Toward a Neo-Piagetian Theory of Cognitive and Emotional Development

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In the present article, a view of children's emotional development is articulated that is consistent with, and which seems necessary to supplement, current neo-Piagetian theories of intellectual development. The basic assumption is that cognition and emotion are generated by different systems, each of which is necessary to normal functioning, and which together produce the structures that are characteristic of normal human development. On the basis of this assumption, it is hypothesized that any change in one system will have a concomitant or subsequent effect on the other. In particular, it is hypothesized that the arrival at a new cognitive-developmental stage will influence (A1) the types of emotions children are likely to experience, (A2) the types of situations in which they are likely to display these emotions, and (A3) the nature of the control structures they can develop for dealing with these situations and/or the emotions they elicit. At the same time, and reciprocally, it is hypothesized that exposure to certain specifiable emotional situations will have the potential to influence (B1) the amount of time children spend in epistemic activity, and hence their rate and terminal level of cognitive development, (B2) the particular directions in which they channel their epistemic activity, and hence their cognitive-developmental profile or their cognitive style, and (B3) the efficiency of their basic cognitive processes, either general or specific. The paper concludes with three preliminary tests of these hypotheses. The first study tests hypotheses A1 and A2 by examining the emotional responses of children at different cognitive stages to a situation where their mother ignores them for another child (either a newborn baby or a peer). The second study tests the same two hypotheses longitudinally, by examining infants' emotional reactions to a brief separation from their mother as they approach and then pass into a new stage of cognitive development. Finally, the third study tests hypotheses B2 and B3, by assessing the cognitive development of children who are either emotionally disturbed or normal, and who either have or have not experienced the death of a loved one at an early age. © 1988 Academic Press, Inc.

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Over the past 10 years, a variety of neo-Piagetian theories have emerged (Case, 1978, 1985; Fischer, 1980; Halford, 1982; Mounoud, 1986; Pascual-Leone & Goodman, 1979). In most of these theories, the core assumptions of classical Piagetian theory have been preserved. These include its assumptions about the constructive nature of human thought, the universal levels through which this thought progresses, and the structural relationship that exists between one level of thought and the next. At the same time, a number of new assumptions have been introduced, ones which are intended to correct perceived deficiencies in the classical Piagetian system. Very often these new assumptions have been drawn from the framework provided by contemporary cognitive science (e.g., Chomsky, 1957; Newell, Shaw, & Simon, 1958), or by the historicocultural view of intellectual growth (e.g., Bruner, 1964; Vygotsky, 1962).

In the present article, we present a view of children’s emotional development that is consistent with, and which seems necessary to supplement, one particular neo-Piagetian theory, the one with which we ourselves have been most closely associated (Case, 1985). More specifically, we present our own particular view of the way in which children’s emotional processes change with age, and the reciprocal relationship that exists between these changes and those which take place in the intellectual realm.

Such an endeavor is very much in the spirit of the times. In recent years, a growing number of investigators have begun to study developmental phenomena in which both emotional and cognitive changes play a role (e.g., Bretherton & Waters, 1985; Haith & Campos, 1977; Fast, 1985; Fischer, 1981; Fischer & Pipp, 1985; Emde, 1983; Gouin Décarie, 1978; Gnepp & Gould. 1985; Izard, 1978, 1984; Izard & Malatesta, 1984; Kagan, 1983; Klinnert, Campos, Sorce, Emde, & Svejda, 1983; Pascual-Leone, 1983; Sroufe, 1979; Stern, 1983). As a result of this work, a number of interesting general models have also been proposed in an attempt to spell out the relationship between these two strands of development as clearly as possible, and to provide a framework for interpreting and guiding further empirical research (e.g., Izard, 1978; Kagan, 1983; Sroufe, 1979). As yet, however, no such general model has been proposed which adopts a neo-Piagetian perspective.

That is our objective in the present article. In keeping with this objective, we have adopted the following organizational format.

1. In the first section, we present a number of propositions about the human cognitive system and its development, which are drawn from recent neo-Piagetian work in this area.

2. In the second section, we present a number of additional propositions about the emotional system and its development, which are drawn
from the current experimental, neurological, ethological, and clinical literature.

3. In the third and fourth sections, we attempt to combine the propositions from the first two sections in a way that suggests a number of new hypotheses, particularly concerning the way these two strands of development may be related.

4. Finally, in the fifth section, we describe our ongoing efforts to evaluate and refine some of these hypotheses through empirical investigation.

I. A NEO-PIAGETIAN THEORY OF INTELLECTUAL DEVELOPMENT

In the present section we outline the three sets of postulates which form the core of our own theory of intellectual development. We also indicate the extent to which each postulate is or is not consistent with classical Piagetian theory, and with the theories that have been proposed by other neo-Piagetian theorists.

A. Competencies that are Present from Birth

A1. The first postulate is that infants' earliest cognitive structures are of two general types: (i) those which represent recurrent patterns of stimulation (figurative schemes), and (ii) those which represent operations that can be executed when a particular figurative scheme (or group of schemes) is present. The distinction between figurative and operative schemes is of course one which has its roots in classical Piagetian theory (Piaget, 1969). With the exception of Pascual-Leone (1983), no other contemporary neo-Piagetian theorist has placed much weight on this distinction. However, the distinction is also not one which has generated any serious controversy. Thus, the first postulate may be treated as being consistent with both classical and contemporary Piagetian theory.

A2. The second postulate is that, from the age of birth, the activation of any scheme or set of schemes is experienced by the young infant as having a particular affective character, either positive, negative, or neutral. Once again, this assumption is consistent with classical Piagetian theory (Piaget, 1981), and with most neo-Piagetian theory and research as well.

A3. The third postulate is that, from the age of birth, infants can exercise at least some degree of control over their own cognitive and affective experience. Whether this assumption is consistent with classical Piagetian theory is open to debate (cf. Piaget, 1952, 1954). In most neo-Piagetian theories, however, the notion of control plays an extremely central role (e.g., Case, 1978, 1985; Fischer, 1980; Pascual-Leone & Goodman, 1979). Moreover, at least in the present theory, the assumption is that such control is present from birth onwards.

A4. The final postulate is that the structures which permit children to
exercise this sort of control consist of temporally organized sequences of
figurative and operative schemes, which may be parsed into three com-
ponents: (i) schemes representing some particular state in which the child
recurrently finds itself, (ii) schemes representing some other state which
has a higher affective value, and (iii) schemes representing the sequence
of operations which will take the child from one of these states to the
other. This particular parsing of children’s mental activity is unique to the
present theory, and derives from the work of Newell et al. (1958). How-
ever, once again, there is nothing in this parsing that is inconsistent with
the work of other contemporary neo-Piagetian theorists.

B. Structural Changes That Take Place in the Months and Years
following Birth

The second set of postulates concerns the age-related changes that take
place in children’s earliest control structures, during the course of their
subsequent intellectual growth.

B1. Although each control structure represents a device for dealing
with a different and reasonably specific external situation, all control
structures nevertheless undergo a similar set of transformations with
time, given exposure to an appropriate environment. This assumption is
one which derives from classical Piagetian theory, although the emphasis
on structural specificity is more pronounced in the present theory. Once
again, this postulate is one to which most other neo-Piagetian theorists
are committed.

B2. The second postulate is that four major transformations take place
between the age of birth and 18 years, with the result that four general
stages of development may be identified. As we have indicated elsewhere
(Case, 1986), current neo-Piagetian theorists are divided as to whether to
postulate three or four major stages in development, a division that can
be traced to Piaget’s own inconsistency on this same point. The present
position, however, is that the four-stage division of cognitive develop-
ment is the more promising.

B3. The third postulate is that the structures of any one stage bear a
hierarchical relationship to those of the previous stage. That is, at each
stage, the control structures which children assemble are comprised of
two hierarchically integrated structures, each of which was consolidated
as a distinct and qualitatively unique entity in its own right during the
previous stage. Once again, this postulate has its origins in classical Pia-
getian theory, and finds its counterpart in virtually all neo-Piagetian theo-
ries as well.¹

B4. The fourth postulate is that, within each major stage, a universal
sequence of three substages may be identified, namely the substages of

¹ An apparent exception is Mounoud’s (1986) theory, in which the transition to a new
stage takes place due to the maturationally based emergence of a new level of "code."
unifocal, bifocal, and elaborated coordination. This proposition has its origins in the Piagetian notion of vertical décalage. However, as Pascual-Leone (1986) has pointed out, it is a good deal stronger and more precise, in that it proposes a developmental recycling that is both qualitative and quantitative in nature. In the present theory, it is presumed that the major feature which distinguishes the three substages is the number of elements that children can coordinate in order to achieve the control they desire. An implication is that, while each substage is quantitatively more complex than the previous one, it does not entail the same sort of major transformation as occurs across stage boundaries, when the change is primarily in the level of *abstraction* of children's basic operations. This latter proposition also features prominently in the theories of Fischer (1980) and Mounoud (1986).

B5. The final structural postulate is that, under normal rearing conditions, each stage and substage of development is traversed during a characteristic time period, across whatever range of content domains is of greatest cultural significance. The particular age ranges and structural forms that are proposed in the present theory are shown in Fig. 1, and will be referred to again in subsequent sections. It should be noted, however, that these ages bear a reasonably good resemblance to those postulated by most other neo-Piagetian theorists, even those who divide development into three rather than four major stages.

C. Factors Underlying the Process of Structural Transformation

The final set of postulates concerns the underlying processes that govern the transition from one stage or substage of development to the next.

C1. The first postulate is that structural development depends on a number of elementary information processes such as schematic search, evaluation, retagging, and consolidation.

C2. The second postulate is that these elementary processes form a natural part of children's day-to-day activities, both those that are independent, and those that are socially facilitated. They form a particularly important part of children's *independent exploration* and *problem solving* on the one hand, and their *imitation* and *mutual regulation* on the other. Both of these first two postulates are unique to the present theory; however, the general conception on which they are based is not. This is that there is no need to postulate some special form of activity such as "reflective abstraction" or "conflict-resolution" in order to explain the stage transition process.

C3. The third postulate is that, regardless of the general process by which it is produced, children's capability for schematic integration is

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Even in this theory, however, it is acknowledged that higher level structures may represent the relationship between preexisting structures at a lower level.
Fig. 1. Hypothesized stages and substages of cognitive development. [Note: The general form of notation in this figure is taken from Fischer (1980). The particular representation of substage 3 thought is taken from Pascual-Leone (1969)].
constrained by the size of this short term storage space (STSS). Moreover, since STSS grows at a regular and specifiable rate, the complexity or "optimum level" of children's structures grows in the same orderly fashion. Once again, this general postulate is one which is advanced explicitly by most other neo-Piagetian theorists (see Fischer, 1980; Halford, 1982; Pascual-Leone, 1969) although the values that are assigned to STSS and the factors that are seen as controlling its growth vary considerably.  

C4. The final postulate is that, the further one proceeds in development, the less important maturational factors such as the growth of STSS become and the more important cultural and educational factors become. This is because, during the early stages of development, both the nature of children's control structures and the experiences on which their acquisition depends tend to be culturally universal. By contrast, during the later stages of development, these factors tend to be unique to the particular culture in which the child is being raised. Although it is at variance with certain of Piaget's writings on the topic (Piaget, 1972), this postulate is once again common to most other neo-Piagetian theories.

Taken together, the above three sets of postulates may be regarded as an attempt to capture the overall structure and process of children's intellectual growth. While much further work remains to be done in order to validate each postulate, the emphasis in the present article will not be on the validity of the postulates but rather on their implications, once certain additional assumptions are made about the emotional system and its development. Note that, while all of the postulates that have been outlined will be drawn on to at least some extent, the greatest emphasis will be placed on those on which there is the greatest degree of agreement among neo-Piagetian theorists. The reason for introducing this constraint is to maximize the likelihood that the resultant model of emotion–cognition relations will have some general utility.

D. Summary

Contemporary neo-Piagetian theorists are agreed that neonates can achieve a considerable degree of control over their own cognitive and affective experience. They are also agreed that the various structures by means of which they do so are functionally autonomous, and tailored to the particular environmental conditions under which they must be applied.

2 For example, in the present theory, the growth of STSS at any stage is seen as progressing from 1 to 4 units; moreover, this growth is seen as stemming from an increase in the efficiency of the operations which are characteristic of the stage in question, due to experiential as well as maturational factors. In other neo-Piagetian theories, different values are assigned to STSS, and growth is normally presumed to stem primarily from maturational factors (see Pascual, 1970; Halford, 1982).
Notwithstanding the contextual specificity of children's cognitive structures, however, there is also agreement that certain very general sorts of transformations may be identified, which show the same general properties across different content domains and contexts, and which occur during the same general time periods, at least under optimal environmental circumstances. In addition, there is agreement that a number of more minor transformations take place following each major transformation, with the nature and number of these transformations showing a considerable degree of constancy from one major stage of development to the next.

On the question of how children make the transition from one stage or substage of development to the next, there is perhaps the greatest diversity of opinion. Even here, however, two general propositions have received general assent. One is that the growth of short-term storage space (or "working memory") plays at least some role in the transition process, by opening up the possibility of forming structures at a new level of complexity. The other is that the process by which new structures are formed does not necessarily have to involve either conflict or reflective abstraction, but can take place as a result of children's everyday mental activity, even that which is relatively nonreflective, and which is conducted under some sort of adult guidance.

II. THE EMOTIONAL SYSTEM, AND ITS RELATIONSHIP TO OTHER PSYCHOLOGICAL SYSTEMS

The only propositions about emotion that have been advanced so far are those which have traditionally been made in the Piagetian literature, namely that emotion is the energizer and the director of children's thought (Piaget, 1981). Given these assumptions (postulates A2–A4), together with the additional assumptions about the universality of certain early forms of cognitive activity (postulates C1 and C2) it follows that children must be endowed with a natural tendency to experience certain early forms of activity as positive, and certain other forms as either less positive or actively negative. For example, given that neonates universally engage in visual scanning, it follows that they must experience this form of activity as positive, or at least more positive than the other sorts of activity in which they might engage in the same circumstances. While this suggestion is reasonable, however, it is also somewhat tautological. If one is to build a more detailed model of the way in which cognition and emotion interact, one must progress beyond the exercise of merely postulating some universal emotion to energize and guide each universal form of early human cognition, or some universal form of cognition which "flows from" each universal emotion.

3 For a summary of the empirical evidence relating to each postulate, see Case (1986).
In the present section, therefore, a set of general propositions about children's emotions will be abstracted from the experimental, ethological, neurological, and clinical literature. Then, in the sections that follow, an attempt will be made to use these general propositions, in conjunction with those of the previous section, to develop a more detailed model of the way in which cognition and emotion can interact in the course of human growth.

A. The Function of Emotion

The biological function of emotion is to ensure the survival and reproduction of the organism. Of the many situational features that any organism is capable of representing, of the many types of goals it is capable of setting for itself, and of the many strategies it is capable of executing, certain ones are far more important for its survival and procreation than others. Not only has nature endowed each higher species with the cognitive capability to detect such important features in its environment, then, it has endowed them with a mechanism—namely emotion—which ensures that these features are responded to instantly, appropriately, and with suitable intensity. It has also ensured that the elicitation of a strong emotion in one member of a species will tend to elicit a complementary emotion in any other member of the same species who happens to be in the vicinity. Thus, what we experience when we feel some intense emotion such as terror, rage, grief, or joy is the activation of a biological system, one which has been designed for mobilizing us to react promptly and energetically to events that have some particular life-threatening or life-enhancing potential, and one which has also been designed to signal other members of our species that we are doing so. The same holds true for less intense emotions such as interest. Such emotions are presumably designed to ensure the survival of the organism over the long haul, by guaranteeing that it will engage in productive activity such as exploration under relatively neutral circumstances. However, such emotions are also designed so that the activity which they promote will be overridden by other activity of more immediate survival value, when any life-threatening or life-enhancing situation is encountered. Hence the subjective experience that intense interest is somehow less "all-consuming" than intense anger, fear, or grief.

B. The Neurological and Psychological Underpinnings of Emotion

To say that emotion is designed to serve a biological purpose is one thing; to say how that purpose is actually accomplished is another. As Levanthal (1982) has pointed out, the underlying mechanism by which emotion operates has been described in two quite different ways in the psychological literature. In what might be termed the reductionist tradition, which has its origins in the writings of James (1884), emotional phe-
nomena have been treated as being reducible to some other set of phenomena. Thus, for example, the experience of sadness has been treated as being reducible to feedback from the motor act of crying, coupled with some cognitive interpretation concerning the original releasing event (James, 1884). More recently, the experience of anger has been treated as being reducible to the presence of strong arousal, coupled with a cognitive interpretation of the event which the organism presumes to have elicited that arousal (Schachter & Singer, 1962; Mandler, 1975).

By contrast, in what might be termed the realist tradition, emotion has been treated as a real and distinct entity in its own right, both phenomenologically and biologically. This position has its origins in the work of Darwin (1872) and Cannon (1927). While it does not deny that the experience of emotion normally entails motor feedback, high arousal, and a cognitive interpretation, this position asserts that the core nature of a feeling is not reducible to a simple sum of these three factors. Thus, for example, rage is seen as involving more than the simple interpretation of an event as annoying, coupled with the experience of high arousal and the attribution of this arousal to the annoying event. Rather, it is seen as involving a distinctive internal experience, which has its origins in the activation of a distinctive neurological system.

In the present article, it is the latter position that will be adopted. Where there is a wide range of data that can be marshalled in support of this position (see Leventhal, 1982; Zajonc, 1980), perhaps the most persuasive are those data that have been gathered by neuropsychologists. Thus, for example, it has been found that tumors or lesions in particular areas of the limbic system will leave an individual open to uncontrollable feelings of different sorts, as a function of the location of the tumor or lesion in question. Similarly, it has been found that direct electrical stimulation of these same areas will give rise to uncontrollable feelings, as well as actions that are appropriate to them (see Kelly & Stinus, 1984; Luria, 1973). Finally, at least in the animal literature, it has been shown that the experience of emotion and the actions that normally flow from this emotion are neurologically distinct. In cats, for example, stimulation in one area of the limbic system will produce all the physiological and behavioral manifestations of anger without attack, while stimulation of a different region will produce attack without any apparent sign of anger (Flynn, Venegas, Foote, & Edwards, 1970).

Given that there is a distinctive neurological system which is capable of producing emotional states and/or behavior, it seems at least reasonable to suggest that this neurological system may have a psychological counterpart. It is this assumption, then, which we shall make for the balance of the present article.
C. The Relationship between the Emotional System and Other Systems

Once it is assumed that emotion is controlled by a distinctive psychological system, it becomes important to specify the sort of relationship that exists between this system and other psychological systems. The present position is that the emotional system is linked directly to all of the other major systems and can therefore influence or be influenced by them in a direct fashion (cf. Pascual-Leone, 1983). Figure 2 illustrates the major systems that are postulated, as well as the linkages that are proposed among them. As may be seen, one assumption which underlies the diagram is that the perceptual system is capable, at least under certain circumstances (e.g., upon detecting a loud noise) of eliciting a response in the emotional system without any cognitive mediation. The reciprocal assumption is that, in the presence of a powerful emotion, the subject's perceptual system can be directly affected. Not only can the muscles that direct the various sense organs be influenced (so that, for example, the eyes may engage in rapid scanning in the presence of fear), but there can be a highlighting of stimuli that are within the perceptual field and that are of potential relevance to the emotion in question.

A similar position is taken with regard to the relationship between the motor and the emotional systems. Once an emotion is elicited, it is assumed that there is an immediate priming of the motor systems that are associated with this emotion, both those that are designed to signal other members of the species that the emotion is being experienced (e.g., widening of the eyes and drawing back of the lips in the case of fear), and those that are designed to help the organism deal with the situation that elicited the emotion in the first place (e.g., running away). At the same time, there is assumed to be a reciprocal influence as well, that is, a feedback loop from the muscle systems, so that further experience of the emotion will be modulated by the ongoing motor activity.

The relationship between the arousal and the emotional systems is also
presumed to be reciprocal. Once an emotion is experienced, the assumption is that an immediate signal is sent to the arousal system, in order to ensure that the organism will respond to the situation with appropriate energy. At the same time, and reciprocally, the presence of strong arousal acts back on the emotional system, such that the threshold for experiencing other related emotions is altered, as is the intensity with which they are experienced once they are elicited (see Schachter & Singer, 1962).

While the foregoing reciprocal relationships are all important, the relationship on which the present paper will focus most directly is that between the emotional system and the cognitive system. Here, too, the general assumption will be that the relationship between these two systems is reciprocal. Thus, it will be assumed that emotions can be released in the absence of any direct perceptual stimulation—simply by the activation of a particular thought. Moreover, it will be assumed that the subject's cognitive state almost always plays some role in modulating the emotion that is experienced, even when the primary "releaser" of the emotion appears to be the occurrence of a sensory event. At the same time, it will be assumed that a reciprocal influence is always present as well. Once a change in an organism's emotional state is elicited—by whatever means—the organism's subsequent cognition is immediately affected. First of all, the organism's current goal is altered, either subtly or radically, in response to the newly emerging affective state (Simon, 1967). Second, the nature of the organism's train of thought is altered, such that the thoughts that are activated are likely to be related to the organism's ongoing affective state (Bower & Cohen, 1982; Isen, 1984).

D. Subsystems within the Emotional System

So far, the emotional system has been treated as a rather monolithic entity, which can be differentiated from other systems such as the perceptual or cognitive system, but which has no internal organization of its own. In fact, the actual state of affairs is quite different. Different types of emotion can be distinguished, and it seems likely that these, too, are controlled by distinctive structures, that is, by subsystems within the emotional system. At a very general level, one can distinguish between positive and negative feelings. Moreover, within each category, one can make a number of finer grained distinctions, such as between the negative feelings of sadness, anger, and fear, and the positive feelings of interest and joy.

Once it is assumed that the emotional system is organized into subsystems, it becomes necessary to specify the relationships among these subsystems as well. The assumptions that will be made on this point have been influenced by Pascual-Leone's theory of mental functioning, in which the neurological and psychodynamic approaches to cognition are
combined with a cognitive-developmental one (Pascual-Leone, 1969; Pas-
cual-Leone & Goodman, 1979). The most important assumptions will be
as follows:
— Emotions may either be compatible or incompatible.
— The motor components of compatible emotions may be combined. 
Thus, when two such emotions are elicited simultaneously, what results
is a blended pattern of behavior. This blending may be discerned both in
the pattern of the organism's emotional expression, and in the goals
which it pursues.
— The motor components of incompatible emotions cannot be com-
bined; thus such emotions tend to actively interfere with each other’s
expression, as well as with the accompanying goal-directed action.
— When two incompatible emotions are activated, one will generally
predominate over the other and inhibit its expression.
— During the period in which the less dominant emotion is inhibited, it
may remain in an active state, thus contributing to an altered state of
general arousal, and continuing to shape the organism's performance in
subtle ways.
— If at any point in such an emotional conflict, the dominant emotion
begins to wane, the less dominant emotion can reassert itself, thus inhib-
itng the dominant emotion in its turn, and producing a sudden shift in
both mood and emotional expression.

E. Patterns of Emotional Response, and the Mechanisms by Which
They Are Controlled

Although all the major psychological systems respond directly and im-
mediately to events that occur in the emotional system, the most profit-
able way to analyze an emotional response is not necessarily by consid-
ering each of its components separately, but rather by considering the
overall organization or pattern that the response assumes (Sroufe, 1979).
In the present paper, two general types of responses will be distin-
guished, namely those whose primary function is to change the external
situation in which the organism finds itself, and those whose primary
function is to change the organism's emotional experience of that situa-
tion.

F. External Control Structures

One possible response to the experience of emotion, and indeed the
preferred one at all phylogenetic levels, is to act on the external situation
that elicited that emotion. As an organism encounters a situation which
elicits an emotional response, three changes are presumed to take place,
more or less simultaneously. First, the organism orients toward that
aspect of the situation that is most directly emotion laden, turning its
sensory apparatus and cognitive processes in an appropriate direction.
Second, the organism displays with its posture and facial gesture some indication of its inner emotional state. Third, the organism begins to experience a change in its level of general arousal, and a "push" toward some new form of action.

As the above three events take place, the organism's goals in the situation also change, and it attempts to alter the situation in some fashion, either to eliminate that aspect of the situation which it finds upsetting (if the emotion is negative), or to preserve and modulate that aspect of the situation which it finds pleasant (if the emotion is positive).

During the course of their life histories, most human beings encounter certain general classes of emotion-provoking situations with considerable regularity. Accordingly, they develop characteristic ways of expressing their feelings about each situation and a repertoire of goals and strategies for dealing with them. The underlying control structures which generate these patterns of behavior will be referred to for the balance of the present paper as external control structures. While these structures will be presumed to vary in content from emotion to emotion and from situation to situation, certain aspects of their underlying form will be presumed to be constant, and subject to the same general laws of development as were summarized in the first section. In particular, it will be presumed (1) that such structures increase in complexity according to the same epigenetic schedule which applies to all other structures (see Figure 1), (2) that the maturationally governed increase in STSS that takes place with age plays a major role in determining this schedule, and (3) that the constraints imposed by STSS play a less important role in determining the content of these structures with age, while the constraints imposed by the cultural and educational influences become more important.

G. Internal Control Structures

The responses that have been described so far have their effect by acting on the aspect of the external situation which released the experience of emotion in the first place. In the case of positive emotion, they act so as to preserve and/or modulate that aspect of the situation. In the case of negative emotion, they act so as to eliminate that aspect of the situation.

There exists a second class of response, however, which has its effect in a somewhat different fashion. Such responses alter the organism's experience of emotion without altering the aspect of the situation which was responsible for producing it. They are necessary because there is often some block—either in the situation or in the organism itself—which prevents the situation from being dealt with in any satisfactory manner. The result is that the organism's arousal begins to mount to an intolerable level, and mechanisms are necessary for reducing it.

In the present paper, the underlying structures which generate this
second category of response will be referred to as internal control structures. Two subclasses of such structures will be distinguished: those that have their effect by distorting the organism’s perceptions or cognitions about the situation, and those that have their effect without introducing any such distortion. Reality-distorting structures, as their name implies, achieve their effect by distorting the organism’s perception of its external or internal situation in some fashion, and eliciting an emotion that is appropriate for the distorted rather than the actual situation. Examples of this sort of mechanism are to be found in the clinical literature on pathological defenses, and include such responses as denial and projection.

Reality-preserving structures produce their effect without introducing any such distortion. In general, they produce their effect by switching the organism’s attention to some different aspect of the situation, and involving the organism in some new form of activity. The result is that a more positive emotion is elicited, and pitted against the negative emotion, thus attenuating its effects by means of the inhibitory process referred to in Section II D. Examples of these latter structures are to be found in the clinical literature on “coping mechanisms.” They include such activities as comforting oneself by sucking one’s thumb (for a toddler), or deciding to go out and “keep active” in order to inhibit consciously experienced feelings of grief (for adults).

As was the case for external control structures, the assumption will be that all internal control structures, regardless of whether they are reality distorting or reality preserving, are shaped by the maturational and social influences that were described in the first section (see postulates C3–C6).

H. Innate Emotions and Emotional Responses

Students of emotion are not in complete agreement on how many emotions to postulate as basic or innate (see Ekman & Friesen, 1975; Izard, 1971; Sroufe, 1979). The present position, however, is that only two contrasting pairs of affective states can be experienced at birth, namely contentment vs distress, and sensory engagement (a precursor of interest or awe) vs sensory disengagement (a precursor of boredom or aversion). Subsequent emotional responses, even those that are often taken as biological “primitives” in other theoretical systems, are presumed to evolve gradually out of these basic affective states, by a process that includes both perceptual and cognitive change as vital components.

The process by which this development takes place will be outlined in the next section. For the moment, however, it is important to point out

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4 Since reality-preserving structures all depend for their action on inhibition, there may be some release or discharge of the original feeling, once the source of this inhibition is removed. Both displacement and dreaming may have their origin in such a release.
that the emotional responses that are taken as innate in the present framework are also presumed to form parts of the more general and organized response patterns that were referred to in postulate A4, and that can be termed elementary control structures. Stated differently, it is presumed that infants are born with the capacity to represent certain features in their first environment (e.g., the sensory pattern formed by a pair of human eyes inspecting a baby from a distance of about 8 in.). They are also born with a tendency to experience an emotional response when the figurative schemes that represent these features are activated (in the above example, the emotional response would be sensory engagement or interest). Finally, they are born with the capacity to set certain primitive "goals" (e.g., keeping the interesting pattern in view), and to apply certain basic operative schemes (e.g., those that control eye movement) in pursuit of them.

It is from these original and largely innate cognitive-affective control structures, then, that all subsequent control structures are presumed to be assembled, under the influence of the maturational and cultural-experiential factors that were mentioned in the first section.

I. Summary

The propositions about emotion that have been outlined in the present section may be summarized as follows:

1. Emotion is designed to serve a distinct biological purpose, and is controlled by a distinct neurological and psychological system.

2. Notwithstanding its distinctness, the emotional system can both influence and be influenced by events that take place in all the other major psychological and neurological systems.

3. Within the emotional system, several different subsystems can be isolated, each with its own distinct set of properties.

4a. When two compatible emotions are coactivated, what results is some form of combination, coupled with an alteration in the level of general arousal.

4b. When two incompatible emotions are activated, what results is some form of conflict and/or reciprocal inhibition, again coupled with an alteration in the level of general arousal.

5a. When an emotion or set of emotions is elicited by an external event, the organism's first response is to attempt to control or modulate its own relationship to that event. The structures which accomplish this goal may be referred to as external control structures.

5b. If this sort of control or modulation fails, the organism's emotion and arousal are dealt with in some other fashion, most notably by internal control structures, which either distort the organism's perception of the event, or redirect its attention and efforts in a more positive direction.

6. Human infants are born with the capability for experiencing two
contrasting pairs of affective states, namely contentment versus distress and sensory engagement versus disengagement. They are also born with certain primitive feature detecting (i.e., figurative) schemes that can release these emotions, and certain primitive operations (i.e., operative schemes) that can be mobilized to deal with the resultant cognitive and emotional states.

7. More complex control structures, including those that are sometimes seen as involving basic biological "primitives" in other theories, are presumed to develop out of this initial set of components, and to be regulated by the same maturational and cultural-experiential factors as were described in the first section.

If the model in the present section is valid, it follows that children's emotional and cognitive development must be closely interwoven. In addition, it follows that three complementary approaches may be taken, in any attempt to characterize the process by which this interweaving takes place:

1. The first approach is to specify the general ways in which cognitive-developmental factors can influence the process of emotional development.

2. The second approach is to specify the general ways in which emotional factors can influence the process of cognitive development.

3. Finally, the third approach is to characterize the general types of control structure that emerge at each major stage of development, and to indicate the way in which each one simultaneously builds on the cognitive and emotional properties of those that precede it and prepares the way for those that will come next.

In the next two sections, the first two of these approaches will be explored. Then, in the section that follows, the empirical consequences of this exploration will be subjected to empirical scrutiny.

III. COGNITIVE-DEVELOPMENTAL INFLUENCES ON THE COURSE OF EMOTIONAL GROWTH

As was indicated in Section I, a basic assumption shared by all neo-Piagetian theories is that children do not simply "register" the patterns of stimulation to which they are exposed. Rather, they actively interpret and attempt to control them (postulates A3–A4). A second assumption is that there is a change in the level and complexity of the patterns children can apprehend and manipulate, as they progress from one stage or sub-stage of development to the next (postulate B3). Now a further assumption that has been introduced is that children's emotions need not be released directly by their perception of the outer world, but may be triggered by their own representations and manipulations of it (Fig. 2). Given

5 For an exploration of the third option, see Case (in press).
these three assumptions, it follows that there should be a corresponding
change in children's emotional responsivity, for every change in their
general level of cognitive development. Several different categories of
such change may be distinguished.

A. Changes in the Types of Emotions Children Experience

The first sort of change is in the types of emotion children are capable
of experiencing at different stages in their development. As was men-
tioned in Section II, the only emotions for which clear behavioral evi-
dence exists at birth are rather diffuse ones, such as contentment versus
distress, and interest (or engagement) versus aversion (or disengagement)
(Davidson, 1984; Sroufe, 1979). As children grow older, however, emo-
tions such as rage, joy, and fear emerge, to be followed at a considerably
later point in time by emotions such as jealousy, shame, and pride
(Bridges, 1932; Sroufe, 1979).

In the present view, one can not hope to understand the order or abso-
lute age at which these different emotions emerge without considering the
concomitant developments that are taking place in the cognitive system.
Consider, for example, the sort of cognitive functioning that is typical
during the period from 1 to 4 months. As was mentioned above, this pe-
riod is one during which infants gradually develop their first structures
for preserving and modulating the pleasant stimulation to which they are
recurrently exposed, and for avoiding or reducing the intensity of any
recurrent stimulation that is aversive. One of the most universal struc-
tures that is seen during this period is one for adapting the rate and inten-
sity of sucking to the nature of the flow of milk from the nipple (Bruner,
1968). Another very common structure is one for modulating the nature
of face-to-face interaction with the primary caretaker: in particular, for
controlling the proximity of the mother's face, and her affective expres-
sion (Stern, 1977; Trevarthan, 1977).

Now as the first control structures of this sort develop, there is a
change in each one of the three components of which they are comprised,
as well as in the overall degree of integration of the structures as a whole
(Case, 1985). Thus, for example, there is a change in the sophistication of
the infant's (figurative) schemes for representing the current state of ob-
jects such as nipples and faces during the first few months of life. At the
same time there is a change in the infant's (operative) schemes for manip-
ulating such objects, via motor operations such as sucking, wriggling,
gurgling, staring, etc. Finally, there is a change in the (figurative)
schemes representing the results of such operative activity, and hence the
goals that the infant is capable of pursuing. As these three changes take
place, children's procedures for achieving control in these situations
begin to take on the status of smoothly running "programmes," while the
goals toward which they are directed begin to take on the status of expectations.

The present position is that "basic" emotions such as rage, fear, and delight are critically dependent on the emergence of these first control structures, and the attendant expectations they engender. The experience of rage, for example, is seen as being a universal human response to any situation where one is blocked from attaining a goal (1) which one intensely desires, (2) which one has a reasonable expectation of attaining, and (3) which one is currently in the process of pursuing. While infants might be expected to experience distress at the interruption of feeding from the age of birth, then, this distress should not take on the character of rage until some time during the period from 1 to 4 months, when the first control structures for actively regulating the feeding process are assembled, and the infant has come to expect that feeding should unfold in a particular fashion. In fact, it is in precisely such contexts, and during precisely this time period, that infants' first expressions of rage are observed (Sroufe, 1979).

A similar analysis can be made of the more positive emotion of pleasure or delight. Once again, this emotion may be seen as being a universal human response to particular classes of situations. For example, the emotion would be expected to be observed in any situation where one suddenly attains a goal (1) which one intensely desires, (2) which one has a less than certain expectation of achieving, and (3) toward which one has been actively working. Once again, such conditions would not be expected to obtain at birth. Rather, they would be expected to develop rather gradually during the period from 1 to 4 months, in contexts such as those of face-to-face interaction with the primary caretaker. It should only be when the infant knows it can sometimes elicit a smile from its mother and actively tries to do so that it should have its first experience of delight when it actually succeeds. Once again, it is in precisely these contexts, and during precisely this age range, that the first expressions of joy or delight are normally observed (Bridges, 1932; Sroufe, 1979; Stern, 1983).

A detailed account of the conditions underlying all the other emotions which emerge in human ontogenesis is beyond the scope of the present paper. It is perhaps worthwhile to consider one further example, however, in order to demonstrate that the same sort of analysis can, in principle, be applied to the later emerging emotions as well. The emotion of jealousy provides a convenient example, since it is one to which we have devoted considerable empirical study (Hayward, 1986). In the present view, the emotion of jealousy is seen as being a universal human response to any situation (1) where one realizes that an affectionate transaction is taking place between a loved one and some other person and (2)
where one anticipates that this transaction might possibly preclude a similar transaction with oneself.

In the context of the present theory, the ability to focus on one relationship or transaction, and discriminate it from other possible relationships or transactions, is presumed to develop during the final substage of the sensorimotor period (12–18 months). The ability to relate one such relationship to another, thus apprehending the second-order relationship of exclusion, is presumed to develop soon afterward, during the first substage of the interrelational period (18–24 months). According to this analysis, then, jealousy in its standard adult form would not be expected to emerge until children begin to make the transition from sensorimotor to interrelational thought, that is, at about the age of 18 months.

A test of this prediction will be reported in the final section of the present article. For the moment, however, the general point is simply this. At least in principle, it should be possible to develop a model of the internal representations that are necessary to experience any human emotion. Having done so, it should then be possible to predict the age at which this emotion should emerge, by relating the characteristics specified by the model to those specified by neo-Piagetian theory.

B. Changes in the Power of Particular Situations to Elicit Particular Emotions

A second change that takes place with development is in the power of particular situations to elicit particular emotions. Although basic emotions such as anger and joy emerge during the first few months of life, the range of situations in which they may be observed is extremely limited. What happens with development is that this range expands. Moreover, at least within the present context, the reason for this expansion may be localized squarely in the cognitive system.

The emotion of joy may be used to illustrate the process by which this expansion takes place. As suggested above, one experience which is likely to produce a joyful feeling at any age is that of attempting to produce a fervently desired but less than certain outcome, and then actually succeeding in doing so. This being the case, it would be expected that joy would be observed under radically different conditions at different stages of development, as a function of the goals that children can envision, and the means they have at their disposal for pursuing them. Thus, as has already been suggested, joy should be readily observable during the first few months of life in contexts such as provided by reciprocal cooing games with a loving caretaker. Under these circumstances, infants should gradually learn to expect that, when they respond to some initiation by their caretaker with a smile and a coo, they are likely (though not certain) to receive a further smile and a coo in return. As this expectation de-
velops, they should begin to respond in this fashion with the active intention or hope that they will receive a further coo and smile in response, and brighten and wriggle with joy when they actually do so.

As the transition to the first substage of the sensorimotor period takes place, joy should now be observable when infants are placed in close proximity to objects such as rattles or newspapers, which do not actually initiate interaction but which are capable of some forms of interesting response. Under these circumstances, children should be capable of setting themselves the goal of producing some sort of interesting sight or sound, by hitting, pushing, or otherwise prodding the object into action. Moreover, they should light up with joy when they actually succeed in doing so. A similar sort of reaction should be observable in simple tool-use or reciprocal exchange activities at the end of the sensorimotor period.

Finally, as children make the transition to subsequent stages of development, new activities that are associated with the goals of each of these periods should come within children's comprehension. Obvious situations that might be associated with such goals, and hence potentially with feelings of joy as well, would include stick-and-ball or chase games during the relational period, rule-based games or contests during the dimensional period, and abstract activities such as "getting a computer programme to run" during the vectorial period.

Table 1 presents examples of the sorts of changing situations which might elicit two of the other basic emotions mentioned above (anger and fear) at different points in children's cognitive growth. While the details of these analyses are no doubt open to question, two general points will hopefully be clear: (a) that the conditions which will release any given emotion vary radically with children's level of cognitive development, and (b) that neo-Piagetian theory—because it provides a way of characterizing children's cognitive development—also provides a potential means of predicting and/or explicating these changes.

C. Changes in Children's Mechanisms for Dealing with Their Emotions

A final change that takes place with development is in the structures that children can assemble for dealing with their emotions. As was suggested in Section II, two different sorts of structures can serve this purpose, namely structures for altering the state of children's external world, and structures for altering the state of their inner world. Potentially at least, children's level of cognitive development can influence both.

1. External control structures. Consider first children's structures for controlling their external world, so that positive feelings can be maintained and modulated, while negative feelings are avoided or diminished. Elsewhere, we have shown that children's early structures for eliciting
<table>
<thead>
<tr>
<th>Stage/substage (age)</th>
<th>Hypothetical situation</th>
<th>Analysis of situation</th>
<th>Hypothetical situation</th>
<th>Analysis of situation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sensorimotor consolidation</td>
<td>Approach of secondary caretaker, after period of persistent abuse</td>
<td>As scheme of caretaker is consolidated, pain gradually becomes predominant association</td>
<td>Disturbance of feeding or restraint of head movement</td>
<td>As routines for eating and visual exploration are consolidated, interference with</td>
</tr>
<tr>
<td>(1–4 months)</td>
<td></td>
<td>with it; scheme activation thus leads to anticipation of pain</td>
<td></td>
<td>either routine is experienced as frustrating</td>
</tr>
<tr>
<td>Sensorimotor coordination</td>
<td>Presence of &quot;stimulus&quot; (e.g., cat) paired with painful event (e.g., scratching) on one</td>
<td>Scheme of painful event associated with scheme representing prior conditions; activation of one leads to anticipated activation of other</td>
<td>Failure of caretaker to approach when wanted, or restraint of hand movement when toy present</td>
<td></td>
</tr>
<tr>
<td>(4–8 months)</td>
<td>or two prior trials</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Bifocal sensorimotor</td>
<td>Invitation to approach (generated by mother or attractive object) coupled with past</td>
<td>Child's own action on an object or in a situation becomes associated with a secondary</td>
<td>Interposition of barrier between child and caretaker or child and toy when either is</td>
<td></td>
</tr>
<tr>
<td>coordination (8–12 months)</td>
<td>experience of secondary upsetting incident (e.g., falling down &quot;cliff&quot; or being shouted</td>
<td>result that leads to distress; invitation to approach evokes anticipation of this</td>
<td>desired</td>
<td></td>
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<tr>
<td></td>
<td>at for touching object)</td>
<td></td>
<td></td>
<td></td>
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<tr>
<td>Elaborated sensorimotor</td>
<td>Hostile action against someone who tends to react</td>
<td>Child can now understand reciprocal relation between</td>
<td>Failure of caretaker to follow order, or to</td>
<td></td>
</tr>
<tr>
<td>coordination</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

*a:* Fear/wariness  
*b:* Anger/distress
<table>
<thead>
<tr>
<th>Age Range</th>
<th>Event</th>
<th>Thought Type</th>
<th>Example</th>
<th>Note</th>
</tr>
</thead>
<tbody>
<tr>
<td>(12–18 months)</td>
<td>in a hostile fashion in return (although in a friendly fashion at other times)</td>
<td>Relational thought (18 months–5 years)</td>
<td>his own particular actions and the particular reactions of others; certain reactions or actions may thus elicit wariness, even before they are executed</td>
<td>understand meaning of first &quot;proto-words&quot; for self and other object, whether social or physical; any breakdown of such a relation can therefore be experienced as frustrating</td>
</tr>
<tr>
<td></td>
<td>Verbal threat of harm: thought of monsters or imaginary events</td>
<td>Dimensional thought (5–11 years)</td>
<td>As children master second-order relations between words and events, descriptions or symbols of harmful events, even those not as yet experienced, can elicit fear</td>
<td>Failure of caretaker to pay proper proportion of attention to self, vis-à-vis another; having other child take child's own toy; failure of plans for controlling event sequence</td>
</tr>
<tr>
<td></td>
<td>Threat of being judged deficient along such dimensions as &quot;goodness&quot; or &quot;intelligence,&quot; especially if some physical or social pain is likely consequence</td>
<td>Vectorial thought (11–18 years)</td>
<td>As children construct notion of continuous dimension, and of second-order relational systems in general, potentially harmful consequences of the workings of such systems become apparent</td>
<td>Failure of any significant other to behave according to agreed-upon roles of &quot;alliance,&quot; &quot;contract,&quot; or &quot;game&quot;</td>
</tr>
<tr>
<td></td>
<td>Perception of abstract &quot;forces&quot; or &quot;plots&quot; (real or otherwise) acting against self</td>
<td></td>
<td>As abstract systems assume a psychological reality, the fact that they can be responsible for genuine harm can also be appreciated</td>
<td>Perception of &quot;social injustice,&quot; failure of abstract plans (as in chess) or procedures (as in algebra or computer programming)</td>
</tr>
</tbody>
</table>

*a* Note that all events signal potential harm to self. What changes is complexity or level of abstraction at which event in question must be represented.

*b* Note that all events block child from achieving desired goals, or violate positively cathected expectancy. What changes is complexity or level of abstraction of goals or expectancy in question.
and maintaining positive social interactions go through a sequence of transformations during the first 5 years of their lives which correspond in both timing and form to the other structural changes that occur during this same time period (Case, 1985). This being so, it follows that a similar progression should take place for structures aimed at controlling negative social interactions during the same time period. It also follows that the progression should continue for both sorts of structure during the dimensional and vectorial stages. The progression during these later stages should have the same general characteristics as at earlier stages, but should deal with whatever higher order dimensions and vectors emerge as being of emotional significance in the culture during this time period (e.g., attributions of beauty, intelligence, physical prowess).

2. Internal control structures. Consider next children's structures for controlling the state of their internal world under circumstances where there is some barrier to direct external action. In the literature on adaptation and defense, it is increasingly acknowledged that a hierarchy of such mechanisms exists, with those at the bottom of the hierarchy appearing earlier in development, and being harder to penetrate in therapeutic situations. It has also been suggested that children's level of cognitive development may set a limit on the highest level in this hierarchy at which they can function at any given point in time (Kernberg, 1976, p. 68; Vaillant, 1977, p. 89). It seems quite possible, then, that children's internal control structures may be subject to the same sort of stage-related limitations as their external control structures. It also seems possible that a neo-Piagetian theory may provide a useful framework for explicating the nature of these limitations.

Once again, a detailed analysis of how this might be done is beyond the scope of the present paper. However, at least at a general level, it seems clear that one would want to distinguish four broad categories of internal control structure, and to explicate the nature of the underlying mechanism entailed by each. A few examples will serve to illustrate this point.

The sensorimotor stage. At the most primitive level, a defense such as displacement might require no more than the ability to redirect the focus of one's attention from an object that provokes two conflicting emotions (e.g., anger and fear) toward some other object which is less threatening. Since the less threatening object would elicit less fear, the new object could easily become the target of aggression, as there would be a release from the inhibitory effect of fear and the anger would have a tendency to discharge itself (see section IID). Now the ability to displace attention from one object to another, while maintaining the capability of responding to each, is a characteristic of the bifocal substage of the sensorimotor period. Thus, it follows that one should be able to observe some
sort of primitive displacement of aggression under appropriate circumstances by the age of approximately 8 to 12 months.

*The interrelational stage.* Consider next the defense of projection, in its nondelusional form. In this defense, one once again redirects one’s attention. However, this time one redirects attention from the cues that would allow one to recognize and label a conflict-inducing emotion in oneself (such as anger at a loved one) toward the cues that would allow one to recognize and label the same emotion in someone else. Having done so, one may then experience and deal with the emotion in a fashion which reduces its intensity.

Now the ability to focus on one’s own expression of emotion, and to appreciate its relationship to an external set of events, is not present during the sensorimotor period. The ability depends on being able to consider a set of events in which one is the emotional “reactor” in a relationship, with a set of events in which one assumes the role of either “initiator” or “observer.” As with other abilities that entail a coordination of two relational operations, it does not appear until the beginning of the interrelational stage (Bruchkowsky, 1984; Case, 1985). Moreover, since projection in effect entails a displacement of attention from one such relational pair to another, one could hypothesize that it should first emerge at the bifocal substage of this period, that is, at approximately 2½ to 3½ years of age.

*The dimensional stage.* A defense which is likely to be associated with the dimensional stage is rationalization. In rationalization, one acts under the influence of a feeling in a way that is judged to be socially unacceptable, but creates in one’s own mind a more acceptable motivational and affective basis for initiating this sort of action. Now although the capacity for focusing on and labeling one’s own feelings is present during the interrelational stage, the ability to judge simultaneously these feelings and their associated motives along some dimension of cultural acceptability is not present until the dimensional stage. It seems quite possible, then, that the ability to shift one’s focus from a dimension along which one’s motives and feelings would be socially unacceptable to one which would be more acceptable might not appear until the bifocal substage of the dimensional period, that is, until about 7–9 years.

*The vectorial stage.* A defense which might be associated with the vectorial stage is sublimation. In its most common form, this defense involves taking a feeling and accompanying action tendency which are socially unacceptable, and redirecting or displacing them toward some more lofty goal, that is, one which is judged to be acceptable by a fairly abstract criterion. As will no doubt be apparent, this sort of redirection requires the same ability to classify certain forms of motivation as so-
cially inappropriate as does rationalization. However, it also requires the ability to understand abstract entities such as "cause" or "criterion." As a consequence, it seems unlikely that the defense would emerge—at least in its full form—until well into the vectorial stage.

The above examples all deal with internal control structures which distort the reality with which a person is confronted in some fashion, often due to the presence of an emotional conflict. What about structures where this reality is preserved, and where the negative feeling is dealt with by pitting a more positive one against it? These sorts of structures are normally referred to in the literature as "coping mechanisms." Moreover, as Haan (1962) has pointed out, they often bear a formal similarity to mechanisms or structures which are defensive in nature. To the extent that this is correct, then, one would expect that it would also be possible to isolate four broad categories of reality-preserving control structures as well, and to associate each with the mental apparatus of a particular developmental stage. Such an endeavor could have an important place in any research program which aims to clarify the developmental relationships between cognition and emotion.

D. Summary

In the present section, three major ways have been hypothesized in which cognitive-developmental factors may influence development in the emotional realm:

1. By setting a limit on the types of emotions that children can experience at different ages;
2. By setting a limit on the types of situations to which children can respond in an emotional fashion;
3. By setting a limit on the nature of the control structures (both internal and external, distorting and nondistorting) that children can develop for dealing with such situations and the emotions they elicit.

IV. EMOTIONAL INFLUENCES ON THE COURSE OF COGNITIVE GROWTH

Although children's level of cognitive development can exert a strong influence on their emotional experience, the reverse is also true. The particular emotional experiences that children encounter, and the structures they assemble for dealing with them, can also exert a strong impact on their cognitive development. Recall that the rate and terminal level of children's cognitive development are viewed in the present theoretical system as being under the control of certain very general classes of epi-
stemic activity, activities such as exploration, problem solving, imitation, and mutual regulation (postulate C2). Recall further that children are not presumed to engage in any of the above activities automatically, or in a vacuum. Rather, they are expected to engage in them because, in the environment in which they find themselves, they experience these activities as producing a movement from their current state to one with a higher affective value (postulates A3–4). Putting these postulates together, one can suggest that any factor which affects the emotional substrate on which epistemic activity depends should also have the potential to affect the course of children's subsequent cognitive growth.

Three general classes of such factors may be distinguished.

A. Factors Affecting the Total Amount of Time Children Spend in Epistemic Activity

The first group of factors comprise any emotion-related experience which either increases or decreases children's natural motivation to engage in epistemic activity, across the full range of environmental situations such as joy, anger, and fear are not seen as being innate in the present system. Rather, they are seen as emerging in the course of the first few months of life, as the infant engages in such normal species-typical behaviors as nursing and face-to-face interaction with its primary caretaker, and gradually forms its first structures for controlling or at least modulating the basic sources of pleasure and distress which these situations afford.

Now the literature contains a number of examples of early child-rearing situations which are highly deviant, and which might be expected to interfere with the development of these first postnatal structures. One of these occurs when infants are born with a malformed esophagus, and fed through a fistula at frequent intervals over which they have no control (Dowling, 1977).

Given that infants encounter an atypical experience of this sort, it seems quite possible that they might never develop the normal repertoire of postnatal control structures, since they would be deprived of both the face-to-face interaction with a loving caretaker and the opportunity to play an active role in negotiating their own degree of hunger/satiety. As a further consequence, it seems possible that they might not develop in any

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6 For a description of the effects of esophageal fistula on face to face interaction, see Dowling (1977).
of the basic emotions on which epistemic activity depends, and that their intellectual development might be severely stunted as a result.

In fact, this appears to be the case. Infants who are exposed to such a situation are reported to show a profound and chronic apathy. In addition, they are reported to show a degree of intellectual retardation which is remarkable, and which often includes not walking or talking by the age of 4 years. In the present context, such retardation would be seen as being the indirect consequence of not engaging in sufficient early epistemic activity, and this failure would in turn be traced to the absence of any significant emotional reward for doing so.

2. Continued emotional availability of a significant attachment figure during the sensorimotor stage. Assuming that children do develop a normal repertoire of early postnatal control structures and emotions, one would expect that their subsequent intellectual development would progress through the sequence of stages and substages indicated in Fig. 1 under most circumstances, since there would almost always be an emotional payoff of some sort for engaging in at least one of the four sorts of epistemic activity mentioned above (i.e., exploration, problem solving, imitation, and mutual regulation). Even here, however, a caveat must be entered. Throughout the sensorimotor stage, a great deal of children’s socially directed activity centers on their primary caretaker (Schaffer, 1977; Stern, 1977). In addition, much of children’s independent activity takes place in the secure context which she provides (Ainsworth, Blehar, Waters, & Wall, 1978; Bowlby, 1969; Bretherton & Waters, 1986). An implication is that a great deal of the child’s epistemic activity remains dependent on the ability of the primary caretaker to provide this sort of security.

If a situation were to arise, therefore, in which infants received reasonably good maternal care from birth to 4 months but then were deprived of such care between the ages of 4 and 18 months, the infants might well be at risk from a cognitive as well as an emotional point of view. Inasmuch as there would be no maternal presence to provide a secure base for independent problem solving and exploration, the child’s activity in both these areas might be severely restricted. In addition, since the mother would no longer be available for significant social interaction, the opportunity for mutual regulation and imitation could be restricted as well. Instead of the joy to which it was normally accustomed, then, the most likely initial emotion that the infant would experience during the period of maternal deprivation would be anger, followed by maternal sadness as its attempts to engineer the return of the mother met with no success.

7 For a theoretical analysis of the changes in attachment that take place during this period, see Case (in press).
Now sadness is unlike most of the other basic emotions, in that it tends
to depress the organism's activity, rather than energize it. In fact, its bio-
logical function may well be to energize the behavior of other species
members, that is, to alert them to the fact that a loss has taken place, and
to elicit some sort of compensatory nurturing behavior. If no substitute
nurturing were forthcoming, then, the infant might possibly experience a
serious and prolonged depression. And, if it did, the most probable result
would be a drastic reduction in the amount of time it spent in epistemic
activity of any sort, and a corresponding reduction in its rate of intellec-
tual growth.

Although the evidence is not completely clear on this point, there have
been a number of cases where infants have been removed from their nat-
ural parents during the first year of life, and placed in an orphanage
where they received only minimal custodial care (Hunt, 1980; Spitz,
1950). Once again, the result appears to be a drastic reduction in the
children's overall rate of intellectual growth.8

B. Factors Affecting the Channeling of Epistemic Activity into One
Particular Class of Activity or Another

The factors that have been considered so far are ones which would be
likely to affect children's motivation to engage in any sort of epistemic
activity whatever, and thus influence the likelihood they will reach the
optimal level of functioning that is set by size of their STSS. A much
more common event, however, is for children to encounter an emotional
experience that affects their epistemic motivation in a more subtle and
activity-specific fashion. In effect, what happens is that a particular class
of events acquires a particular emotional significance, and the child's epi-
stemic activity is channeled into or away from this class of events as a
result.

1. Domain-specific channeling. Since intellectual development never
occurs in isolation from experience (postulate B1), it of course follows
that children will fail to live up to their biological potential in any domain
which they avoid completely. What may be less obvious, however, is that
they may also transcend what would otherwise be viewed as their normal
biological limit, if they channel a disproportionate amount of their ac-
tivity into one particular domain. The reason this can happen is that the
factor which sets a limit on the rate of cognitive development in any area
—namely the rate of growth of STSS—does not set its limit directly.
Rather, it sets its limit indirectly, by determining the maximum number of

8 A similar result may possibly occur if the mother is beset by some severe mental de-
pression or other affective disorder (Province, 1983). Here the problem is not the mother's
physical unavailability, of course, but her emotional unavailability.
schemes that can be attended to simultaneously. Under appropriate conditions—such as those provided by massive general experience or intensely focused instruction—the schemes that would be independent for someone who was encountering a problem for the first time can become "chunked" together. When this occurs, an experience that for most children would require the application of two or more schemes may be handled by a highly practiced child with only a single scheme. As a consequence, the child can exhibit a higher level of functioning in any problem domain where this "superscheme" is applicable.

What sort of emotional factors might predispose a child to channel an unusually high proportion of its early activity into one particular content domain and thus achieve this sort of cognitive benefit? A number of possible factors might be cited. However, the following are likely to be among the most important:

—Some children might have a natural talent for one sort of activity or another. This might lead them to derive more satisfaction from the activity, either because they experience their greater potential in this area directly (and hence derive a sense of joy and mastery from it) or because they experience increased social approval.

—Quite independently of endogenous talent, some children might grow up in a family or culture where one form of activity was rewarded more highly than another. Such children might therefore experience more social satisfaction in this activity, and come to value and/or enjoy it more than others.

—Some children might grow up in an environment where one person was of particular emotional significance. As a result of their relationship with this person, these children might acquire strong positive feelings relating to any activity with which this other person was associated.

—Some children might have a natural affinity or "love" for one sort of activity or another, for endogenous reasons which we at present do not understand.

Exactly what magnitude of effect one would expect from any of the above factors is not yet clear, since little systematic research has been devoted to this question. However, at least in the case of domain-specific prodigies, it seems that one or more of the above factors is almost always operative and that the effects can be quite substantial (e.g., on the order of several developmental substages). Note that a domain specific retardation of a similar magnitude might be expected as a result of factors that were equivalent to those mentioned above, but which channeled children’s activity away from a particular domain rather than into it. Finally, note that the emotional valence of a factor would not be the key determinant of whether cognitive development was accelerated or decelerated but rather the direction in which activity was channeled. A child could just as easily channel a disproportionate amount of its activity into a par-
ticular domain because it was afraid of not doing so, as because it was eager to do so. And, while the long-term social effects would be quite different, the short-term effects on “cognitive profile” would probably be quite similar.

2. Process-specific channeling. In principle, each of the above factors could also affect the particular category of mental activity children come to prefer, as well as the particular domain of activity they come to prefer. The mental activity of reflecting on all possible response alternatives (Kagan, 1965) may be taken as an example. A preference for this sort of activity could result from a natural love for the reflective process, or from the sense of mastery and/or power that the exercise of the reflective process can generate. Alternatively, it might stem from exposure to a culture that placed a particularly high value on reflectivity, or a parent or other role model who was a reflective person. Finally, it could result from emotional factors with a negative rather than a positive valence. In effect, one might develop a reflective tendency because one was afraid of the consequences of premature response (e.g., error and criticism), rather than because one was attracted to reflective activity, per se.

Regardless of its specific etiology, the result would be a child who developed a distinctive reflective style, that is, a preference for reflective activity that would manifest itself across a wide variety of content domains. Moreover, while a reflective style might be no more conducive to cognitive growth during the first two stages of development, it might become increasingly advantageous during the third and fourth stages, as development becomes increasingly dependent on cultural experiences of an educational sort (postulate C4). The same general classes of emotional factors might also be expected to play a role in forming the other cognitive styles that have been mentioned in the literature (e.g., Shapiro, 1965; Witkin, Dyk, Faterson, Goodenough, & Karp, 1962). Finally, they might be expected to exert an influence on the particular epistemic activity a child came to favor (e.g., independent problem solving vs imitation) which could form the basis of a particular stylistic preference as well.

C. Factors Affecting the Efficiency of Children’s Epistemic Processes

There is a third and final way in which emotional factors might affect children’s pattern of cognitive growth, and that is by influencing the efficiency of their epistemic processes.

The ways in which emotional factors can influence cognitive efficiency are not as yet well understood. If one considers the emotional experience of anxiety, however, one can get an intuitive sense of how such factors might operate. As was suggested in Section II, the experience of increased arousal is a natural human response to many situations where two conflicting emotions are elicited. Now if one or both of the two emo-
tions that are elicited by a particular situation is fear, then the increased arousal is apt to be accompanied by mounting anxiety. For most children it may be presumed that such situations are relatively rare, and that when a particular anxiety-provoking situation does happen to recur in their lives, it will be dealt with by assembling a control structure which will serve to contain this anxiety within reasonable limits. One can further presume that epistemic activity itself (e.g., gaining more knowledge about the situation) may play such an anxiety-reducing role, and thus come to acquire a secondary, anxiety-reducing value.

As the clinical literature makes abundantly clear, however, there are certain children who are exposed to recurrent anxiety-provoking situations which are out of all proportion to their resources for dealing with them. And, as a consequence, they experience a high degree of anxiety on a day-to-day basis, with frequent emotional "disturbances." Now since the experience of anxiety reduces the amount of attention that is available for processing and/or short-term storage by a small but measurable amount (Link, 1979), it follows from the present theory that such children should be slightly behind their peers in their general rate of cognitive development, if the anxiety itself is general. Alternatively, if the anxiety is specific to some particular domain or process, it follows that they should be slightly behind their peers in that specific area.

Note that the above conclusions are considerably different from the ones that would be generated by classical Piagetian theory. In the context of the classical Piagetian system, what would be more important would be the extent to which any anxiety that was experienced would lead children to shy away from cognitive conflict and/or to avoid reflecting on their experience, since these are the primary stage transition mechanisms. In extreme cases, where a child might avoid cognitive conflict or reflective activity entirely, the prediction would have to be that he or she would show no further cognitive development. In the present system, however, the prediction is quite different. Since any kind of mental activity, even that resulting from reality-distorting structures, can lead to advances in the level and complexity of children's mental functioning, the prediction is that cognitive development should continue, albeit at a slightly reduced rate, through the entire sequence of stages and substages that are observed in more normal emotional circumstances.

D. Summary

In the present section, three major ways have been hypothesized in which emotional factors can influence the course of children's cognitive growth:

1. The first is by determining the amount of time children spend in
epistemic activity, which in turn will influence both their rate and terminal level of cognitive development.

2. The second is by channeling children’s epistemic activity in particular directions, which in turn will influence either their cognitive-developmental profile or their cognitive style (or both).

3. The third is by influencing the efficiency of children’s cognitive processes, in a way that may be either very general or specific to some particular class of mental processes.

V. EXPERIMENTAL STUDIES

As yet, no attempt has been made to test the present theoretical framework in a systematic manner. Three exploratory studies have been completed, however, which indicate the direction that future programmatic research might take.

Study Number One: A Developmental Investigation of Children’s Responses to Social Triangles

The first study was conducted by Sonia Hayward (1986). The general objectives of the study were to determine (a) whether children’s level of cognitive development would influence the emotional responses they exhibit in a particular situation, and (b) whether the present neo-Piagetian theory could be of any use in predicting and interpreting these responses.

The particular emotion that was investigated was jealousy. As was mentioned in the Section III, the present position with regard to jealousy is that it should be primarily a “relational” phenomenon; that is, it should depend on observing a relationship between two other people, at least one of whom is the object of one’s affection, and then comparing this relationship to one’s own relationship with the love object in an indvidious fashion. According to this view, jealousy should not normally play a very significant role in children’s lives until the last substage of the sensorimotor period, since this is the first time when children become capable of focusing on a single relationship, and exploring its properties via trial and error. A further implication is that, as children enter the relational stage, they should begin to experience jealousy more directly and immediately, since they can now compare two relationships mentally and understanding how one can affect another (e.g., by precluding it). Finally, the period that follows the first experience of jealousy (i.e., the relational stage) should be one when children develop control structures for dealing with a variety of social triangles, and the new feelings these triangles elicit.

In order to test the above propositions, a group of mothers was asked to participate in a simple experiment. For 2 min they sat on a chair in an
experimental room, while their child either played on the floor nearby with a set of toys or interacted with a second child whose mother had left him/her in the same room. Throughout this period, the mothers were instructed to ignore both children as much as possible, and to busy themselves in filling out a life-history questionnaire that had been provided.

After the initial 2-min period was over, a tone sounded. On this cue, the mother got up from her chair, went over to the second child, and brought this child back to the chair with her. She then engaged in a 2-min interaction with this child, in a fashion that excluded her own child as much as possible. The interaction took one of two forms, depending on the experimental condition. In one condition, the second child was a newborn infant. Here the interaction took the form of cooing and cuddling. In the other condition, the second child was of the same age and sex as her own. Here the interaction took the form of encircling the other child with her arms, and reading from an age-appropriate picture book.

Subjects

Subjects for the study were recruited by newspaper and radio advertisements, as well as by word of mouth. From an original pool of about 150 volunteers, 112 mothers were selected for participation in the study, in such a fashion that eight male and eight female children could be observed at each of the stage-transition points indicated in Fig. 1.

Experimental Measures

Throughout the experimental session, the children’s behavior was videotaped through a one-way mirror. One video camera was trained on the general situation; a second was trained on the face of the target child. The two records were then recorded simultaneously so that raters could see both images at once, and make a detailed evaluation of the target child’s response to the general situation. The children were also administered an omnibus IQ test in a second session, so that their mental age could be assessed.

Predictions

The predictions that were advanced were as follows:

1. The majority of children should not show any evidence of jealousy before the final substage of the sensorimotor period, that is, prior to attaining a mental age of 12 months.

2. The majority of children should show clear evidence of jealousy by the time they reach the relational stage, that is, by the time they reach a mental age of 18 months.

3. By the end of the relational stage, children should show characteris-
COGNITIVE AND EMOTIONAL DEVELOPMENT 35
tically structured ways of dealing with the triangular situations they en-
counter, and the feelings these situations elicit.

While these predictions were rather general, they were at least as spe-
cific as those which could be generated on the basis of any other theoret-
cial framework. In the context of psychoanalytic theory, for example, the
most intense period of jealousy is normally presumed to be the oedipal
stage, which is usually placed somewhere between 4 and 7 years of age.
In the context of classical cognitive-developmental theory, no theoretical
analysis of jealousy has been attempted. Moreover, such empirical inves-
tigations as have been conducted have been vague as to their assessment
procedures and contradictory in the conclusions they have reached. In an
early article, for example, Bridges (1932) suggested that jealousy was first
differentiated from other emotions about the age of 1½ years, a sugges-
tion which fits well with our own predictions. However, Bridges did not
indicate the sorts of situations in which this differentiation could be ob-
served, not did any subsequent study confirm her hypothesis. More re-
cently, White (1975) has suggested that children will experience more
jealousy if a sibling is born during the first 3 years of their life than if it is
born after they have reached this critical age. Once again, however,
White did not indicate exactly what sorts of observation this conclusion
was based on, nor have subsequent studies which have been conducted
to test this hypothesis as yet produced any support (e.g., Abramovitch,
Corter, & Lando, 1979).

The above three predictions thus seemed at least as strong as those
that could be advanced on the basis of any other theoretical framework,
and a good deal stronger than those that could be advanced on the basis
of the existing empirical literature.

Results

Children's emotional states during the baseline and experimental ses-
sions were rated on a six-point scale which ranged from very happy
through neutral to extremely upset. Two raters were used, and the inter-
rater reliability was found to be high (Cronbach's α ranged from .94 to .96
in the various conditions).

Figure 3 presents the percentage of children who showed a deteriora-
tion in mood, as a function of mental age and experimental condition. As
may be seen, the pattern was quite regular, and in good agreement with
the general expectations. During the early sensorimotor period, there
was little sign of negative affect in either condition. Moreover, the few
children who did display negative affect did not appear to be reacting to
the mother's behavior toward the other child, so much as her general
unavailability in a strange situation. As children progressed through the
FIG. 3. Percentage of children showing an increase in negative affect when their mother ignores them for a 2-min period and pays attention to an infant or a peer (from Hayward, 1986).

sensorimotor period, the first signs of negative affect that was caused by the mother's attention to the other child began to emerge. Finally, as the children entered the relational period, the majority exhibited negative affect under both experimental conditions. This negative affect often took the form of whining or crying, and trying to break in on the ongoing interaction between the mother and the other child.

As children progressed through the relational period, a second trend began to show itself. This was that children's reactions to the peer and infant situations became quite different. While the negative responses in the infant condition began to taper off, negative affect in the peer condition remained strong, and in fact increased to a value in excess of 80%. As might be expected given this general pattern of results, analysis of variance revealed (1) significantly more negative affect in children whose mental age was greater than 1 year than in younger children, $F(1,56) = 4.63, p < .05$, and (2) significantly less negative affect in the infant condition in children whose mental age was greater than 2.7 years than in children whose mental age was between 1 year and this value, $F(1,56) = 8.94, p < .01$.

Discussion

Within the present framework, the low percentage of negative affect...
during the early sensorimotor period would be seen as stemming from the infants' inability to focus on two external objects at once, and to conceptualize the relationship between them. Similarly, the increase in negative affect at the beginning of the relational period would be seen as stemming from children's developing cognitive ability, first to focus on a transaction between their mother and another child and recognize this transaction as affectionate, and then to realize that this transaction might preclude their engaging in a similar transaction themselves. Finally, the affective differentiation that took place as children moved through the relational period would be seen as stemming, at least in part, from the cognitive differentiation which takes place during this same time period, and which enables children to focus not only on the nature of a transaction but also on the characteristics of the participants (Fischer, Hand, Watson, Van Paris, & Tucker, 1985). The capability would be seen as giving children the ability to focus on the social category or role of any potential rival, and this in turn would be seen as enabling them to respond differentially as a function of this role.

In her qualitative analysis of the results, Dr. Hayward found considerable support for this latter suggestion. A great many of the responses that children exhibited during the older age range—in contrast to those exhibited earlier—took some explicit account of the baby's different social status in some fashion. One of the most commonly exhibited behaviors was to approach the mother and to assume a complementary nurturing role, thus in effect becoming a part of the ongoing transaction rather than being excluded. Another common strategy was to avoid looking at the upsetting interaction, and to deprecate the potential rival (e.g., "Her's just a little baby; her can't even talk yet.")) It seems reasonable to hypothesize, then, that both external and internal control structures for dealing with feelings of jealousy were developing during the latter part of the relational period, and that both forms of structure drew on children's newly emerging cognitive capacity for role differentiation in some fashion.

Of course, the fact that certain cognitive abilities and certain types of emotional responses emerge at approximately the same point in children's development does not, in and of itself, demonstrate a causal link between them, let alone that the above hypotheses concerning the nature of this link are viable. That some sort of close connection between emotional and cognitive variables was operative, however, was suggested by the pattern of sex differences that emerged. In the age range from 1 to 2.7 years, it appeared at first glance that girls showed more jealousy than boys. However, the girls at these ages were also found to be more advanced than the boys in mental age. Moreover, when jealousy was plotted against mental rather than chronological age, the difference in the
response patterns for the two sexes disappeared. Given that the experience of jealousy is more closely linked to children's mental age than their chronological age, it seems reasonable to presume that cognitive factors were playing at least some role in influencing children's emotional response, and to subject the above account of this influence to further scrutiny.

**Study Number Two: A Longitudinal Investigation of Infants' Reactions to Brief Periods of Maternal Separation**

As an empirical documentation of the changes that take place in children's response to a jealousy-inducing situation, the above results were of considerable interest in their own right. They were also of interest as a preliminary demonstration of the utility of neo-Piagetian theory in predicting and/or interpreting certain aspects of children's emotional development. To assert that the results actually proved any of the theory's core postulates, however, would be too strong a claim. Recall that the theory asserts that, as a result of certain fundamental changes in children's nervous systems, there is a change in their capacity for processing and storing information (postulate C3). This change then produces a corresponding change in the type of pattern children are capable of detecting in their interactions with their environment (postulates B3, C3) which in turn produces a potential change in the emotions these interactions can elicit (Section III). Finally, in any situation where such a sequence of changes does take place, children gradually develop a new set of operations for dealing with the new feelings, either by acting on the situation which produces them or by engaging in some other operation which modulates their affective experience more directly (Section III C).

What sort of study would be necessary to document this core set of claims? As a minimum, it would seem necessary to develop independent measures of children's capacity for processing and storing information on the one hand, and their emotional response to a particular class of situations on the other, and then to administer these measures to children at several different points in their development, and to demonstrate that a change takes place in both variables in close synchrony. A study which utilized this methodology has recently been completed by Marc Lewis (1986).

**Objective**

The general objective of the study was to explore the relationship between infants' capacity for processing one versus two items of information on the one hand, and the nature of their emotional responses to their mothers' departure on the other. In particular, it was hypothesized that a 2-unit capacity would be necessary to store an image of an absent loved
one while scanning a current environment, and thus to experience distress as a result of any abrupt maternal departure.

**Subjects**

Six mothers participated in the study. Three of these had male babies, while three had female babies. All six appeared to have healthy and satisfying relationships with their infants.

**Measures**

The first group of measures was designed to determine whether infants were capable of executing two well-consolidated sensorimotor operations in an integrated fashion, or merely one sensorimotor operation in isolation. Five different measures were used to make this assessment. Each measure was first scored on a pass/fail basis; then the five measures were summed to yield an aggregate score which was presumed to reflect children’s underlying information processing capacity.

_Infant balance beam_. This is a test designed by Case and Hayward (1984) to determine children’s cognitive developmental level within the present framework. The item which is critical for the 4-month transition is one in which the baby is placed in a seat at the center point of a large (3-ft) balance beam. An object is placed on each end of the beam, and the armature is set in a rocking motion. Infants who focus on only one side of the rocking balance are considered to be at the stage of isolated sensorimotor operations. Infants whose gaze alternates between the left and the right sides are considered to be at the stage of coordinated sensorimotor operations, that is, to have a sensorimotor capacity of 2.

_Revolving object_. This item was a variant of a Piagetian (1954) task which was originally designed to assess infants’ capacity to anticipate the reappearance of an object. An attractive toy was slowly revolved around the infants’ head. When it disappeared from the visual field, infants who continued gazing in the direction of the object’s disappearance, or who gazed about the room haphazardly, were considered to be at the stage of isolated sensorimotor operations. Infants who switched their gaze from the point of the object’s disappearance to the point of its anticipated reappearance were considered to be at the stage of sensorimotor coordination.

_Object relocation_. This task was adapted from the Uzgiris–Hunt Scale of Object Permanence (Uzgiris & Hunt, 1975). An attractive object was brought into the child’s view, and then displaced to behind a screen. Children whose gaze wandered off to other interesting objects were considered to be at the stage of isolated sensorimotor operations. Children who appeared to search at the point of displacement for 5 to 10 s were considered to be at the stage of sensorimotor coordination—the infer-
ence being that they could coordinate the scanning of the present visual environment (i.e., the screen) with the ongoing memory of the object that had just disappeared, and which they had been tracking previously.

**Facial scanning/tracking.** On this item, the experimenter suspended a brightly colored object on a string, and set it in motion at a distance of about 4 in. in front of his own face as he looked at the baby. Infants who tracked the moving object but did not scan the experimenter’s face (or vice versa) were considered to be at the stage of isolated sensorimotor operations. Infants who alternated between scanning the stationary face and tracking the moving object were considered to be at the stage of coordinated sensorimotor operations.

**Tracking/reaching.** On this test, a small attractive object was moved slowly in front of the baby, within easy reach of its hand. Infants who made no attempt to grasp the object, or who reached toward a particular spot in space with no lateral adjustment, were considered to be at the stage of isolated sensorimotor operations. Infants who stretched their hand out toward the object with lateral adjustment were considered to be at the stage of coordinated sensorimotor operations, the inference being that they were coordinating the activity of visual tracking with that of reaching.

All of the above test items clearly have an emotional component, as does all the child’s goal-directed behavior in any particular situation at this age. However, the emotion that drives most of these responses is the positive and relatively weak one on which cognitive measures have traditionally relied, namely interest. Moreover, this emotion may be presumed to remain in operation whether children respond to one or two elements of the situation. In contrast, the second measure was designed to explore children’s experience of an emotion that is negative and a good deal stronger. In particular, they were designed to tap the negative emotion that children experience when a loving interaction with their caretaker is abruptly terminated. On the assumption that one must be able to keep an image or memory of the loved one active while scanning one’s present environment in order to be distressed by such an event, it was hypothesized that infants would show no particular signs of separation distress until they reached the 2-unit stage, that is, the stage of sensorimotor coordination.

**Separation distress.** In the first part of the test, mothers were asked to engage in loving face-to-face interaction with their babies. Then, at a point in time when the baby was still enjoying the interaction, they were asked to leave the room abruptly for a 60-s period. A seven-point scale was devised to measure the extent of separation distress shown by the baby, as indicated by fussing, frowning, whimpering, and crying.
Procedure

Since the transition from a sensorimotor capacity of 1 to 2 units was hypothesized to occur at approximately 4 months, the study focused on the period immediately prior to and following this age. Beginning at 2–3 months, all infants were seen at home on a weekly basis, at a time when their mothers expected them to be awake and alert. At least 10 min was allowed to elapse after feeding before sessions were initiated (or recommenced, if hunger interrupted them). Sessions were interrupted whenever fussiness or distress became evident prior to any measure, and rescheduled if the fussiness did not subside.

Each session began with a getting-acquainted period, in which the investigator played with the infant to promote familiarity. Then the five coordination tasks were administered, followed by the two socioemotional measures (contented interaction, followed by separation). For these last two measures, the experimenter positioned himself behind a large cardboard screen about 5 ft away from the infant, and observed its facial, vocal and postural reactions through a small peephole.

Results

The results are presented in Fig. 4. As may be seen, there was a correspondence between the onset of sensorimotor coordination and the onset of separation distress. Most infants showed very little emotional response
to their mother's departure prior to 4 months. Between 4 and 5 months, however, when the majority of sensorimotor measures were being passed for the first time, most reacted with frowning, fussing or whimpering on at least half of the experimental sessions.

Discussion

At first glance, the results of the second study may appear to be just as predictable from classical Piagetian theory as from neo-Piagetian theory. To be sure, Piaget did assert that emotional as well as cognitive changes should be associated with stage transition (Piaget, 1981). At this general level of analysis, then, it is true that the results are just as compatible with the classical Piagetian position as with the present one.

It is important to realize, however, that the particular emotion–cognition correspondence which the above data indicate is not one which would have been predicted within the context of classical Piagetian theory. It is also important to realize that the results could not have been predicted on the basis of the existing empirical literature. In the context of classical Piagetian theory, children are not presumed to have a sufficiently permanent concept of the object to experience a sense of personal loss until approximately 8 or 9 months (Gouin-Decarie, 1965). Moreover, previous tests of separation anxiety—at least within the Ainsworth paradigm—have suggested that a sense of loss is not present until that time. It is quite unlikely, then, that the above results would have been predicted within the classical Piagetian framework, or even within the framework being developed by contemporary attachment theorists (see Bretherton & Waters, 1985). Nor would the results have been predicted on the basis of other empirical investigations of cognition–emotion parallels. What these investigations have shown is that the expected coemergence of cognitive and emotional changes fails to materialize when children’s development in each domain is compared using Piagetian measures (Gouin-Décarie, 1965, Haith & Campos, 1977).

Since these previous findings are at variance with the present ones, the discrepancy warrants some attempt at explanation. Two different but mutually compatible possibilities can be suggested. First, previous studies have tended to concentrate their efforts at the bifocal substage of the sensorimotor period, when the underlying cognitive reorganization may not be major as when children first enter the sensorimotor stage. Second, previous studies have tended to focus on one particular Piagetian task (normally the classical test of object permanence) rather than on the more fundamental systemic reorganization from which this change derives. As Rushton, Brainerd, and Pressley (1980) have pointed out, this
sort of narrowly based assessment is unlikely to turn up evidence of positive relationships, for methodological as well as theoretical reasons.

Of course, an obvious limitation of our own study is that a very small number of subjects were employed. We are currently in the process of gathering more data, however, and the original trend does not appear to be holding up. Thus, it would appear that the new features which neo-Piagetian theory brings to classical Piagetian theory may well prove to be an asset in exploring the developmenta relationship between cognition and emotion.

Study Number Three: The Influence of Early Loss and/or Emotional Disturbance on Children's Subsequent Rate of Cognitive Growth

The third study was conducted by Paul Hurst (1980). Its general objective was to determine whether emotional factors could be shown to influence children's rate of progress through the stages and substages of cognitive development. Recall that, in contrast to certain psychoanalytic theories, the present theory holds that chronic internal conflict and anxiety should only lead to a very modest deceleration in children's normal rate of cognitive growth (see Section IVC.). It also holds that many specific events that are emotionally disturbing will actually lead to an acceleration of children's cognitive development in the domains to which they are relevant, by increasing the amount of time children devote to related epistemic activity (Section IVB).

In Hurst's study the first variable (chronic anxiety) was manipulated by selecting a population of emotionally disturbed children at different age levels, and comparing them to a group of normal children whose measured level of anxiety was substantially lower. The test of chronic anxiety was the Spielberger Anxiety Scale, and the test of children's cognitive development was Noelting's test of ratio and proportion. The expectations were (a) that there would be a substantial difference between the normal and emotionally disturbed groups at all age levels on the anxiety scale and (b) that there would also be some modest difference at all age levels (favoring the normals) on the measure of cognitive development.

The second independent variable was the experience of a domain-specific disturbing event. This variable was manipulated by examining subgroups of normal and disturbed children who either had or had not lost a loved one prior to the age of 5 years, when mature defenses are normally thought of as being possible. Although a variety of types of loss were considered, the one on which attention focused primarily was death. Thus, what was of interest was how children's development of the death concept would be affected by this experience in subsequent years. From
the classical psychoanalytic perspective, one might expect that young children would blame themselves for the death of a loved one, and defend against the feelings of anxiety and guilt that they experience by a variety of reality-distorting defense mechanisms (Freud, 1915). As a consequence, one might further expect that they would be slower to understand the nature of death than normal children, that is, that they should lag behind normal children in the development of the death concept.

From the present perspective, the expectation was quite different. A child who loses a close relative must continue to live in an environment which contains objects that remind him or her of that relative. He or she must also continue to associate with other families in which such a relative is not absent. While such children may very well develop structures for inhibiting their experience of sadness and/or guilt, and while these structures may even contain strong distorting components, they are unlikely to stop the child from thinking about the topic of death completely. To the contrary, the structures are likely to contain or reduce the children's painful feelings in some fashion, thus increasing the amount of time they can spend contemplating the subject, and contributing to a further reduction in negative affect.

Now it will be remembered that, within the present framework, accelerations or retardations of specific developmental sequences are presumed to occur because of increases or decreases in the amount of time that children engage in domain- or task-related epistemic activity. It follows then, that children's development of the death concept should be accelerated, not retarded, in cases where death is encountered first hand. Moreover, to the extent that death remains an emotionally salient topic, children's understanding of the death concept should remain accelerated, even years after the event. In effect, such children should be "pushed" by their feelings to reconstruct a new understanding of the death concept, at each successive stage and substage of their development.

Subjects

Four groups of children were formed. The first group (n = 34) consisted of normal children who had experienced a traumatic loss prior to the dimensional stage (i.e., prior to age 5), and who were currently attending nondenominational public or private Catholic schools in the local area. The second group of children (n = 51) was comparable in all respects to the first, except that these children had not experienced any loss of a traumatic sort. The third and fourth groups (n = 34 and n = 37) were comparable to the first and second, except that they had all been classified as emotionally disturbed, and were receiving therapy in either residential (small home) or nonresidential settings.
Measures

A variety of measures were administered. For the present purpose, the four most important were the following.

Noelting's juice-mixing task. This is a pencil and paper test that was designed by Noelting (1982) for children from the mid-relational to the late vectorial stages. Within the context of the present theory, the test permits one to classify children with regard to their general stage and substage of cognitive functioning (see Case, 1985).

Death concept. This test was designed by Hurst on the basis of the work done by Laurendeau and Pinard (1962) and utilized the structured-questionnaire format that they developed.

Spielberger anxiety scale. This test was designed by Spielberger (1966) to assess children's level of chronic or "trait" anxiety.

Results

The first comparison that was of interest was between the normal and the emotionally disturbed children. Here the findings were essentially as predicted. It was found that the emotionally disturbed children had significantly higher scores on trait anxiety as measured by the Spielberger Scale at all age levels \((F(1,148) = 7.04, p < .01)\). It was also found that they had a significantly lower level of cognitive development, as judged not only by Noelting's measure but also by a variety of other measures that were administered. The magnitude of this difference was not very large, being on the order of only one-third substage at any age level. However, it was statistically significant \((F(1,147) = 10.93, p < .01)\).

The second comparison of interest was between the children who had experienced pre-5 loss and those who had not. Here the results showed that the pre-5 loss children did not experience more chronic anxiety than other children, nor did they experience more specific anxiety as a result of being questioned about the death concept. These findings were of importance in view of the rationale for predicting an advance in their understanding of the death concept. If the structures these children had developed for coping with their early loss had not been sufficiently effective to ward off general or specific anxiety, then it is conceivable that they might have avoided any epistemic activity related to this topic, and actually been retarded in their understanding of it. Since they did not experience such anxiety, however, one would expect that they would continue to be drawn to the topic due to its emotional salience for them, and that their understanding of the concept would be advanced.

As indicated in Fig. 5, this was generally the case. The children who had experienced pre-5 loss remained accelerated in their understanding
of the death concept as long as 7 years after their original experience. This was in spite of the fact that their general cognitive development was in all other respects indistinguishable from that of other children. Once again, the magnitude of this acceleration was not large. However, it was statistically significant ($F(1,158) = 5.6, p < .05$).

**Discussion**

Given the nature of the sampling procedure, the conclusions that can be drawn from the third study are somewhat limited. However, it does seem clear (a) that emotional factors can influence children's assessed developmental level in either a positive or a negative direction, and (b) that the magnitude of these effects may be relatively small, at least for children who have not experienced extreme depression at an early age, or for a prolonged period of time. Finally, it seems clear that the general experimental paradigm that was employed offers some potential for further clarification of the nature of emotion-cognition relations.

**V. CONCLUSION**

As Izard and Malatesta (1984) have pointed out, contemporary views
of cognitive and emotional development can be divided into two general
camps: those that assign one of the two processes (usually cognition) a
primary role (e.g., Kagan, 1983) and those that assign the two processes
an equal and interactive role (e.g., Izard, 1984; Sroufe, 1979). The
present view clearly falls within this latter camp. Moreover, within that
camp, it falls closest to the view that has been articulated by Sroufe and
his colleagues (Sroufe, 1979, 1982; Sroufe & Waters, 1976). Like these
investigators, the perspective we have adopted is an organizational one.
Like them, too, we have assumed that the emergence of new emotions at
predictable points in children's lives is best thought of as demonstrating
their arrival at a new stage in a general and interactive process, rather
than the activation of an emotion-specific and solely maturational mecha-
nism.

Where the present view hopefully extends that of Sroufe, while at the
same time building on it, is in the adoption of a neo-Piagetian rather than
a classic Piagetian perspective. It was the neo-Piagetian aspect of the
present position that provided the basis for most of the novel suggestions
that were proposed, as well as most of the successful predictions.

As was mentioned in the introduction, a whole family of neo-Piagetian
theories have emerged in recent years (Case, 1985; Fischer, 1980; Hal-
ford, 1982; Mounoud, 1985; Pascual-Leone & Goodman, 1979). Thus, the
view of development that was presented in the present article is by no
means the only one that can lay claim to this title. As was also indicated,
however, there is a substantial degree of agreement among neo-Piagetian
theorists with regard to the general equipment with which children set
out on their developmental journeys (postulates A1–A4), and the se-
quen ce of structural transformations that take place at certain key points
in their later lives (postulates B1–B6). It is primarily with regard to the
stage-transition process (postulates C1–C4) that disagreement is present,
and even here certain general points of agreement may still be noted,
particularly with regard to the relevance of a broad range of "everyday"'
cognitive processes for the assembly of new cognitive structures and the
limits that are imposed on these processes by the slow growth of working
memory.

Since the present article has drawn primarily on those postulates on
which an agreement is present, it is probable that the view it puts forward
will be broadly compatible with that held by most other neo-Piagetian
theorists. Of course, other neo-Piagetian theorists will only make similar
assertions to the extent that they also adopt a similar position on the
nature of the emotional system, and its relationship to the cognitive
system. Moreover, even if other theorists should adopt identical positions
on these two points, there is the possibility of more specific differences in
the analyses of particular emotions, emotion-inducing situations, or emo-
tional control structures. It thus seems unlikely that complete agreement will be reached on these matters in the near future, even among investigators who are basically of like minds.

This state of affairs, however, seems to us to be exactly as it should be. For while the goal that we are pursuing is a common one, it is important that we fan out as broadly as possible in our pursuit of it. Only in that way will we be able to explore the full terrain, and map out the relationship between cognitive and emotional development as precisely and completely as possible.

REFERENCES


