HUMAN AGGRESSION

THEORIES, RESEARCH, AND IMPLICATIONS FOR SOCIAL POLICY

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The Role of Social Information Processing and Cognitive Schema in the Acquisition and Maintenance of Habitual Aggressive Behavior

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INTRODUCTION

One of the essential ways in which humans are different from all other species is in their well-developed ability to represent, process, and communicate information. The psychological processes that humans invoke to perform these tasks are called cognitive processes, and the internal representations of information utilized in these processes are denoted as cognitions. Some reflexive behaviors may usually involve only peripheral processing, but more central cognitive processes often override these reflexes, e.g., one can will oneself to keep one's hand on a hot coal. From this perspective all human social behavior, including aggressive behavior, is mediated by the cognitions and cognitive processing of the participants. This does not mean that cognitive processes "cause" social behavior. Rather, as mediating processes, they connect biological, environmental, and situational inputs to behavioral outputs. However, as described in this chapter, different patterns of cognitive processing are more conducive to one kind of social behavior than to another.

Human Aggression: Theories, Research, and Implications for Social Policy

In recent years theorists writing about aggression have generally accepted the importance of cognitions. All the chapters in the theoretical perspectives section of this book, in fact, deal with the role of cognitions in one way or another: hormones and conceptions of domination, cuing of aggressive thoughts, conceptions of self-esteem, and interpretations of arousal as anger. However, there have only been a few attempts to move the next step forward; that is, to integrate the large amount of empirical data accumulated about aggressive behavior and related cognitions into comprehensive *information processing models* for explaining aggressive behavior and how it develops. What do we mean by "information processing models?" An information processing model is a description of the cognitive data structures a person utilizes and the sequence of cognitive operations the person executes in order to generate the cognitions and behaviors that are output from given input. It is most analogous to a computer program that describes the output a computer produces from given input.

The major aim of this chapter is to show how the development and occurrence of human aggressive behavior are explained by social-cognitive information processing theory and to review the empirical evidence supporting the theory. However, the history and fundamentals of information processing models in general and of models for social cognition in particular must be reviewed briefly.

EMERGENCE OF INFORMATION PROCESSING MODELS OF SOCIAL BEHAVIOR

Early in 1996 a computer program named "Deep Blue" shocked the chess world by defeating the reigning champion, Gary Kasparov, in one game. Less than a year later, "Deep Blue" went on to defeat Kasparov in a match—an event that stimulated anew the discussion of the differences, if any, between artificial intelligence and human intelligence. This is not the place to pursue that argument in detail, but "Deep Blue's" victory is a mark of the advances that have been made in our understanding of how humans process information. Artificially intelligent programs like "Deep Blue" do not succeed in solving complex problems simply because they can compute very rapidly. They succeed because they also incorporate models of how human experts process information to solve problems.

It is not surprising that the use of information processing models to describe human behavior first flourished in studies of human problem solving (Newell, Shaw, & Simon, 1958; Newell & Simon, 1972; Simon, 1978). For one thing, the expertise in computer programming that such modeling requires tended to be concentrated in that area. However, as Herbert Simon, the father of information processing modeling, has cogently argued: the formalization and detailed specification of processes required in information processing models make them more valuable than either natural language or mathematical statistics for modeling any kind of human behavior (Gregg & Simon, 1967). In the early 1960s, two books—

Feigenbaum's (1963) *Computers and Thought,* and Miller, Galanter, and Pribram's (1960), *Plans and the Structure of Behavior* (1960)—stimulated thinking about information processing in many areas of psychology. By the mid-1960s, Abelson (1968), Gullahorn and Gullahorn (1963), Loehlin (1969), Simon (1957, 1967, 1969), and others had begun to describe psychological models of a variety of social behaviors in terms of underlying information processes. By the early 1970s more specific information processing theories of different kinds of social and abnormal behavior were appearing (Abelson, 1976; Carroll & Payne, 1976; Colby, Hilf, Weber, & Kraemer, 1972; Hastie & Carlston, 1980; Huesmann, 1978; Huesmann & Levinger, 1976; Wyer, 1974; Wyer & Srull, 1980). During this same period, the knowledge that cognitive psychologists were accumulating about basic human cognitive processes was also increasing exponentially and was being organized in an information processing framework. Textbooks by Neisser (1967), Lindsay and Norman (1977), and Anderson (1980) marked both this explosion in empirical knowledge and the progressive domination of cognitive psychology by the information processing approach. It should not be surprising then that the attention that social psychologists were giving to cognitions and information processing was also increasing dramatically during this period. The term social cognition became popular sometime in the late 1970s (Wyer & Carlston, 1979; Wyer & Srull, 1980), but it was really the publication of Fiske and Taylor's (1984) book on social cognition that marked the convergence of the cognitive and information processing trends into the mainstream of social theorizing.

For students of aggressive behavior the early 1980s also brought the first information processing analyses of aggression. Huesmann (1980, 1982b, 1986, 1988; Huesmann and Eron, 1984) offered a general information processing model for aggression, focusing particularly on observational learning, and Dodge (1980, 1986; Crick & Dodge, 1994; Dodge & Frame, 1982) offered a general information processing model for aggression, focusing particularly on perceptions and attributions. Since then, a variety of elaborations of the models have emerged and a reasonable consensus has developed about the ways in which human cognitions and cognitive processes mediate aggressive behavior. But before turning to a more detailed discussion of those models, we must review a number of general principles of information processing.

FUNDAMENTALS OF INFORMATION PROCESSING MODELS

What are the principles underlying information processing models of cognition and behavior? Information processing models formally lay out the sequence of cognitive processes involved in the occurrence of a behavior much as a computer program lays out the sequences of operations in a computer that produces a particular output. A basic assumption is that the human mind can be viewed as

analogous to a computer. Behavior is the output of software programs operating within the biological hardware constraints of the brain. The difference between hardware and software is viewed as much less distinct than in most mechanical computers and the biological hardware is certainly less hard. It is the conceptual distinction of having more malleable programs and data stored and operating within less malleable processing systems that makes the analogy. A closely related assumption is that behavior is best modeled with hierarchical levels of explanation. For example, an aggressive interaction might most easily first be modeled in terms of relevant interacting behavior sequences (e.g., she shouted at him; he told her to shut up; she shouted again; he hit her). The behavior sequence might then be modeled in terms of a relatively high level program for behavior (e.g., follow rule to retaliate when insulted by a woman). The operation of these programs might then be modeled in terms of more fundamental cognitive processes, e.g., retrieval of rules by spreading activation; these more fundamental processes might be modeled in terms of neurophysiological reactions, which in turn might be modeled in terms of biochemical processes. Different theories of social behavior may use different levels of explanation within this hierarchy, but generally most theories adopt a level analogous to programming in a high level computer language. The formal properties and limitations these programming languages and symbol systems place on the modeled processes are well understood, and the natural language interpretations of the programs are also usually easily followed by other researchers.

Information processing models of social cognition assume that a person's social behavior is completely determined by the configuration of hardware, software, knowledge structures, and environmental inputs that the organism has experienced. Yet such models should not be called mechanistic. Process models sometimes include stochastic elements to model individual variations, but, even without them, complex variations in behaviors and cognitions are obtained because of the wide diversity of experiences encountered by different individuals. Information processing models are models of individuals' social cognitions and social behaviors, not of group means. Different individuals have different hardware, software, and data structures. Different situations generate different inputs. Most often models are developed that assume similar programs and structures for different individuals with well-defined loci for individual differences, e.g., perhaps the procedure for deciding whether to attribute hostility to another is the same for most individuals, but the database of past experiences on which they base their decision varies.

Every information processing model of social behavior must have a defined behavior space within which it operates. This space is characterized by a set of potential social behaviors (e.g., how one greets a stranger on the street) that the model is designed to explain and a set of potential inputs that define the variations in the current environment that the model is supposed to handle (e.g., location of meeting, characteristics of stranger, mood of person, etc.). In addition, every information processing model has an *executive program* (i.e., operating system) that

specifies the overall flow of cognitive processes that are hypothesized, *subroutines* that represent the detailed operation of specific cognitive processes that are available, and multiple data structures in *memory* that represent the modeled individual's cognitions.

Some information processing models may include mechanisms for self-modification of the cognitions through a variety of learning processes. Others assume static cognitive structures. Generally, information processing models assume that humans employ the same basic kinds of processing operations and techniques that have been proven by IP mathematicians and theorists to be sufficient (or in some cases necessary) to do the kinds of cognitive processing that humans do, e.g., stored programs with branching instruction sequences, test–operate–test–execute sequences (TOTE), or node-link memory structures. In addition, the processes that have emerged as viable alternatives in computer science are usually the ones that are proposed as viable alternatives for human information processing models, e.g., top-down versus bottom-up tree searches, reproductive versus reconstructive retrieval from memory, or on-line calculation versus retrieval from stored schemas.

CONNECTIONIST ALTERNATIVES

One obvious limitation of information processing models is that the relations between the basic information processes and the underlying neurophysiological processes remain obscure. A second related problem is that information processing models of cognition most often hypothesize multiple programs that operate sequentially instead of in parallel (probably because until recently the machine languages available to simulate cognitive processes operated sequentially). However, there is significant evidence that many human cognitive processes occur in parallel.

One consequence of these problems has been the emergence of what have come to be called "connectionist" models of cognitive processing (Feldman & Ballard, 1982; Rumelhart & McClelland, 1986). Such models attempt to describe cognitive processes and related behaviors using simulated neural networks in which parallel processing is a natural property. Somewhat lost in the excitement over this "new" approach is the fact that it is actually a reemergence of a very old approach to pattern recognition called "perceptrons" (see McCulloch & Pitts, 1943; Minsky & Papert, 1969; Nilsson, 1965; Rosenblatt, 1960). Thus, arguments about the value of the two approaches have a long history (Newell & Simon, 1972).

Although neural network models undoubtedly bear a closer resemblance to the human central nervous system than information processing models, they do not have a one-to-one correspondence. More important, as Smolensky has argued (1988), it is still unclear that connectionist models offer a sound basis for modeling human cognition. The processes occurring in neural networks are usually as far removed from our empirical data on human cognitive processes as the processes in information processing models are removed from observed neurophysiological processes.

The parallel processing argument for connectionist modeling is also not as strong as it might seem at first. In fact, numerous information processing models of "parallel" processes have been proposed and even simulated over the past 25 years with information processing models that included parallel processing subroutines (e.g., Chase & Simon, 1973; Huesmann & Woocher, 1976; Townsend, 1976). Although simulations on nonparallel processing computers must, of course, simulate parallelism with sequential operations, that does not change the essential parallelism of the model. The related point is that serial processes inside the human head can appear to be parallel from outside the head (Simon, 1979, p. 4).

A third argument against information processing models is that they are "linear" (see, e.g., Crick & Dodge, 1994). This argument often reflects a confusion between linear and sequential. The fundamental structure of information processing models as described earlier allows outputs to be related to inputs in any nonlinear matter unless the model is specifically designed to produce linear outputs. Information processing models are "essentially" less linear and more readily falsifiable than path models and stochastic models of social behavior (Huesmann, 1982a) and less linear than many connectionist models that use only linear connections.

INFORMATION PROCESSING PRINCIPLES APPLIED TO SOCIAL COGNITION

Information processing models of social cognition have drawn on empirical knowledge about human cognition and human social behavior to define a set of basic processes and data structures that seem to characterize human cognitions about social behavior. As mentioned earlier, one can think of any information processing system as consisting of a *memory* in which *data and programs* can be stored and an *executive program* that distributes resources and has overall control over the system. The system processes *input* stimuli and cognitions and generates *outputs* that may be behaviors or cognitions. For social behavior, we conceive of this information processing system as accepting inputs of social stimuli that define a particular social situation. The executive program calls upon appropriate subroutines to process the inputs, search memory for relevant information, and generate output behaviors for that situation. Let us now examine several of the components involved in these processes in more detail.

MEMORY STRUCTURES FOR SOCIAL-INFORMATION PROCESSING

Human memory can be thought of as a network of nodes and links that represents encoded propositions (Rumelhart, Lindsay, & Norman, 1972). The meaning of each node is defined by its associated links that represent labeled attributes whose values are other nodes. Thus, a male friend Sam may be denoted by a node with links such as gender = male, relation = friend, height = tall, works at = uni-

versity. The meaning of male, friend, tall, and university, in turn, is defined by their links. Nodes can represent semantic constructs or episodic constructs (events, people, objects). Thus, one may refer to episodic or semantic memory.

Information is *encoded* by being integrated into the memory network. Encoding means the "formation of a representation of an external stimulus in the memory system" (Kintsch, 1977, p. 485). *Elaborative rehearsal* of information generates more links to the rest of the network and more firmly encodes information in the network. Elaborative rehearsal goes beyond simple repetition of information and involves consideration of how the new information fits with other knowledge already encoded.

Information is *retrieved* by being *activated.* One can imagine a *spread* of activation emanating out from one node to connected nodes. A cue, either an external stimulus or an internally activated schema or mood, activates the first node. As each successive node becomes activated it is said to be retrieved, but the strength of activation diminishes as greater distance separates linked nodes. Clearly multiple links enhance the likelihood of recall, although multiple nodes with similar links may produce inaccurate recall due to *interference.* However, retrieval of information generally is not viewed as a blind spreading activation process but rather as a more directed *heuristic search.* Particular branches of the network are followed that appear particularly promising, and the activated nodes are tested to see if they meet a criterion for what is being sought. Thus, memory search can be conceptualized as an example of the standard information processing technique of *generate and test.*

It is also clear that there are conceptually distinct *short-term* and *long-term* memory processes. Short-term memory has a very limited capacity and is sometimes called working memory because it contains the information currently being processed or being "activated." If information is activated long enough in short-term memory, it is likely to be integrated into the unlimited capacity long-term memory. Thus, attention to social information (i.e., maintaining it in short-term memory) can have a direct effect on the likelihood that it will be encoded in long-term memory (see, e.g., Hastie, 1988).

It is convenient to distinguish between two types of information about social behavior that one might store in memory: *declarative* and *procedural* (Anderson, 1983). Procedural knowledge can be thought of as knowledge about "how things are done" and is represented by stored programs. These programs are most commonly represented as sequences of if-then statements called *productions.* One can easily imagine many basic social skills being represented by short sequences of imperative productions, e.g., "if someone says hello to me, then I should say hello back." A production can be viewed as a particular type of link between an "input node" (the condition that must be satisfied) and an "output node" (the action).

Within this framework, *schema* is a term used to refer to any macro knowledge structure encoded in memory that represents substantial knowledge about a concept, its attributes, and its relations to other concepts. We can discuss our "self-schemas," which are organized knowledge about ourselves, "event schemas," which are organized knowledge about events, "belief schemas," which are organized sets of

beliefs, and so on. Of course, we use such organized knowledge to make inferences and to draw conclusions in what is called *top-down* processing because our existing knowledge influences the conclusions we reach. One particularly important kind of inference in social cognition is *causal attribution,* which is an inference about why someone does something, believes something, or acts in a particular way. Attributions are often schema driven, i.e., they are influenced strongly by existing schemas (Fiske & Taylor, 1991), but often the outcome of an attribution process also leads to changes in schemas.

When a schema is formed that links together in a sequence many simpler event schemas representing expected events and actions, that schema is called a *script.* A script makes use of both *declarative* and *procedural* knowledge and may contain productions. This use of the term was first coined by Abelson (1976). A script serves as a guide for behavior by laying out the sequence of events that one believes are likely to happen and the behaviors that one believes are possible or appropriate for a particular situation. For example, almost everyone has a restaurant script that tells them that when they enter a restaurant someone will take them to a table and give them menus, that a waitress/waiter will appear to whom they should give an order, and so on.

Scripts have a strong influence on all sorts of social behavior, including aggressive behavior. For example, suppose you are sitting in a car alone on the New York subway when two tough-looking young men get on the train. The situation cues the retrieval of a script that might start out this way:

> The young toughs approach you with their hands in their pockets and ask "Can you give us 20 bucks?" Your script then branches. If you give them the $20, they leave, and you have lost $20. If you do not give them the money, they pull a revolver out of their pocket demand the money again, and your life is in danger.

The script could continue, but let us examine how it may influence your behavior to this point. Of course, the young toughs may never approach you, but the activation of the script has sensitized you to watch for signs of approach. The retrieval of the particular script has biased you toward making hostile intent attributions. If the toughs do start to approach, you may well watch their hands carefully. You may search for the consequences of alternative behaviors on your part. For example, if you have a gun in your pocket, you may retrieve the script sequence, "I shoot them before they can shoot me, and I don't lose my money or my life." If they approach you with their hands in their pockets and demand money, you may follow this script and shoot them, a la Bernard Goetz.

AUTOMATIC OR CONTROLLED COGNITIVE PROCESSING

Studies of cognitive processing have revealed that at least two different modes of processing exist with quite different speeds and demands on conscious resources (Schneider & Shiffrin, 1977; Shiffrin & Schneider, 1977). *Automatic processes* occur very rapidly, without using many cognitive resources and without

any conscious executive decisions being made about the process. Reading is one example. Many social-perception processes are automatic, including "schema-triggered affect" (Fiske, 1982), memory priming effects, and spontaneous trait inferences (Bargh, 1982). *Controlled processes* occur more slowly, require more cognitive resources, and demand conscious executive control. Conscious planning of how to deal with a social situation would be one example. The boundaries are sometimes fuzzy, and many controlled processes may become automatic either as part of a child's development or with repeated practice or rehearsal. For example, in a novel social situation, a person may engage in a controlled search for scripts that could be used in that situation. However, highly familiar situations quite probably automatically trigger scripts that fit the situation.

RETRIEVING SOCIAL INFORMATION

As described earlier, the ease with which any kind of information or response can be accessed in the human central nervous system depends on how elaborately it has been encoded. Even simple S–R pairings are more likely to be elicited if there are multiple paths from stimulus to response. Both controlled and automatic activation of information in memory can be viewed as spreading activation processes. The spread of activation is often guided by already encoded schemas (heuristic search). For example, if you see someone you know as a librarian walking down the street, your mental search for explanations for what he or she is doing will be influenced by your schema for librarians.

Such memory search is activated by immediate *social cues* that provide the input to begin the search, e.g., the librarian in the previous example. However, the speed and success of retrieving social information are also influenced by recent stimuli that may have activated relevant schemas in memory, making them more accessible. This process is known as *priming*. For example, you may be more likely to recognize the librarian on the street if you have just previously walked by the library and had the library schema activated. *Emotions and moods,* such as anger or depression, also serve as cues that activate related schemas or scripts.

The activation of a particular schema, script, or node in memory has automatic effects on social inference and behavior, but another process called *filtering* may limit the effect of any activated information. Filtering is the testing process through which the executive routine decides if the activated information is the information sought or whether the search should continue. Filters may be simple tests of accuracy for the information or they may be tests of appropriateness of the scripts or behaviors activated. For social behavior, filters represent what Bandura (1986) has called self-regulating internal standards or what Huesmann and Guerra (1997) have termed normative beliefs.

SOCIAL PERCEPTION

Whether a particular social cue will stimulate the retrieval of much social information depends to a great extent on its *salience* and the extent to which one

attends to the cue. Cues need not be attended to consciously, but the human perceptual system distributes processing resources differentially, and inputs that do not have many resources directed at them (i.e., receive little attention) are unlikely to have much of an effect on the information processing system. For each information processing system there are certain properties of stimuli that attract attention (salient properties) and make the stimulus salient to the processor. However, what makes a stimulus salient to a person often varies from situation to situation. People who look strange or behave in different ways, for example, have high social salience for most people. What is most salient and attracts attention also depends on what moods and schemas are currently activated. A young female walking on the street who is worrying about being attacked will focus her attention on different cues in the males she sees than would a young female at a party who is thinking about potential mates.

In addition to being affected by the differential direction of attention, social perception is also affected by differential *interpretations* that may be given to the same cues. Most social cues are open to alternative plausible interpretations, e.g., "is the person smiling at you because she likes you," or "is the person smiling at you because he wants something." Of particular importance to social perception are the kinds of *causal attributions* one makes about others' social behaviors (Jones & Davis, 1965; Kelley, 1967; Weiner, 1986). As with stimulus salience, interpretations of social stimuli and causal attributions depend on the kinds of schemas that are activated in the processor as well as characteristics of the stimuli. The person who is "looking for trouble" may well "see trouble" where others would not.

Although social perception often involves "controlled" processes requiring the distribution of resources, many processes have been shown to operate "automatically" with little conscious control. For example, people make spontaneous inferences about the dispositions of those around them, e.g., are they angry or afraid, without consciously devoting cognitive resources to the processes (Bargh & Pietromonaco, 1982; Quattrone, 1982; Winter & Uleman, 1984). Again, the exact kind of interpretation that is made may depend on the schemas that are currently activated.

ENCODING MECHANISMS

Once social information is attended to and interpreted, it can be *encoded* into the node link memory structure. As described earlier, *elaborative rehearsal* of information builds many connections in memory and makes the information more accessible and more easily retrieved. However, the exact way in which information is integrated in memory depends on the information already there and the schemas that are activated. For example, if one's schema for Russia is that it is an aggressive, imperialistic country, it would be more difficult to encode any of its new peaceful actions into memory. A script may be closely associated with specific cues in the encoding context or may be an abstraction less connected to specific cues. To encode an observed sequence of behaviors as a script, a person must first attend to the sequence. Thus, scripts with particularly salient cues for the per-

son are more likely to be encoded. However, many observed sequences might never be encoded because the person perceives them as inappropriate.

Social learning, i.e., the encoding of new connections between social stimuli and social schemas, scripts, or behaviors, occurs through either *enactive learning* or *observational learning* (Bandura, 1986). Enactive learning encompasses both instrumental and classical conditioning—a person engages in actual behaviors and experiences positive or negative consequences. Depending on the consequences, the social script employed to generate the behaviors becomes more or less accessible in the future. Observational learning occurs when a person encodes schemas, scripts, or behaviors that they have simply observed others utilizing. An important encoding principle is what is known as *encoding specificity* (Tulving & Thompson, 1973). This refers to the empirical fact that the specific context in which information appears when it is encoded becomes associated with the encoded information and can trigger its activation in memory better than other semantically related information. Thus, for example, the color of a room in which a violent act is observed may later trigger memories of that act. A variety of factors are known to affect the likelihood of observed social information being encoded, including, as described earlier, the saliency of the stimuli, the schemas already active, and the interpretation given to the information. In addition, however, the more the actor possesses characteristics valued by the observer, the greater is the likelihood of encoding (Huesmann, 1982b). The observer may also experience *vicariously* the reinforcements and consequences that the observed model experiences (Bandura, Ross, & Ross, 1963) and encode these outcomes as part of the social script derived from the observation. Of course, observed scripts that are not very salient and have observed consequences that are not very desirable are not very likely to be encoded as possible scripts for future use.

STRESS, MOOD, AROUSAL, AND INFORMATION PROCESSING

The level of arousal that the human information processor is experiencing seems to change information processing in a number of ways. As arousal levels become higher than normal, attention seems to be directed more narrowly at a few cues that seem to be the most salient (Broadbent, 1971; Easterbrook, 1959). Very high levels of arousal seem to decrease working memory capacity, narrow memory search, make activation of weakly associated schemas less likely, and make the activation of the best connected schemas and scripts most likely (Luria, 1973; Anderson, 1990). For simple tasks, this restriction can produce enhanced performance that may provide an evolutionary explanation for the phenomenon. For complex tasks requiring an extensive heuristic search for solutions, performance will worsen. Of course, stress is one of the most common causes of high arousal. As a result, in stressful social situations, one can expect that a person will focus on what seems to be the most salient social cues, activate only the schemas and scripts that are most closely connected to those cues, and generate a narrow range

of behaviors. Thus, when stress is coupled with emotions such as fear or anger and coupled with situational cues linked to aggressive scripts, only violent schemas are likely to be activated. For example, a young male whose life is being threatened by another young male with a gun may find it very difficult to attend to any cues in the environment other than the gun or to retrieve any other scripts than simple scripts for fighting or fleeing.

AGGRESSIVE BEHAVIOR, ANGER, AND SOCIAL COGNITION

Let us now turn to more specific applications of these social information processing principles to understanding aggressive behavior. Our knowledge of human information processing and social cognition as outlined earlier provides important insights into the processes involved in many social behaviors, including aggression. But it is important to realize from the start that social cognition is *not* a cause of aggressive behavior. Social cognition is a *mediating* process that connects external situations, internal schemas, and social behavior in predictable ways.

AGGRESSIVE BEHAVIOR

Aggressive behavior means any behavior that is intended to injure or irritate another person (Berkowitz, 1993; Eron et al., 1971). Specifically excluded from this definition is the "assertive" behavior of dynamic sales people and executives that is often called "aggressive" by the public. Psychologists have long distinguished between the kind of aggressive behavior that is directed at the goal of obtaining a tangible reward for the aggressor (*instrumental or proactive*) and the kind of aggressive behavior that is simply intended to hurt someone else (at different times denoted *hostile, angry, emotional, or reactive aggression*) (Feshbach, 1964). However, an examination of the underlying cognitive processes involved (e.g., Dodge & Coie, 1987) has led to a realization that many of the same mechanisms are involved in both types of aggression. Clearly, anger plays a more important role in hostile aggression, but that does not mean that anger is not present in both types. One solution is to view the role of emotional anger in aggressive behavior as one that varies along a continuum. Instrumental aggression and hostile aggression are at opposite ends of this particular continuum but they are mediated by many common cognitive processes.

ANGER

What is anger then? From a social/cognitive perspective, anger occurs when one is emotionally aroused and the memory node labeled "anger" is activated. How does a node come to be labeled anger? Some argue from an evolutionary perspective that human infants (at least after a few months growth) become pre-

disposed to respond to frustration (e.g., restraint) with a specific combination of general arousal, physiological responses, and muscle tensions that most observers would label anger (Stenberg & Campos, 1990). The node associated with this pattern of activation subsequently becomes labeled as anger by the growing organism. Others argue that the process involves more learning—that each person acquires a cognitive schema for anger defined in terms of a template of situational cues that must be matched (e.g., Fiske, 1982). Still others suggest that a node such as anger is defined in terms of the outcome of an "appraisal" process in which the person evaluates the current situation in terms of such characteristics as pleasantness (e.g., unpleasant), agency (e.g., another), uncertainty (e.g., certain), and attention (e.g., ruminating) (Smith & Ellsworth, 1985; Smith, 1989). In either case the activation of the "anger" node is the result of a cognitive evaluation of external and internal cues. For example, one may sense a variety of changes in muscles (e.g., facial expressions such as tensing, frowning, flaring nostrils) and internal physiology (release of epinephrine) in response to external social cues. Feelings of wanting to attack a target may also be present. The information processing executive perceives all or some of these components and labels the state as one of anger, which in turn may increase the component reactions present. Some theorists (e.g., Berkowitz, 1993) distinguish between anger and hostility. Hostile individuals are said to be those who are "typically quick to voice or otherwise indicate negative evaluations of others (p. 21)." Although such a distinction has pedagogic value, it is not a necessary distinction within a social cognitive framework. Different particular occurrences of anger may be connected to different specific targets. However, individuals can still vary in their disposition to experience anger because of the cognitions they hold and processes they employ.

BIOSOCIAL INTERACTIONS AND THE DEVELOPMENT OF AGGRESSION

Three important facts about anger and aggressive behavior in humans need to be summarized before proceeding with our elaboration of the role of social cognition. First, habitual aggressive behavior usually emerges early in life, and early aggressive behavior is very predictive of later aggressive behavior and even of aggressive behavior of offspring (Farrington, 1982; 1985; Huesmann, Eron, Lefkowitz & Walder, 1984; Loeber & Dishion, 1983; Magnusson, Duner, & Zetterblom, 1975; Olweus, 1979). Process models for aggressive behavior need to explain this continuity over time and across generations. Second, severe aggression is most often a product of multiple interacting factors (Coie & Dodge, in press), including genetic predispositions (Cloninger & Gottesman, 1987; Mednick, Gabrielli, & Hutchins, 1984; Rushton et al., 1986), environment/genetic interactions (Lagerspetz & Lagerspetz, 1971; Lagerspetz & Sandnabba, 1982), central nervous system trauma and neurophysiological abnormalities (Moyer, 1976; Nachson & Denno, 1987; Pontius, 1984), early temperament or attention difficulties (Kagan, 1988; Moffitt, 1990), arousal levels (Raine & Jones, 1987), hormonal

levels (Olweus, Mattsson, Schalling, & Low, 1988), family violence (Widom, 1989), cultural perspectives (Staub, 1996), poor parenting (Patterson, 1995), inappropriate punishment (Eron, Walder, & Lefkowitz, 1971), environmental poverty and stress (Guerra, Huesmann, Tolan, Eron, & VanAcker, 1995), peer-group identification (Patterson, Capaldi, & Bank, 1991), and other factors. No one causal factor by itself explains more than a small portion of individual differences in aggressiveness. Third, early learning and socialization processes play a key role in the development of habitual aggression (Bandura, 1973; Berkowitz, 1974; Eron, Walder, & Lefkowitz, 1971). Aggression is most likely to develop in children who grow up in environments that reinforce aggression, provide aggressive models, frustrate and victimize them, and teach them that aggression is acceptable.

More generally the existing research suggests that habitual aggressive behavior in young humans develops out of a combination of innate predisposing factors, the child's early interactions with the environment, and situationally specific precipitating factors. From a social cognitive perspective the variety of predisposing factors discussed earlier may make the emergence of certain specific cognitive routines, scripts, and schemas more likely, but these cognitions develop through interactions of the child with the environment and are designed to respond to different environmental situations.

ENVIRONMENTAL INSTIGATORS AND SOCIALIZERS

When examining how the human information processing system responds to environmental inputs relevant to aggressive behavior, one must distinguish between *situational instigators* that may precipitate, motivate, or cue aggressive cognitions and responses and those more lasting components of the child's *environment* that mold the child's cognitions (schemas, scripts, normative beliefs) over time and therefore socialize the child to respond in characteristic ways to the environment. An environment rife with deprivations, frustrations, and provocations is one in which habitual aggression readily develops, as is seen in the high level of aggression in our urban ghettos.

In summary, compelling empirical evidence suggests that the interaction of predisposing personal factors with environmental forces shape a child's cognitions to make aggressive behavior more or less likely when certain situational cues occur. Let us now review the processes through which these cognitions influence aggressive behavior and through which the cognitions are shaped by the interaction of the environment with predisposing personal factors.

COGNITIVE PROCESSES MEDIATING AGGRESSIVE BEHAVIOR

Since the early 1980s, two general cognitive/information processing models have emerged to explain how humans acquire and maintain aggressive habits.

One, developed by Huesmann and colleagues (Huesmann, 1977, 1982a, b, 1986, 1988; Huesmann and Eron, 1984; Huesmann & Guerra, 1997), initially focused particularly on scripts, beliefs, and observational learning, whereas the other, developed by Dodge and colleagues (1980, 1986, 1993; Crick & Dodge, 1994; Dodge & Frame, 1982), focused particularly on perceptions and attributions. However, both hypothesize a similar core of information processing, both rely heavily on the work of cognitive psychologists and information processing theory, and both draw from Bandura's (1977, 1986) earlier formulations of cognitive processing in social learning as well as Berkowitz's (1990) neoassociationist thinking.

According to Bandura's (1986) social/cognitive formulations, social behavior is under the control of internal self-regulating processes. What is important is the cognitive evaluation of events taking place in the child's environment, how the child interprets these events, and how competent the child feels in responding in different ways. These cognitions provide a basis for stability of behavior tendencies across a variety of situations. Internalized standards for behavior are developed from information conveyed by a variety of sources of social influence. Children have many opportunities to observe the standards of others, including through the mass media.

Berkowitz (1990), while not disputing the importance of internalized standards, has emphasized the importance of enduring associations among affect, cognition, and situational cues. He argues that such learned associations produce stable behavioral tendencies whenever specific situational cues occur.

The central core of processes hypothesized by both Huesmann (1986, 1988) and Dodge (Crick and Dodge, 1994; Dodge, 1986) are diagrammed in Figure 4.1. Both models draw on Berkowitz and Bandura's thinking. Both models suggest that any individual faced with a social problem evaluates and interprets situational cues, searches memory for guides to behavior, evaluates and decides on the best behavior, and enacts that response. The essential operations of encoding and interpreting cues, selecting a goal and behaviors for attaining it, and evaluating the behaviors on multiple dimensions are common to both models. Thus, in accord with Bandura's position, the cognitive interpretation of environmental events and the comparison of potential responses to self-regulating standards is important, whereas in accord with Berkowitz the associations between cues and encoded schemas are also important.

Huesmann's model focuses first on scripts, their acquisition and retrieval. His model assumes that people use a heuristic search process to retrieve a script that is relevant for the situation. More aggressive people are presumed to have encoded a larger number of aggressive scripts. The learning of scripts is assumed to be influenced both by observational learning and by conditioning, and more aggressive youth are expected to have more opportunities to observe aggression in others. Huesmann's model also hypothesizes a key role for what are called normative beliefs—internalized proscriptions about what is inappropriate behavior for the individual.

One of the most important elements in Dodge's model is cue interpretation. Aggressive individuals are presumed to have a bias toward interpreting ambiguous

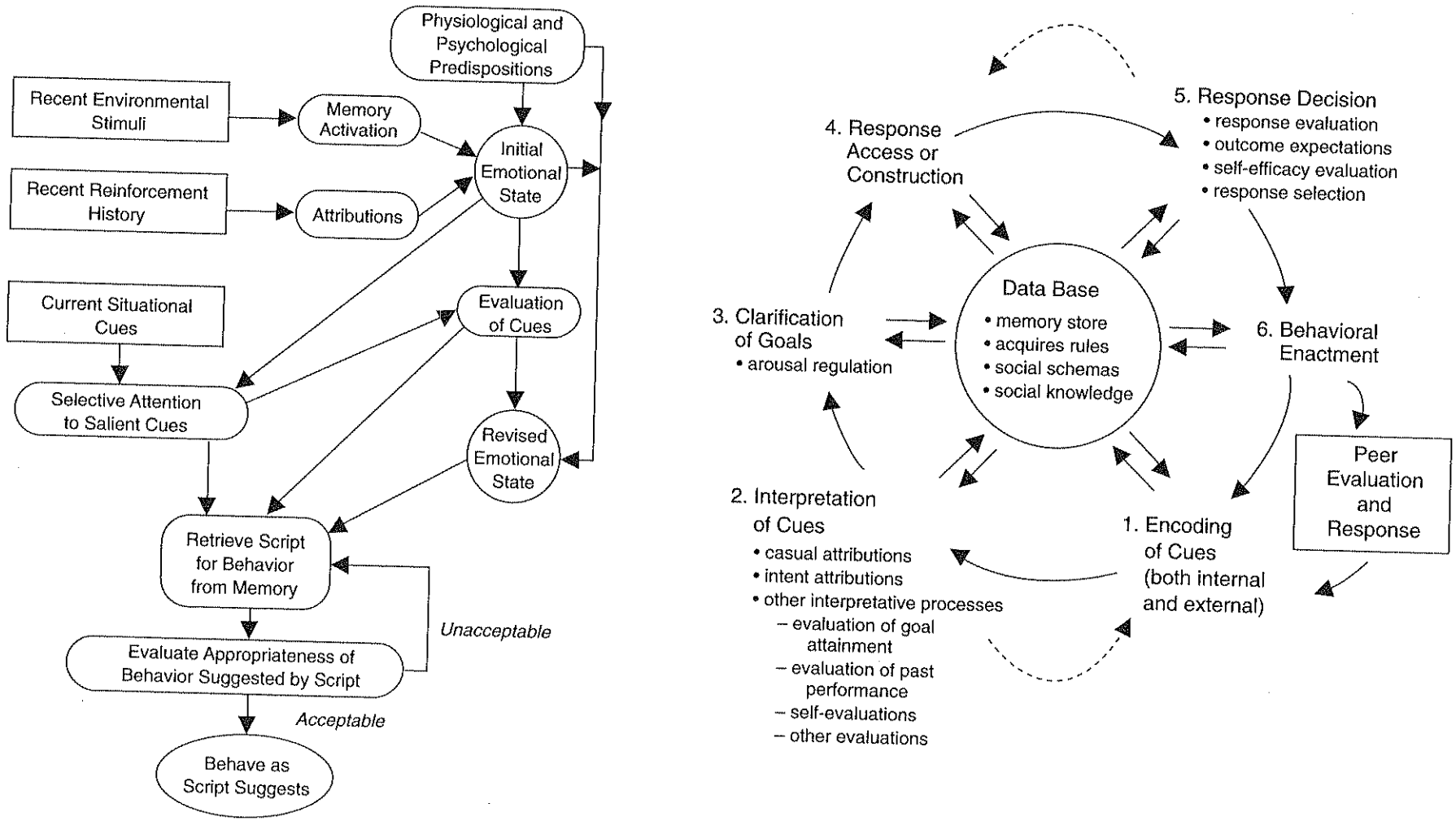

FIGURE 4.1 Huesmann's (1988) initial model (left) and Crick and Dodge's (1994) reformulated model (right).

cues as hostile. Another important focus of Dodge's model is the effect that society's (e.g., peers') responses to one's behaviors have on one's schemas. It is argued that an individual encodes and interprets peer's responses to one's behaviors and that those interpretations may change one's self-schema and thus one's future behaviors. For example, children who are rejected by their peers may develop schemas that deemphasize the importance of peers. In turn this may lead to the development of decision heuristics for social behavior (or the development of scripts, to use Huesmann's terminology) that emphasize tangible rewards over relationship rewards. Dodge's model also stresses the role of developmental changes in information processing *skills* in addition to the kinds of developmental changes in social knowledge (schemas, scripts, etc.) hypothesized by both models. It is presumed that attention span, speed of processing, encoding efficiency, heuristic search skills, and other basic information processes improve with age. Developmental delays may lead to less efficient information processing. Because nonaggressive, prosocial problem solving generally requires more complex information processing skills, this delayed development might well promote aggressive social behavior.

From their early formulations, these models of Dodge and Huesmann have evolved in parallel toward a common core model for the role of information processing and cognitive processes in aggressive behavior. Dodge's elaborations of the role of information processing in social behavior have attracted wide attention in the social development sphere where his model has had a major impact on the direction of the field; however, it has probably not received the attention it deserves among human and animal aggression researchers. Huesmann's elaborations have had an impact on core thinking about the observational learning of aggression and the role of media violence and to a lesser extent in the traditional aggression research domain, but have been missed by many developmental researchers on social adjustment. Yet taken together these elaborations define a powerful theory for how cognitive processes regulate aggressive behavior and for how aggressive behavior develops through early interactions between a child and the child's environment.

A UNIFIED INFORMATION PROCESSING MODEL FOR AGGRESSION

Figure 4.2 integrates the key elements of the two models in order to create a unified information processing theory of aggression that explains the role of cognition in aggressive behavior. This model incorporates the premise that social behavior is controlled to a great extent by cognitive *scripts* (Abelson, 1981) that are stored in a person's memory and are used as guides for behavior and social problem solving. As described earlier, a script incorporates both procedural and declarative knowledge and suggests what events are to happen in the environment, how the person should behave in response to these events, and what the likely outcome of those behaviors would be. It is presumed that while scripts are first being established they

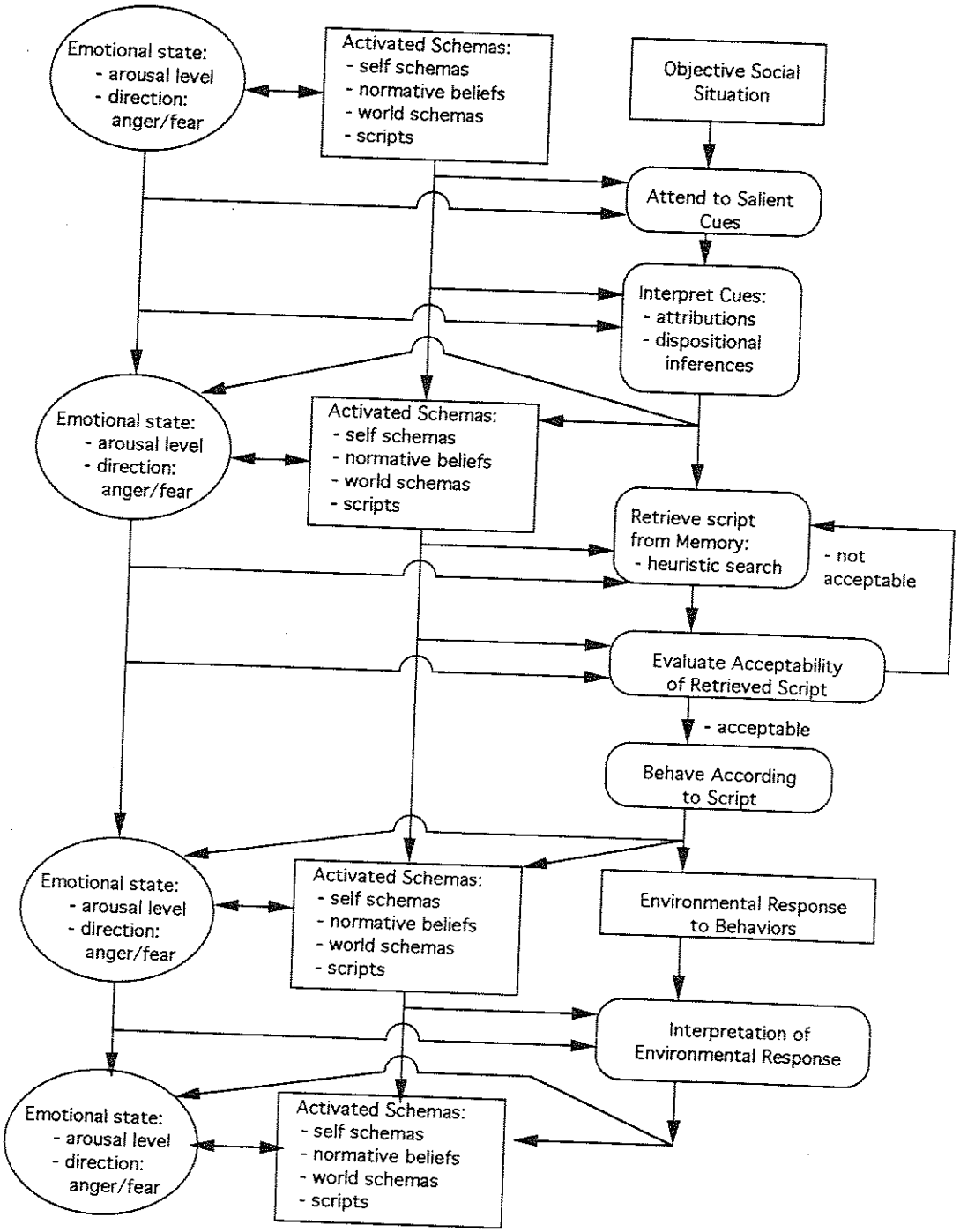

FIGURE 4.2 A unified social information processing model for aggressive behavior. Arrows indicate the direction of influence and flow of control. The diagram represents one cycle of social information processing. The terminal emotional state and activated schemas are the input for the next cycle.

influence the child's behavior through "controlled" mental processes (Schneider & Shriffrin, 1977; see earlier), but these processes become "automatic" as the child matures. Scripts that persist in a child's repertoire become increasingly more resistant to modification and change as they are rehearsed, enacted, and generate con-

sequences. *Normative beliefs* are the second kind of cognitive schema hypothesized to play a central role in regulating aggressive behavior. Normative beliefs are cognitions about the appropriateness of aggressive behavior. They are related to perceived social norms but are different in that they concern what is "right for you." According to Huesmann and Guerra (1997), normative beliefs prime schemas used to evaluate other's behaviors, guide the search for social scripts, and filter out inappropriate scripts and behaviors.

Although this unified model does not adopt the circular form of the 1994 Crick and Dodge model, it is assumed that the internal states and external situations at the bottom of the diagram lead back into the top of the diagram. In other words, the process is continuous.

One can see within this model that there are four possible loci at which individual differences and situational variations can influence aggressive behavior.

Cue Attention and Evaluation

First, the objective situation is defined by the social problem and the environmental cues. However, which cues are given most attention and the interpretation of those cues may vary from person to person and may depend on a person's neurophysiological predispositions, current mood state, and previous learning history as reflected in activated schemas, including normative beliefs. Because emotional states may persist for some time, a person may enter a social interaction in an emotional state that is unrelated to the current situational cues. For example, a person exposed repeatedly to frustrating situations, who attributes the goal blocking to the actions of others, may enter a social interaction in an aroused state with hostile feelings toward everyone. Environmental stimuli may also directly trigger conditioned emotional reactions and may cue the retrieval from memory of cognitions that define the current emotional state. For example, the "sight of an enemy" or the "smell of a battlefield" may provoke both instantaneous physiological arousal and the recall of thoughts about the "enemy" that give meaning to the aroused state as anger. That emotional state may influence both which cues the person attends to and how the person interprets the cues to which he or she does attend. A highly aroused, angry person may focus on just a few highly salient cues and ignore others that convey equally important information about the social situation. Then the angry person's evaluation of these cues may be biased toward perceiving hostility when none is present. A person who finds hostile cues the most salient or who interprets ambiguous cues as hostile will be more likely to experience anger and activate schemas and scripts related to aggression

Script and Schema Activation and Retrieval

Second, the search for a script to guide behavior also accounts for substantial differences in aggressive responding. It is presumed that more aggressive individuals have encoded in memory more extensive, well-connected networks of social scripts emphasizing aggressive problem solving. Therefore, such a script is more

likely to be retrieved during any search. However, the search for a script is also strongly affected by one's interpretation of the social cues, one's activated schemas including normative beliefs, and one's mood state and arousal. For example, anger, even in the absence of supporting cues, will make the retrieval of scripts previously associated with anger more likely; the presence of a weapon, even in the absence of anger, will make the retrieval of scripts associated with weapons more likely; and the perception that another person has hostile intentions will activate scripts related to hostility. Additionally, the schemas that have been activated, particularly the self-schema and normative beliefs, will influence the direction of the search for a script. The man who believes in "an eye for an eye" and perceives himself as "an avenger" is more likely to retrieve a script emphasizing aggressive retaliation.

Evaluation of Scripts

The third locus for the expression of individual differences and situational variation occurs after a script is activated. Before acting out the script, it is proposed that one evaluates the script in light of internalized activated schemas and normative beliefs to determine if the suggested behaviors are socially appropriate and possible to do and if the expected outcome is likely to be desirable. Different people may evaluate the same script quite differently, and the same person may evaluate the same script differently at different times. Persons under high stress and time pressures may devote much less time and resources to evaluation than they would otherwise.

On the average, however, habitually aggressive persons are expected to hold normative beliefs condoning more aggression and thus will employ more aggressive scripts. For example, if a man suddenly discovers that his wife has been unfaithful, he may experience rage and access a script for physical retribution. However, whether the man executes that script will depend on his normative beliefs about the appropriateness of "hitting a female." Even within the same person, different normative beliefs may be activated in different situations and different mood states. The person who has just been to church may have activated quite different normative beliefs than the person who has just watched a fight in a hockey game on TV. While evaluation of the script on the basis of one's normative beliefs is the most important filtering process, two other evaluations also play a role. First, one needs to be able to predict the desirability of the consequences of utilizing a script. Scripts include predictions about likely outcomes, but people differ in their capacities to think about the future, in their concern with the future, and in their evaluation of the desirability of an outcome. Information processing theory shows that the more a person focuses on immediate consequences and the less the person is concerned with the future, the more palatable a self-centered solution to a social problem may seem (Huesmann & Levinger, 1976). For example, if the man described earlier who hit his spouse was concerned about what his in-laws will think of him if they hear about it in a few days, he might not have hit her. Of course, people may also misperceive the likely consequences of aggressive acts

simply because their scripts are inaccurate in predicting consequences for the current situation. Additionally, people differ in their evaluations of the desirability of an outcome. For some people the respect of their peers may be the most important evaluative dimension for an outcome from a social conflict while for others simply ending the conflict may be most important. The other dimension on which people evaluate generated scripts is the extent to which the behaviors in the script seem doable. A person with low perceived self-efficacy for prosocial behaviors may turn to aggressive scripts by default. A person with low perceived self-efficacy for aggressive behavior may avoid aggressive scripts at all costs.

Interpretation of Environmental Responses

Finally, as the bottom right box in Figure 4.2 shows, it is not simply society's response to a person's aggressive behavior per se that affects the person's future behavior, but the person's interpretation of society's response and how that interpretation affects the person's schemas and mood. This opens several important channels for explaining how aggressive scripts may be maintained even in the face of strong negative responses from society. For example, a boy who is severely beaten for behaving aggressively may attribute the beating to being disliked by the punisher rather than to anything he did. An aggressive teenage male, rather than changing his aggressive behaviors, which perhaps provide immediate gratification on some dimensions, may alter his normative beliefs to make the feedback he is receiving seem less negative. He might integrate some of the readily available aphorisms about aggression into his regulatory schemata. The boy who is told he is bad because he pushed others out of the way may shrug his shoulders and think, "Nice guys finish last." The boy who shoves a child who bumped into him may think, "An eye for an eye." Alternatively, he may mitigate society's punishments for his aggressive behavior by choosing environments in which aggression is more accepted. Thus, the more aggressive adolescent male may spend more time interacting with other aggressive peers who accept his behaviors as a way of life. Not only do such social networks provide adolescents with environments in which aggression is not discouraged, such social networks promote the internalization of normative beliefs favoring aggression. The important point sometimes lost on social engineers is that it is not just society's response to aggression that is important, but how the aggressor interprets that response.

EMOTIONAL AROUSAL, SCHEMA ACTIVATION, SCRIPT GENERATION, AND EVALUATION

Information processing models of social behavior are sometimes thought of as "cold" models with little room for affect. However, the evolving information processing model for the development of aggression described here hypothesizes a key role for emotion at each stage of information processing. An individual's absolute arousal level and the valence of the arousal affect aggressiveness at each

stage. Existing negative affect interpreted as anger will bias cue interpretation toward hostility, will prime the retrieval of aggressive scripts, and will cue normative beliefs more supporting of aggression. As described earlier, in high states of arousal, because individuals search less widely and deeply for scripts and retrieve the best connected scripts, aggressive behavior becomes even more likely in highly arousing situations for persons with predominately aggressive scripts. For the individual with a large, well-learned repertoire of simple, direct aggressive scripts for solving social problems and a smaller, less well-learned repertoire of complex, indirect scripts for prosocial solutions, the arousal associated with anger will make the selection of an aggressive script even more likely than priming from the anger would by itself. Furthermore, one can expect similar effects for script evaluation. A person in a highly aroused state of rage because of a provocation will evaluate scripts less carefully and focus on retaliation beliefs in evaluating scripts. At the other extreme, individuals who are very hard to arouse may evaluate scripts accurately but misevaluate societal responses to their behaviors and perceive the outcome of their aggressive behavior as more desirable than it really will be.

ACQUIRING AND MAINTAINING AGGRESSIVE SCRIPTS AND SCHEMAS

So far we have examined how existing scripts may be accessed and used to guide behavior, and how certain individual and environmental factors might promote the use of aggressive scripts. Within this framework a habitually aggressive person is presumed to be someone who regularly retrieves and employs aggressive scripts for social behavior. A number of factors have been noted that might promote the retrieval and utilization of aggressive scripts. It may be, for example, that the cues present in the environment trigger the recall only of aggressive scripts. However, the regular retrieval and use of aggressive scripts would suggest above all that a large number of aggressive scripts have been stored in memory. Similarly, the regular execution of such scripts would suggest that normative beliefs and other schemas supporting aggression have been acquired and encoded. Thus, we must examine how schemas and scripts are acquired.

Huesmann (1982b, 1986, 1988) has argued that while a variety of preexisting neurophysiological factors can predispose individuals toward particular modes of cognitive processing or toward particular schemas and scripts, the child's early learning experiences play a critical role in the acquisition of scripts and schemas for social behavior just as early learning plays a key role in the acquisition of procedural and declarative knowledge relevant to intellectual life. Evolutionary forces and random variation create communalities and individual differences in the biological mechanisms underlying cognition and behavior. These individual differences in biology interact with individual differences in environment to mold the software and data structures directly controlling the child's cognitive processing and social behavior. As described earlier in the discussion on social learning theory, observational and enactive learning combine to shape the development of the child's scripts

and schemas. A script is most likely to first be acquired by observing others and then more firmly established by having its use reinforced.

During the observational learning process the person's current emotional state and current memory contents influence which existing schemas are activated. The activated schemas in turn influence how well the observed script can be encoded and integrated into memory. If the activated schemas are discrepant with the observed script, encoding is difficult; if they are consistent it is easier. When highly aroused and angry, for example, persons may view a physically aggressive sequence of behaviors as more appropriate than they would otherwise. A young boy who can only recall seeing aggressive behaviors is more likely to encode a newly observed aggressive behavior than is a boy whose mind is filled with memories of prosocial solutions. A child with normative beliefs accepting of aggression is much more likely to encode new aggressive scripts for behavior.

The maintenance of a script in memory will be influenced by the extent to which its use produces desired consequences, i.e., by instrumental learning. One might think that because aggressive behavior very often produces negative consequences for the aggressor, the retrieval of aggressive scripts would extinguish. However, the unified information processing theory asserts that such instrumental learning depends on how the individual interprets society's response to the behavior. As described earlier, very often, because of the schemas activated, the aggressor does not attribute the negative reaction of society to the specific script that the aggressor employed, and no learning takes place. The boy who is harshly punished by a teacher for taking another child's toy will not unlearn the behavior if he interprets the cause of his punishment as dislike by the teacher.

As with all learned information, in order to maintain a script in memory, a child would probably need to rehearse it from time to time. The rehearsal may take several different forms, from simple recall of the original scene, to fantasizing about it, to play acting. The more elaborative, ruminative type of rehearsal characteristic of children's fantasizing is likely to generate greater connectedness for the script, thereby increasing its accessibility in memory. Also, through such elaborative rehearsal the child may abstract higher-order scripts representing more general strategies for behavior than the ones initially stored. Of course, rehearsal also provides another opportunity for reevaluation of any script. It may be that some scripts initially accepted as appropriate (under specific emotional and memory states) may be judged as inappropriate during rehearsal.

EMPIRICAL DATA ON INFORMATION PROCESSING AND AGGRESSION

This unified information processing model for the development of aggressive behavior has grown out of an accumulating body of empirical data linking a variety of cognitive processes to social behavior in general and aggressive behavior in particular. The model is based on the presumption that predisposing

personal factors and environmental context interact through observational and enactive learning to lead to the emergence of cognitive processes (including emotional processes) and cognitive schemas that promote aggression. Cue attention and evaluation, script and schema acquisition and retrieval, script evaluation, and evaluation of the environment's responses to one's actions are the four key parts of the social/cognitive performance model as outlined in Figure 4.2. In this section a subset of key studies will be reviewed that provide evidence about the variety of cognitive processes implicated within this model.

CUE ATTENTION AND EVALUATION

An extensive literature has grown up addressing the extent to which more aggressive individuals tend to perceive hostility in others where there actually is no hostility, i.e., display a hostile attributional bias. Dodge and Newman (1981) have reported evidence that aggressive boys attend to fewer social cues in their environment, and Gouze (1987) reports that they tend to focus on cues more suggestive of aggression. Equally important, there is good evidence that aggressive children are more likely to interpret an ambiguous act by another as indicating hostility (Dodge, 1980; Dodge & Coie, 1987; Dodge & Frame, 1982; Dodge, Price, Bachorowski, & Newman, 1990; Graham & Hudley, 1994; Nasby, Hayden & DePaulo, 1979; Slaby & Guerra, 1988; Steinberg & Dodge, 1983). Longitudinal analyses have suggested that a propensity toward hostile attributional bias mediates the relation between early childhood aggression and later antisocial behavior (Dodge, Pettit, Bates & Valente, 1995). Although this relation between aggression and hostile attributional bias can sometimes be difficult to detect (e.g., Pettit, Dodge, & Brown, 1988; Zelli & Huesmann, 1993), one should not be surprised by the lack of large effects given the multidetermined nature of aggressive behavior. Furthermore, experiments with random assignment of subjects have shown that improving the accuracy of intent attributions decreases the likelihood of aggressive behavior in children (Hudley & Graham, 1993).

The fact that one's interpretations of potentially hostile social cues are affected by the schemas one has encoded and activated is not only supported by a long history of research on social perception (e.g., see Fiske & Taylor, 1991; Schneider, 1991) but is also supported by a variety of research on aggression. Dodge and Tomlin (1987) reported evidence that aggressive children rely on their own encoded aggressive self-schemas and stereotypes in making intent attributions. Zelli and Huesmann (1993) have found that college students with greater ingrained persecution beliefs are more likely to perceive hostility when none is there. There is also strong evidence that these hostile cue interpretations become an automatic cognitive process. Bargh (1989) and Winter and Uleman (1984) have shown that inferences about the dispositions of others occur automatically without conscious awareness. More recently, Zelli, Huesmann, and Cervone (1995) have shown that more aggressive individuals automatically encode ambiguous sentences with an aggressive interpretation and then are more likely to recall them when prompted with an aggressive cue. Along these lines the "cultivation" effects data on media exposure

reported by Gerbner and colleagues (Gerbner & Gross, 1980) suggest that high exposure to media violence in adults makes them see the world as a more hostile place and thus primes them for hostile attributional bias. Finally, Dodge and Somberg (1987) have shown that hostile attributional bias, as predicted by information processing theory, is more likely to occur under conditions of high emotional arousal.

ACQUISITION, MAINTENANCE, AND RETRIEVAL OF SCRIPTS AND SCHEMAS

Although it is methodologically more difficult to assess the kinds of scripts that individuals have encoded, one can assess the kinds of scripts they are most likely to retrieve and make inferences from those data. Available evidence suggests that, in fact, the more accessible scripts for more aggressive children are more aggressive. The scripts retrieved by more aggressive children to solve hypothetical problems tend to incorporate more physical aggression and manipulation actions (Rubin, Bream & Rose-Krasnor, 1991; Rubin, Moller, & Emptage, 1987; Waas, 1988). Priming by negative intent cues is more likely to activate an aggressive script in aggressive children (Graham & Hudley, 1994). Aggressive children are less likely to generate more subtle prosocial scripts to solve social problems (Deluty, 1981; Taylor & Gabriel, 1989), and there is some evidence that, as hypothesized, a narrower search process for a script is associated with more aggressive behavior (Shure & Spivack, 1980).

There is also extensive evidence that, as predicted, the observation of aggressive scripts in real life or in the mass visual media leads to the encoding of such scripts. Of course, children growing up observing violence around them behave more violently (e.g., Guerra, Huesmann, Tolan, VanAcker & Eron, 1995), and children whose parents physically aggress against them are more likely to aggress physically against their own children later in life (Widom, 1989). Nevertheless, it is hard to show that such effects are due to the acquisition of specific scripts through observation. Research on media violence and aggression provides more compelling evidence of that process. Copycat crimes and the well-known contagion of suicide (Berkowitz, 1993) provide some of the clearest examples of specific aggressive scripts being acquired by adults through observation from the media. More importantly from a scientific standpoint perhaps, numerous laboratory and field experiments (see Paik & Comstock, 1994; Huesmann, 1982b; Huesmann, Moise, & Podolski, in press) have demonstrated the encoding of specific scripts from such observations. It is also clear that new aggressive scripts are abstracted out of the elements of specific scripts being observed. Thus, the aggressive scripts that children display after being exposed to violent scenes are not exactly the same as the scripts observed (Bjorkqvist, 1985). These observational learning studies have also confirmed the validity of the encoding specificity principle with regard to aggressive scripts. Even a neutral cue that is present in an observed aggressive script may trigger the retrieval of that script. For example, Josephenson (1987) showed that a walkie-talkie present in an aggressive video could trigger aggressive behavior in boys who had watched that video.

A substantial body of research in cognitive psychology has shown that rehearsal of information enhances its connectedness in the memory network and makes it more accessible (Klatzky, 1980). Thus, as argued earlier, a child's rehearsal of an aggressive script should make its retrieval more likely in the future. One common type of rehearsal of social behavior is fantasizing, and empirical evidence shows that fantasizing about aggressive behaviors is positively related to behaving aggressively. Early studies clearly showed that more aggressive adults scored higher on projective tests of hostility imagery (Eron, 1959). More recently, direct measures of children's fantasizing have been related to children's aggressive behavior (Rosenfeld, Huesmann, Eron, & Torney-Purta, 1982). For example, in a longitudinal study of early elementary school children conducted in five different countries, Huesmann and Eron (1984) reported that self-reported fantasizing about aggression was correlated with peer-nominated aggressive behavior in all five countries. Both Viemero (Viemero & Paajanen, 1992) and Huesmann (1986) have also found in field studies that TV violence viewing predicts fantasizing about aggression, which in turn predicts later aggressive behavior.

There is also significant empirical support for the premise that even quite different specific aggressive scripts and schemas are linked together in one's memory network by a common "hostility" node and thus can be primed by other aggressive ideas or cues, even if they have no substantive connection. The classic example of such an effect is the Berkowitz and LePage (1967) "gun" experiment. In this study, subjects gave larger shocks to punish a partner who was not learning if there was a gun in the experimental room. The gun cues the hostility node, which leads to the utilization of a more aggressive script for behaving in the experiment. The priming cue need not be a tangible object; the same effect can be obtained when the cue activating the "hostility" node is anger or another negative emotion (Berkowitz, Cochran, & Embree, 1981). In addition, the observation of violence in the mass media or environment has been shown to prime a wide variety of hostile thoughts (Bushman & Geen, 1990).

Actually, according to the information processing model, violent cues, bad moods, irritability, and arousal affect all four aspects of social information processing: cue attention and interpretation, script retrieval, script evaluation, and evaluation of environmental response. The dysphoric valence of the emotion activates schemas related to hostility, and the arousal narrows memory activation. Thus, it is not surprising that high temperatures (Anderson & Anderson, 1984), crowding (Matthews, Paulus, & Baron, 1979), and other irritators and stressors (Guerra, Huesmann, Tolan, Eron, & VanAcker, 1995) increase aggression. Also, as predicted from the social/cognitive model, reflection on the cause of the irritation that would reduce the activation of a general hostility node reduces aggression at unrelated targets (Berkowitz & Troccoli, 1990).

EVALUATION OF SCRIPTS

Once a script has been activated, it still may not be employed if it is evaluated negatively. The behaviors involved may be evaluated as inappropriate when fil-

tered through an individual's normative beliefs about aggression; its expected outcome may be evaluated as undesirable when filtered through beliefs about environmental responses; or it may be evaluated as undoable when filtered through conceptions of self-efficacy. Huesmann and associates (Huesmann and Guerra, 1997; Guerra, Huesmann, & Hanish, 1994; Huesmann, Guerra, Zelli, & Miller, 1992; Huesmann, Zelli, Fraczek, & Upmeyer, 1993) have developed a reliable measure of normative beliefs about general aggression (e.g., "It is usually okay to push and shove other people around?") and retaliation (e.g., "If a girl screams at you, is it okay to hit her?") and have shown that children and adults who are more aggressive have normative beliefs that are more approving of aggression. More important, longitudinal studies have shown that normative beliefs about aggression seem to crystalize during early childhood (Huesmann & Guerra, 1997). For children aged 6 or 7, such beliefs are very unstable and do not predict much about subsequent aggressive behavior. However, such beliefs are predicted by the child's own previous behavior. For children aged 10 and 11, the picture changes. Normative beliefs are now stable and predict subsequent aggressive behavior. Thus, ages 6 to 9 seem to be a period during which normative beliefs and other schemas relating to aggressive social behavior are being developed through interactions with the environment. According to the unified information processing model of aggression, normative beliefs exert effects not just on the filtering of scripts, but on the activation of schemas relevant to cue interpretation and script retrieval. So far no studies have been undertaken to discriminate between these different effects.

Normative beliefs are not the only schemas relevant to script selection and evaluation. Self-schemas provide an internal context within which scripts must be evaluated as well. Heightened activation of self-schemas decrease the likelihood of aggression when the self-schema is nonaggressive (Carver, 1974), probably by filtering out potential aggressive scripts. However, as Baumeister (Baumeister, Smart, & Boden, 1996) has shown, a self-schema that includes an extremely positive evaluation of oneself can promote the selection of aggressive scripts when a person threatens that self-evaluation. Perceptions of self-efficacy for executing the script in question would also be expected to be important in the evaluation of a script (Bandura, 1986; McFall, 1982). The implication for aggressive behavior would seem to be that those with high self-efficacy for prosocial behavior would be less likely to behave aggressively. Unfortunately, data have not born this out. In at least two studies, children who scored higher on self-efficacy for prosocial or competent behavior actually behaved more aggressively (Crick & Dodge, 1989; Huesmann, Guerra, Eron, Miller, Zelli, Wroblewska, & Adami, 1991). One possible explanation may be that the high self-esteem associated with general feelings of self-efficacy marks individuals who, when threatened, are particularly prone to anger (Baumeister, Smart, & Boden, 1996).

Not only are self-schemas relevant to script evaluation, schemas about others are relevant too. Schemas about others that promote deindividuation allow the utilization of aggressive scripts that might otherwise be unacceptable (Diener, 1976; Prentice-Dunn & Rogers, 1983). Schemas about others' beliefs and attitudes, e.g., what others respect or disrespect, may make some scripts more acceptable than

others. In this unified information processing model, outcome expectancies are viewed as mostly an inherent part of social scripts rather than a separate component of behavior evaluation as Crick and Dodge (1994) suggested. Each script represents a sequence of behaviors and expected outcomes or responses of the environment. However, the meaning and value of objectively similar outcomes may change depending on one's schemas about the world. Thus, the evaluation process for a generated script includes an assessment of outcome "desirability." In fact, there is accumulating evidence that more aggressive children tend to believe that aggressive behavior will have more desirable outcomes (Crick & Ladd, 1990; Deluty, 1983; Dodge, Pettit, McClaskey, & Brown, 1986; Perry, Perry, & Rasmussen, 1986; Quiggle, Panak, Garber, & Dodge, 1992) and that prosocial behavior will have less favorable outcomes (Quiggle et al., 1992).

These studies have shown that aggressive youth differ from other youth in the beliefs and schemas they use to evaluate the appropriateness and effectiveness of potential scripts. However, there is also evidence that some youth are more aggressive because they do not devote much cognitive effort to this filtering step. For example, empirical data suggest that certain children, e.g., attention deficit hyperactivity disorder (ADHD) children, are neurophysiologically predisposed toward minimizing this evaluation step. The result is what many observers would call impulsive behavior (Barkley, 1995; Kendall & Braswell, 1985). If the first scripts activated are aggressive scripts, the result is aggressive behavior even if the child "knows" upon reflection that the behavior was inappropriate.

INFORMATION PROCESSING: HOSTILE AND INSTRUMENTAL AGGRESSION

Evidence reviewed to this point has not addressed the issue of how cognitive processes differ between instrumental (proactive) and hostile (reactive) aggression. However, the predictions of this information processing theory of aggression are clear. Both kinds of aggression depend on the person having aggressive scripts along with normative beliefs and schemas supporting the positive evaluation of aggression. On the one hand, individuals most at risk for hostile (reactive) aggression should also display higher emotional reactivity in response to provocation and greater hostile attributional bias, which would lead to more impulsive, immediate responses to provocation. On the other hand, instrumental aggression should be more a function of having encoded a large repertoire of aggressive scripts for solving social problems and of having acquired normative beliefs approving of aggression. Instrumentally aggressive individuals do not need to be particularly reactive to provocation and should not display much anxiety in response to thoughts of aggression. In fact, empirical studies on arousability suggest that difficult to arouse individuals may indeed be more at risk for instrumentally aggressive behavior (Raine & Venables, 1981; Raine, Venables, & Wilson, in press). However, more easily arousable individuals seem to be more at risk for hostile aggression (Baker et al., 1984) and violent crimes (Hare & McPherson,

1984). In fact, Crick and Dodge (in press; Craven & Lochman, 1997; Dodge, 1997) have reported empirical data with children that seem to be consistent with these predictions, i.e., more arousable children display more hostile attributional bias and hostile aggression.

CONCLUSIONS

Over the past several decades it has become clear that an understanding of how human cognitive processes operate is necessary for an understanding of human social behavior in general and aggressive behavior in particular. Extensive empirical research on social information processing coupled with theoretical elaborations of cognitive science constructs has led to the emergence of a unified model of social information processing in aggressive behavior. The model identifies four processes in social problem solving where emotional arousal, activated schemas, and situational cues interact to affect aggression: (1) cue attention and interpretation, (2) script retrieval, (3) script evaluation and selection, and (4) evaluation of society's response to one's behavior. Although these processes may first require cognitive control in the developing child, they eventually seem to operate as relatively automatic cognitive processes.

Evidence suggests that humans attend to environmental cues differentially and interpret the cues differently as a function of predisposing neurophysiological factors, their emotional arousal, the kinds of cognitive schemas they have acquired, and which schemas are activated. More aggressive individuals tend to focus on fewer cues and cues that are more frequently symptomatic of hostility, tend to interpret ambiguous cues more readily as symptomatic of hostility, and tend to believe that the world is more hostile. This is particularly true when the individual is angry, either because of situational factors or a predisposition toward more general hostility. More aggressive individuals also have a greater proportion of aggressive scripts encoded in memory with more accessible links to everyday cues. They have been found to rehearse their aggressive scripts more through aggressive fantasizing and to recall more aggressive scripts from ambiguous cues. It has been shown that while young children do not have well-defined or stable normative beliefs about the appropriateness of aggression, older children do have well-formed beliefs, and those beliefs influence how they evaluate retrieved scripts. Finally, aggressive individuals often do not expect their own aggressive behaviors to have bad consequences for them.

Within this framework, what causes one child to become more aggressive than another? Clearly, we need to explore further the role of genetics, neurophysiology, and evolutionary forces in predisposing individuals to process information in ways that promote aggression. But we already have a pretty good idea of what causes one child to learn more aggressive scripts than another. Certainly instrumental conditioning plays a role. If a specific aggressive behavior is reinforced, the script that suggested that response is more likely to be retrieved and to be employed in the

future. Furthermore, the effect of the reinforcement may generalize to scripts that are abstractions of the specific script, promoting a generalized disinhibition of aggression. The boy who solves a social problem successfully by hitting will be more likely in the future not just to hit, but to kick, punch, or push. Nevertheless, it is difficult to believe that the complex scripts for social behavior that children rapidly acquire are the result of random emission and selective reinforcement. Laboratory and field evidence suggests that, on the contrary, scripts for social behavior are often encoded from patterns of behaviors observed in others. Just as a boy may encode a motor program for throwing a football from observing others throw, a boy may encode a script for hitting those who victimize him from observing others hit those who victimize them. Children are constantly observing others, encoding what they see that seems salient, and integrating these observations into encoded scripts for behavior. Not every aggressive behavior they observe is encoded or stimulates the encoding of an aggressive script. Not every aggressive script is retained or remains accessible for long. The more salient an observed aggressive scene is to the child initially, and the more the child ruminates upon, fantasizes about, and rehearses the observed scene, the more likely it is that an aggressive script based on that scene is recalled and followed in a social problem-solving situation. The more the aggressive scene is consistent with the scripts for behavior that the child has already acquired, the more easily it is integrated into memory. The more the aggressive scene is perceived as consistent with the child's own normative beliefs about the appropriateness of social behavior, the more likely it is to be integrated into memory. The child encodes scripts for behavior that have subjective utility as potential strategies for social problem solving. The child encodes these scripts in the context of the situational cues, and the likelihood that a child will access a script for specific aggressive behaviors is dependent on how many relevant cues are reproduced in the environment at recall time.

In summary, from the social/cognitive perspective it is easy to see that once a child begins to perceive the world as hostile, to acquire scripts and schemas emphasizing aggression, and to believe that aggression is acceptable, the child enters a vicious cycle that will be difficult to stop. Cognitions, behavior, observations of others, and the responses of others all combine to promote aggression. If not interrupted, the cycle can be expected to continue into adulthood, maintaining aggressive behavior throughout the life span.

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