only made communication across theoretical systems and research paradigms difficult, it has also significantly restricted our descriptive approach to the infant-adult tie.

The basic data from which much of attachment theory and research proceed can be summarized very briefly. Attachment implies that an infant is able to distinguish a presumed attachment figure from other adults; it implies that the infant is aware of the attachment figure's existence even when she or he is not within sight (i.e., object permanence); and it implies that contact with the attachment figure is in some sense or at least in some circumstances preferred to contact with other adults. Behaviorally, the early signs of attachment involve following and greeting behavior, separation protest, and the tendency to use the attachment figure as a base from which to explore. By age 1 year, most home-reared infants are quite sensitive to their surroundings. They explore more actively in their mother's presence than in her absence, especially in unfamiliar environments. Most 1-year-olds are more comfortable with unfamiliar adults when an attachment figure is present. Although 1-year-olds clearly show both interest and affiliative behavior toward strangers, bids for

physical contact and for comfort are preferentially displayed toward attachment figures. When 1-year-olds are separated from an attachment figure in an unfamiliar setting, exploratory behavior typically gives way to search and/or protest. Even when this behavior diminishes, exploratory behavior is typically limited until the attachment figure returns. Upon reunion, most 1-year-olds seek proximity and/or contact and eventually return to play. Protest during brief separations declines after age 3. Systematic studies of the organization and development of these behavior patterns are reviewed by Ainsworth (1973a) and by Ainsworth et al. (1978).

The first type of attachment model reviewed here is the trait model. On examination it appears that theorists of diverse persuasions have implicitly conceptualized attachment in terms usually applied to the analysis of personality

traits. In research from many perspectives, attachment has often been operationalized in terms of a small number of behavioral indices (e.g., touching, looking, vocalizing, approaching). These indices are usually assumed to be correlated, and their use suggests that "intensity" is the major dimension along which attachment relationships would develop and differ. When this implicit trait model is made explicit, it is not widely accepted within any of the major developmental perspectives. Everyone seems to have had something more involved in mind. Trait models have certain inherent weaknesses, particularly their inability to deal with the context sensitivity and environmental responsiveness of infant behavior. Nonetheless, with some revision of the conventional trait model, trait-type models or descriptions can be of use in the design of specific studies and may find a place in attachment theory.

Behavioral systems models explicitly take into account the organization, context sensitivity, and environmental responsiveness of attachment behavior. Behavioral systems models tend to involve a normative point of view and focus on behavioral detail. Although they can incorporate trait-type variables to some extent, they are not easily applied to studies of individual relationships.

Models of relationships focus less on behavioral detail than on the global organization and functioning of behavior between two individuals across time. Although relationships differ one from another and although these differences can perhaps be expressed using global trait-type descriptions, relationship models explicitly emphasize that the object of study is the dyad. A relationship is not an attribute of either partner.

None of these models is necessarily or exclusively the tool of a particular ~ theoretical perspective. Even within a given theoretical framework, an

exhaustive description of infant-adult attachment would require attention to both behavioral detail and behavioral/interactive trends. Both the consistency and the environmental responsiveness of attachment deserve attention. And both the individual's contributions to interaction and the dyad's history of interactions have important implications for a developmental theory of attachment. Thus the models reviewed below are not alternatives but facets of descriptive analysis. If considering complementary models can help broaden the descriptive base within competing theoretical perspectives, then perhaps as a result the prospects for communication and integration across paradigms can be improved.

ATTACHMENT AS A TRAIT CONSTRUCT

What is a trait?

The study of trait constructs has long been the dominant paradigm in personality research. It entails both a theory of trait-type constructs and a model for the measurement of individual differences. According to the classic view of personality, traits are causal constructs. They are the prime determinants of behavior and are the basis for behavioral consistency across situations and across time.

In addition to a theory of trait constructs as major determinants of behavior, the trait paradigm involves a measurement model that assumes that (1) there is a single true score for each individual on each quantitative trait dimension and (2) there is a linear relationship between a person's true score on a trait dimension and his score on response measures (behavior, self-report, etc.) that index the trait in question. The model has generally involved the prediction that rank orders of individuals across situations are stable with respect to indices of a given trait, and by and large the paradigm has been associated with correlational studies of individual differences rather than experimental studies of groups and treatments.

In practice, trait constructs are operationally defined and validated by construction of reliable measures and by evaluating both the convergence of measures of the same construct and the independence of measures of theoretically unrelated constructs (e.g., Campbell & Fiske 1959).

Recently critics from within the field of personality research have taken exception to the notion of traits as underlying causes of behavior (Wiggins 1974) and, in the face of situationalist critiques of the entire individual differences tradition (e.g., Mischel 1968, 1973), they have suggested modifications of the classic view to take into account the environmental responsiveness of behavior that has been such a problem for the trait approach (Endler & Magnusson 1976).

In defense of traits, Wiggins (1974) argues that trait attributions can be appropriate characterizations of an action ("John clung to her affectionately") when they specify that an action belongs to a class of actions that are likely to lead to a particular social outcome. They can also be appropriate characterizations of persons when they are used as categorical summaries of a person's behavior to date ("So far, *affectionate* is the right word to summarize the general trend of John's behavior"). At the same time, Wiggins argues convincingly that trait language does not appropriately refer to (1) primary qualities of particular behaviors, (2) evaluative responses of the observer, (3) intentions of the actor, (4) tendencies of the actor, (5) conditions antecedent to the act, or (6) consequences of the act. In addition, he argues that, contrary to the classic view, traits are inappropriate as causal constructs. Traits are lost causes, patterns of consistency that require rather than provide explanations. As outlined below, these inappropriate uses of trait language correspond closely to the ways in which implicit trait models have typically been employed in attachment theory and research. Endler and Magnusson (1976) have provided a detailed comparison of trait and nontrait models in personality research. They have suggested that models that assess both individuals and situations and that focus upon the interaction of traits and situations offer promising alternatives to the classic trait approach. Both Wiggins's suggestions for more thoughtful use of trait constructs and Endler and Magnusson's suggestions for more elaborate models within the personality paradigm are highly relevant to the existing attachment literature.

Research on attachment as a trait construct

Coates et al. (1972a:218) have observed that "underlying (most recent attachment research) is the tacit assumption that the measures chosen are indices of a unitary trait (i.e., attachment). It is assumed, although seldom explicitly, that different measures such as staying close to the mother and crying following separation are closely correlated. Such interrelations are presumed to hold across time within particular subject samples, and also across samples and stimulus situations."

Procedurally, most research on infant-adult ties has been confined to the study of a relatively small class of individual behaviors in an even smaller set of laboratory settings. Unfortunately, the same measures and procedures are often used in research undertaken from trait (e.g., social learning) and nontrait (ethological) attachment models. This has been particularly true of the widely used Ainsworth and Wittig (1969) Strange Situation. This standardized laboratory procedure involves eight brief (3-minute) episodes and provides opportunities to observe a variety of the 12- to 24-month-old infant's responses to the stress of a new environment and of separation from an attachment figure. As outlined in Table 25.1, mother (or father) and infant are introduced into a room containing toys for the infant and chairs for the mother and another adult. After 3 minutes an unfamiliar adult enters, sits quietly, and eventually engages the infant in play. The mother is signaled to leave; after 3 minutes she returns and the stranger leaves quietly. After 3 minutes more, the separation-reunion sequence is repeated. The procedure was initially developed as an adjunct to an intensive longitudinal study of infant-mother interaction at home and was structured to allow observation of the infant in increasingly (mildly) stressful circumstances (new room, new person, separated but not alone, separated and alone).

The hypotheses by Ainsworth's group were not derived from trait formulations but from Bowlby's (1969) ethological theory. In addition, three distinct types of measurement were developed for analysis of the data: (1) frequency counts and time samples of particular behaviors (touch, look, approach, etc.), (2) scales to assess broad categories of behavior (proximity and interaction avoiding, contact resisting, distance interaction), and (3) a

classification system designed to assess the infant's ability to use the adult as a secure base from which to explore and as a source of security when distressed (secure versus insecure or anxious attachment).

Unfortunately, as a matter of convenience, the Strange Situation has become *the* attachment situation in most recent research and has served as a substitute for rather than an adjunct to field observation. Even more unfortunately, most of the research outside of Ainsworth's group has focused on the method of counting discrete behaviors. Because much of this research tacitly adopted a trait orientation, emphasis was placed on the quantity of behavioral output as an index of the strength of the infant-adult bond.

Table 25.1. Summary of Strange Situation Procedure

Episode	Persons Present	Time	Events and Procedures
1	M, B	Variable (approx. 1 min.)	M and B are introduced into S/ S room by E. If necessary, M interests B in toys before being seated. M does not initiate interaction but is responsive to bids from B
2	M, B	3 minutes	M remains seated and is responsive to bids for interaction but does not initiate
3	M, B, S	3 minutes	S enters and is seated; sits silently for 1 minute; talks to M for 1 minute; engages B in interaction and/or toy play for 1 minute
4	B, S	3 minutes (less if B extremely distressed)	M leaves room, S allows B to play alone but remains responsive to interactive bids. If B is crying, S offers contact and tries to comfort. If B refuses or resists, S does not persist. Terminate episode after
5	M, B	3 minutes	1 minute hard crying or on M's request M calls B from outside door and steps inside, pausing at doorway to greet B and to reach and offer contact. If necessary, B is held and comforted then reinterested in toys; otherwise, M is seated and remains responsive to bids from B but does not initiate
6	B	3 minutes (less if B extremely distressed)	M leaves room; B remains alone. Terminate episode if 1 minute hard crying ensues or on M's request
7	B, S	3 minutes (less if B extremely distressed)	S returns and is seated. If B is crying or begins to cry without pause, S offers contact and tries to comfort. If B cannot be comforted and crying continues (or on M's request), terminate episode
8	M, B, S	3 minutes	M calls B from outside door and steps inside, pausing at doorway to greet B and to reach and offer contact. If necessary, B is held and comforted and then reinterested in toys; otherwise M is seated and remains responsive to bids from B but does not initiate if B is content in toy play

M, mother; B, baby; S, stranger.

Source: Waters (1978).

Several major studies of infants ranging from 10 months to 3 years of age have examined the correlations of looking, touching, approaching, crying, and other presumed attachment behaviors both within a single laboratory session and across intervals of 4 months and longer (Coates et al. 1972a, 1972b; Maccoby & Feldman 1972). In addition, the same researchers have reported on the intercorrelations among these behaviors at various ages. Similar data from extended home observations during the first year of life have been reported by Ainsworth et al. (1972) and by Stayton et al. (1973). Although the results of these studies are complicated and numerous, Coates et al. aptly summarize much of the data:

Significant correlations were found at all ages among visual regard, touching, proximity to the mother, and among crying and three measures of orientation to the locus of her disappearance. Crying was correlated significantly with touching and proximity to the mother... There was some variation in the magnitude and patterning of the correlations

as a function of age and the social situation (before or after separation). The results provide some support for the hypothesis that the patterning of infant social behavior is sufficiently extensive to warrant use of the attachment concept. [Coates et al. 1972a:218]

The results of correlational analyses of discrete behaviors across repeated laboratory sessions are equally complex. In general, however, they have been interpreted in terms of trait-like consistency and/or substantive developmental change, and have generally led to a similar conclusion regarding the value of an attachment concept. Unfortunately these conclusions have not often been tested by relating discrete behaviors in the laboratory to behavior in other settings. Thus the notion that some infants are more strongly attached than others and the notion that attachment to parents wanes after the second year of life have rested primarily upon these data.

A recent critique

Masters and Wellman (1974) have used these same data in an influential critical assessment of the attachment construct. Based on the critical perspective employed by Mischel (1968), the critique is important not only for its analysis of the attachment research but also for the sweeping implications drawn by its authors concerning individual differences strategies in general. In brief, Masters and Wellman ask three questions of the data: (1) are scores on individual attachment behaviors stable within and across laboratory sessions? (2) are the behaviors scored strongly intercorrelated, as measures of the same construct should be? (3) are the behaviors used to measure attachment independent of nonattachment variables such as temperament or cognitive level?

Stability. The stability of four discrete behaviors scored in the Coates et al. (1972b) study was assessed by correlating scores for each behavior across the first, second, and last 3 minutes of a 10-minute nonseparation segment of their modified Strange Situation at age 14 months. Overall, only 5 of 16 correlations were significant in the two samples studied at that age. When data on the entire 10-minute nonseparation period were correlated with data from a 3-minute preseparation period the next day, only one of the four correlations was significant in both samples. Thus the rank order of subjects was not stable with respect to most of the discrete behaviors over even the shortest intervals.

The analyses of temporal stability in discrete behaviors over longer time periods (Coates et al. 1972b; Maccoby & Feldman 1972) yielded similar results, and a brief summary will suffice. The stability of visual regard, vocalization, touching the mother, and proximity seeking across segments of the same laboratory session at 10, 14, and 18 months in the Coates et al. data yielded only 30 significant correlations out of a possible 64. With a single day intervening between laboratory sessions at each age, only 3 of 12 correlations were significant. Over the periods 10 to 14 months and 14 to 18 months only 6 of 16 correlations were significant. Maccoby and Feldman (1972) report stability correlations for proximity seeking, looking, vocalizing, smiling, and crying in a modified Strange Situation from ages 2 to 2.5, 2.5 to 3, and 2 to 3 years. Overall, only 9 of 24 were significant, and of these 3 were less than 0.40. Thus Masters and Wellman (1974:223) conclude that "little stability of attachment behaviors was found if the intervening time was three minutes, one day, three months, four months, or longer."

Intercorrelations among attachment behaviors. Coates et al. (1972a) presented intercorrelations among discrete behaviors within preseparation and nonseparation segments by age. Overall, 25 of 48 correlations were significant. Many of these were the obvious correlations between seeking proximity to the mother and touching her (median $r = 0.83$). Maccoby and Feldman (1972) presented similar data by age and situation, and overall 20 of 60 correlations among attachment behaviors were significant. Thus the data do not strongly support the notion that the behaviors scored consistently assess the same attachment construct.

Independence of nonattachment measures. Masters and Wellman (1974) found few data from which to assess the extent to which discrete attachment behaviors are independent of theoretically irrelevant variables (e.g.,

temperament, intelligence quotient, social class). In view of the low stability and low levels of intercorrelation reviewed above, however, this would not seem to be a decisive issue.

In summary, Masters and Wellman extended their remarks about the unreliability of the data reviewed to include an assessment of the attachment construct that underlies much of the correlational research on discrete attachment behaviors. They concluded (1974:288) that "the correlational analysis of human infant attachment behaviors does not provide support for the concept of attachment as a psychological trait or as a central motive state. The stability and functional equivalence of theoretically relevant behaviors required by such conceptualizations is not found in the empirical data." As a procedural alternative to the analysis of individual differences, they suggest greater attention to normative data, especially to data reflecting the proportion of subjects whose behavior is affected in the same way (increase, decrease, no change) by various situational factors.

An evaluation

The Masters and Wellman critique is noteworthy for the approach to construct validation that it brings to the study of infant-adult ties. In addition, their review is useful in rendering the implicit trait model underlying so much attachment research more explicit. At the same time, its negative conclusions have discouraged interest in the attachment construct. After more than five years, their review has stimulated little theoretical progress and little methodological innovation, and it has foreclosed consideration of alternative non-trait, non-situationalist models. This seems premature because many of the "negative indications" discovered by Masters and Wellman, and indeed many of their conclusions (insofar as they concern primarily discrete behaviors), have been noted in previous literature.

Others are assimilable within alternative models of the infant-adult tie without the negative implications for an attachment construct implied by Masters and Wellman. For example, Bowlby (1969) has emphasized that behaviors serving the same function need not be positively correlated and may even be mutually exclusive (e.g., flight and freezing or approach and distance interaction). In addition, Baerends (1972) has provided excellent illustrations of the complex influence that time intervals and other aspects of method can have on correlations among behaviors. The same behaviors (e.g., preening and nest building) can be negatively correlated (mutually exclusive) in short intervals, uncorrelated in intermediate intervals (preening serving many functions), and positively correlated (both correlated with reproductive state) over longer intervals. Thus Masters and Wellman's critique itself deserves a critical evaluation, in part because non-trait models may yet be consistent with the data they review and in part because the data may at least warrant narrower conclusions than they offer.

Finally, Masters and Wellman's critique deserves critical evaluation if only because of the logic by which it proceeds from the data to its conclusions. As Cronbach and Meehl (1955) pointed out years ago, negative results in construct validation research are not readily interpretable. They could indicate that the measures employed have not measured the construct well; or they could mean that the experimental design failed to test (or poorly represented) the hypotheses derived from the theory in question; or they could indicate that the body of theory surrounding the construct is incorrect. Only the last possibility is seriously entertained in Masters and Wellman's critique.

Many of the shortcomings in the data reviewed by Masters and Wellman could, they concede, be remedied by the use of larger samples. Nonetheless, a critical review of the time-sampling procedures employed in most Strange Situation research reveals a problem that is a priori more crucial for the interpretation of negative evidence than is the overwhelming number of the nonsignificant correlations cited by Masters and Wellman.

In discussing their results on the stability of attachment behaviors, which they admittedly do not find overwhelming, Coates et al. (1972b) wondered

whether the evidence would have been stronger if they had used longer sampling intervals. Indeed, inspection of the reported means and standard deviations for their samples of discrete behaviors reveals that most of the behaviors

occurred at relatively low rates (many less than 1.5 per minute). In addition to the possible effect of range restriction on the expression of individual differences, it seems likely that 3- and 4-minute observations are too brief to provide reliable samples of individual differences. If so, this would have clear implications for the interpretation of negative results.

The most elementary fact of time-sampling methodology is that samples of a behavior must accurately estimate the parameters of the population from which they are taken (in this case, one subject's behavior) in order to be useful. In all behavior sampling techniques, the adequacy of a behavior sample is determined by the interplay of sampling interval durations, by the number of times and frequency with which intervals are sampled, and by the duration of each occurrence of the behavior, its rate of occurrence, and temporal patterning (see Altmann 1974). Where the criterion behavior is as rare as each of the discrete behaviors sampled in the Coates et al. nonseparation segments, a large number of observation intervals are necessary to obtain reliable estimates of individual scores. Samples of two, three, or five instances of a behavior easily show fluctuations of 20 to 200% on the basis of differences in behavior that should be trivial for the hypotheses under consideration. Is a child who looks at its mother once today and twice tomorrow twice as strongly attached in only a day's time?

One approach to this issue is afforded by the classical psychometric theory of test reliability (Nunnally 1967). If we consider each sampling interval (5-, 10-, 15-, etc.) to be an item scored pass/fail (i.e., the behavior occurs or does not) and consider the entire sample (usually 3 to 4 minutes) a test of so many items, we can easily compute an index of the dependability of individual scores (Cronbach's alpha). Because a major assumption of time-sampling methods is that the behavior is equally likely to occur in any sampling interval, we can make use of the simplifying assumption that each of our items has the same mean (difficulty level).

I have recently reported this analysis (Waters 1978) for data on looking, vocalizing, smiling, gesturing, approaching, and touching, using Strange Situation data comparable to those of Coates et al. and Maccoby and Feldman. The sample consisted of 30 infants at 12 and 18 months of age. For behavior toward the mother, median alphas were 0.46, 0.61, 0.51, and 0.57 for preseparation and reunion episodes of 6 and 7 minutes at both 12 and 18 months. Spearman-Brown estimates of alpha for the more typical 3- and 4-minute episodes are substantially lower (0.30, 0.45, 0.39, and 0.43, respectively). Behavior toward the stranger in preseparation episodes and separation episodes yielded similar low levels of reliability. These impose severe upper limits on how strongly each of the variables can correlate with itself across time or with other variables.

Spearman-Brown estimates of the length of time sample necessary to yield an alpha of 0.9 (maximum value is 1.0) were particularly telling as to the adequacy of typical assessments of individual differences in discrete attachment behaviors. The estimates for all but the most high-frequency behaviors (e.g., holding on to the mother during reunion) ranged from 20 to over 2,000 minutes (median 74, 34, 60, and 70 minutes for preseparation and reunion behavior to the mother at 12 and 18 months, respectively). These results suggest that the interpretation of low reliability, stability, and convergent validity of discrete attachment behaviors should focus on measurement failure and need not reflect upon the attachment construct at all in the present case. The assessment procedures employed in the research reviewed by Masters and Wellman seem to have been inadequate for reliable assessments of individual differences.

In the report cited above (Waters 1978), assessments based on Ainsworth's broader behavior scales and classification procedures yielded striking stability across the period from 12 to 18 months. In a subsequent study (Waters et al. 1979), similar assessments at age 15 months were strongly related to social competence in the preschool playgroup at age 3.5 years and were shown to be independent of cognitive level.

At present, hypotheses concerning trait-like consistency among discrete behaviors appear neither to have been demonstrated, nor disproved, nor even fairly tested. Moreover, the importance of stable individual differences in

attachment behavior at other levels of analysis remains largely unexplored. Alternatives to trait models are presented below, and although they do not entail a role for traits as causal constructs, they point to important roles for the study of behavioral individuality. But even when trait attributions are used in the manner proposed by Wiggins (1974), they clearly cannot support a comprehensive view of infant-adult ties on their own. We need to look into the behavioral systems that organize attachment behavior during interaction in order to understand what it is that an individual brings to social situations. We also need to highlight the sense in which infant-adult ties are relationships rather than properties of individuals.

ATTACHMENT AS A BEHAVIORAL SYSTEM

A relatively recent approach to the problem of organization and continuity in the context of flexible and changing behavior patterns is the analysis of systems underlying the structure of behavior (e.g., Miller et al. 1960; Baerends 1972; Bertalanffy 1969; Bischof 1975). The study of behavioral systems attempts to describe the mechanisms that organize behavior and contribute both stability and flexibility to social behavior. It is an effort to specify one aspect of the individual's contribution to interactive phenomena that are dyadic (if not even more complex) in nature. From a behavioral systems perspective, every individual brings an internal structural basis for coordinating and regulating behavioral and affective responses to any interactive situation. One great advantage of behavioral systems models over modified S-R and other linear models is their ability to take into account the effects of contextual variables that manifestly affect most social behavior. This is an important characteristic because the argument for situationalism in the study of behavior (Mischel 1968; 1973) depends upon the assumption that there are no models of behavioral consistency that can accomplish this. The development of models that can meet the situationalist challenge is one alternative to adopting situationalism by default rather than on its merits.

Characteristics of behavioral systems

The simplest model for a behavioral system is a thermostat, an apparatus for regulating the behavior of a heating plant. The basic elements of a self-regulating system are a *receptor*, which accepts some type of environmental input (e.g., temperature data); a *center*, which in some way reacts to the input; and an *effector*, which on a signal from the center generates some response to the environmental input (e.g., switch burner off). The output of the control system is monitored by a *feedback loop* to the receptor, which thereby apprises the system of the effects of its response (e.g., "It's cooling off now"). Continuous monitoring of the environment and reference to some standard (set point or set goal) makes self-regulation possible. More complex systems can, of course, be imagined.

Models of this kind have found wide applicability in research on animal behavior, as alternatives to teleological explanations and untenable drive models of motivated and apparently purposive behavior. Behavioral systems capture both the stability and the context sensitivity of behavior. At the same time, they are easily integrated into developmental models. This is because, in their more elaborate forms, behavioral systems share the following characteristics:

- 1 *Structure*. In contrast to unitary drives, behavioral systems have components. These include sensors, effectors, and comparators.
- 2 *Inter-reference*. The components of a behavioral system receive input not only about the environment but about the status of other components within the system. Insofar as this input influences the action of a given component, one component of a behavioral system can be part of the environment of other components. This is a major feature contributing to the ability of behavioral systems to take situational or contextual information into account in responding to a stimulus. It affords the opportunity to make a response conditional upon contextual variables and plays an important role in the development and organization of adaptive behavior.

- 3 *Selectivity.* Behavioral systems do not respond to every type of environmental stimulus or even to the entire range of stimuli from a single source. This is due in part to and is reflected in species characteristic constraints and biases in learning abilities.
- 4 *Calibration.* The goal of a behavioral system is specified by the values of internal parameters to which various inputs are compared. Homeostats have fixed values for these parameters. More complex designs may adjust the parameters in real time by reference to information about either internal or external events or states, as these bear upon the system's status relative to its environment.
- 5 *Integrity.* The components of a behavioral system are organized such that the system acts as a whole. That is, a response to a stimulus is not the interaction of several components' responses; it is the single (perhaps complex) response selected after all relevant inputs from components are compiled. A behavioral system may often generate behavioral outputs that compete with the output of another system, but a given system is not conceived of as competing with itself to produce a response.
- 6 *Need for support.* The behaviors initiated, modulated, or terminated by the effector components of a behavioral system are not properly part of the system. They belong to the animal's repertoire of action skills. Any action skill may at various times serve more than one behavioral system. In addition, a behavioral system may require input from the operation of relevant action skills during development in order to become properly organized and calibrated.
- 7 *Development.* Behavioral systems are not necessarily operative or even assembled at birth.
- 8 *Adaptation.* The developmental blueprint for a given behavioral system reflects a specie's long experience with an average expectable environment. In that context the system can provide relevant and adaptive response to environmental inputs. In other contexts, as a consequence of either developmental deviations or the type of inputs received, the system may not provide adaptive responses.

It may well be objected that models of this complexity violate the principle of parsimony. But it is important to remember that the principle of parsimony applies to the explanation of a phenomenon, not to its definition. Modified S-R models and causal trait models are parsimonious explanations of infant-adult ties only when we define these relationships in terms narrow enough to fit such models. Suppose instead that we first describe the behavioral basis of infant-adult ties in their own right and then search for parsimonious explanations. That is, suppose we allow that infant-adult ties exist in some substantive sense and that defining them to suit our models will not make them so. Suddenly modified S-R and causal trait models appear inadequate or become complexly ad hoc and cumbersome. The elegance and simplicity of behavioral systems models are most apparent when the behavioral complexity and context sensitivity of infant-adult ties are recognized and understood in detail.

Ethological/ control-systems theory

From a behavioral systems point of view, the hallmark of the infant-adult bond is a balance between attachment and exploratory behavior that has as its predictable outcome the maintenance of a certain access or degree of proximity to the mother. This is typically seen by the end of the first year of life. The control system that is said to organize this behavior regulates the infant's exploratory behavior, signaling and approach behavior, and contact-maintaining behavior by reference to an internal characteristic that Bowlby refers to as a *set goal*. A set goal is not a goal object but a degree of access or proximity to the adult that is maintained by periodic activation of increased rates of attachment (proximity-promoting) behavior. By specifying a number of internal and environmental inputs that can influence the calibration of the set goal, the model encompasses the observations that (1) infants seem to desire closer proximity or more contact when they are ill, tired, or frightened, (2) certain situations seem prepotent stimuli

to proximity seeking (e.g., darkness, unfamiliar settings, mother's absence), and (3) infants actively explore away from adults in coordination with proximity seeking rather than despite or at the expense of it.

Despite its originality and the contribution it has made in only a few years' time, Bowlby's theory has been subject to several pointed criticisms from within the psychoanalytic tradition in which he was trained. Most of the criticism concerns violations of cherished psychoanalytic concepts and dogma. Engel (1971), however, has added a number of incisive observations from the point of view of general systems theory to his reservations about Bowlby's interpretation of psychoanalytic theory. He points out, for example, that Bowlby's model is primarily a homeostatic mechanism designed to account for the infant's tendency to maintain a degree of proximity to adults. The mechanism is closed with respect to what Bertalanffy (1969) calls exchange of matter with the environment. That is, although set goals may be modified from time to time, the mechanism itself remains unchanged. Concepts of growth, development, differentiation, and accommodation are not as easily related to Bowlby's model as they might be to more elaborate models.

In addition, Engel observes that although a number of internal inputs (feelings) are allowed to modify the set goal in Bowlby's model, external events related to infant-mother distance are the major stimuli to action. When the set goal of the attachment behavioral system is viewed as a degree of proximity to an adult, it is difficult to explain the infant's tendency to be more readily upset by repetitions of separation-reunion experiences. Moreover, the effectiveness of alternatives to proximity (e.g., distal interactions such as showing, looking, vocalizing) is difficult to understand when the set goal is so defined. It also seems fair to suggest that if the evolution of an attachment behavioral system reflects nothing more than the advantages of proximity to adults, then this goal could be more economically accomplished by the evolution of a tendency to cling unremittingly than the evolution of a complex system to organize the balance between attachment and exploratory behavior. Finally, Bowlby's control system model does not seem to point the way toward integration of attachment behavior with control system formulations of other behavior patterns such as wariness, fear, play, and exploration.

Toward an ethological-organizational view of infant-adult ties

Ainsworth et al. (1978) have recently collected a large body of data relevant to Bowlby's theory. In the course of an extensive longitudinal ethological study of infant and caretaker behavior at home and in the laboratory, Ainsworth has both elaborated Bowlby's formulation and added descriptive insights of her own. Her work, along with a recent extension of Bowlby's control system model by Bischof (1975) and a recent review by Sroufe and Waters (1977a, 1977b), points the way toward an integrative view of infant-adult ties in terms of the organization of affect, cognition, and behavior in the structure of behavioral systems.

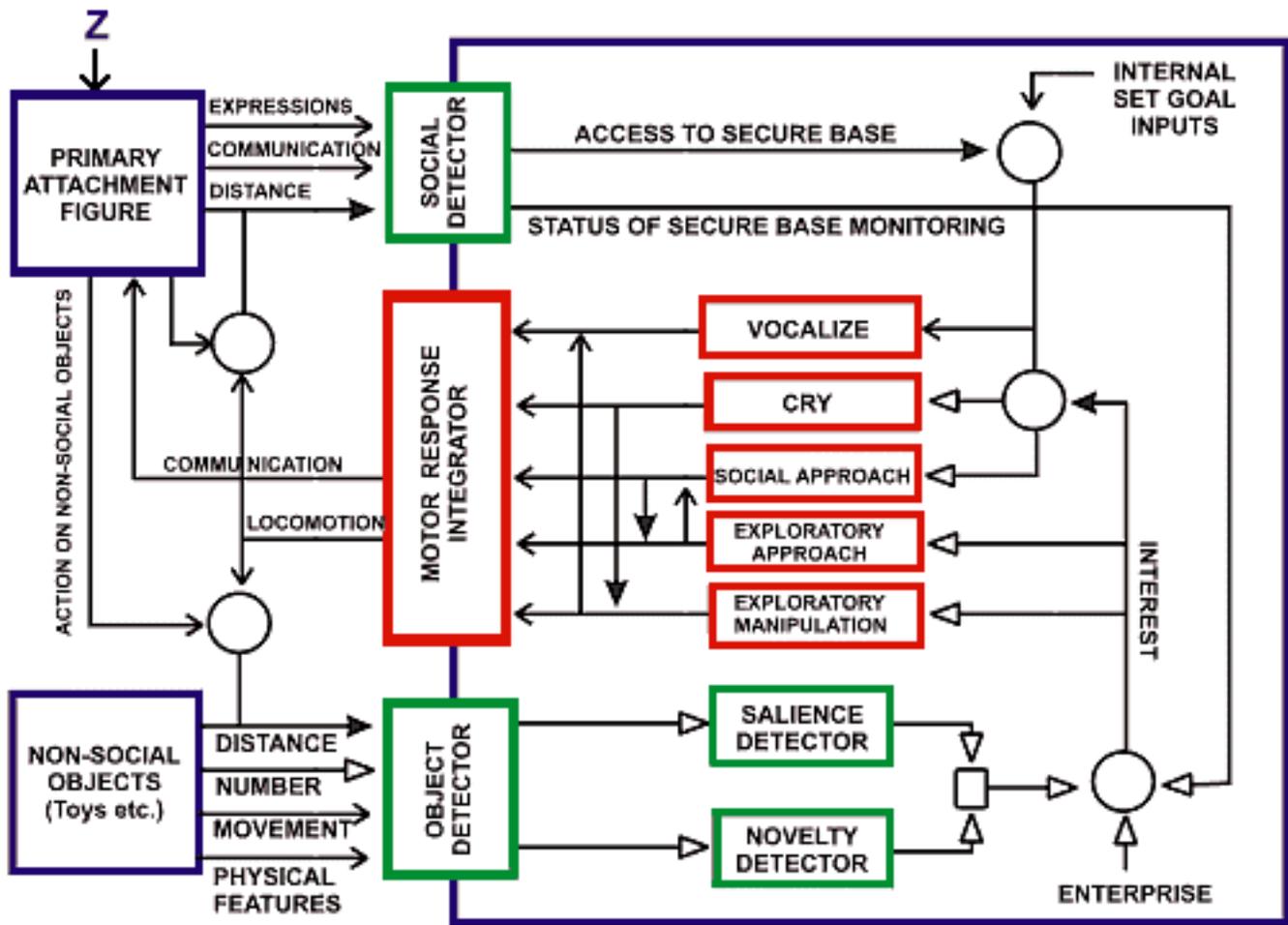
Ainsworth's major conceptual and descriptive contributions to an ethological-organizational view of infant-adult ties lie in her development of two related concepts, the attachment-exploration balance and the secure base phenomenon. In Bowlby's (1969) control system model, the set goal guiding the infant's attachment behavior was maintenance of a certain degree of proximity to an adult. Although this has the advantage of accounting for the goal-corrected aspect of the infant's behavior, it suggests unfortunate analogies with the imprinting phenomena observed in precocial birds and mammals. That is, it is essentially a unidirectional model. It defines inter-infant-adult distance in terms of the physical distance of the infant from the adult and thus overlooks complex aspects of the infant's active interest in the environment.

Ainsworth has reformulated the unidirectional model in terms of a bi-directional model of the attachment-exploration balance. A major function of the attachment behavioral system is to mediate the infant's excursions into the environment and to shift the balance of behavior from exploration to proximity seeking in response to various contingencies. Notably, Ainsworth points out that infants not only return to attachment figures in response to

external stimuli but also reliably approach, signal, or make contact as part of an ongoing monitoring of the adult's availability. The emphasis upon the attachment-exploration balance as the basic unit of analysis in observing the infant-adult tie is an important descriptive insight that has not been matched by modified S-R or causal trait analyses. Because the attachment-exploration balance is best observed during extended observations of a variety of behaviors in a variety of contexts, emphasis on this aspect of the infant-adult tie highlights the importance of coordinating laboratory observation with ethological studies of the infant and adult on their own territories. It also points to one possible disadvantage of equating a construct like attachment with one or a few behaviors without first evaluating patterning and functional equivalences that may be evident only in naturalistic settings and over a period of time.

The *secure base phenomenon* refers to the observation, mentioned above, that an infant often approaches an attachment figure spontaneously or seeks contact for affection as often as for comfort or safety. Within Ainsworth's formulation, the set goal of the attachment behavioral system is not the congruence of interpersonal distance with an internal criterion but rather the congruence of the infant's appraisal of a variety of internal and external inputs with a criterion of *felt security*. Affect is a major component of our experience in adult-adult ties, and the infant's distress and despair during separation and its happy greetings upon reunion suggest that affect is part of its experience as well. But in Bowlby's control system model, information (discrepancy) rather than affect is the primary influence on behavior. There is no evaluation of the meaning of a real world-set goal discrepancy. Loevinger (1976) has pointed out that the inability to explain the evaluative influences on behavior is one of the consistent failures of cognitive models of behavior and development. We are still unable to explain the origin of affect in infant-adult ties, but a first step is to recognize that affect and evaluative appraisals are major inputs into the attachment behavioral system. Recognition of the role of affect in the organization of attachment behavior has important implications for assessment that are described below.

Bischof (1975) has presented an elaborate general systems formulation of the attachment-exploration balance and has incorporated the notion of felt security into his model. And although he sees it as only a second step toward conceptualizing behavior in systems terms, it is an elegant integration of current theories of attachment, fear, and exploration. The model also suggests interesting possibilities for incorporating individual differences such as dependency and enterprise as co-determinants of the action of behavioral systems. In Figure 25.11 I have proposed a simplified and modified extension of Bischof's model of attachment and exploratory systems and their interactions. I have retained Bischof's notation and although the model may seem complex at first glance, it is in fact much simpler than an infant. A closer approximation to a complete model would certainly be vastly more involved. Nonetheless the model proposed here can convey the sense of a behavioral systems approach to the attachment construct; it can help summarize the observations and predictions upon which an ethological-organizational attachment theory rests; and in emphasizing the context sensitivity and environmental responsiveness of attachment behavior, it can vividly illustrate the limitations of simple trait models.



The symbols used in the model are as follows. Organisms and objects (e.g., primary attachment figure, nonsocial objects, infant) are enclosed by double lines. The larger system represents the infant, and only its internal systems are presented. Blocks indicate systems or subsystems within the infant system. These may involve either sensory processing or motor programming. Variables within the infant system are indicated by arrows. The orientation of the arrowheads indicates the direction of causation: Arrows pointing toward blocks (inputs) act on arrows leading from the same blocks (output variables).

Arrows originating in open space (e.g., internal set goal inputs) are influences not fully specified by the model but worthy of note. Arrows branch when a variable acts on more than one block. Open triangular arrowheads indicate that a variable is positively correlated with the output variables it influences. Solid triangular arrowheads indicate that a variable is negatively correlated with the output variables it influences. Two-line arrowheads indicate influences that can be either positive or negative and are not specified by the model. Small open circles represent an operation resembling addition (inputs are added or subtracted to determine influence on output). Small squares represent an operation resembling multiplication (if either input is zero, the value of output is zero). Note that only a few of the features of the primary attachment figure and of nonsocial objects that can influence the infant are indicated by arrows between these systems. The many external factors that can influence the primary attachment figure are represented by the single arrow, Z . Finally, within the infant system, arrows indicating motor outputs (more precisely, outputs to action skills) are connected by arrows simply to reflect a few of the operations accomplished during motor integration and that limit the value of single behaviors as indices of attachment.

The major differences between the present model and Bischof's involve the elimination of a complex array of motivational constructs and drives from the infant system, definition of causal arrows in terms more directly tied to attachment theory than to motivational theories, and specification of motor output interactions. In brief, the model specifies that the infant's attachment behaviors are complexly influenced in a coordinated manner by features of the social and nonsocial environment and by the structure of the attachment behavioral system. Within the infant system, exploratory behavior is influenced by characteristics of nonsocial objects, by an individual differences variable reflecting the consequences of past behavior (enterprise), and by the status of the secure base monitor (essentially a function of time away from the adult and/or change in the location or behavior of the adult). Similarly, proximity-seeking behavior is influenced by the accessibility of the primary attachment figure, by internal set goal inputs such as infant state, recent events in the environment, and perhaps by selected individual differences. In addition, proximity-seeking behavior is influenced by the degree of competing interest elicited by salient and novel objects in the environment.

In contrast to trait models that equate all instances of similar behaviors, the model distinguishes two types of locomotion, social approach and exploratory approach. The latter can be directed toward nonsocial objects, unfamiliar social objects, and even attachment figures, especially during play and interaction that involves sharing objects. Thus approach per se is not invariably an index of attachment, and approach to objects has different implications than approach to conspecifics. The model also specifies that related modes of motor response can be viewed as alternatives and that they need not be expected to show strong positive correlations, as required by trait models.

A much more complex model would be required to capture the actual complexity of the attachment-exploration balance, much less the variety of behavior in interactive play between infant and adult. The model proposed here at least has the advantage of pointing to the types of data needed for extensions of this approach. In addition, it defines the attachment-exploration phenomenon in a complexity that is closer to the behavioral details and at the same time apparently beyond the scope of the trait constructs that have dominated attachment theory for so long.

The attachment-exploration balance is so characteristic of the infant-adult relationship that Ainsworth (1973b; Ainsworth et al. 1978; Stayton et al. 1973) has suggested that clear evidence of this kind of organization in the infant's behavior in a variety of situations is the best criterion for the existence of an attachment to an adult in infancy. It is important to note that using this criterion the Strange Situation procedure is not an adequate technique for determining the onset of attachment. Indeed, Ainsworth has never used it for this purpose or for the purpose of assessing the strength of attachment relationships. The Strange Situation provides opportunities to observe a variety of behaviors that, if they can be validated against concurrent observations of the attachment-exploration balance in the field, can be used to assess individual differences in the adaptive functioning of the attachment behavioral system. This, of course, involves the complex problem of developing an appropriate measurement model and the elaboration of attachment theory along lines necessary to support this model. Progress in the assessment of attachment relationships through the use of behavior categories as an alternative to individual discrete behaviors and through the use of profile analyses and classification schemes has recently been summarized by Ainsworth et al. (1978).

Attachment As An Ethological-Organizational Construct: Redefinition and Implications

Attachment and the meaning of behavior. A wide variety of behaviors support the development of the attachment relationship or mediate proximity seeking and contact maintenance after attachments have formed. These have been labeled *attachment behaviors* because they have the predictable outcome of promoting infant-adult

proximity and interaction. This use of the term is consistent with Wiggins's (1974) suggestion that such labels should refer to likely social outcomes of a behavior rather than to some quality of the act itself. Unfortunately, the term *attachment behavior* has most often been interpreted in the latter sense. That is, because the behavior is identified with the attachment construct, it becomes an index of attachment when measurements are required (e.g., Coates et al. 1972a, 1972b; Feldman & Ingham 1975; Masters & Wellman 1974). Although this is entirely consistent with trait models discussed above, it is quite different from the meaning of attachment behavior within an ethological-organizational perspective.

A behavior is an attachment behavior by virtue of, and only insofar as, it is employed in the service of the attachment behavioral system. Most of the individual behavioral signs of the secure base phenomenon are independently present in the infant's behavior prior to the onset of attachment. Eventually these behaviors become integrated with the attachment behavioral system (or they do not) on the basis of experience (Ainsworth 1973b). And, as discussed above, any behavioral skill can serve more than one behavioral system. Sucking and proximity seeking are two clear examples. Bowlby (1969) identified nutritive sucking and nonnutritive sucking as behaviors that promote infant-adult proximity and contact; and yet sucking is also used extensively in exploration throughout infancy. Although it supports the infant's interest in the outside world, it is surely not an index of relationships formed with inanimate objects; nor does its absence in a father's arms mean that he will not become an attachment figure. Similarly, approach behaviors often serve the attachment behavioral system in the operation of the attachment-exploration balance. As such, they are often heightened by threats to the infant (separation, strangers, injury). Approach behaviors also serve the infant's active interest in exploring new environments. Infants often use adults as instruments of their exploratory goals: They find a new toy and carry it to an adult, not because they need proximity but because they need help. In other cases, an infant will approach an unfamiliar adult in what is clearly an exploratory approach rather than a sign of attachment. These approaches often include offering a toy and rarely end in physical contact; they are often followed by a full or partial retreat to an attachment figure, with continued visual regard of the unfamiliar adult. Exploratory approaches of this kind are influenced by the same variables as exploratory behavior toward toys. That is, they are clearly related to the exploratory side of the attachment-exploration balance and do not indicate attachment to an unfamiliar adult.

Cohen (1974) has suggested that because attachment relationships are focused or specific to one or a few figures, the best criterion for validating a behavior as an index of attachment would be differentiability toward presumed attachment figures. In her view, an attachment behavior should be shown more often toward a presumed attachment figure than toward a stranger. Unfortunately, because most behaviors that serve the attachment system can serve other functions as well, it seems possible to design situations in which any of them will be exhibited more often toward nonattachment figures. Needless to say, they remain attachment behaviors under the conditions and in the sense described above.

Whenever attachment relevance is viewed as a quality of a behavior, contextual influences are necessarily ignored. This problem is solved within an ethological-organizational approach by considering the structure and function of the attachment behavioral system when we interpret the meaning of behavior. In addition, we consistently consider the behavioral context in which behavior occurs whenever we attempt to define behavior categories. The importance of this is evident from Tracy et al.'s (1976) demonstration that approach behavior is strikingly differential toward attachment figures when an infant is distressed and when the behavior is defined as approach ending with a bid to be picked up. Approaches mediated by toys are either not shown differentially or are shown more often to nonattachment figures in nonstress free choice situations.

Main's research on active avoidance of the mother upon reunion (Chap. 26) provides excellent examples of the role of context within the ethological-organizational approach. When an infant is distressed by separation and yet refuses to look at or aborts a full approach toward its mother, the attachment behavioral system is clearly not

operating in the service of the usual set goal. Under other circumstances, however, an infant's refusal to abandon a toy or an infant's change of direction from the mother to a nearby toy seems to indicate that the infant is comfortably using the mother as a secure base from which to explore. The attachment behavioral system is working as usual. Observers can readily make these distinctions, though the scoring of avoidance does require training.

Maccoby and Feldman (1972) and Feldman and Ingham (1975) have scored avoidance operationally in terms of looking away from the mother, without consideration of context, and have failed to find consistency across time or the kind of correlates reported in Ainsworth et al. (1978). Avoidance is dismissed as "distraction" or preoccupation with toys. Nonetheless, Sroufe and Waters (1977a) have provided a degree of discrimination between distraction and active avoidance of attachment figures through the use of concurrent heart rate recordings. When avoidance is scored, some infants have failed to show characteristic heart rate deceleration in response to objects visually fixated during play. Close behavioral observation suggests that avoidant infants are in fact often looking through or past the objects of their apparent attention, and manipulation of the objects (if any) is often repetitive and stereotyped. This clearly gives the impression of displacement activity, which is Ainsworth's and Main's interpretation of active avoidance upon reunion. In addition, in a study of 50 infants, Waters (1978) reported that avoidance scores were clearly much more stable from age 12 to age 18 months ($r = 0.62$) than scores based on the number of times an infant looked at its mother ($r = 0.22$).

The point here is that within the ethological-organizational approach, the same meaning is not attributed to every instance of phenotypically similar behaviors. The meaning of behavior is acknowledged to be a function of context, including behavioral context. In addition, it is recognized that behaviors can be grouped into meaningful categories on the basis of criteria other than phenotypic similarity. Categories may consist of behaviors that have similar eliciting or terminating conditions, predictable outcomes, developmental histories, correlates, and so on, regardless of whether the behaviors also serve a variety of functions. Any behavior category is a construct and requires validation.

The meaning of attachment. From an ethological-organizational point of view, an infant is attached to an adult when its behavior toward the adult is organized in a manner characteristic of control by the attachment behavioral system. That is, the emergence of the attachment-exploration balance and the secure base phenomenon is the criterion for the presence of an infant-adult bond. To be attached to an adult means that the adult can play a specific role vis-a'-vis the operation of the attachment behavioral system. This requires that the infant be able to discriminate the adult from other adults, that he have acquired some expectations as to the adult's behavior in various situations, that infant and adult acquire a repertoire of reciprocal signals and behaviors to mediate interaction, that the infant have some internal mechanism for coordinating behavior toward the adult, and that this mechanism be attuned or sensitive to (calibrated for) features of the adult and the typical environment. Attachment is a product of learning, to be sure, but of a more complex learning experience than the accretion of so many discrete behaviors.

Masters and Wellman (1974), Gewirtz (1972b), and Cairns (1972) have objected to formulations in which the attachment is an entity residing within the infant. Rosenthal (1973) and Weinraub et al. (1977) have also objected to the idea of a structural basis for attachments. Rather than allow that there is an individual contribution to the dyadic phenomenon labeled *attachment*, they suggest that the attachment exists entirely within the interaction between infant and adult. According to the ethological-organizational point of view, however, there is a structural basis for attachment and it does reside within each individual. But it is not the attachment per se, and it does not completely define a relationship. What resides within the infant is the attachment behavioral system that mediates attachment behavior and a store of experience built up during interaction with the adult in question. Attachment figures are defined as those with respect to whom the attachment behavioral system can function.

It could be objected that conceding an individual contribution to the development and maintenance of attachments does not necessarily entail constructs such as the attachment behavioral system. Perhaps an individual brings nothing more than the familiar repertoire of social/cognitive problem-solving and role-playing skills to interpersonal encounters. That is, the individual contribution might not be as specific to attachment as the behavioral system concept implies. In this regard, it is worth noting that there are individuals who are unable to form attachments (McCord & McCord 1964; Rutter 1972). There is no evidence that a comprehensive explanation of this phenomenon (psychopathy) or of the *affectionless character syndrome* can be made by reference to specific cognitive deficits. Rutter (1972) has reviewed the literature on maternal deprivation and concluded that it is most clearly associated with *bond privation*, the failure to form bonds early in life. From an ethological-organizational point of view, this suggests that the attachment behavioral system is never fully established in these cases. The organization of behavior but not the content of the behavioral repertoire would thus be deficient. This hypothesis is consistent with the clinical picture in such individuals, and thus the hypothesis of an attachment-specific individual contribution to interpersonal ties finds some support here.

Strength of attachment. When attachment is thought of as a unitary drive or causal trait and operationalized in terms of the amount of attachment behavior shown, the major dimension of individual differences becomes the strength of the attachment. The more attachment behavior, the stronger the bond.

When we study infants of an age at which attachment relationships are first developing (7 to 10 months), it seems reasonable to suggest that the more often aspects of the attachment-exploration balance are seen, the more confident we can be that an attachment behavioral system is in operation. Later (12 to 24 months), when all normal home-reared infants can be assumed to have formed attachments to at least one or a few adults, neither the operating characteristics of the behavioral system nor the qualities of the relationship with an attachment figure can be described by the amount of behavior seen. Analogies are easy to think of: The more often a man goes to the bank, the more confident we are that he has some money in an account. But we cannot infer from the frequency of his visits how much money he has or what he plans to do with it or even that he manages his finances well.

From an ethological-organizational point of view, the strength of an attachment bond could perhaps refer to the resistance of the bond to dissolution. How much time and experience would be necessary for an attachment figure to become a neutral input to the attachment behavioral system under all circumstances? For adults this can often take years, if it is accomplished even then. And it clearly is not correlated with either the amount of interactive behavior that typified the relationship before the separation or the degree of protest or distress after separation. Strength of attachment is a concept more akin to the notion of penetrance of relationships, discussed below, than to any operating characteristic of a behavioral system. Although the term *strength of attachment* does mean something, it does not correspond to the dimensions of individual differences that are usually of interest in developmental research. Moreover, it does not seem to be a concept amenable to ethical developmental research.

Development. Operationalizing attachment in terms of one or a few criterion behaviors (usually separation protest and/or following) has led to the conclusion that attachments emerge fully formed toward the end of the first year of life (Coates et al. 1972a; Shaffer & Emerson 1964). Attachment is said to be present when the indices of strength are greater than zero. This view certainly does not leave much for the developmentalist to do, beyond observing the frequency with which discrete behaviors arise during the second year of life and then decline.

The view that attachment relationships emerge fully formed and then change only in intensity is not consistent with the view that attachment is based on the operation of a behavioral system. Behavioral systems develop; they have to be put together, and they change across time. Stayton et al. (1973) have reported a developmental progression in infant responses to separation that seems to reflect the development of a behavioral system rather than the emergence of a unitary drive or a fully formed behavioral trait. Their observations of routine separations at home (mother moves from room to room or leaves the house briefly) indicate that the infant's earliest responses to

separation involve only positive greeting of the adult on reunion (early in the second quarter of the first year). Separation protest was seen late in the second quarter, followed by some instances of continued crying and mixed greetings on reunion early in the third quarter of the first year. Following in response to separation emerged late in the third quarter of the first year. From a behavioral systems point of view, these observations are much more interesting for what they tell us about the organization and control of behavior than they are for what the data on individual behaviors might tell us about the onset of strength of an infant-adult tie.

Finally, from a developmental point of view, the concept of strength of attachment has the disadvantage of implying that beyond the second year of life, attachments must either weaken or become a developmental liability. Emphasis on the secure base phenomenon, however, suggests that flexibility rather than dependency is the hallmark of the typical infant-adult tie during the end of the first year and into the second year of life. Attachment is not normally the antithesis of interest in the environment. Thus it seems important to work toward a conceptualization in which infant-adult and later adult-adult ties can be viewed as assets in the development of competence rather than as liabilities.

ATTACHMENT AS A RELATIONSHIP

Both trait constructs and behavioral systems models refer to individual contributions to interactive social situations. Neither explicitly refers to the history of interaction that characterizes each infant-adult dyad. Indeed neither explicitly analyzes attachment as a dyadic phenomenon with a history or affords a means of describing differences in the attachment relationship either across time or across dyads. Thus the concept of a relationship seems indispensable to any definition of the child's tie to an adult (or an adult's tie to a child). It captures the breadth of interactions that constitute interpersonal experience, and it provides descriptive insights into qualitative differences that are not encompassed by the notion of the strength of a tie. The analysis of relationships also has the advantage of placing the infant-adult tie and its constituent interactions in a broader temporal framework than trait attributions have in the past. Relationships develop and change in time, and yet retain a quality that Hinde and Stevenson-Hinde (1976) call *dynamic stability*. The issue of stability or continuity within change is a central one in developmental theory, and it seems that detailed behavioral description, analyses of behavioral systems, and judicious use of trait attributions can each play important roles in efforts to face the issue.

The feasibility of characterizing relationships, and the advantages of doing so where feasible, have been demonstrated in several ethological studies of infant responses to separation and reunion. Hinde and Spencer-Booth (1971, 1971a) have demonstrated that the distress shown by infant rhesus macaques after reunion with their mothers is related to certain aspects of the infant-mother relationship prior to separation. In particular, measures of how often the infant's attempts to gain contact with the mother were rejected, and measures of the infant's active role in maintaining mutual proximity to the mother when they were not in contact, were related to the infant's ability to be comforted by contact. Ainsworth et al. (1971) have demonstrated similar phenomena in human 1-year-olds. And indeed, a wide range of studies within the ethological perspective point to the generalization that the quality of relationships rather than the quantity or intensity of interaction is the better predictor of the development of social competence (see Ainsworth et al. 1978 for reviews).

Hinde (1975, 1976; Hinde & Stevenson-Hinde 1976) has recently outlined a view of the relationship between social interaction and social relationships. Both the theory and its application provide descriptive insights that would not have been possible within the quantitative trait paradigm. At the same time, they offer new opportunities for the assessment of dimensions of infant-adult ties that with appropriate measurement models, may reveal greater consistency than has been apparent in studies of discrete behaviors. They also suggest possibilities for the descriptive use of trait attributions in developmental theory.

Describing relationships

A relationship involves a series of interactions (Hinde 1976). One reason that modified S-R models cannot capture qualities often attributed to relationships arises from this fact. The determinants of interactive behavior between individuals who have a long history of interaction do not necessarily lie within a given interaction. They often lie in the (relatively) remote past.

To describe relationships, it is necessary to describe both the content and quality of interactions that occur within the relationship.

It is necessary to describe what A did to B (and B to A). They may for instance be talking or fighting or kissing. In addition we must specify how they are doing it - are they talking in an animated or dispassionate fashion? What are they talking about? Are they fighting savagely? Kissing passionately, tenderly, or dutifully? In more general terms, to what extent are they involved in what they are doing? To what extent are the different aspects of their behavior consistent with each other?. We may refer to such properties of interactions as qualities, without of course any implication that they cannot be subjected to quantitative treatment. In human interactions such qualities can be as or more important than that the interactants actually did together.

[Hinde 1976,p.3]

In addition to the content and qualities of interactions, it is also necessary to describe how the interactions are patterned, their absolute frequencies, relative frequencies, when they occur with respect to each other, and how they affect each other. Ultimately, we make an abstraction in characterizing a relationship from observations of interaction. The contrast to the cumulative discrete behavior approach lies in taking the meaning of behavior into account, that is, in paying attention to the behavioral context of behavior, in realizing that all instances of a behavior are not equivalent. This is contextualism as opposed to situationalism.

Dimensions of relationships

In addition to the methodological and measurement problems discussed above, trait theories of attachment have consistently narrowed our view of the range of individual differences in infant-adult relationships. Overemphasis on the strength of infant-adult ties will not be corrected by improving methodology and measurement techniques. We need to develop a broader conceptual framework in which to define the attachment construct.

Hinde (1976) has suggested a number of dimensions along which relationships can be said to differ: (1) content of component interactions; (2) diversity of interactions; (3) reciprocity versus complementarity; (4) qualities of component interactions; (5) relative frequency and patterning of interactions; (6) multidimensional qualities (e.g., "warmth," "rejectingness"); and (7) levels of perspective. There are undoubtedly more that could be added to the list. But a brief outline of the relevance of these dimensions to the description of infant-adult relationships will demonstrate the sense in which we often narrow our perspective when we define the attachment construct to fit a point of view (be it social learning theory, strict operationism, quantitative trait theory, or a preference for a particular methodology).

Content of interactions. The quality of any relationship may depend on the presence or prominence of certain types of interactions. Infant-mother attachment relationships certainly entail many different kinds of interactions that are never observed in the laboratory or that cannot be captured in terms of discrete behavioral acts (e.g., categories of interactive behavior such as play, affection, punishment). We can use the content of interactions to distinguish among types of relationships (e.g., friendship versus love), as well as to distinguish between different relationships of the same type. For example, we are more likely to describe a relationship as harmonious if there is a predominance of positive affect in interaction and if interactions are initiated and concluded without conflict rather than if negative affect and conflict predominate. Brief observations are not well suited to these types of data, nor are observations in only one or a few contexts or occasions.

Diversity of interactions. Some infant-mother relationships are largely characterized by routine caretaking, whereas others appear to have more breadth, a wider range of interactive patterns. Some mothers may see their interactions with their infants in terms of a few types of interaction, whereas others view the same behaviors in more highly differentiated terms. One feels trapped; another finds it anything but routine. All relationships change in the diversity of interactions across time, a fact not reflected in the analyses of Strange Situation behavior. Hinde (1976:5-6) discusses several reasons for the diversification of interactive behaviors within a relationship.

Reciprocity versus complementarity. Infant-adult interactions are dyadic affairs. That is, they are better viewed in terms of the role each partner plays in the behavior of the other than in terms of the behavior of each taken alone (Cappella 1981; Hartup & Lempers 1972; Hinde & White 1974; contributors to Lewis & Rosenblum 1974). When both participants in an interaction show similar behavior patterns, the interaction is said to be reciprocal in nature. When the interaction is carried out by the meshing of different repertoires of behavior, the relationship is said to be complementary. Infant-adult interactions are, by nature, complementary in the beginning. But dyads differ in the extent to which complementarity is developed. Insofar as a mother allows and facilitates her infant's participation in interaction, she is laying the foundation for the later development of reciprocity, in what Bowlby (1969) calls a *goal-corrected partnership*. Ainsworth has spoken of this aspect of interaction in terms of the mother's cooperation versus interference with the infant's ongoing behavior (Ainsworth et al. 1971, 1977). Hinde proposes that complementarity and reciprocity in interactions and the extent to which interaction is codetermined or unilaterally dictated are important determinants of both stability and change in relationships.

Qualities of interactions. One important quality of interactions within relationships is the extent to which the behavior of one partner is coordinated with or meshes with the behavior of the other. Ainsworth has discussed maternal sensitivity to infant signals in just those terms (Ainsworth et al. 1971). Sensitivity involves (1) perceiving the signal, (2) correctly interpreting it, (3) selecting an appropriate response, and (4) delivering the response in a timely (or contingent) fashion. A given maternal behavior in response to a signal may be timely and appropriate, or it may be inappropriate or too delayed for the infant to notice the contingency. Sensitivity or contingent responsiveness may be characteristic of a wide variety of interactions or limited to one or a few domains (e.g., play but not feeding or other caretaking situations). There are, of course, many more qualities of infant-mother interactions that could be mentioned. Because the rewards obtained in a relationship may depend not only on what the participants do together but also on how they do it, Hinde suggests that qualities of interactions may be of crucial importance for the stability of relationships.

Relative frequency and patterning of interactions. We are not always interested only in the absolute frequency of different behaviors or types of interaction. For example, the relative rather than absolute frequency of maternal behaviors is the key characterizing interactions as responsive or unresponsive. In addition, certain emergent qualities of interactions (e.g., consistency) are not characteristic of any one interaction but only of the patterning of interactions across time.

Multidimensional qualities. Many qualities of interactions cannot be identified with the presence/absence or intensity of a given behavior, but depend instead upon the concurrence of a number of characteristics. Many everyday judgments about relationships turn out to depend on such multidimensional observations. For example, Hinde (1976) suggests that we are most likely to describe a relationship as an affectionate relationship (or bond) if:

1. It involves a diversity of interactions
- 2 It is of long duration
- 3 Both partners act to regain proximity when separated from one another
- 4 The behavior of each is organized in relation to the ongoing behavior of the other

5 The presence of the partner alleviates distress due to strange objects or situations

6 Actions conducive to the welfare of the other are likely to be repeated

Not all of these characteristics imply bonding or attachment, nor is each always present in such relationships. This characterization points, among other things, to the weakness of unidimensional characterizations of relationships (as in strength) and to the inherent weakness of simple operational definitions of multidimensional phenomena. It also makes clear that such qualities will be hard to assess from brief observations of a few behaviors in only a few contexts on only a few occasions.

Levels of perspective. Relationships differ in the level of cognitive complexity with which either or both partners view themselves, each other, the relationship, and so on. They also differ in terms of the congruence of perspectives within a relationship. Infant-adult relationships are strikingly asymmetrical in this respect. In addition, some adults are more realistic than others in their view of what they or their behavior means to an infant. As mentioned above, a major goal of the analysis of infant-adult interaction is to analyze the behavior involved in terms of the level at which it has an impact upon the infant or adult. It is worth repeating that it is not enough to "call them as we see them." In the study of infant-adult ties, attention to levels of perspective implies careful attention to developmental level, probably more attention than we see in comparisons of 12-month-old and 3-year-old behavior in the Strange Situation. Do such comparisons tell us more about the nature of the parent-child tie at different ages or about children's perceptions of the Strange Situation?

Prospects for the study of relationships

The view of relationships sketched here affords opportunities that have not been seized upon in previous attachment research. First, it offers a level of analysis and a unit of analysis that complements both the trait and the behavioral systems approaches. Whereas the trait and behavioral systems models emphasize the individual and his contribution to interaction, the relationship perspective emphasizes the dyad as the basic unit of analysis and focuses on the interactions to which the individual contributes. In this regard, recent suggestions that we shift from emphasis on individuals to emphasis on interactions (e.g., Weinraub et al. 1977) seem as limiting as the imbalances they propose to correct. The coordination of individual and dyadic levels of analysis seems to offer more and can play an important role in expanding our descriptive approach to attachment phenomena and their adaptive significance.

So far, the dimensions of relationships outlined above represent only an early conceptual analysis. The approach is continuing to evolve, and at some point conceptual dimensions will have to be operationalized in terms of measures. In developing means of measuring dimensions of relationships, we would do well to learn from our experience with trait constructs in earlier attachment research. We should recognize the power of the individual-differences measurement models developed within the trait paradigm and take advantage of them in the assessment of dyadic relationships. We should also take advantage of the approaches to reliability and validity developed within that tradition. At the same time, the relationship between measurement models and the construct being measured needs to be kept more explicit than in the past. Relationships can be assessed in terms of dimensions without assuming that these dimensions are causal influences on the behavior of the individuals involved and without assuming that relationships are not responsive to environmental influences. But these are tempting modes of thinking after so much practice. Wiggins's (1974) and Endler and Magnusson's (1976) papers are well worth rereading with the problem of assessing relationships in mind.

Finally, the study of relationships seems to offer new and concrete prospects for interdisciplinary analyses of attachment phenomena. The prospects for fresh input from sociological, anthropological, and social psychological research and theory seem particularly inviting because these approaches have been kept at arm's length by our overemphasis on the individual as the unit of analysis. In brief, the consideration of models of the attachment construct offers fertile ground for cross-paradigm communication and promises at least to broaden our descriptive

view of attachment phenomena. It is hoped that the effort will foster more constructive communication across theoretical orientations as well.

SUMMARY

Cross-paradigm communication in the study of infant-adult ties has long proven difficult. The problem appears to lie in part in the failure to look beyond theoretical (psychoanalytic, social learning, ethological) orientations in order to examine models of the attachment construct. Most attachment research has implicitly involved a causal trait model of the construct. This has led to emphasis on intensity or strength of attachment bonds as the major dimension along which relationships develop and differ.

Trait models generally imply that (1) trait dimensions (e.g., dependency) are the major determinants of behavior, (2) individuals' scores on trait dimensions are related to response measures in a simple linear manner, and (3) individual differences on trait dimensions are stable over time and situations. In more recent formulations, trait language is used only to summarize consistency in behavior, not to explain behavior. In addition, recent approaches have moved toward recognition of the environmental responsiveness of individual differences.

The most influential critiques of the attachment construct are in fact critiques of the classical trait concept and have limited empirical or conceptual implication for the study of attachment from other perspectives. A behavioral systems approach to infant-adult ties emphasizes the mechanisms that organize attachment behavior and coordinate it with exploratory behavior. This model can help analyze the individual's contribution to social interaction and present a much more complex descriptive picture of attachment phenomena than is often reflected in laboratory-based attachment research of the past.

Models of relationships emphasize the infant-adult dyad as a unit of analysis and suggest dimensions along which relationships differ. The analysis of relationships complements the study of behavioral systems, and both suggest roles for the study of individual differences variables. It is to be hoped that consideration of models of the attachment construct will facilitate broader descriptive research and constructive communication across paradigms in the study of this important aspect of behavioral development.

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