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TARGET ARTICLE

The Development of Intentionality and the Role of Consciousness

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Starting with the observation of a very young child's learning of an instrumental response and the child's frustration in being unable to control what was once a controllable behavior, I seek to explore the origins of intentionality. Three models are considered. In the mechanistic model, the construct of intentionality is considered irrelevant because action is viewed as caused by the environment or internal biological dispositions. In a second world view, intentionality exists but not always and not for all social creatures; it is an emergent property of organisms. The third view, presented here, argues for intention as a property of all goal-directed systems. Within this view I seek to describe the various levels of intentionality and to develop a system that will enable us to explain intention in such divergent actions as a plant's movement toward the sun, a newborn child's movement toward a brightly colored object, and an adult's conscious goal-directed behavior.

Two World Views

Two views of human nature predominate in our theories of development. In the first, the human is acted on by surrounding forces, and in the second, the human acts on these forces (Reese & Overton, 1970). The reactive view generates two major theoretical paradigms, biological and social control. The active view, on the other hand, has generated the constructivist or developmental-cognitive theoretical paradigm. The place of intention within these two world views differs greatly. Let us consider these views in their extreme forms to show how their respective theories might treat the issue of intention.

In both the biological-motivational or social-control paradigms, the causes of behavior or action are forces which act on the organism causing it to behave. These may be internal biological features of the species, including species-specific causes of behavior, or the external social control of conspecifics—these, too, may be species specific. In all cases within this world view, the organism is acted on and the causes of its action (including its development) are external to it. Thus, for example, the major determinant of sex-role behavior is thought to be biological, that is, determined by sex, in this case, by the effects of hormones (Money & Ehrhardt, 1972) or lateralization (Buffery & Gray, 1972). Alternatively, sex-role behavior can be determined externally by the shaping effect of the social environment, either the differential rewards of conspecifics (Fagot, 1973) or the differential construction of the social world. Examples of the former are already well-known (e.g., parental praising or punishing of specific sex-role-appropriate actions, such as playing with particular toys; see Goldberg & Lewis, 1969; Rheingold & Cook, 1975). Examples of construction of the social world include giving the child a male or female name. These do not imply reinforcement control but structural control. In such external control paradigms we need not infer will, intention, or plan.

In contrast to this passive view is the constructivist paradigm based on the world view that the organism acts on its environment and participates in it. The organism has desires and plans. These desires and goals are constructed, as are most of the actions enabling the organism to behave adaptively. This view does not necessitate discarding either biological imperatives or social control as potential causes of behavior, because humans are both biological and social creatures and both, to some degree and in some combination, must affect behavior. I prefer to think of these biological and social forces as nothing more than the raw materials for the construction of cognitive structures including goals and desires, plans, and action patterns themselves (see Fodor, 1981b, for a similar view). Taking the example of sex-role behavior, I argue that hormones and social control become the material for cognitive structures. Such structures might take the form "I am male or female," "Males or females behave this way or that way," "To receive the praise of others (a desired goal) I should act either this way or that." Such cognitions and their accompanying goals and desires, along with cognitions concerning information about the world, enable the child to intend, that is, to will to act in a particular fashion.

These two world views are present in all psychological inquiry. The mechanistic model receives support in the case of the biological study of action (e.g., T-cells tracing foreign proteins that have entered the body). Constructivist views are supported by theories of the mind (Neisser, 1967). It should not go unnoticed that with the growth of cognitive science, the idea of constructing mental representations (that do not correspond in any one-to-one fashion with the "real" world) and with them, plans and intentions, has become more acceptable to psychology proper (see Gardner's, 1985, review).

The Problem of Intention

Central to this article, however, is the problem of the development of intention. In so stating the problem, I beg the question of whether there is such a thing as intention. Intuitively, most of us are comfortable in believing that intention exists. There is no difficulty for any of us in using terms such as "I intend to go to the market tomorrow," or in understanding that an intentional act of violence is a more serious transgression than an unintentional one. Nor do we have difficulty in explaining our action as intentional: "I went to the refrigerator because I intended to get the butter."

Even so, accepting the notion of intentionality raises difficulties. Some forms of action are more difficult to explain as intentional; unaware action, for example, "I did not realize I was angry and did not intend to push you away." Freud suggested that action we are unaware of is unconsciously intentional. Other actions appear so rote and mechanical we hardly believe that they were planned or were intentional, for example, walking actions, or even talking or listening. These, too, are intentional if we consider that intention need not be always pure intention, but can be "intentions in action" (Searle, 1984, p. 65). Nevertheless, I claim that adult humans are intentional, or if not so, then at least we *believe* that we and others are intentional (Dennett, 1987).

Make no mistake: The claim that intentionality exists is made without any basis of proof, only that we have such an idea; there might be cultures and times that would deny such a concept. The same, however, might be said for any mental structure or operation. Here I am willing to consider Rorty's (1989) analysis of truth. If we follow his analysis correctly, we cannot make the claim that intentionality exists out there, only our understanding of it exists and is "real." There is no Truth out there to which some language (read here *world view* or *model*) is better than another.

> Truth cannot be out there—cannot exist independently of the human mind—because sentences cannot so exist, or be out there. The world is out there, but descriptions of the world are not, only descriptions of the world can be true or false. The world on its own—unaided by the describing activities of human beings—cannot. (Rorty, 1989, p. 5)

Adopting this conceptualization permits us to choose between descriptions of reality and allows us to test our choice for truthfulness vis-à-vis another description. In this case, our choice is between a model that does not require intention and one that does. Because I wish to focus on the topic of ontogenetic change in intentional behavior, I choose the model asserting that it exists. Our problem then becomes how to study the development of this concept. I choose to focus on the topic of development, for it seems to capture the problems inherent in any discussion of intention—for example, the question of intention in animals (Griffin, 1984), in machines (Newell, 1982), and in different cultures (D'Andrade, 1981). The ontogenesis of humans allows us to consider the issue of intention from a broad perspective in *the same organism at different points in its life*. Because we have some idea of the similarities and differences among infants, children, and adults, we may have more information to aid us in understanding intention. The problem of generalizing from animals or machines to humans or from one culture to another is avoided. For these reasons, the study of the development of intention is of some general interest.

One way to pursue this topic is to ask how children come to understand the concept of intention. We might, for example, ask at what age children come to understand the differences between accidental or intentional behavior (see, e.g., Berndt & Berndt, 1975; Dunn, 1988). The problem here is that such studies tend to learn more about the child's understanding of the terms *accidental* versus *intentional* than they do about the child's knowledge of intention. Nevertheless, this approach has been followed by many (e.g., Dodge, Murphy, & Buchsbaum, 1984; Keasey, 1977). Another difficulty is that studies of this type require that children be able to speak or at least understand the language. Because the language has terms such as *intention* and *accidental,* we may be inquiring into the child's socialization rather than into its logical structures. There is clear evidence that children show behaviors, prior to language, that would lead the observer to believe they have an understanding of intention and of causality, a closely related problem (see, e.g., Leslie & Keeble, 1987; Michotte, 1963).

The Development of Intentionality

It is Piaget (1936/1952) who has offered us a developmental blueprint of the development of causality and intention in the opening years of life. To summarize, Piaget employs a mixed model in his description of the development of intentionality. In the earliest stages of development, children's actions are simply biologically given action patterns. After a time, these action patterns produce (still without intention) outcomes. It is these outcomes which in turn produce the action patterns. Thus A accidentally causes B (an effect) and B in turn produces A. Piaget characterizes this chain of events as a *simple circular action* pattern. Notice that the control of the action is associated with the simplest of mental representations. The representation is the association between A and B as mutually connected. Nevertheless, it is B, an environmental event, (an effect in the world) which causes A (the action) to occur. I think it is safe to conclude that, for Piaget, the child starts the developmental process without intentions.

However, by the end of the first year of life, children "set out to obtain a certain result" (Piaget & Inhelder, 1969, p. 10). By now, the means—formerly A (both action and representation)—have become independent of outcome, B. The mental representation associating A and B, which appeared at the beginning of life, has now been separated. In a sense, Piaget describes the child as changing from reactive to active and from rote associative reproduction to the pursuit of a goal. Here, then, he starts to speak of intention. However, it is still a limited intentionality; it is only the separation of means and end in the utilization of an *available* means for a new end. It is not until the end of the fifth stage (somewhere around 15 months) that intentionality is assumed. For Piaget, intentionality makes possible the creation of goals and plans in the absence of external events and in the establishment of new schemata—multiple means associated with multiple ends.

Piaget's model denies the existence of intentionality at the beginning of life, but allows for its development over the first

2 years. The difficulty with such a mixed model of development is in the question of how is intention created? If we accept, for example, the mechanistic model, we can dismiss intention as an unnecessary mentalistic construct having little utility at any point in development. For the constructivist, however, intentionality is a property of the mind, as is believing, desiring, hoping, fearing, and so on. There is no need to create it, because it is a part of our mental states. For example, consider the position of Searle (1984). For him, actions consist of two components—one mental, one physical; the mental component is an intention. That is, a mental component is an intention because it is about something. These two components go together: "The mental component as part of its condition of satisfaction has to both represent and cause the physical component" (p. 64). In this sense, Searle turns the problem of how to go from thought to action into another problem, which is that action, by its nature, is part thought (mental) and part physical. Whatever the argument one adopts, the claim that intention exists as a property of mind does not require that it be created. Piaget's explanation for the development of intention utilizing a mixed model seems to me to be the most difficult model to justify. The problem remains of how to go from the absence of the mental state—intention—to its presence? A mechanistic stance might ask, "If in the beginning of development you do not claim intention, even though one might describe the behavior that way, then why do you claim intention later for similar behaviors?" In other words, if we do not need it in one case, what allows us to claim it for another. I return to the basis of this claim shortly.

The mixed model requires that we address the question "Where does intention come from?" How can the infant discover intentions if it does not already possess them? Like other ideas, intention needs to be discovered. However, the problem of discovering something that one does know becomes an issue. This problem of how to know of something one does not know is too complex to deal with here. Fodor (1975) in his critique of Piaget's theory of concept acquisition raises the same problem of how children can learn a new concept unless they already have the ability to hypothesize the concept. If they already have this ability, then they already possess the concept. This is a particular problem for Piaget, because the idea of the intention is part of the logicomathematical structure existing in the child's head. As such, it does no good to argue that the child does not create it, but rather borrows it from the language of the adults around him. In some sense, then, Piaget's mixed model is of some concern. However, there is not another well-articulated theory of development to take its place. One of the purposes of this article, then, is to suggest a starting point for such a theory. One way to explore the relation between thought and action is to consider the literature on cognition and emotion (or desire) because desire may be synonymous with intention.

Relationship Between Cognition and Emotion

To explore the relation between thought and action, I turn to a discussion of the association between cognition (representations) and emotion (action or motives). The association is often discussed as one leading to the other, either cognition leading to emotion or emotion leading to cognition. Thus, in either case we have assumed a connection between them, a position not unlike that held by those who would see in representations an action potential, that is, a desire for or a desire to do something (e.g., Searle, 1984).

Cognition Before Emotion?

From the point of view of cognition leading to emotion, appraisal theories regard emotion as the product of information processing. Arnold's (1960, 1970) theory of emotion has as its central construct the cognitive act of appraisal, whereas Lazarus (1982) held to a view that appraisal leads to certain kinds of activities as a way to adjust to the environment. It is the appraisal itself that leads to the emotion. Discrepancy theory, a part of general appraisal theories, argues for an even more direct connection between cognition and emotion (Hebb, 1946, 1949). Berlyne (1960), for example, suggested that unfamiliar events evoke fear, a view taken by others (Kagan, 1974; Lewis & Goldberg, 1969). Siminov (1970) defined emotion in terms of information processing. In his model, emotion is the consequence of the organism's need for information with respect to reaching a goal, multiplied by the difference between "necessary" and "available" information. Notice that here emotion is defined at the cognitive-process level rather than at the goal level. If, on the other hand, we defined emotion as the goal or the desire to achieve the goal, we would consider emotion as a precursor to cognition. This point is important, because if emotion is to be defined at this point, then emotions are not only caused by cognitions, but, in turn, produce cognitions.

Emotion Before Cognition?

We can approach this problem from another perspective. Emotions have been viewed as preceding cognitions from three perspectives: as motive, marker, and instigator.

Emotions as motives. Since Darwin (1872), the notion of emotions as sources of action has been useful as a theory of motivation. Theories that consider emotions as motives can be divided into two classes: (a) those viewing emotion as a consequence of thought and thereby reinforcing thought and (b) those viewing emotion as causing thought based on the evolutionary history of the species. The central issue of the hedonic tradition is the belief that people think in such ways as to reproduce pleasure and avoid pain. The emotional consequence of a thought is regarded as the primary cause of that action.

This view of emotions as motivating action through the emotional consequences of that action appears reasonable. For example, students may study for examinations because it feels good to pass and it feels bad to fail; children engage in symbolic play to experience the pleasures in solving a problem. It should be noted that this view of emotion considers thought to be motivated by the *possibility* of its emotional consequence. Even though the emotional experience occurs after the thought, it is believed that the reinforcement value of this experience serves to produce the same set of behaviors to reexperience the particular emotion. So although emotion is initially a consequence of thought, the expectation or memory of the emotional state may precede and influence subsequent thought.

If one thinks of emotion in this way, then emotions, especially feeling good and feeling bad, act as rewards to particular patterns of thought. In many cases, these hedonic events seem to be unlearned. For example, it is unlikely that the good feeling produced by eating when hungry is learned. Rather, eating feels good because of an innate biological connection between food in the digestive tract and relief from hunger. On the other hand, some emotional reinforcers seem, at least at first glance, to be learned. There is no intrinsic reason that it should feel good to get an "A" on a French examination.

Emotion may be not only the rewarding outcome of thought, but also its antecedent. This view of emotion is usually associated with biological explanations of emotion. Darwin (1872), the source of the evolutionary tradition in the study of emotion, argued that the process of evolution applies not only to anatomical structures, but to intellectual and expressive behaviors as well. Emotions are by their nature associated with patterns that the organism needs for survival. For example, the sight of a predator will elicit fear in the organism, the action pattern of which is to flee. Or, a baby's cry will elicit nurturance in the mother with a concomitant behavioral repertoire of nursing, holding, or retrieving the infant. Viewed in this way, emotion is both a state of the organism and a response that is basic to life and survival. In all cases of positive and negative emotions, the emotional elicitor produces specific action patterns (including cognitions) as a part of the emotion.

Plutchik (1980) enumerated eight basic functional patterns of behavior that have adaptive significance for all organisms in their struggle for survival. The prototypic patterns include incorporation, rejection, destruction, protection, reproduction, reintegration, orientation, and exploration. These basic adaptive patterns are thought to be the functional bases for all emotions recognized in humans and animals. Eight emotions accompany the functional patterns: acceptance, disgust, anger, fear, joy, sadness, surprise, and expectancy. Although the specific behaviors that accompany these patterns may vary across different species, their survival function is common to all species.

Zajonc (1980) offered a view similar to the evolutionary position. For Zajonc, some of the behaviors associated with an emotional state may have "hard-wired" cognitive representations; that is, they may be independent of cognitive systems and, in fact, may precede perceptual and cognitive operations. Zajonc discussed the primacy of emotion with regard to preferences and attitudes, but his argument was essentially that emotion "accompanies all cognitions, that it arises early in the process of registration and retrieval . . . and it derives from a parallel, separate, and partly independent system in the organism" (p. 154). In short, emotions may be associated with basic adaptive functions and have as their biological consequence a set of dispositions, including actions as well as thoughts.

Emotions as markers. Much attention has been focused on the roles of "hot" versus "cold" cognitions. The general assumption underlying this belief is that cognitive processes have different levels of efficiency or outcome depending on how these cognitive processes are tagged with specific emotional tones (see Zajonc, 1980). One might argue that certain cognitive processes marked with emotion might be more efficient than those not marked. For example, the retrieval of past events, both in short-term and long-term memory, is facilitated by specific affective markers (Norman & Rumelhart, 1975). It is reasonable to assume that information may enter memory not only as a function of the content or sequence of the material, but also as a function of the type of emotional tag; clearly, the schema of a man in a white coat is more likely to be remembered if it is associated with high fear than if it is marked with low interest and fear. Markers may also be associated with the emotional content of events as they relate to the emotional state of the organism. The research on state-dependent learning indicates that emotions may have a powerful influence on cognitive processes, including free recall, imaginative fantasies, and social perception. For example, Bower (1981) found that people recall more events that are affectively congruent with their mood during recall. Here, emotions as markers refer not only to the emotional tag attached to the cognitive event but also to the emotional state of the subject as the subject interacts with the cognitive event.

Emotions as instigators. The third role of emotion in cognition addresses the following question: Do certain feelings necessarily lead people to think in particular ways? One way to approach this issue is to consider patterns as related to specific emotions. Emotions may not only lead in some biological fashion to action patterns (Plutchik, 1980), but emotions may in fact produce specific thinking patterns.

One aspect of this issue is related to the nature or the content of the thought. For instance, someone may tell you that your cousin was hit by a car, or someone may tell you that your cousin won the lottery. The emotions produced by the information about your cousin in these two cases might influence your subsequent thoughts. Isen (1984), for example, demonstrated that happy moods produce more associations than unhappy moods.

This discussion suggests that it is unreasonable to consider cognition and emotion as unrelated. Within the organism, these processes coexist and are interdependent. That we separate them reflects an Aristotelian view, not necessarily correct. In fact, it is difficult to think without action, because thinking is always associated with emotions, and emotions, for the most part, either (a) have action patterns associated with them or (b) are themselves the goals of thought. Such an analysis again leads us to the connection and interdependence between thought and desire; that is, intentions consist of actions and thoughts, although as we shall see, the level of thought may vary considerably.

Behaviors as Measures of Intention

Leaving the problem of the mixed model aside, it might be the case that Piaget's observations, and those of others before him (e.g., Baldwin, 1894/1903), might allow us to come to understand how he claims intentionality from the observation of behavior. In some way, it may be useful to use Piaget's observations to construct a model of the development of intention from a single stance. Piaget, in thinking about the development of intention, introduces two central features of mental life: (a) means and end and (b) schema development. Let us consider each in turn to see whether these mental operations and the behaviors associated with them aid our understanding of the developmental process.

Means and end. The 3-day-old infant is attached to an apparatus that delivers a sweet liquor if it sucks at a certain rate. Within a few minutes, the infant is able to alter its behavior so as to get the liquor. It is clear that, for Piaget, conditioning in a very young child does not represent intentionality. The child at very early ages may be taught to suck on a nipple "in order to produce" an effect (Lipsitt, 1976); however, the behavioral connection between the sucking response and the outcome are not intended. These he saw as habits, imposed externally. There is no mental separation between the means and end and therefore no intentionality. Moreover, and perhaps more important, we might argue that the simple circular reaction is as much caused by the outward reaction as the child's desire to act and thus fails to be intentional because it is imposed.

It is believed that intentions can be inferred only when there is variation in behavior. Piaget acknowledged this when he spoke of multiple means to the same end or, alternatively, the same means to multiple ends. Although Piaget inferred the development of mental structures that logically must be associated with such actions, to infer intention only requires that multiple means and ends be available. When they are, we need to infer some mechanism within the organism enabling the choice. In doing so, we assume that there are no simple habits that can account for our observation.

However, we are not helped as much by this observation as we might at first assume. In the case of a repeated similar action, we cannot assume that the same means to an end does not reflect intention. First, no action is ever the same, thus even a child's simple kick is different each time (Thelen, Kelso, & Fogel, 1987). Moreover, certain means may be preferred and are repeated not because they are controlled externally, but because they are valued. I may put my left shoe on first each day because I prefer it, not because the perception of shoes compels me to put the left one on first.

For the case of multiple means to an end, there also may be logical problems. For example, it seems possible to construct a machine (or instruct a child) to produce any one of several actions to produce a given result. The training of such a complex habit or rule (or its programming, using the computer metaphor) only requires that a particular response be selected and its effect vis-à-vis the end be evaluated. If a particular means succeeds, alternative means are not needed. Such an analysis poses some difficulty for any theory of the development of intention that assumes we can move logically from an action to an inferred mental state. I do not think that any specific action on objects as in means–end or its development will satisfy this demand alone, nor will multiple observations.

Schema development. On this topic, Piaget suggested that the infant shows us that it is not passive to events around it, but takes an active stance. The child in Stage 5 starts to coordinate different combinations into new and meaningful schemata. So, for example, the child knows how to pull on a rug to bring the rug toward itself. The child sees an object that it wants to possess, but is out of reach. By pulling the rug, the object comes into reach and is possessed. This is for the child the coordination of previously independent schemata.

> Now, in order that two schemata, until then detached, may be coordinated with one another in a single act, the subject must *aim* to attain an end which is not directly within reach and to put to work, with this intention, the schemata hitherto related to other situations. (Piaget, 1936/1952, p. 211)

The child moves from a trial-and-error behavior pattern, in which a solution is eventually found, to an insightful period. In this latter period, possible solutions are presumed to occur as mental representations, which are created and combined and, only after, displayed as action.

Here, too, it is difficult to see how such behavior can help us assume intention. Piaget's language employs an intentional stance to show it is intentional. It is not clear—unless we believe that by Stage 4 the child has gained, at least, primitive intention—that the actions and combinations themselves satisfy our need. Consider reaching for an object no longer in sight, at about 8 months. We know that prior to this time, the child's reaching is related to a complex schema which combines reaching with seeing. If seeing is blocked, reaching ceases. The development of active memory at this point may allow the child to continue to see the object, but now in memory, thus reaching continues. Alternatively, children might reach for something they see because they want it. They cease to reach when the wanted object is out of sight because they cannot remember it, but with the advent of a maturing memory system, they can remember, and so they continue to reach for it. Notice that in the former example, the belief in the lack of intention associated with the reach does not easily allow us to associate intention with the reach at a latter point—the problem of the mixed model. This problem does not occur when we adopt a model including intention from the start. Piaget's argument for intentionality at a particular point in development, but not before, strikes me as assuming a selective ontogenetic intentional stance, something akin to a limited intentional stance (Dennett, 1987).

How Infants Learn and What Happens When What Works Doesn't

Given these concerns, especially with the problem of a mixed model, we need to return to the phenomena that need explaining. Rather than choose real-life examples, I use a particular study of learning that my colleagues and I have already reported (Alessandri, Sullivan, & Lewis, in press; Lewis, Alessandri, & Sullivan, in press). Because this study is carefully described elsewhere, I address only its main features here. We studied how children learn and what happens when the rules are changed. Our experiment involved intentionality, and, because we studied infants over the first year of life, starting with the 8-week-old, we can explore the topic almost from the child's beginning of life. After explaining the study and its findings, I use it to consider a theory of the development of intention. From the outset, it should be clear that the position I adopt attributes intention to any system that is goal directed. My basic premise is that *all goal-directed systems are intentional,* but that different *levels* or *types* of intention may be useful in understanding animate, inanimate, phylogenetic, and ontogenetic differences.

The experimental paradigm was intended to examine whether young infants could learn a simple task and, once they had learned the task, what would happen when the rules changed. Because the learning consisted of pulling a string to obtain a reward, their motor actions were observed to assess learning. In addition, their faces were continuously monitored to measure their emotional expression. A simple operant-conditioning task was used (see Lewis, Sullivan, & Brooks-Gunn, 1985, for details). A string connected to a velcro wristcuff activated a microswitch. A pulling movement of the string triggered a brief presentation of a color slide showing an infant's smiling face, accompanied by a recording of children's voices singing the "Sesame Street" theme song. Arm-pulling responses were recorded and each child was videotaped.

Each experimental session included a 2-min baseline during which we were able to determine the baseline or ongoing rate of arm movement. Infants then received a learning phase of contingent stimulation in which the audio-visual stimuli were activated by each arm pull. All infants learned the task within the first 3 min of the learning period. When learning was achieved, a 2-min extinction phase occurred, followed by a second 3-min learning phase. During extinction, no event was presented after an arm pull.

Rates of arm pulling throughout the session were computed as the total number of arm pulls per minute. Facial movements were coded from videotapes of the infants using the Maximally Discriminative Facial Movement Coding System (MAX; Izard, 1979). Coders sampled the videotape segments of each subject using a frame-by-frame analysis of the videotape for each of three facial regions: brows, eyes, and mouth. After coding each component, facial expressions were identified by MAX formulas and their frequency tabulated for each minute of the session. We describe only two, joy and anger face, which could be coded with over 90% agreement between judges.

At each age (2, 4, 6, and 8 months), infants were assigned to the experimental and yoked-control conditions. The experimental subjects' arm pulls resulted in the event occurring whereas the control subjects received the same amount of the event as did the experimental subjects, but it was not related to their arm-pull behavior. For them, there was no possibility of associating a cause and effect.

Look first at the arm-pull data for each age group (see Figure 1). Notice that control subjects showed no change from the base period to the learning, extinction, and second-learning phases. Not so for the experimental subjects: To begin with, the infants who could cause the event to go on significantly increased their arm-pull behavior. Of particular interest are the subjects' responses once the association between arm pull and event ceased to work (extinction). Notice that when the arm pull no longer caused the event, arm-pulling behavior significantly increased rather than declined over the period of disassociation. In fact, during the disassociation phase, there was a 154% increase in arm pulling over the learning phase and a 376% increase over the base phase! Once the extinction phase was over, the infants returned to the rate of arm pulling they showed during the first learning phase. These differences were all highly significant. Now let us turn to the emotional behavior.

Joy expression follows what we have reported before

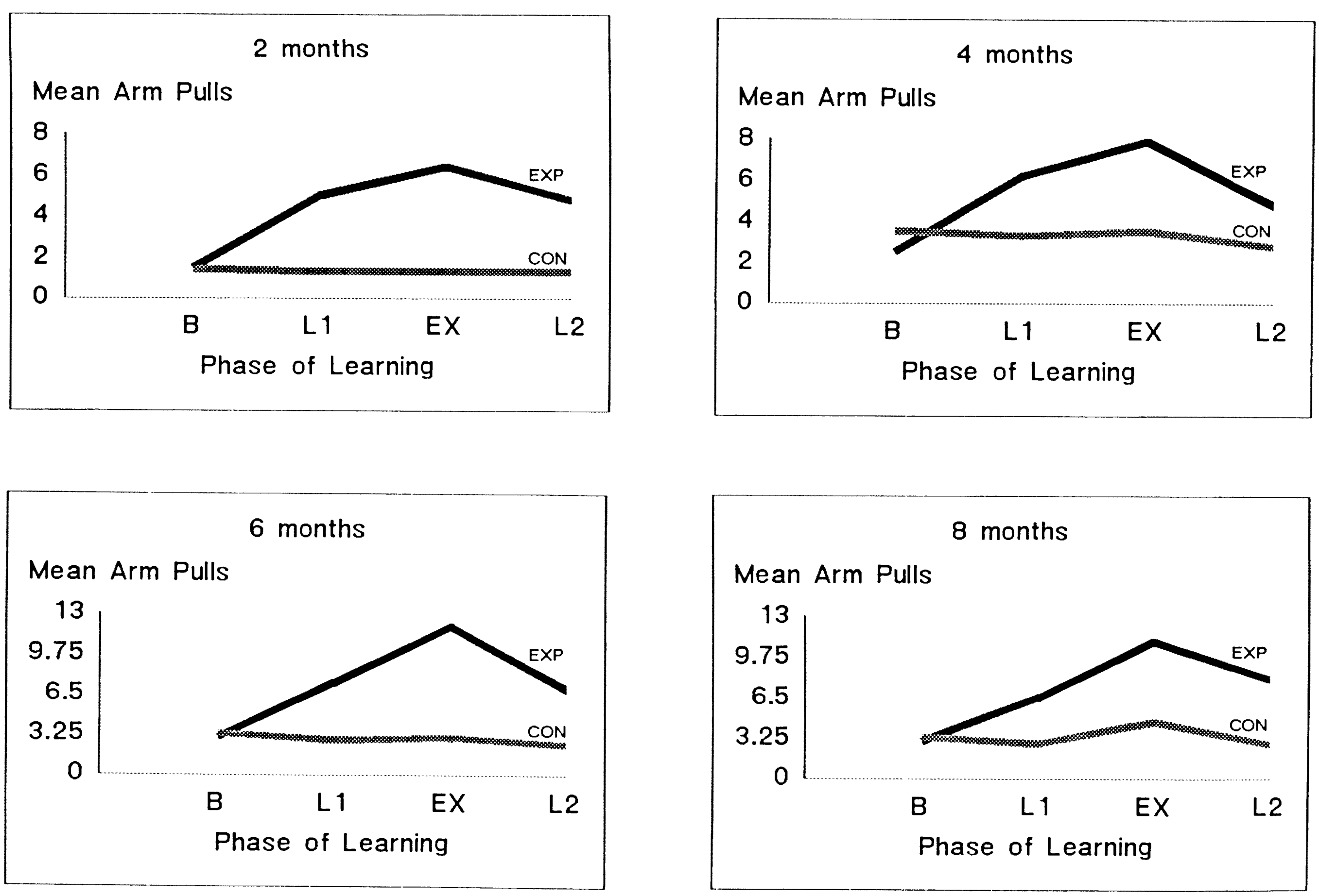

Figure 1. Arm pulling by condition as a function of age.

(Lewis, Sullivan, & Michalson, 1984). There was little joy during the base phase and no change for the control subjects (see Figure 2). The subjects who learned showed increases in joy during the initial learning phase, a total decline during extinction, and renewed joy once the second learning phase began. Angry expressions follow a reverse pattern (see Figure 3). There is little anger during the base or during the initial learning phase. Anger increased markedly once the association between action and outcome was broken and declined as rapidly once the second learning phase began.

Age effects reveal that 2-month-olds behave in the same manner as do 8-month-olds. Notice that arm-pull behavior patterns do not vary by age. Although arm-pull rates, over all phases, are greater the older the infant, there are no interactions between age and phase. In other words, 2-month-olds show proportionally the same increases as the oldest infants (344% for 2-month-olds and 393% for 8-month-olds from base rate to extinction).

The emotional data reveal the same findings. Again, overall amount of expression demonstrated increases with age but there are no Age × Phase interactions. Thus, even for 2-month-olds, the construction of an association between an action and outcome is accompanied by increases in positive affect, and the disassociation between them results in the appearance of anger which declines once the association is restored. I might point out that the original design called for a second disassociation (extinction) and a third association (learning) phase, but too few subjects were able to finish all seven parts. The 40% that did, showed an increase in arm pull and anger and a decrease in joy during the second disassociation, and an increase in joy and decrease in anger and arm pull once the association was restored.

It is also important to note that there was a high correlation between arm-pull rate during the disassociation and angry faces. One more finding is necessary before we ask what this all means. We measured the activity in each of the child's arms and found that although movement in both was present to begin with, during the learning of the association only the arm or hand pulling the string increased in activity; the hand not pulling, decreased. More important, when arm-pull rate increased as the angry face appeared, it was only in the arm associated with the response. The response to the dissociation, even in the 8-week-olds, was not a generalized activation, but a highly specific response to a learned association.

Let me try to summarize the results of these observations. To observe how children in the first year of life learn, and what they do when what they have learned changes, we created a situation where an arm pull resulted in some unusual event. I say unusual because from our perspective we have no reason to believe that the child, prior to our manipulation, has ever experienced an association between an arm pull and the appearance of pictures and sounds. Certainly it is possible that the children, in their cribs, learned that moving their arms produced some effect such as the shaking of the mobile above them, but pictures and sounds, are unlikely.

Regardless of whether or not it was an unusual associa-

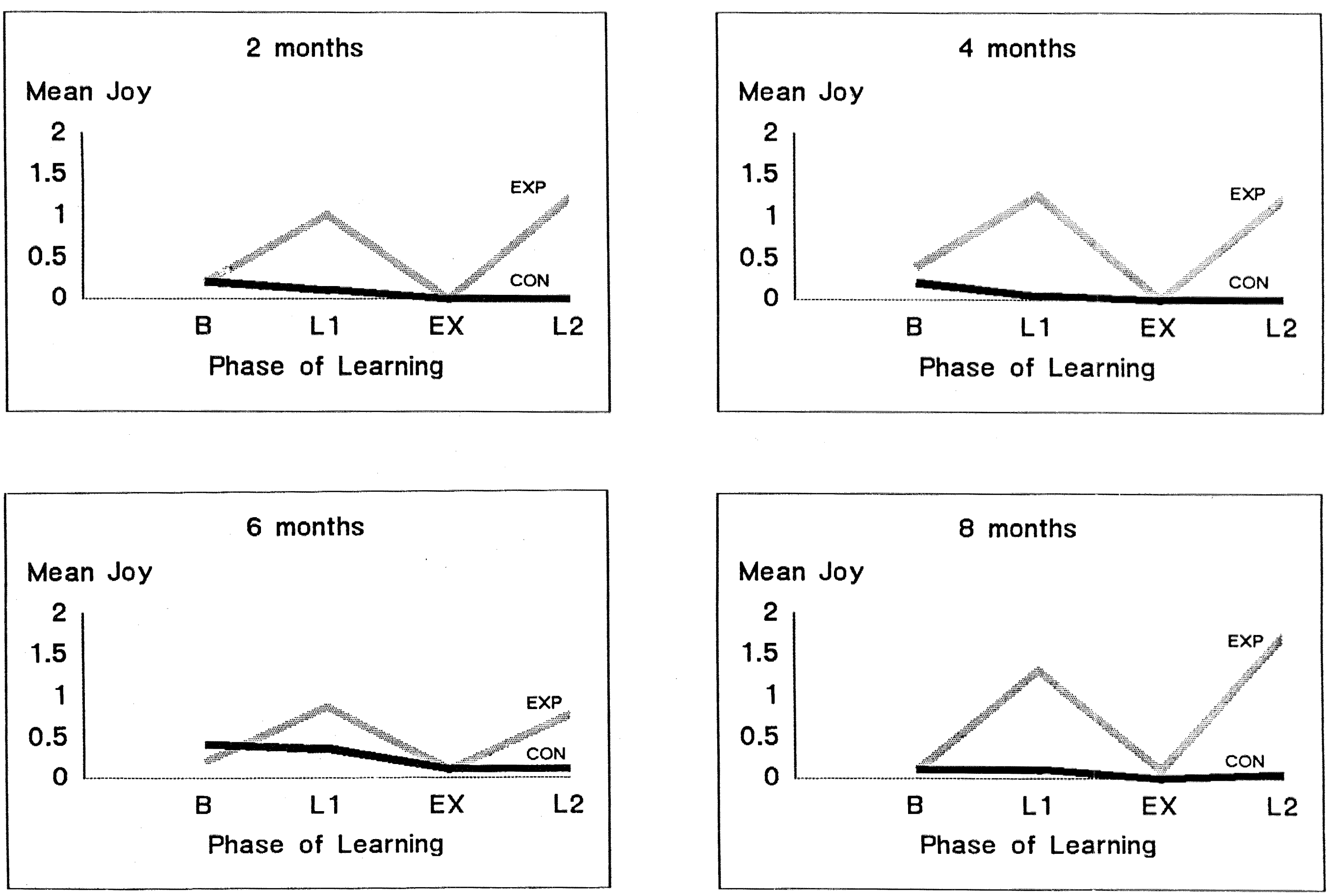

Figure 2. Facial expression of joy by condition as a function of age.

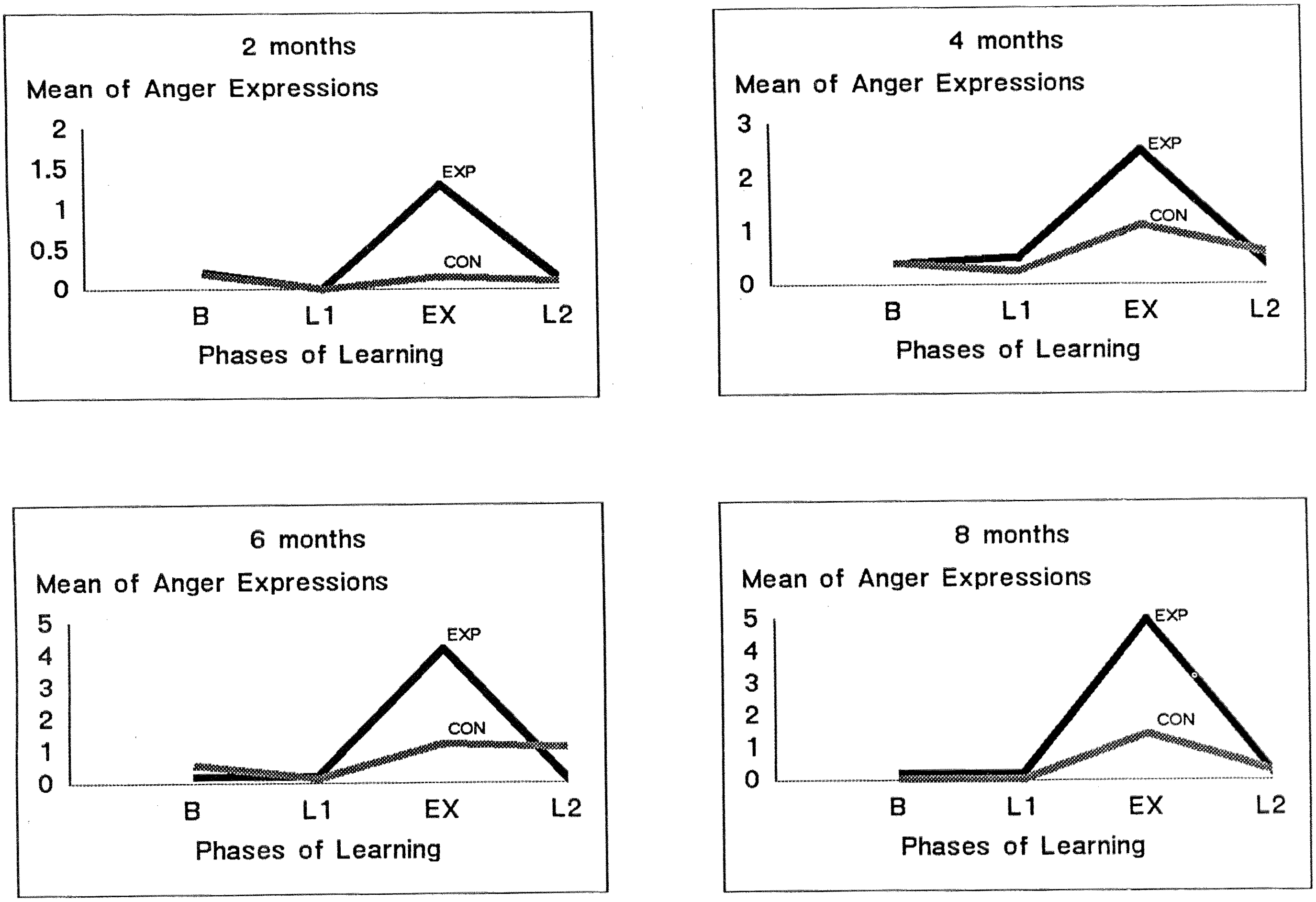

Figure 3. Facial expression of anger by condition as a function of age.

tion, the children demonstrated that they could learn, and learn quickly, that the arm movement would increase the occurrence of this event. Moreover, as they learned this response they showed an interested face as well as joy and surprise. All infants regardless of age learned this association. We cannot tell if they wished to learn this response, because we made the connection or association for them by our electronic/mechanical contraption. However, once attached to it, they did appear interested and happy when they made it work. They could stop their arm pulling if they so desired, and so we can argue that its continuation reflected a desire to do so. Alternatively, Piaget (1936/1952) would argue that they neither desired to nor were interested in engaging in this task. Once in the situation, the infant continued in it because the event (our outcome of face and voice) led to its continuation. It was not the child who desired but the outcome that controlled. This is how Piaget avoided imparting to the 8-week-old the mental property of intentionality. I return to this point shortly, but let me report the remainder of the study.

Having learned this association between arm pull and event, the event suddenly stopped. The arm pull no longer resulted in this event. The infants' joy disappeared, they became angry (some infants showed fear and sadness as well). Notice now what occurred. The response that led to the event did not work and so infants increased their response level and at the same time appeared angry. Moreover, we know the increased effort to produce the effect and the angry face are related to the disassociation between action and outcome because *as soon as* the association is restored, the anger disappears, arm-pull frequency declines, and the joy response returns. These children, even the 8-week-olds, appear to be angry when they do not get what they expect to get. Moreover, like the angry adults who bang the pay telephone when they lose their quarter, the increased action directed at causing the event disappears once the event returns.[1]

Explanation: Associative-Learning Model

Let me try to apply a simple associational or learning perspective. From such a mechanistic view, the positive reinforcement of *A* (the arm pull) with *B* (the picture and sound) should result in an increase in the rate of *A*. So far, so good. Now, the reinforcement stops. One might expect *A* to stop if it was controlled by *B*. *A* continues and we explain this continuance as a habit, or something learned. Exactly what this habit is, is unclear; nevertheless, we can assume that it is some altered structure in the nervous system of the infant. Thus *A* should continue, and we assume that if there was no

[1] We also measured the activity of the arm not attached to the string. This arm did not show an increase in arm pulling as a result of the frustration. Because of this, it is difficult to argue that the increase in arm pull was part of a general response.

further reward, *A* would eventually decrease its frequency, at least back to the level we saw at the beginning of the study. But *A* does not decrease in the absence of *B*. Quite to the contrary, *A* increases in the absence of *B*. Now this becomes more difficult to explain by simple associative learning because a habit learned may continue but not increase. In fact, it is necessary to now introduce a new construct, namely, the increase in *A* is due to the absence of *B*. This increase we call frustration/anger and claim that once the association is made between *A* and *B*, the elimination of *B* produces in the infant a new structure which calls forth a new response. But now the notion of a simple habit has broken down and we need far too many additional structures to support a simple associative model. Even here in this simple model, we run into trouble because even associative models of this kind involve cognition and, possibly, intention (Rescorla, 1987).

Explanation: Sensorimotor Intelligence

As I have indicated previously, I find no ready answer within a sensorimotor-intelligence framework. Circular reactions, as we would expect at this age, are also like habits. There is no mentalism here. Piaget and Inhelder (1969) stated that, at Stage 2,

> an elementary "habit" is based on a general sensorimotor scheme within which there is not yet, from the subjects' point of view, any differentiation between means and ends. The end in question is attained only by a necessary succession of movements which lead to it, without one's being able to distinguish either an end pursued from the start or means chosen from among various possible schemes. (p. 9)

Nor is there yet any notion in the 2-month-old of causality because the infant is unaware of the spatial and physical connection between actions.

We recognize that in Stage 3 or even Stage 4, a child who has learned an association between a particular means and end will continue that means in the absence of the ends. So, for example, the 10-month-old child returns to search for the object once found in location *X* even when the object is no longer to be found in that location but is seen moving to location *Y*. By Stage 5, this is no longer the case; however, our 2-month-olds are not in Stage 4 or 5, so we remain perplexed as to why by 2 months such association continues. Even more puzzling is why in the absence of the end (*B* event), the response increases.

Perhaps the movement from reflexes to intentions of the kind we observe here begins earlier or occurs more rapidly than has been thought. Perhaps they can be observed provided we construct the appropriate experimental conditions. Such a view allows for the maintenance of the sensorimotor sequence, as specified by Piaget, but requires that we change the timing of these emerging skills. By changing the timing in this fashion, we give to the very young infant intelligent behavior almost from birth, or at least soon after. Thus, the behavior of these 2-month-olds is not only centered around their own bodies, but involves attempts to produce environmental actions, and so are secondary circular reactions. The effect of this interpretation is to reduce the mixed model Piaget offers to a single one in which intentions appear from the beginning. This also has the effect of either restricting any developmental sequence to a brief period—the first 2 months of life—or to promoting a nativistic view.

Intention, Desire, and Consciousness

It seems obvious that our very description of what happens in this experiment assumes an interpretive and therefore a particular stance (see Hirsch, 1967, for an analysis of this problem.) Given that I assume a particular stance, let me restate it explicitly: All goal-directed systems are intentional.

How these goal-directed systems differ depends on the process underlying the goals. For all goals, intention is determined by the affective states comprising part of the goal. However, some goals contain both affective and knowledge states (or knowledge systems; see Newell, 1982), and some even the addition of the cognitive state of consciousness or objective self-awareness (see Duval & Wicklund, 1972).

Such a propositional system, if developed, enables us to deal with such diverse questions as "Does a T-cell have intention when it moves after a foreign protein?" "Does a leaf have intention when it moves toward the sun?" "Does an 8-week-old intend to learn?" or "intend to try to get the lost objects back?" "Do adults intend to go to work each day?" In each case, the answer to the question is "yes," and we need to see how it might be the case.

Levels of Meaning

What is meant when we say that an infant, child, or adult has intention? I believe that to understand this problem we need to resort to a levels-of-meaning analysis. Human organisms may achieve a level different from animals and within the human organism levels may differ as a function of ontogeny. A levels analysis has been explored by Fischer (1980) and Mounoud (1976), and I borrow from their analysis. It may be the case that different levels of ability require different degrees of experiential interaction. The lowest levels of an ability may require almost no experience for their emergence or, in fact, may exist at or prior to birth. Within the organism, higher levels of skill may require more experience or may be totally dependent on learning and culture. Such a view of levels allows for both a nativistic and culture-influenced world view. It may be the case that, across organisms, the same level of an ability may be achieved through different means. As such, one should be wary of concluding that similar abilities across species have similar histories. Werner (1961) considered this problem in his analysis of the equivalence of behaviors and called this the "constancy fallacy."

This level-of-ability approach touches on an issue that remains a considerable problem in development. This is the notion of equivalence of behaviors across age. One can often observe that a very young infant can perform some action that, when performed at an older age, would be considered to represent some underlying complex structure. Take, for example, the problem of imitation. Imitation is particularly important because the establishment of a true imitative response heralds the development of an understanding of self (Baldwin, 1894/1903).

The newborn infant will imitate certain body movements. For example, a tongue protrusion by an adult will produce a tongue protrusion in the infant (Meltzoff & Moore, 1977). Other forms of imitative behavior have been reported (Field, Woodson, Greenberg, & Cohen, 1982). Although there may be some question as to the reliability of this behavior (Anisfeld, 1988), such actions have been called "imitation." Imitation has a particular meaning, usually inferring some intentionality on the part of the imitator (Piaget, 1937/1954). The finding that matching behavior exists in the newborn constitutes a challenge for developmental theory. We could claim intentional behavior (like that in the adult) in the newborn. However, this is a nativistic explanation implying that there is no development in imitation nor in the process of intention. Alternatively, the same behavior can be said to have different meanings. We can say that the behavior at Time 1 is called "X," whereas at Time 2 it is called "Y." This solution has the effect of saying that behavior "Y," the more mature behavior, does not exist until Time 2. Thus, for example, imitation in the newborn is called "matching behavior," whereas in the 8-month-old, it is called "imitation" (Jacobson, 1979). It is much like a stage-theory notion because behavior "X" at Time 1 is not "Y," and it is not "Y"-like.

Another way of handling this problem of the meaning of behavior is to consider that both "X" and "Y" are functionally similar but that they represent different levels of the same meaning. In this case, "X" and "Y" behavior could be called the same, recognizing that "X" and "Y" are at different levels. In the imitation example, both behaviors are called "imitation," but we recognize that newborn imitation is at a level different from 8-month-old imitation. This position requires that we consider that a particular ability may have multiple levels. These levels are ordered and may be controlled by different processes. Moreover, the level of the ability may be found *both* as a phylogenetic as well as an ontogenetic function. Thus, from a phylogenetic perspective, a nonhuman animal, a rat, may imitate, but this imitation is at a level different from that achieved by a 1-year-old child. Likewise, from an ontogenetic perspective, newborn humans may imitate, but newborn imitation is not at the same level as that achieved by a 2-year-old. Whether the levels found phylogenetically match those found ontogenetically is unknown, although there is every reason to assume that they do.

Such a view of levels allows for the development of an ability while at the same time allowing for its existence across the entire developmental span. Moreover, this developmental process may be seen both within and across species. The problem of equivalency is especially relevant to the understanding of intention.

Because the theory of intention across age requires the assumption of various levels of intention, I describe these in some detail, with particular focus on the last level to emerge. The last level is based on the acquisition of self-consciousness or objective self-awareness, and therefore touches on the development of the self system. I cannot pursue here the development of self per se so the interested reader is referred to Fischer and Pipp (1984), Lewis (1990b), and Lewis and Brooks-Gunn (1979).

Levels of Intention

I propose three types of intentional processes, all related to goals. The first process is affectively bound and is connected to goals as actions of desire. The emotional property of goals gives them action because emotions, in part, are themselves action patterns (see Darwin, 1872; Searle, 1984). The second process is the knowledge-bound connection to goals. Consider Newell's (1982) construct of a knowledge level. In every system, there is a hierarchy of knowledge. Even at the lowest level of knowledge, the system has a body of knowledge which includes knowledge of that system's goals. Each system acts using the knowledge at that particular level to attain its particular goals.

Newell would not need a third process, such as self-consciousness (or *knowledge of* knowledge of goals) because he would include this as another level of the hierarchy system. To the extent that I claim this third process has no different status—it is the same substance as the second—I have little disagreement. Nevertheless, I see this process as uniquely different from the other two. On what basis could such a claim rest? Perhaps on no more than the general claim that a metacognition is not in the same knowledge level as another cognition. Consider the case of memory. A memory of a memory is not of the same class as another memory, because the systems (or levels) that support it and the material from which it is made may not be the same. We can think of this difference in knowledge and in knowledge of knowledge (what we wish to call consciousness) as emanating from different parts of the brain (Jaynes, 1977). Duval and Wicklund (1972) made use of objective self-awareness (knowledge of knowledge of goals), first by differentiating it from subjective self-awareness (knowledge of goals) and then by showing how it affects conformity.

Consider the metaphor, often mentioned, that the property of wetness cannot be derived from the properties of oxygen and hydrogen. In the same fashion, "consciousness emerged at some point in evolution *and in ontogeny,* in a way underivable from its constituent parts" (Jaynes, 1977, p. 12; italics in original). Searle (1984) made a similar claim in regard to properties of the mind. In discussing artificial intelligence, he asserted that different types of knowledge come from different types of "machines." A human brain is not a computer and because "understanding is a property that comes from a certain kind of machine only, a machine like the human brain" (Gardner, 1985, p. 174), Searle applied such an analysis to intentionality as well. He saw intentions as caused by the specific properties of the human brain.

For this analysis, a claim is made that knowledge processes or levels can be divided into two levels. In the first, a nonconscious knowledge level of high order exists, what Duval and Wicklund have called *subjective self-awareness.* Indeed, most human thinking occurs at this level. I am unusually unaware (what I mean here by nonconscious) of the processes of my thought, although I may become aware of them through special effort. For example, there are times when I desire to trace a set of associations. We all have experienced this ability to retrace our mental steps and arrive at a satisfactory recognition of what occurred without at first using our objective awareness. This subjective self-awareness has knowledge and goals and therefore intentions. For example, incomplete actions toward goals set up intentions (perhaps we might call these *tensions* if we used another language—see Freud, 1915/1959), which are then satisfied.

There is another knowledge level, *objective self-awareness,* when we are aware of our thoughts, feelings, and actions. Phenomenonologically, we appear to be watching ourselves. This knowledge level often involves our emotional life, as when we become embarrassed by some action, thought, or feeling of the self (Lewis, 1990b; Lewis, Sullivan, Stanger, & Weiss, 1989). Blushing, as Darwin (1872) first noted, is the most human of all emotional expressions. He stated (p. 325) that "it is not the simple act of reflecting on our own appearance, but the thinking what others think of us, which excites a blush." It seems clear that this knowledge level (objective self-awareness) is in some way unique to the other form of knowing (subjective self-awareness) and that it is reasonable to assume that a metaknowledge (knowledge of knowledge) has differential effects vis-à-vis the levels of intention we seek to explain. Intentions associated with this level of knowledge phenomenonologically appear quite different from intentions at another level. For example, I intend to study a particular problem. This is a direct operation on a plan which is quite different from the intentions following this, which proceed from the plan of which I have no awareness (although I might), and which act, as it seems, independent of my generation of other plans or intentions. It is a familiar experience to most of us to be thinking about a problem—a direct intention—when another intention arises, for example, a desire for a glass of water. Intentional action on this desire does not prevent intentions at other levels from proceeding. This possibility appears to occur. In fact, it is one way of conceiving of intrapsychic conflict which was given so much attention in Freud's tripartite notion of the psyche (Freud, 1923/1961).

In this overview, three processes have been identified that support the idea of levels of intention. These are (a) adaptive intention, (b) knowledge intention (or subjective self-awareness), and (c) conscious intention (or objective self-awareness). These levels have an ontogenetic course and may have a phylogenetic one as well. Most important from our point of view, these levels, once developed, do not become transformed as new levels are reached. For each adult human, therefore, these three levels coexist and at times may even conflict. Moreover, a particular level may be involved for one set of goals and another for another set. The regulation of our immunocompetence system is usually left to the first level or perhaps even to the second. Yet even here the third or conscious level may be employed. There are those who subscribe to the view that deliberate attempts (conscious) to make yourself happy, or to reduce stress, will affect the immune system.

Applying these three processes in the search for levels has proved useful, as have Dennett's (1987) work on intentional stance, Fodor's (1981a, 1981b) work on propositional attitudes, and Mitchell's (1987) analysis of deception. I have borrowed from each of these to outline a levels analysis. In doing so, I have strayed from the theory of sensorimotor intelligence in several respects.

1. Intentionality as a property of all goal-directed systems is assumed, thus avoiding the problem of a mixed model.
2. Development is not transformational, at least in this regard. Such a view allows for the operation of all achieved levels throughout development. This avoids the inherent problem of regression, which is not readily handled by transformational theories.
3. Emotional properties (the desire/goal feature to all representations) underlie all intentions.
4. The levels view allows for the consideration of consciousness as the highest level of intentionality.

Table 1 presents in some abbreviated form the five levels we consider. It includes the names assigned to the levels, their relation to sensorimotor intelligence, and the level of emotion (desire) present at each level. A full explanation of this table is presented within the text.

Level I

The first level of intentionality, which corresponds to the reflex period in sensorimotor development, we call, *necessity*. The action, although intentional, is both predicated and prescribed by survival. This intentionality can apply to cells and infants and even in some aspects to mature humans. For example, breathing or heart action are examples of this first level. That automatic or involuntary processes are intentional appears to violate our common-sense understanding. At this level, intentions are all derived through adaptive functions related to survival. Commerce with the external environment is all in the service of the internal adaptive function within the infant. These adaptive functions necessitate no response from the environment. They act on the environment but, in general, are not acted on. Consider the early capacities of the infant. These response systems operate so that the infant intends to suck when an object is placed in its mouth, to blink its eyes when an object expands in its visual space, and to grasp an object when it is placed in its palm. They grow out of the child (are part of its biological heritage) and may be accommodated to by the environment but are not created by them. These behaviors are goal-directed, internal, self-sustaining, and adaptive.

The organism acts from goals built into its systems. Recall that for us, as for others, goals contain desires. Survival or adaptation is the intended goal (or cause of action). Desires at this level are global emotions, they are simply positive or negative (approach vs. avoid) states which are associated with action to satisfy a goal. At this level, necessity, intention, and emotion are equivalent. Organisms behave so as to have positive emotions and to avoid negative ones. The actions are built into the emotions (see, e.g., Darwin, 1872, and Plutchik, 1980, for analyses of emotions as motives and goals). Intentionality is a part of the system because the knowledge system is controlled by the emotions. For the infant, this means that its action is intentional because it is built into a system. It is controlled by desire. Behaviors occur which cause pleasure and which avoid pain (as defined by biological information).

Necessity is synonymous with adaptation. Pure desires are goals; there is no mental representation except as desires can be represented (see Zajonc, 1980). Perhaps it is described by the statement "doing what feels good and avoiding what feels bad." Feeling good and bad are the only two emotional states attached to desire at this level. The desire system itself remains undifferentiated. The differentiation of this system is important for our understanding of the intentional system because as desires (goals) differentiate, the intentional system expands. A more complete discussion of the development of the desire system can be found in Bridges (1932), Sroufe (1979) for the earliest emotions, and Lewis et al. (1989) for the self-conscious emotions.

Do we wish to claim that this lowest level is intentional

Table 1. *Levels of Intention*

Level	Nature of Intention	Knowledge (Causality)	Desire
I	Necessity	Reflexes (Innate)	1. Global emotions: approach (+), avoid (−). 2. Internal adaptive functions.
II	Interactive Necessity	Circular Reactions	1. Simple emotional differentiation. 2. Internal and external adaptive functions.
III	Action Intent	Complex Circular Reactions	1. Differentiated emotions. 2. Internal and external adaptive functions. 3. Simple representations and adaptive anticipation.
IV	Divergent Intent	Insight	1. Differentiated primary emotions. 2. Internal, external, and anticipated adaptive functions. 3. Representations, categorization, and manipulation.
V	Conscious Intent	Self-Awareness	1. Complete primary emotions. 2. Secondary emotions. 3. Internal, external, or anticipated adaptive functions. 4. Representations, categorization, and manipulation. 5. Metarepresentations and emotions.

and what benefit for a theory of intention is derived by doing so? Some might be uncomfortable with including such action within this realm, and might argue that it is not useful to claim any form of mentality for such noncognitive (or intelligent) action. We make the claim for several reasons. To begin with, we assume intention in all goal-directed systems. Moreover, we have no difficulty in ascribing intention to systems operating on the level of adaptation and containing emotions (or desires.) This property is not given to reflexive behavior by Piaget, although here too, simple schemata are proposed which have some action component. Second, although we might agree with a mechanistic (behavioral) view that our belief in intentionality does not affect the observation, we are still troubled by any mixed-model view which first does not, but then does, require intentionality.

Level II

The second level of intention (and all levels thereafter) involve the organism's interaction with the environment. It is similar to the first level in the sense that intention is directly tied to emotion (desire), thus the term, *interactive necessity*. The adaptive functions now require environmental input and as such the intentions are interactive. It could be argued that all an organism's adaptive functions are interactive, that is, are related to the environment. Although this may be so, there appear to be differences that warrant the distinction. The smile of the infant exemplifies this. Until 3 months or so of life, the infant's smile appears related to internal adaptive functions. The infant smiles often when in REM sleep (Wolff, 1963). The infant may or may not smile to a human face. At this first level, the infant's smile does not appear to be related to exogenous factors but rather to endogenous adaptive activities. By Level II, the infant's smile is no longer part of the internal adaptive goals. The infant now smiles to environmental events.

At Level II, infant intentions are related to external events, their presence or absence. For the smile, infants smile in the presence of a human-face-like event and do not smile in the absence of this event. The intentionality can be described in the general form, as given an environmental event (E_1), the child's adaptive goal is to smile (action *a*). Here, unlike Level I, the adaptive goal of smiling is tied to the presence or absence of an event. Notice that smiling is still tied to an adaptive function, but the smile only occurs under specified conditions.

Because of its interactive nature, the observer often assumes the infant's smile at this age is intentional. We do so because the action is specific, that is, based on select environmental events. Parents have been known to report "She likes you because she smiles at you." That parents (or others) assume a more adultlike intentional system may have important implications for its development (Kaye, 1982).

Desires are specific goals which are activated by events outside the organism. The desires, however, are located within the infant. As emotional differentiation occurs (the process for this is unclear, but may be related to maturational factors), more goals are produced than the initial ones of approach and avoidance. At this level, it is the environment that still activates the organism's desire. Because of the contextual differences in the environment, and because there are more emotions, more goals (more intentions) are differentiated.

The conditional nature of the response vis-à-vis its goal allows for simple conditioning and learning. This occurs because the conditions for goal-directed behavior are established by the environment; that is, "I have a desire to smile to a facelike event." If the event occurs, then my goal is activated. Notice these goals still belong to the original adaptive functions. The change has been in the power of the environment to activate them. Such a simple level of interaction can also be seen in adults; for example, I am likely to yawn when another person does so more than when another person does not do so. My yawning is intentional although the activation of the goal is determined by the conditions of the environment (as well as the conditions of the person or organism). Associations or representations are created through the continued activation of goals (actions) with particular environmental events. For example, faces elicit the desire to smile. These representations lead to the next level.

Level III

This level of intentionality, called *action intent,* remains the most problematic. Up until now, goals are located within the organism as part of the infant's adaptive functions. These functions specify goals containing action patterns and these goals are internal; that is, they require only the minimum environmental impact. The second level is also characterized by goals within the organism (again a part of its adaptive function); however, these goals are activated by environmental factors as well as internal ones. Moreover, the goals remain relatively undifferentiated, in part because desires (emotions) remain global. As desires differentiate, goals, too, increase.

At some point, representations of the goals and desires, and the environmental contexts associated with them, are established. This is likely a function of the infant's increased memory capacity. These representations are not necessarily directional. That is, the association itself can give rise to desires and goals which produce environmental contexts with which they have been associated. In fact, it may be the case that it is the anticipated desire, which was caused by the environment, that now becomes the cause of the goal. Anticipated emotion requires representational ability and an active memory capacity which infants of this age now possess (Schaeffer, 1974). For example, if a face produces a goal (desire), the intention to smile, then it is possible for a goal (desire) to intend to produce a face. This might be analogous to superstitious behavior because there is no disassociation between desire and the intended action.

There are several difficulties here, not the least of which is how to understand the association between environmental context, goal (desire) activation, and action. The latter aspect gives little trouble since desires (emotions) have built-in action patterns. The difficulty becomes how to reverse the direction of effect. In Level II, the environment activates the goal. By Level III, goals have become independent of environmental context for their activation. Moreover, because of past connections, goals (desires) have associated with them action patterns relative to specific environmental contexts. The only possible explanation for the independence of goals is (a) their past association with numerous specific environmental contexts and (b) the greater representational capacity of the child. Because goals (desires) have action associated with them and have been repeatedly elicited across a variety of contexts, and because they can now be remembered, the infant is now capable of manipulating these representations and, as such, reversing the order. There is much in Piaget's thinking (also Baldwin, 1894/1903) that informs our discussion about Levels II and III. For example, our Level II is much like the description of accommodation. To paraphrase, in accommodation the movement can be conceived, in a sense, as going from the object toward the subject and compelling the subject to adapt to the object, whereas in assimilation (Level III), the movement proceeds from the subject toward the object. "In the beginning, an infant only accommodates itself to things when it is forced by them, whereas at the outset the infant tries to assimilate the real, impelled by an invincible and vital tendency" (Piaget, 1936/1952, p. 275). We view this tendency as *necessity,* arising from adaptive functions.

Clearly, Level III is the point where intentionality assumes its more mature function: In part, this is due to the further differentiation of desires (emotions) and the increased capacity to represent. For the first time, then, goals have representations that can be manipulated. The ability to activate goals (desires) with associated action-in-the-world allows for *action on* instead of only *action when.* Because of its close association with Level II, it is not clear that Level III represents a new level. Rather, it may be only the elaboration of what occurs in Level II. We chose to differentiate it, primarily because of the increased memory capacity associated with this period.

Level IV

Until this point, intentions were produced by environmental contexts through the activation of goals. Moreover, through representational capacity, goals and their intentions became the activators of environmental contexts. These representational skills enable the anticipation of goals (desires). Thus, actual and anticipated goals (desires) support actions. It must be remembered that intention is built into goals and that action is associated with desire. At first, it is desire alone that drives goals; however, with the development of memory, representations along with desire now drive goals.

Now, at the level of *diverse intent,* the goals have become more differentiated. In fact, by this level all primary desires (emotions) and their goals have become differentiated (see Bridges, 1932; Lewis & Michalson, 1983). Moreover, actions associated with goals themselves have differentially developed. The infant has many more motor patterns and the ability to allow for a greater diversity of action. Finally, representations have become complex and abstract (Fischer, 1980). Representations and desires with their actions represent goals and, increasingly, anticipated representations and desires serve the role formerly held by actual desires. In some sense, desires, and therefore goals, have become less important than representations, in part, because representation of desire is possible.

All these developments give rise to the ability to utilize alternatives. Because divergence is now easy, representations are more readily manipulated and particular goals can be driven by a variety of desires. That is why we call this fourth level, diverse intent. By the time this level is reached, the possibility of diverse goals (intentions), ease of representation, and differentiated desires all permit variation in how particular goals are reached. At this level, we find intentionality attributed by others because the definition of intention is satisfied by the multiple goals and the multiple actions available to achieve each goal. Organisms choose possibilities from a wide array by anticipating (a) which goal is more desirable and (b) which action is most likely to lead to this desire. At this level, organisms choose both the goals and have the flexibility, through trial and error or even insight, to select those actions most likely to lead successfully to the goal. Actions at this level include thoughts about actions (plans) as well as actions themselves—thus, the possibility of solution to problems without observable action exists.

Once the control feature of emotion emerges as in Level III, a new desire is created, that of control itself. This new desire serves as a type of master emotion for all other desires because it naturally seeks variation and diversity of action to goals. The development of memory has enabled the development of categorization. Categorization itself empowers new combinations, both of goals and their actions/desires.

Level V

The final level of intentionality involves fourth-level status plus one further elaboration—consciousness (or objective awareness of intention)—and is called *conscious intent.* Here the organism not only has the flexibility of abstract representation of actions and goals, but is now aware (the self turned toward the self) of these goals and actions. This awareness or consciousness allows the child to consider that it has divergent intents. Consciousness is a metaprocess; for example, the mature human, unlike other organisms, has memory of its memory. This is captured by the recursive statement "I remember that I wished to do something." At this point, intentions, which were flexible vis-à-vis goals and actions, are now viewed by the child itself. By this act of consciousness, intentionality itself becomes available to consider. As such, intentionality itself is changed. I can now say, "I am aware that I intended to do *X,* but that is really not what I wish to do." The manipulation of intentions themselves is one property of objective awareness or consciousness.

Conscious intent, like all levels, is supported by emotion. Nevertheless, cognitive capacity (present at Level IV) and the new emergent structure, objective self-awareness, now become the material of desire. Here we mean that to be aware of desires, as opposed to having them but not being aware, becomes a new kind of desire. This supports a new kind of intention. Now, and for the first time, intentions can be dissociated from the direct effects of emotion. Thinking about the self, independent of direct emotion, can sustain intentions. In a sense, my awareness that "I wish for . . ."—a cognitive act—creates its own emotion. The degree to which I am not self-aware (not conscious) that I want something is the degree to which emotions control my action rather than the other levels of knowledge. Such a view has been addressed in considering the topic of primary versus secondary thinking (Freud, 1915/1959) and is consistent with the assumption that unconscious thought processes are not the equivalent of conscious thought processes. For me, the reason has more to do with the level of cognition and the role of emotion associated with unaware intentions.

The difference between Levels IV and V has to do with objective awareness of intentions. For example, I believe my cat has Level IV but not Level V intentions. I see my cat coming into my study. He wants to jump on my lap which is covered by books. To land on my lap under this condition, he needs to jump up on my desk and walk carefully from there onto my lap. This is not his usual way because he usually jumps directly from the floor onto my lap. Thus, he alters his means to get to the goal. This appears to satisfy at least some aspects of Levels III and IV. However, to the best of our knowledge, the cat does not have objective awareness of his intentions. Thus, the action can be distinguished from actions by human adults who possess, at least at times, this awareness.

The difference between Levels IV and V can be seen in the behavior of animals (or even infants). If intentional systems are organized into a series of increasingly more complex structures, then so, too, must be desires. Elsewhere we have shown that there is a significant change in emotional life with the introduction of objective awareness or consciousness. When consciousness emerges, two classes of emotion are possible: (a) those we have called *self-conscious emotions,* which include embarrassment, empathy, and envy; and (b) those we have called *self-conscious evaluative emotions,* which include pride, shame, guilt, satisfaction/competency (Lewis, 1990a, in press; Lewis et al., 1989). These emotions become the basis of a new set of intentions because humans act so as to avoid shame and guilt and to achieve other preferable emotions, for example, pride.

I have described the five levels of intention and suggested that they have both ontogenetic as well as phylogenetic usefulness. However, I have not explicated how the child moves from level to level. I have made suggestions about what processes are involved in moving to each next level, but these have not been as explicit as is possible. Two major developmental processes appear to underlie the movement through levels: cognitive and emotional. The first has to do with the change in cognitive structure, in particular, the change in representational ability and the growth of memory capacity. Both these capacities exhibit qualitative as well as quantitative changes which are influenced by the genetic code of the species as well as the child's commerce with its environment.

The second process that undergoes change and that underlies the movement through levels is the emotional growth of the child. As I have tried to make clear, I see emotion and desire as similar and the basis of intentions. It is clear that the emotions differentiate themselves. At first they appear as undifferentiated positive and negative affects, and, within the first 2 years of life, they differentiate into the complex array seen in the adult of the species (Bridges, 1932; Lewis & Michalson, 1983). This differentiation, like that for cognitive capacities, also involves both qualitative and quantitative changes. Here, too, both the genetic code of the species and the child's social-interactive level contribute to the development and change of this capacity.

We might ask, "Why then should these developing capacities lead to changes in the level of intention?" The answer appears obvious at first; on reflection, it may not be so clear. That different levels of intention require different capacities, coupled with the fact that capacities change over time, does not necessarily require that levels of intention change. If, however, we return to our original assumption—namely, that goal-directed systems are intentional—our problem is made easier. Different capacities lead to different goals. These goals differ both in quantity and quality. Thus, changing capacities lead to changing goals and therefore changing intentions.

How the Model Informs

From this discussion, it appears possible to distinguish between different types of intentional actions in an organized fashion. Notice that such an organization fits not only intentionality but causality as well. Moreover, other actions, such as deception, are readily incorporated, allowing us to consider a range of such possible actions—from simple deceptions such as an adaptive change in coloration of an animal, an action by which an organism hides from its predator (Level I), to the complex deceptions of human adults (Level V), in which the person is aware of his or her action and the effect of that action on another (Mitchell, 1987). Because levels of intentionality are so closely linked to causality, the discussion also becomes relevant for the acquisition of knowledge. Indeed, for Piaget, this was an important structural feature of his epistemological system.

The intentionality question has been raised here to determine whether levels of intention (or the knowledge of causality) can be used to explain the infant's action. Our problem, one shared with others, is to understand how knowledge, at any level, can lead to action. I use here the term "desire" as the mediating link, giving to this construct the properties usually assigned to such terms as motives, drives, and innate releasing mechanisms. I do this to conform to the added proposition that all intentions have desires. This definition allows us to move from intentions to actions by the expedient of attributing to intentions a motivating power, a quality not unreasonable (Searle, 1984). I argue for a hierarchical organization of intentions and thus for a hierarchical ordering of desire.

As I have tried to demonstrate, a mechanistic world view, one that does not consider mental actions such as intentions, is capable of explaining the research findings I have reported. Indeed, one strength in the mechanistic model is its simplicity. Nevertheless, I reject this view in favor of one in which representations, plans, and desires exist and constitute the units of human life.

The problem, after accepting such a world view, is how to apply it to the developmental issues of growth, change, and transformation. A possible solution might be found in the way others have treated machines or animals vis-à-vis humans in terms of these structures. That is, if we are willing to give these same structures to organisms other than adult humans, we could give them to children and even infants. A reading of the literature suggests both a "yes" and "no" answer to this question. Dennett (1987) and Newell (1982), for example, seemed willing to assign such structures to others, whereas Searle (1984) would restrict them to humans. If we distribute them to others than adult humans and give them similar form, then we run into other problems concerning development. That is, by giving infants and young children these structures we cease to be developmentalists. The position results in no development to study and no model of organism–environment interaction to explain the basis of growth and transformation. If, on the other hand, we give these structures to others but assign them different levels of the material, then we still have a problem to explore.

Another solution to the developmental problem, one which Piaget seems to have adopted is to allow the infant to create these structures through the developmental process itself. Here, at least, at the very beginning of the process of growth, the structures do not exist—they are acquired via the developmental process itself. The problem here, as some have suggested, arises in the difficulty of going from no structure to structure. Discarding this problem, the theory of sensorimotor intelligence is an attempt to deal with the developmental problem and one to which we owe a considerable debt.

In attempting to understand this problem, I have resorted to a position that connects thought to action through emotion. This attempt to give thought action is not new; more than a century ago, Darwin (1872) saw emotion as having such a property. More contemporary theories likewise solve this problem often by introducing emotion through the use of the term "desire." It seems a reasonable solution. In this article, I have argued that all goal-directed systems are intentional. Moreover, our theory suggests, along with others, that goals themselves possess emotional features which include other forms of knowing such as how to achieve the goal. Specifically, for us, *goals are ideas with emotion*. They can be generated by the biology (as in Level I of our model) as well as by the thought of the organism (Level IV), or by self-awareness (Level V). The developmental process is this change.

Recall that in our study, very young infants, long before they should be able, appear to act intentionally. First, they persist in pulling a string to make something happen, and then they become angry when what works once, does not work. First consider the initial learning of the arm pull. From our analysis, this behavior involves both interactive necessity (Level II) and action intent (Level III). To begin with, the accidental appearance of the event (pictures and sound) produces the desire. That is, the infant does not start off with a schema of trying to do something, but if it does, the things it tries to do, do not include pulling a string to get a pleasant event. Rather, the desire grows from the event's occurring contingent on the infant's activity. Initially, the occurrence of the event produces general activity, but within a short time, the desire becomes focused in the arm movement which results in the event. At this point, the desire, which we have described as interest and some pleasure, changes into surprise and joy as the infant discovers that the arm itself can cause the event. Lewis et al. (1984) described this change in desire and we reported similar data to show the effect. It is at this point that interactive necessity becomes action intent. Now the infant has discovered that the desire can be produced by itself, a new knowledge level has been reached. It is the appearance of surprise and joy that marks this transition of levels.

Further support for the action-intent level comes from the next phase of the study in which the cessation of the event, something imposed on the infant, results first in interactive necessity; that is, cessation of the event leads to a new response (anger), something built into the biology of the infant. This change in levels back to interactive necessity is disruptive for some children and they leave the study due to fussiness. For the great majority of others, this level change causes a reinstatement (although exaggerated) of Level III, the action intent—hence, the increased arm-pull behavior.

Clearly, this is only one of many possible explanations and our solution to the problem of the development of intention raises more questions than it answers. Nonetheless, it accounts for the data and provides a basis for further consideration, and, as such, may have heuristic value. What is clear is that the problem of intentionality is central to the issue of the development of the infant's action in the world. Given our belief in intentionality of adults and the possible intentionality of animals, how we understand the intentionality of infants and its development remains an important topic.

Note

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