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OBSERVATIONAL LEARNING OF VIOLENT BEHAVIOR

Social and Biosocial Processes

L. Rowell Huesmann

Research Center for Group Dynamics
Institute for Social Research
University of Michigan
Ann Arbor, Michigan 48106-1248

1. INTRODUCTION

Although habitual aggressive and violent behaviors seldom develop in children unless there is a convergence of multiple predisposing and precipitating biosocial and contextual factors, there is compelling evidence that early observation of aggression and violence in the child's environment or in the mass media contributes substantially to the development of aggressive habits that may persist throughout the life course (Bandura, 1986; Berkowitz, 1993; Paik & Comstock, 1994; Eron, Huesmann, Lefkowitz & Walder, 1972; Huesmann, 1986; Huesmann & Eron, 1986; Huesmann & Miller, 1994). The empirical evidence concerning the importance of observational learning has been accumulating for decades but has been given added relevance by the emergence of social/cognitive process models to explain individual differences in aggression. In this chapter I provide an overview of a unified cognitive/information-processing model of social behavior within which aggression can be understood, I elaborate on the key role that observational learning plays in the development of the cognitive/information-processing structures that control social behavior in general and aggressive behavior in particular; and I discuss the biosocial processes that seem to be involved in observational learning of these cognitive/information-processing structures.

In the context of this chapter, aggressive behavior is any behavior intended to injure or irritate another person (Berkowitz, 1993; Eron et al., 1972). Excluded from this definition is the "assertive" behavior of dynamic sales people and executives that is often called "aggressive" by the public. Psychologists have usually distinguished between the kind of aggressive behavior that is directed at the goal of obtaining a tangible reward for the aggressor (*instrumental or proactive aggression*) and the kind of aggressive behavior that is simply intended to hurt someone else (at different times denoted *hostile, angry, emotional,*

or reactive aggression) (Berkowitz, 1993; Feshbach, 1964). While some scholars have argued that all aggressive behavior is instrumental in some way, rageful assaults out of anger are often so different in character from violent acts committed for tangible gain that the distinction seems valuable. Furthermore, one can often detect individual differences in arousal predispositions associated with people who habitually engage in the different types of aggression (Baker, Hastings, & Hart, 1984; Craven & Lochman, 1997; Raine, Venables, & Williams, 1990). Nevertheless, 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 does not play any role in instrumental aggression. Clearly, lack of self-control plays a role in instrumental aggression, but that does not mean that self-control does not play any role in hostile aggression.

Before proceeding to the major themes of this chapter, I need to review three well-established facts about aggression and violence. *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; 1995; 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*, as the title of this book suggests, severe aggression is most often a product of multiple interacting social and biological factors (Coie & Dodge, in press) including genetic predispositions (Bouchard, 1984; Cloninger & Gottesman, 1987; Mednick, Gabrielli, & Hutchins, 1984; Rushton et al., 1986), environment/genetic interactions (Lagerspetz & Lagerspetz, 1971; Lagerspetz & Sandnabba, 1982), CNS 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; Raine, Venables, & Williams, 1990; in press), 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 play a key role in the development of habitual aggression. From a social cognitive perspective the variety of predisposing factors discussed above may make the emergence of certain specific cognitive routines, scripts, and schemas more likely, but these cognitions are learned through interactions of the child with the environment (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.

To best understand the role that environmental variations play in this process, one must distinguish between *situational instigators* that may precipitate, motivate, or cue aggressive cognitions/responses and those more lasting components of the child's *socializing environment* that mold the child's cognitions (schemas, scripts, normative beliefs) and therefore their responses to these stimuli over time, i.e., that socialize the child. An environment rich with environmental deprivations, frustrations and provocations is one in which aggressive behavior is socialized in children over time and then regularly stimulated in children across situations.

2. COGNITIVE PROCESSES, INFORMATION PROCESSING, AND AGGRESSIVE BEHAVIOR

Over the past 15 years two general cognitive/information processing models have emerged of how humans acquire and maintain aggressive habits. One, developed by Huesmann and his colleagues (Huesmann 1982; 1986; 1988; Huesmann and Eron, 1984) initially focused particularly on scripts, beliefs, and observational learning, and the other developed by Dodge and his colleagues (1980; 1986; Crick & Dodge, 1994; Dodge & Frame, 1982) focused particularly on perceptions and attributions. However, both hypothesize a similar core of information processing, both draw 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.

In Figure 1 I present Huesmann's (in press) recent integration of the key elements of these social/cognitive models into an unified information processing model that explains the role of cognition in aggressive behavior. This model begins with 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. 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 influence the child's behavior through "*controlled*" mental processes (Schneider & Shriffrin, 1977; Shriffrin & Schneider, 1977), but these processes become "*automatic*" as the child matures. Correspondingly, scripts that persist in a child's repertoire, as they are rehearsed, enacted, and generate consequences, become increasingly more resistant to modification and change. *Causal schemas* are a second kind of cognition assumed to influence behaviors. Causal schemas are the data base that the individual employs to evaluate environmental cues and make attributions about others' intentions. These attributions in turn will influence the search for a script for behaving. *Normative beliefs* are a third 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's "right for you." Normative beliefs are used to interpret other's behaviors, to guide the search for social scripts, and to filter out inappropriate scripts and behaviors.

Within this model that there are four possible loci at which individual differences and situational variations can influence aggressive behavior. First, the objective situation primes both cognitive and emotional reactions. However, which environmental cues are given most attention and how they are interpreted 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. Negative affect, e.g. a bad mood, primes the interpretation of environmental events to be more negative. Very aversive situations and frustration will produce negative affect in almost everyone, but the intensity of the affect depends on the interpretation given to the situation. Environmental stimuli may 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

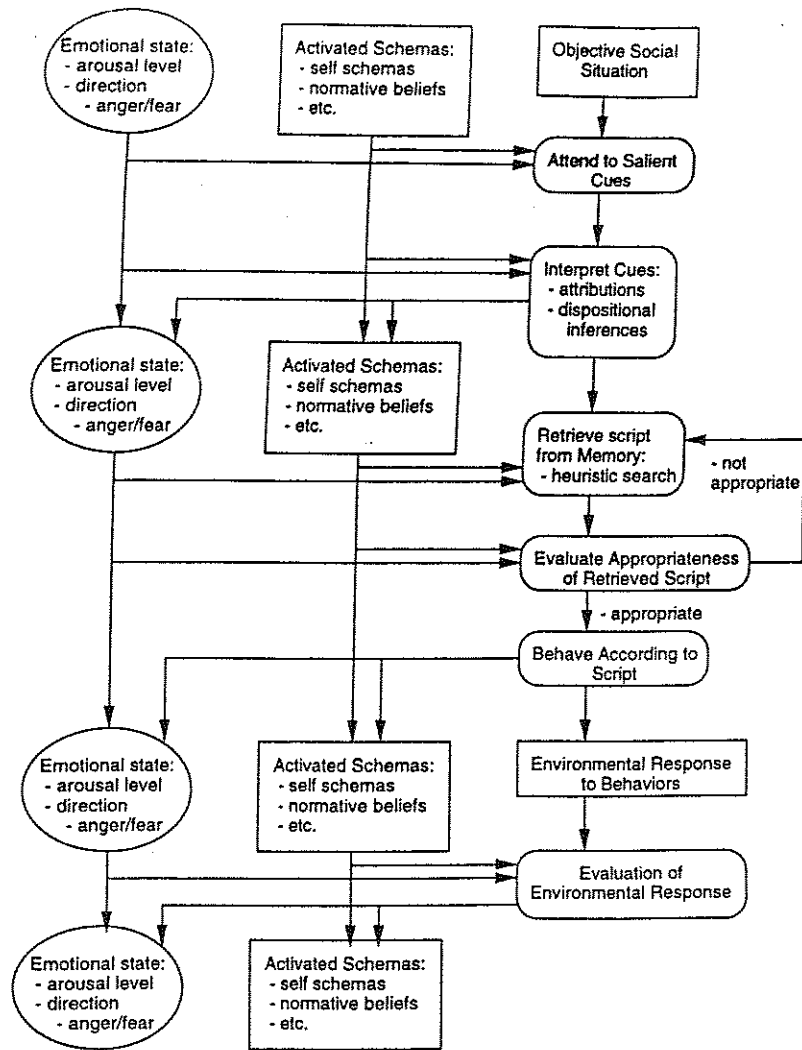


Figure 1. A unified social information processing model for aggressive behavior (Huesmann, in press).

the person attends to and how the person evaluates 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.

A second locus for individual differences is the script generation process. It is presumed that the more aggressive individual has encoded in memory a more extensive, well-connected network 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, bad moods, even in the absence of supporting cues, will make the retrieval of scripts previously associated with bad moods 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. Finally, less direct, more subtle, prosocial approaches to solving social problems may require greater search. It is hypothesized that the angry, aroused person is less likely to engage in broad search and is more likely to retrieve scripts including aggressive, retaliatory actions.

A 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 likely to achieve the desired goal. Different people may evaluate the same script quite differently. The habitually aggressive person is 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 or not 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. Although evaluation of the script on the basis of one's normative beliefs is the most important filtering process according to Huesmann (1988; Guerra, Huesmann, & Hanish, 1994), he suggests that two other evaluations also play a role. First, one needs to be able to predict the desirability of the consequences of utilizing such 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 consequences. The more a person focuses on immediate consequences and the less the person is concerned with the future, the more palatable an aggressive solution to a social problem may seem (Huesmann & Levinger, 1976). In addition, people may consider different dimensions of the outcome in evaluating its desirability. Some may focus on tangible rewards; others may focus on interpersonal relations, for example. Second, even if people predict the consequences of an action accurately and agree on its desirability, they may differ a lot in their evaluation of the possibility of performing according to the script that produces the outcome. A person with low-perceived self-efficacy for non-aggressive behavior may reject most prosocial scripts.

The fourth locus for individual differences in this model is a person's interpretation of society's responses to their behaviors and how that interpretation affects the person's schemas and mood. With the "right" interpretation of society's responses, one may maintain aggressive scripts even in the face of strong negative responses from society. For example, a child 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 teen-age male, rather than change 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 negative reinforcements 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 model described above explains how social scripts that have been acquired by an individual may be accessed and used to guide behavior, and how certain individual and environmental factors could promote greater or lesser use of aggressive scripts. According to this model an habitually aggressive person is one who regularly retrieves and employs scripts for social behavior that emphasize aggressive responding. What might promote the retrieval and utilization of aggressive scripts? Clearly, 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 and maintained.

3. THE ROLE OF OBSERVATIONAL LEARNING IN THE ACQUISITION OF AGGRESSIVE SCRIPTS, SCHEMAS, AND BELIEFS

While a variety of constitutional factors, ranging from body size to brain structure, may predispose individuals toward acquiring particular social beliefs, schemas, and scripts, there is every reason to expect that they must be "acquired." Learning plays the key role in the acquisition of scripts and schemas for social behavior just as learning plays the key role in the acquisition of procedural and declarative knowledge relevant to intellectual life.

Thirty-five years of child development research beginning with Bandura's seminal studies in the early 1960s have suggested that *observational learning and conditioning interact* as the child develops to enable the child to acquire scripts and schemas (Bandura, 1973, 1977, 1986; Bandura, Ross, & Ross, 1961; Coie & Dodge, in press; Eron, Lefkowitz, & Walder, 1971; Huesmann & Eron, 1986; Lefkowitz, Eron, Walder, & Huesmann, 1977). We will review the empirical evidence in more detail below, but the conclusions are clear. A belief, schema, or script is most likely to first be suggested by observing others and then more firmly established by having its use reinforced. Observation of parents, siblings, peers all are important, but so is observation of characters in the mass media.

An important encoding principle applying to observational learning 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 other characteristics of the observed scene enhance or diminish the likelihood of a child encoding the observed scripts, or adopting the

inferred schemas or beliefs. 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. The less children identify with the people being observed and the more unrealistic their actions seem to the children, the less likely children are to encode what they saw. 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. The more social approbation the observed people receive, the less likely is observational learning.

During the observational learning process the schemas that have been primed and are activated influence how well the observed scripts can be encoded and integrated into memory as well as the kinds of inferences that will be made. Both emotional states and situational stimuli may prime schemas. 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.

Once encoded through observational learning, the maintenance of a script or belief in memory will be influenced by instrumental learning. Observed scripts that are imitated but never produce a desirable outcome are likely to extinguish. Observed beliefs that are encoded but never confirmed are less likely to persist. Unfortunately, many beliefs and schemas are likely to be self-fulfilling. The individual who attributes hostility to everyone else, is sooner or later likely to be surrounded by people who really do feel hostile. Similarly, one might think that, because aggressive behavior very often produces negative consequences for the aggressor, the retrieval of aggressive scripts might extinguish. However, such instrumental learning depends on how the individual interprets society's response to the behavior. Often, because of the schemas that the aggressor has 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 without asking will not unlearn the behavior if he interprets the cause of his punishment as dislike by the teacher.

Even if aggressive scripts are not used and reinforced they may become more accessible to a child if the child rehearses them. 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.

4. EMPIRICAL DATA ON INFORMATION PROCESSING, OBSERVATIONAL LEARNING, AND AGGRESSION

The information processing model for the development of aggression described in this chapter is based on the presumption that predisposing personal factors and environ-

mental 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 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 1. In this section I will review the subset of key studies that provide evidence about the variety of cognitive processes implicated within this model and the biological processes that interact with them.

4.1. Hostile Attributional Bias and Observational Learning

It is now well established that aggressive individuals tend to perceive hostility in others where there is no hostility, i.e. display a hostile attributional bias (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). A long history of research on social perception (e.g. see Fiske, 1982; Fiske & Taylor, 1991; Schneider, 1991), as well as recent research on aggression, suggest that this hostile attributional bias is a product of the schemas that an individual has encoded and activating cues. Dodge and Tomlin (1987) reported evidence that aggressive children are relying 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, & 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.

How do schemas promoting hostile attributional bias develop? There is good reason to think that observational learning plays a major role. A variety of evidence exists to support the conclusion that those who see more violent behavior in real life or in the mass media begin to falsely perceive more violence around them than do others. Gerbner and his colleagues (Gerbner & Gross, 1980) have reported that high exposure to media violence in adults makes them see the world as a more hostile place. Similarly both Bryant, Carveth, and Brown (1981) and Tyler & Cook (1984) showed specifically that exposure to media violence increased viewers estimates of the frequency of aggression in society. These schemas representing the frequency of aggressive behavior in one's surroundings can then be expected to influence the attributions one makes about those around them.

4.2. Observational Learning of Deviant Scripts

It is methodologically difficult to assess the kinds of scripts that individuals have encoded; however, one can assess the kinds of scripts they are most likely to retrieve and make inferences from those data. The available evidence suggests that, in fact, the most accessible social scripts for aggressive children are aggressive scripts. For example, 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).

Researchers have also shown that the observation of aggressive scripts in real life or in the mass visual media leads to the encoding of such scripts. 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 physically aggress against their own children later in life (Widom, 1989). However, it is hard to show that such effects are due to the acquisition by the children of specific scripts through observation. The research on media violence and aggression provides more compelling evidence of that process.

Both the well-known contagion of suicide and copycat crimes (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, 1982; Huesmann, Moise, & Podolski, in press) have demonstrated the encoding of specific scripts from such observations. The typical paradigm is that randomly selected children who are shown either a violent or non-violent short film are observed as they play afterwards (Bandura, Ross, & Ross, 1961, 1963a, 1963b). The consistent finding is that children who see the violent film clip behave more aggressively immediately afterwards. Such results have been obtained both for aggression directed at inanimate objects (e.g., "Bobo" dolls) and for aggression directed at peers (Bjorkqvist, 1985; Josephson, 1987). In one very typical study Bjorkqvist (1985) in Finland exposed 5 to 6 year old children to either violent or non-violent films. These children were then observed playing together in a room by two observers who did not know which type of film each child had seen. Children who had just seen the violent film ended up being rated higher on physical aggression (hitting other children, wrestling, etc), verbal aggression (screaming at others, threatening others), and aggression at objects (intentional destruction of toys, etc.). The empirical data are also compelling 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).

The generality of these experimental conclusions has been confirmed by a substantial body of field research showing that early childhood exposure to violence is correlated with childhood aggression and predictive of adult aggression. For example, in a study initiated in 1960 on 870 youth in Columbia County, New York, Eron and his colleagues found that boys who watched more violence in the mass media in elementary school were statistically more likely to be aggressive ten years later (after graduating from high school), even controlling for initial aggressiveness, social class, education, and other relevant variables (Eron, Huesmann, Lefkowitz, & Walder, 1972; Lefkowitz, Eron, Walder, & Huesmann, 1977). A 22-year follow-up of these same subjects revealed that their early violence viewing also related to their adult criminality at age 30 (Huesmann, 1986).

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, Josephson (1987) showed that a walkie-talkie present in an aggressive video could trigger aggressive behavior in boys who had watched that video when they later saw a walkie-talkie.

Information processing theory suggests that even quite different specific aggressive scripts and schemas are linked together in one's memory network by a common "hostility" node and thus should be primed by other aggressive ideas or cues, even if they have no

substantive connection. There is significant evidence supporting this view. 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. In fact, 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 activate a wide variety of hostile thoughts (Bushman & Geen, 1990).

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, 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 the empirical evidence shows that fantasizing about aggressive behaviors is positively related to behaving aggressively. For example, in a longitudinal study of early elementary school children conducted in five different countries, Huesmann and Eron (1984; Rosenfeld, Huesmann, Eron, & Torney-Purta, 1982) 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.

4.3. Observational Learning of Deviant Normative Beliefs

A script may not be employed, even if it has been retrieved, if the script is evaluated as inappropriate when filtered through an individual's normative beliefs about aggression (See Figure 1). 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. "Is it usually O.K. to push and shove other people around?") and retaliation (e.g. "If a girl screams at you, is it O.K. 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, recent longitudinal studies have shown that normative beliefs about aggression seem to crystalize during early childhood (Huesmann & Guerra, 1997). For children age 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 age 10 and 11 the picture changes. Normative beliefs are now stable and predict subsequent aggressive behavior. Thus, age 6 to 9 seems to be a period during which normative beliefs and other schemas relating to aggressive social behavior are being developed through interactions with the environment.

How do children acquire normative beliefs? Again substantial evidence supports a key role for observational learning. Children hear the beliefs expressed by their parents and peers, but they also observe their parents and peers behaviors and draw inferences about the acceptability of aggression and violence from what they see. Thus, their beliefs tend to be correlated with those of parents (Huesmann et al., 1984; Miller, 1991) and peers (Henry, Guerra, Huesmann, & VanAcker, 1996). In addition, observation of violence in the mass media influences beliefs about the acceptability of violence. For example, it has been shown that the more televised violence a child watches, the more accepting is the child's attitude toward aggressive behavior (Dominick & Greenberg,

1972). Longitudinal studies also show that adult normative beliefs about violence are related to observation of violence in childhood (Huesmann, Moise, Podolski, & Eron, 1996). The causal direction of this effect has been established by experimental studies which have demonstrated that children and young adults become more tolerant of aggression immediately after even very brief exposures to violence (Drabman & Thomas, 1974; Thomas & Drabman, 1975; Linz, Donnerstein, & Penrod, 1988; Malamuth & Check, 1981).

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 decreases the likelihood of aggression when the self-schema is non-aggressive (Carver, 1974), probably by filtering out potential aggressive scripts. On the other hand, as Baumeister (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), and 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. Finally, schemas about others may be as important as schemas about oneself in affecting aggressive behavior. Schemas about others which promote disindividuation allow the utilization of aggressive scripts which might otherwise be unacceptable (Diener, 1976; Prentice-Dunn & Rogers, 1983).

What role does observational learning play in the acquisition of schemas about others and the self? Obviously, schemas about others must be mainly acquired through observation. However, there is also a strong argument to be made that observation of the self plays a major role in the acquisition of self-schemas (Bem, 1967). According to self-perception theories, schemas and beliefs about oneself are based to some extent on inferences drawn from observations of one's own behavior. We have already noted that in young children, aggressive behavior is *predictive* of the adoption of normative beliefs accepting of aggression (Huesmann & Guerra, 1997). There is significant evidence that other kinds of self-schemas are also influenced by self-perceptions. For example, subjects who observe themselves describing themselves in flattering terms are more likely to score higher on self-esteem afterwards (Jones, Rhodewalt, Berglas, & Skelton, 1981).

5. BIOSOCIAL PROCESSES IN OBSERVATIONAL LEARNING

These empirical data all point to the importance of observational learning in acquiring the schemas that underlie hostile attributional bias, in acquiring social scripts that control behavior, and in acquiring normative beliefs that filter out inappropriate behaviors. Yet relatively little is known about the biological processes that underlie observational learning. Let us review what is known.

5.1. Neurotransmitter Effects

Two kinds of animal studies have shown that the observation of violence or the perception of the threat of violence produce detectable neuronal activation and neurotransmitter changes. Welch and Welch (1971) showed that mice placed near where other mice were fighting showed increased MAO production. Such production would inhibit norepinephrine and dopamine thereby readying the animal more for aggression. Ogawa and associates (Ishikawa, Hara, Ohdo, & Ogawa, 1992) more recently have shown that obser-

vation of fighting produces stress reactions in rats and increased plasma corticosterone. Equally interesting are the recent experiments of Miczek (1995) on threats of fighting. Animals who are faced with confrontational situations, even if no fighting or overt aggressive behaviors occur, show very specific neuronal activation patterns in the brain stem, specifically c-fos expression in the periaqueductal grey area. What is particularly relevant to this discussion is that these patterns of activation can subsequently be triggered simply by letting the animal view the physical context in which the confrontation took place. For example, Miczek (1995) has demonstrated this phenomenon in rats by first placing a rat for a brief period in a confrontational situation in which the rat is not touched. On the next day he brings the rat back to the same locale. Despite the fact that no other rat is present, and there is no confrontation, the rat displays the brain stem activation pattern characteristic of confrontation. The physical context apparently has "reminded" the rat of the confrontation and "activates" the rat for confrontation. Such studies suggest a biological basis for encoding specificity with anger.

Taken together these animal studies suggest a neurophysiological basis for observational learning. Observation of violence or confrontation produces innate neuronal activation patterns which become associated with cues observed in the environment even in the absence of any reinforcement to the animal. These cues then can trigger the same activation patterns which ready the animal for aggression. Although there are some potential alternative explanations for the effects in all of these studies that need to be explored more, most notably the role of pheromones, they clearly suggest that exposure to violence around the organism produces neurotransmitter changes that ready the organism for violence. It remains to be seen if similar relations can be demonstrated in humans.

5.2. Hormones and Observational Learning

Given the level of evidence for a correlation in humans between testosterone level and dominating others or winning a competition, it would not be surprising to find that the observation of violence under some circumstances would also stimulate increased testosterone production in humans. Unfortunately, only one relevant study seems to have been conducted, and its results were ambiguous. Hellhammer (1985) exposed young, adult males to different kinds of film scenes and then measured their testosterone levels. They found increases in testosterone after exposure to erotic films and decreases after exposure to films generating anxiety but no changes after exposure to aggressive films. Part of the problem may be that, theoretically, the testosterone response of the viewer should depend on with whom the viewer identifies, the victim or the aggressor. This is an important issue because it is well established that hormones can alter the perception of social signals between conspecifics (Brain, 1983). In particular, heightened testosterone can make an organism more sensitive to threatening stimuli. If the observation of violence or the threat of violence produces learned associations between various cues and testosterone responses that distort social signalling, then subsequent aggressive interactions become more likely in similar situations.

5.3. Arousal, Hostile Attributional Bias, and Script Retrieval

These hormonal and neurotransmitter processes related to the observation of violence can be seen as providing a biological contribution to both hostile attributional biases and to the retrieval of aggressive scripts. Cues associated with observing violence trigger physiological responses that prepare one for violence and testosterone sensitizes one to

threatening stimuli. Similarly the arousal associated with observation of violence would be expected to have an effect on the information processing operations governing social behavior. The organism that has been exposed more to violence could be expected to be more generally aroused in the presence of cues previously associated with observation of violence. Too high a general level of arousal makes the difficult task of interpreting ambiguous cues, even more difficult. Thus hostile attributional bias, as predicted, is more likely under conditions of high emotional arousal (Dodge & Somberg, 1987). It also promotes a shallow, quick search for scripts with the best learned scripts dominating retrieval. Finding an appropriate script to respond to a threat without escalating it to violence is not an easy cognitive task and successful performance on difficult cognitive tasks diminishes as arousal becomes very high (Anderson, 1980). If testosterone is also stimulated and distorts the perception of social stimuli, the risk of hostile bias increases and retrieval of aggressive scripts increases. The activation of specific neurotransmitters or neuronal patterns associated with aggression can serve as an additional cue for an aggressive interpretation and retrieval.

Individual differences in arousal can be expected to play another role as well in the acquisition of scripts through observational learning. Those who have a low baseline level of arousal, e.g. extroverts (Eysenck, 1977), can be expected to seek stimulation to raise their level of arousal to an optimal level. In our modern society, observation of violence, in person or through violent movies and films, provides an obvious opportunity to increase arousal. Unfortunately, contrary to this prediction, introverts seem to spend more time watching television in general (Huesmann, 1986); however, this phenomenon could simply be a consequence of introverts' more restricted social lives. It may well be that extroverts when they are exposed to violence are more aroused by it and that arousal is reinforcing. Therefore, they attend more to violence and are more at risk to acquire violent scripts through observational learning. To complicate the picture more, one must consider the valence of the arousal produced by many scenes of violence. Neiss (1988) has argued against the construct of general arousal on the basis that different types of positive and negative arousal have little in common. Arousal produced by horrible scenes of carnage may be experienced as quite unpleasant while arousal produced by erotic scenes of domination may be experienced as quite pleasant by the same person. In addition, different individuals are known to respond to the same scenes with quite different levels of arousal (Malamuth & Donnerstein, 1984). It is therefore plausible to expect that repeated exposures to scenes of violence resulting in habituation could have different consequences for different individuals. For the individual who experiences violence as unpleasantly arousing, habituation could reduce the aversive consequences of behaving violently and make the learning of aggressive scripts more likely. For the individual who experiences violence as pleasantly arousing, habituation could reduce the rewarding consequences of behaving violently and make the learning of aggressive scripts less likely. Clearly, more research is needed in this area.

5.4. Enactive Learning and Biosocial Processes

While the focus of this chapter is on observational learning, observational learning clearly interacts with conditioning. Equally important as observational learning to the acquisition of appropriate scripts should be a child's responsiveness to the consequences of employing the scripts, e.g., rewards and punishments. One would expect that those children who are less easily conditioned by social approbation would be more at risk for acquiring inappropriate aggressive scripts in a normal environment. The child who

experiences less anxiety in response to social disapproval and less gratification in response to social rewards would be expected to be less conditionable. Empirical studies on arousability, as mentioned previously, suggest that difficult to arouse individuals may indeed be less easily conditioned and more at risk for violent and aggressive behavior (Raine & Venables, 1981; Raine, Venables, & Williams, in press). However, information processing theory again suggests that it is important to distinguish between instrumental aggression and hostile aggression in this regard. While more easily arousable and thus conditionable children may be less at risk for instrumental aggression, they should be more at risk for hostile aggression, and, indeed, there is some evidence that they are more at risk (Baker et al., 1984) and commit more violent crimes (Hare & McPherson, 1984).

6. HOSTILE AGGRESSION AND INSTRUMENTAL AGGRESSION REVISITED

Throughout the review and analysis in this chapter, we have seen a number of ways in which the information processing, the schemas, and the biosocial processes underlying hostile and instrumental aggression differ. On the biosocial level, low arousability should be a risk factor for instrumental aggression and high arousability a risk factor for hostile aggression, and we reported some evidence of that. At the information processing level 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. Hostile aggression should be more a function of high emotional responsivity and hostile attributional bias. Crick and Dodge (in press) have recently reported empirical data that seem to be consistent with these predictions.

At the same time the basic social/cognitive processing for all social behavior is the same, and the basic information processing model presented in this paper applies to both kinds of aggression. Similarly, the process of observational learning operates similarly for both types of aggression. One particular biosocial interaction that could be expected to influence both kinds of aggression, therefore, is the interaction between mood and learning or behavior. From the social cognitive perspective, one would expect intense bad moods to enhance the likelihood that previously observed scripts and schemas would be activated. The arousal makes complex cognitive processing less likely. The dysphoric valence of the emotion activates schemas related to hostility, and the arousal narrows memory activation. The result is that observed antisocial, aggressive scripts are more likely to be encoded during such emotional states, and they are more likely to be retrieved and utilized during such emotional states. Thus, it is not surprising that high temperatures (Anderson & Anderson, 1984), crowding (Matthews, Paulus, & Baron, 1979), and other irritators and stressors (Guerra, Huesmann, Tolan, VanAcker, & Eron, 1995) increase all kinds of aggression, while cognitive reflection on the cause of irritation reduces aggression at unrelated targets (Berkowitz & Troccoli, 1990).

7. CONCLUSIONS

Extensive empirical research on social information processing coupled with theoretical elaborations from cognitive science constructs has led to the emergence of a unified model of social information processing in aggressive behavior (Huesmann, in press). The model identifies four processes in social problem solving at which point 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 relative automatic cognitive processes. It is argued that the cognitive programs, scripts, schemas, and beliefs that comprise this information processing system are acquired through a process of observational learning followed by conditioning.

The 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.

Each of these processes depends on cognitive scripts, schemas, and beliefs that must be acquired by the child through interactions with the environment. While evolutionary forces operating through genetic influences on neurophysiology may predispose individuals to process information in one way or another, the existing empirical evidence suggests that learning from observing others is a key process in acquiring scripts and schemas for social behavior. The acquisition through observational learning of scripts, schemas, and beliefs — and the use of these cognitions — is influenced by and influences at least three biological systems implicated in aggression: neurotransmitter processes and specific neuronal activation patterns, arousal patterns and individual differences in arousal, and hormonal responses and individual differences in hormonal responses. Animal data reveal that observation of violence does in fact activate specific neurotransmitter and activation systems. While the evidence on hormonal responses to the observation of violence in humans is inconclusive, it is clear that what human males observe influences their testosterone level, and it is clear that testosterone level can influence information processing. Substantial evidence also suggests that arousal level and individual differences in arousal influence both observational learning and the expression of scripts acquired through observational learning. Some individuals may be predisposed to acquire observed scripts and schemas more easily and to be conditioned more easily. Depending on the social environment in which that individual is raised and that individual's predisposing biological factors (particularly arousal), the individual may learn to be more or less aggressive.

In summary, from the social/cognitive, information-processing 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. Biological predispositions place some children much more at risk for entering this cycle, and interact with observational learning to promote aggression. The biological responses of the organism in turn may promote the continuation of the cycle. If not interrupted, the cycle can be expected to continue into adulthood, maintaining aggressive behavior throughout the life span.

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THE RELATIONSHIP BETWEEN LOW RESTING HEART RATE AND VIOLENCE

David P. Farrington

Institute of Criminology
Cambridge University
Cambridge, United Kingdom

1. HEART RATE AND VIOLENCE

According to Raine (1993, pp. 166-172), one of the most replicable findings in the literature is that antisocial and violent youth tend to have low resting heart rates. A possible explanation of this is that a low heart rate indicates fearlessness. Conversely, high heart rates, especially in infants and young children, are associated with anxiety, behavioral inhibition, and a fearful temperament (Kagan, 1994). Fearful people are unlikely to commit violent acts. Another possibility is that a low heart rate reflects autonomic under-arousal. Low autonomic arousal, like boredom, leads to sensation-seeking and risk-taking in an attempt to increase stimulation and arousal levels. People who take risks are more likely to be violent than others.

In the British National Survey of Health and Development, which is a prospective longitudinal survey of over 5,300 children born in England, Scotland, or Wales in March 1946, heart rate was measured at age 11. A low resting heart rate predicted convictions for violence and sexual offenses up to age 21; 81% of violent offenders and 67% of sexual offenders had below-average heart rates (Wadsworth, 1976, p.249). A low heart rate was especially characteristic of boys who had experienced a broken home before age 5, and among these boys it was not related to violence or sexual offenses. A low heart rate was significantly related to violence and sexual offenses among boys who came from unbroken homes.

In the Cambridge Study in Delinquent Development, which will be described below, resting heart rate was measured at age 18. The boys who were convicted of violence before age 25, and those who were chronic offenders (with six or more convictions), had significantly low heart rates (Farrington, 1987, p.55). Similarly, Raine *et al.* (1990, p.1005) found that boys with low resting heart rates at age 15 were more likely to be convicted up to age 24. Another result which is worth mentioning was obtained in the Montreal longitudinal-experimental study, which is a follow-up of over 100 children originally selected at age 5. Low heart rate at age 11 was significantly associated with teacher ratings of fighting and bullying at the same age (Kindlon *et al.*, 1995).