Proponents of social learning theory suggest that decades of empirical criminological research have validated the core propositions of social learning theory, and that future efforts should be directed toward further theoretical elaboration and integration (see Akers 1998; Akers and Jensen 2006). In response, some critics have suggested that empirical research has failed to isolate the causal mechanisms underlying the correlates of crime and deviance, and, as a result, existing “data are seemingly consistent with several theories at once” (Sampson 1999:443). In this paper, I outline the causal importance of differential reinforcement in Akers’ social learning theory, and I provide a systematic review of a sample of psychological and criminological literature on human reinforcement learning in an attempt to evaluate the current empirical status of Akers’ social learning theory. I find that the empirical evidence supporting human reinforcement learning processes found in the behavioral psychology literature may not be directly generalizable to social learning theory, and that measurement difficulties have led criminology researchers to use indirect measures or to simply leave the concept of differential reinforcement out of empirical analyses altogether. As a result, many of social learning theory’s hypothesized causal linkages remain unexamined. I conclude that future research should be directed toward testing social learning theory’s central hypotheses regarding differential reinforcement before moving on to expand and test the theory’s macro-level implications.
EXAMINING THE EMPIRICAL STATUS OF AKERS’ SOCIAL LEARNING THEORY: A REVIEW OF LITERATURE ON HUMAN REINFORCEMENT LEARNING

by

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BIOGRAPHY

Jonathan Richard Brauer was born on August 17, 1981 in Rockford, Illinois. After graduating from Guilford High School in 1999, Jonathan remained in Rockford to attend Rock Valley College, where he received an Associate of Arts (with Honors) in 2001. Afterwards, he attended Rockford College, a small liberal arts school, from which he received a Bachelor of Science in Sociology and Anthropology (Magna Cum Laude) with a minor in Philosophy in 2003. In 2004, Jonathan began pursuing a graduate education in Sociology at North Carolina State University, where he completed the requirements for a Master’s degree in Sociology in March 2007. Currently, he is pursuing a Doctoral degree in Sociology.
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1.1 Introduction

Proponents of social learning theory suggest that decades of empirical criminological research have validated the core propositions of social learning theory, and that future efforts should be directed toward further theoretical elaboration and integration (see Akers 1998; Akers and Jensen 2006). In response, some critics have suggested that empirical research has failed to isolate the causal mechanisms underlying the correlates of crime and deviance, and, as a result, existing “data are seemingly consistent with several theories at once” (Sampson 1999:443). In this paper, I outline the causal importance of differential reinforcement in Akers’ social learning theory, and argue that empirical validation of the theory requires strong evidence in support of this central causal mechanism. In addition, I provide a systematic review of literature on human reinforcement learning in an attempt to evaluate the current empirical status of Akers’ social learning theory. Finally, I conclude with a discussion of the methodological and theoretical implications of these results for social learning theory.

1.2 Overview of the Problem

From Differential Association to Akers’ Social Learning Theory

Akers’ social learning theory owes its intellectual heritage to Sutherland’s differential association theory (Sutherland and Cressey 1966). Differential association theory suggests
that people learn criminal behaviors in the same way they learn non-criminal behaviors. The theory states that modern society consists of conflicting normative definitions regarding which behaviors are appropriate and which are inappropriate, and individuals learn normative definitions through interactions within intimate personal groups. Further, these intimate groups differentially provide definitions in favor of (or in opposition to) criminal behavior. Thus, if individuals encounter crime-favorable messages in interactions with intimate group members, the theory states they are likely to learn definitions favorable to crime (i.e. motives, drives, and rationalizations). In addition, before an individual can participate in any given criminal behavior, she must learn the necessary techniques or skills required to commit the crime, as well as learn to spot opportunities to commit the crime. Thus, differential association theory claims individuals who associate with crime-relevant patterns and who learn more definitions favorable to crime than those unfavorable to crime are more likely to commit crime themselves (Sutherland and Cressey 1966:77-98; for a summary, see Matsueda 1982:489-90).

Since its introduction to criminology in 1939, Sutherland’s differential association theory has spawned considerable theoretical activity. Over the past seven decades, theorists and researchers have debated, tested, challenged, and integrated its ideas. Its alleged empirical support and explanatory appeal have led some theorists to integrate differential association theory directly into their own complex theoretical frameworks (e.g. Pearson and Weiner 1985). Others have tested empirical models that integrate Sutherland’s ideas with concepts derived from other theories, most notably Hirschi’s social control theory (cf. Massey and Krohn 1986; Marcos, Bahr and Johnson 1986). Other researchers have increased
differential association theory’s overall precision and empirical adequacy by examining limits in its scope, addressing empirical incongruities, and testing important interaction effects (e.g. Warr and Stafford 1991; Agnew 1991).

Despite its immense popularity, ambiguities in Sutherland’s original specification of differential association theory have limited its potential for empirical confirmation (or falsification). For instance, one main criticism is that Sutherland did not specify adequately the process (or processes) by which a person learns criminal behavior. Rather, he simply suggested that criminal behavior is “learned,” usually through interaction with others within intimate personal groups, and he noted ambiguously that a person becomes criminal “because of an excess of definitions” favorable to crime over definitions unfavorable to crime (Sutherland 1966:81). Thus, without adequate theoretical specification of these learning mechanisms to guide research, Sutherland’s original formulation of “learning theory” may be incomplete. Burgess and Akers (1966) recognized the inherent ambiguity in this formulation as an opportunity for theoretical elaboration and integration. Their article integrates concepts derived from psychology’s operant behaviorism with Sutherland’s nine principles of differential association, thus developing the foundation for later formulations of Akers’ social learning theory (see Akers 1973:46-7).

Social learning theory argues, as did Sutherland, that people learn deviant behaviors in the same way they learn non-deviant behaviors. However, social learning theory specifies precisely how people learn these deviant and non-deviant behaviors and behavioral cues (definitions) – through a process of differential reinforcement, as found in the psychological
principles of operant conditioning.¹ In his recent monograph, Akers provides a concise statement of the causal argument in social learning theory:

The probability that persons will engage in criminal and deviant behavior is increased and the probability of their conforming to the norm is decreased when they differentially associate with others who commit criminal behavior and espouse definitions favorable to it, are relatively more exposed in-person or symbolically to salient criminal/deviant models, define it as desirable or justified in a situation discriminative for the behavior, and have received in the past and anticipate in the current or future situation relatively greater reward than punishment for the behavior. (1998:50)

In this statement, Akers identifies the four major concepts of his theory – differential association, differential reinforcement, modeling, and definitions. Two of these, differential association and definitions, are borrowed directly from differential association theory. Individuals are more likely to commit crime when they associate with criminal others and when they learn cognitive definitions (interpreted as behavioral stimuli) favorable to crime. The other two, differential reinforcement and modeling, refer to related operant learning processes, and represent Akers’ novel attempts to fill the theoretical gaps found in Sutherland’s formulation of differential association theory.

Akers summarizes the causal importance of differential reinforcement in explaining participation in deviant behavior.

¹ The term “differential reinforcement” is used in this paper to refer to related operant learning processes involving both rewarding (reinforcement) and aversive (punishment) outcomes. While Burgess and Akers (1966) offered detailed explanations for these distinct operant processes (i.e., see their discussion of positive and negative reinforcement and punishment), later formulations of social learning theory use the term “differential reinforcement” to encompass both reward and punishment processes.
Whether individuals will refrain from or initiate, continue committing, or desist from criminal and deviant acts depends on the relative frequency, amount, and probability of past, present, and anticipated rewards and punishments perceived to be attached to the behavior. (1998:66)

Akers then describes differential reinforcement as “the balance of anticipated or actual rewards and punishments that follow or are consequences of behavior” (1998:67). Recent formulations of social learning theory suggest that this learning process is a result of both direct and vicarious behavioral reinforcement. While Burgess and Akers (1966) originally integrated differential association theory with direct reinforcement principles derived from Skinnerian operant behaviorism, Akers’ current social learning theory also incorporates the concept of imitation from cognitive learning theories (cf. Bandura 1986:302-303). Imitation refers to a “separate learning mechanism characterized by modeling one’s own actions on the observed behavior of others and on the consequences of that behavior” (Akers 1998:58). In other words, individual behavior always reflects anticipated rewards and punishments, but individuals can learn to anticipate these consequences directly (via operant conditioning) or vicariously by observing the experiences of others (imitation).

Differential Associations and Definitions as Correlates of Deviance

In sum, social learning theory argues that individuals learn to anticipate rewards and punishments for behaviors that have been reinforced previously, either directly or vicariously. Additionally, following instrumental behavioral psychology, the theory assumes that individuals behave in a manner that maximizes rewards and minimizes punishments (also known as the utilitarian principle; see Tittle 1995:10-12,108). Akers argues that
learning occurs “through differential association with those persons and groups (primary, secondary, reference, and symbolic) that comprise or control the individual’s major sources of reinforcement, most salient behavioral models, and most effective definitions and other discriminative stimuli for committing and repeating behavior” (1998:52-3). To aid in testing the theory’s basic causal arguments, Akers specifies four falsifiable hypotheses. These hypotheses state that individuals are more likely to commit crime when:

1. He or she differentially associates with others who commit, model, and support violations of social and legal norms.
2. The violative behavior is differentially reinforced over behavior in conformity to the norm.
3. He or she is more exposed to and observes more deviant than conforming models.
4. His or her own learned definitions are favorable toward committing the deviant acts.

(Akers 1998:51)

The first and fourth hypotheses relate both to social learning and to differential association theories. As a result, empirical tests of differential association theory that include tests of hypotheses one and four are also relevant to social learning theory.

Researchers testing the predictive power of differential association theory’s key variables (differential associations, definitions) have consistently found support for the theory (e.g. Andrews 1980; Dull 1983). Others have tested integrated causal models and found support for variables derived from differential association theory (e.g. Marcos et al. 1986; Massey and Krohn 1986; Warr 1993). Still others have tested differential association in competition with other criminological theories, such as strain and social control, in an effort to determine which theory better predicts deviant/delinquent/criminal behaviors. In doing so,
these researchers claim empirical support for differential association’s main propositions over those of other theories (see Matsueda 1982; White et al. 1986; Matsueda and Heimer 1987).

Numerous studies have demonstrated empirical support for the hypothesized correlation between differential associations and deviant behavior, and/or between definitions and deviant behavior. The most frequently used measure of differential association in the criminological literature is the number of delinquent peers (actual or perceived) with whom a respondent associates; this measure most frequently has the highest correlation with delinquency as well (cf. Agnew 1991; Warr and Stafford 1991; Warr 2002; Akers 1998:115-117). In fact, Akers notes,

Other than one’s own prior deviant behavior, the best single predictor of the onset and the continuance or desistance of criminal and delinquency activity is differential association with conforming or law-violating peers….This impact of differential peer association is found so routinely that it is no overstatement to say that it is among the most fully substantiated and replicated findings in criminological literature. (Akers 1998:116)

Akers claims differential association should be highly correlated with behavior because it serves as a proxy for the learning mechanisms specified by social learning theory (1998:172; 1999:487). However, while most agree to the existence of a correlation between delinquent peer associations and one’s own delinquent behavior, scholars debate the reasons for this correlation. Some argue that causal interpretations of this correlation, like those outlined in learning theories, are misleading, since the correlation is possibly due to “faulty measurement and the tendency of people to seek the company of others like themselves” (Gottfredson and Hirschi 1990:156; see also Tittle, Burke and Jackson 1986:427). Other
researchers have suggested this relationship may be due to a variety of other mechanisms (see especially, Warr 2002:45-89), such as individuals seeking out delinquent subcultures in an attempt to insulate themselves from outside stress (Hagan 1997) or to manage stigmatization (Braithwaite 1989).

Many researchers have also demonstrated empirical support for the hypothesized relationship between deviant definitions and deviant behavior. However, scholars do not agree upon the exact nature of this relationship. Some researchers find that definitions partially mediate the effect of peer associations on deviant behavior, while claiming peer association also has a substantial direct effect on behavior (Agnew 1991; Warr and Stafford 1991). Proponents of social learning theory point out that imitation is not included in the concept of learned definitions, and attribute the direct effect of associations to imitation (or vicarious reinforcement). Other researchers find that learned definitions fully mediate the effect of peer association on deviant behavior; these findings contradict the hypothesis that peer association has a direct effect on behavior through imitation (Matsueda 1982; Tittle et al. 1986; Heimer 1997). In addition, evidence of a correlation between definitions and behavior does not necessarily imply support for social learning theory; common measures of definitions favorable or unfavorable to delinquency may tap concepts found in other theories as well, while some question the proper causal ordering among these variables (for a detailed review, see Warr 2002; see also Matsueda and Anderson 1998). For instance, the correlation between definitions and deviant behavior could be due to processes involving the development or maintenance of self-concepts and other psychic processes (Tittle et al. 1986:425), or to a role-taking process as outlined in Heimer and Matsueda’s differential
social control theory (1994), or to a number of other factors such as retrospective reinterpretation or defiant personalities (see Sampson 1999:440).

Overall, few debate the existence of an empirical correlation between peer associations and participation in deviant behavior, or between cognitive attitudes (definitions) and participation in deviant behavior. However, as noted above, scholars continue to debate the interpretations or exact causal mechanisms underlying these empirical relationships (see Warr 2002 for a similar argument). As is true in any branch of science, different theories often provide different causal mechanisms that purport to explain the same observed facts. Thus, while Akers claims any research demonstrating the posited relationship between peer associations or cognitive attitudes and crime/delinquency is “obviously supportive of social learning theory” (1998:112), it is easy to understand why this claim is not so obvious to critics. To appease critics, social learning researchers must demonstrate strong supportive evidence for its central causal mechanism and its hypothesized causal process.

**Beyond Associations and Definitions: The Role of Differential Reinforcement**

Recall that the empirical validity of Akers’ hypotheses one and four are important for confirming (or failing to falsify) social learning theory. According to the theory, differential association is important because groups expose one to definitions, present models to imitate, and provide differential reinforcement for criminal behavior (Akers 1998:62). Definitions are important because they act as cognitive discriminative stimuli cuing certain behaviors as rewarding or punishing; one learns these definitions through a process of direct or vicarious
reinforcement within differential associations (77-87). Further, hypothesis three attempts to address the concept of imitation/modeling separately; however, if the majority of one’s models are located in primary associations, then this hypothesis is merely a corollary to or restatement of hypothesis one. Additionally, recall that imitation, or modeling, is mainly important because it provides an individual with an opportunity to observe and learn behaviors or behavioral cues through vicarious reinforcement (see Akers 1973:52; Akers 1998:75-6).

Therefore, the concept of differential reinforcement, Akers’ key contribution to differential association theory, underlies the interpretation of all other elements in social learning theory. Differential reinforcement, then, is the central causal mechanism in Akers’ theory, since differential association, definitions, and imitation/modeling all affect one’s probability of committing deviance in relation to a process of differential reinforcement. As a result, any claims of support for social learning theory by using these three concepts are necessarily contingent upon having demonstrated empirical support for differential reinforcement as well. In other words, empirical support for Akers’ first, third and fourth hypotheses will also serve as support for social learning only if Akers’ second hypothesis has been validated empirically as well. After all, recall that Akers’ main goal in elaborating differential association theory was to specify the learning mechanisms underlying the relationship between differential associations, definitions and behavior (Burgess and Akers 1966). On the other hand, without an empirically valid differential reinforcement learning process, the “learning” theories – both social learning and differential association – remain incomplete.
Despite its pivotal role in social learning theory, Akers does not personally demonstrate the empirical status of reinforcement learning. Rather, he states,

The basic processes of instrumental and classical conditioning, observational learning, discriminative stimuli, schedules of reinforcement, the matching law, and other behavioral principles…have received empirical support from systematic experimental studies with both animal and human subjects…. Rather than reviewing that research, I refer the reader…to the large body of research literature in behavioral psychology and behavior modification in psychology and social exchange in sociology. (1998:107-8)

Unfortunately, this response portrays the human reinforcement learning process as irrefutably supported by extant psychological and sociological research. As a result, scholars are faced with two options: either one must assume science has confirmed that human behavior primarily is a function of reinforcement learning, or one must attempt to determine the actual empirical validity of reinforcement learning on her own. Faced with this choice, researchers typically choose the first option, and assume (as Akers does) science has confirmed that human behavior primarily reflects reinforcement processes. With the assumption that reinforcement is at work, one can move on to the more manageable task of testing social learning theory’s other hypotheses regarding crime. However, as far as I know, demonstration that reinforcement underlies the processes of differential association, imitation, and definitions has not yet occurred. In response, I survey a sample literature from experimental psychology in an attempt to determine the empirical status of the reinforcement learning process, social learning theory’s key explanatory variable. This survey is conducted systematically, in a manner similar to a content analysis, in order to ascertain the extent and type of empirical evidence available concerning the reinforcement learning process. I follow
by reviewing a sample of empirical literature from criminology in an attempt to determine which parts of social learning theory’s causal process have been tested and which parts have been neglected, paying particular attention to the extent to which the reinforcement process has been examined.

CHAPTER TWO

METHODS

2.1 Research Sample

In order to assess the extent to which empirical research has established the process of reinforcement learning, I follow Akers’ advice and begin by examining evidence within the literature on psychological behaviorism. This sample is drawn from a population of empirical literature from experimental psychology that relates to human reinforcement learning. I limit this sample to human articles because prior research has demonstrated notable differences between human and nonhuman behavior, particularly with regard to reinforcement schedule performances (for a review, see Dymond, Roche and Barnes-Holmes 2003). The general population from which I have selected a sample includes all data-oriented articles on the experimental analysis of human behavior published in the Journal of the Experimental Analysis of Behavior (JEAB) from its inception in 1958 through 2005. This journal consistently has been the primary outlet for articles on the experimental analysis of human behavior (Buskist and Miller 1982a, 1982b; Hyten and Reilly 1992; Dougherty, Nedelmann and Alfred 1993; Dymond and Critchfield 2001). For articles published from 1958 through
1992, the initial population was further limited to include only articles that prior researchers have categorized as examining “reinforcement and punishment” or “social and verbal behavior” (Buskist and Miller 1982b; Dougherty et al. 1993). For articles published from 1993 through 2005, all data-oriented articles that examined human subjects were included in the initial population. The total population as described consists of 333 articles; using a random number generator, I selected a random sample of 179 articles (see Appendix 1). After filtering out non-applicable articles (see Appendix 2), the final sample analyzed consists of 130 articles.

In addition to analyzing the JEAB articles, I also examine the extent to which the causal structure of Akers’ theory has been tested and established within criminological literature. To locate relevant criminological literature on social learning theory, I began with a list of eighty-three sources from the past five decades that Akers cites as offering support for social learning theory (Akers 1998:110-11; Akers and Jensen 2006:48-49). Specifically, he claims these studies have used “measures of one or more of the social learning variables of differential association, imitation, definitions, and differential reinforcement [and] have continued to report findings that uphold the theory’s hypotheses” (1998:110; see also 2006:48-9 for an updated list). Sixty-nine studies are peer-reviewed journal articles, thirteen citations refer to books or book chapters, and one citation refers to a dissertation. Here, I

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2 Buskist and Miller’s (1982b) article includes a topical bibliography of human operant research published in JEAB during the years 1958-1981. Dougherty et al.’s (1993) article extended this bibliography for the following ten years, from 1982-1992. Unfortunately, I was unable to find a similar topical bibliography after 1992.

3 A sample size of 179 articles, drawn from a population of 333 articles, allows me to generalize any findings at a 95% confidence level with a +/-5% confidence interval. The random number generator used can be found at [http://www.randomizer.org/].

4 Fifty-three of these studies appear in Akers’ book and in Akers and Jensen’s chapter (1998; 2006). Three of these studies are cited only in Akers’ book (1998). Twenty-seven are cited only in Akers and Jensen’s chapter; these represent more recent studies that were published since the publication of Akers’ 1998 book.
examine the sixty-seven peer-reviewed journal articles cited by Akers as supportive of social learning theory in which the author[s] includes an empirical test (see Appendix 3). In addition, in the discussion section of this paper I will compare these results with four studies conducted by Akers and colleagues (described in Akers 1998, chapters 7-10), since the above list of journal articles does not include any of Akers’ own empirical work on social learning theory.

2.2 Evaluation Criteria: Experimental Psychology sample

In order to examine systematically the psychological literature on human reinforcement learning, I categorize these articles by sample characteristics, type of reinforcer/punisher, operant response type, and results. Sample characteristics include sampling method, sample size and subjects. Since this body of literature relies on experimental methods, experimental psychology researchers usually sample a population and further divide their sample into experimental and control groups. Therefore, I classify the sampling method used into three groups: probability samples with random group assignment; non-probability samples with random group assignment; and non-probability sample with non-random group assignment. Additionally, I classify the sample sizes used into five categories: less than 10 subjects; 10 to 19; 20 to 39; 40 to 59; and 60 subjects or more. Finally, I classify research subjects into five categories: infants/toddlers (less than 2 years

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5 Two of the original sixty-nine articles were omitted from this analysis because they do not include an empirical test (one is a review article, while the other relies solely on qualitative or descriptive methods).

6 If the authors note a total sample size, then assign members of this sample to separate experiments, the total sample size is recorded. If authors have multiple experiments with more than one sample, but fail to note the total sample size, the article is classified by the largest sample size used in any one experiment. This practice helps to avoid double-counting, since many studies repeatedly use the same subjects in multiple experiments.
old); youth (2 to 17 years old); college students (most or all subjects were college students); adults (18 and older, non-college student or not specified); and mentally challenged (e.g., autistic, mentally ill, mentally retarded). Research that uses probability samples, random group assignments, and large sample sizes will offer the greatest generalizability and strength of causal inference for their results, while those that use non-probability samples, non-random group assignments, and small sample sizes instill much less confidence in the generalizability and causal weight of their results. Further, classifying by research subject type allows me to make a general assessment of the extent to which the evidence supporting reinforcement is generalizable to different population types.

In addition to sample characteristics, I classify the types of reinforcers or punishers used in an article into three categories: social-intangible, social-tangible, and nonsocial reinforcers/punishers. Although Akers admits the distinction between social and nonsocial reinforcement may be somewhat vague or complicated, (see 1998:70-72), he does differentiate between these two main forms and he claims social learning theory applies to both social and nonsocial reinforcement. He defines social reinforcement as "involving not just the direct reactions of others present while an act is performed, but also the whole range of tangible and intangible rewards valued in society and its subgroups" (71; italics added). His definition of nonsocial reinforcement "includes experiencing unconditioned positive and negative effects of physiological and physical stimuli - for example, from the direct neurological effects of drugs and alcohol." (71). Therefore, “social-intangible” reinforcers and punishers include social feedback that is rewarding or punishing, such as experimenter or peer approval and disapproval. “Social-tangible” refers to rewards or punishments that are
socially tangible, such as money or access to other valued social commodities or events. “Non-social” refers more narrowly to reinforcers or punishers like drugs, food, noise, or shock; although people’s experiences of any of these events as rewarding or punishing may be due to prior conditioning, these examples are closest to what Akers refers to as non-social reinforcement. In this analysis, articles may be classified into more than one of these three categories if the researcher used multiple reinforcer or punisher types. By classifying the reinforcer/punisher types, I can make a general assessment of the relative amount of evidence available for each type.

“Operant responses” refer to the types of behaviors that have been examined or reinforced in the research, and are categorized as either “simple behaviors” or “complex behaviors.” Simple behaviors are commonly observed in experimental research using non-humans, while complex behaviors are rarely observed in non-human research. “Simple behaviors” include operant responses such as lever pulling, button pressing, simple imitation, automated (reflex) responses, as well as computer tasks like simple key presses used in basic memory or matching-to-sample research. “Complex behaviors” include social and verbal behavior, complex tasks (i.e., tasks that require a chain of distinct responses before behavior is reinforced), complex imitation (a chain of imitated responses is required before reinforcement), as well as complex computer tasks such as computer games and sophisticated matching-to-sample involving derived stimulus relations. Social learning theory views deviant behaviors as a type of operant response (i.e., learned via reinforcement and performed in anticipation of rewards/punishments). Further, most deviant behaviors would be considered complex behaviors, as they are often social behaviors that may require a chain of
several responses before achieving reinforcement (e.g., money, peer approval, etc.). Therefore, classifying operant response types as simple or complex behaviors allows me to examine the extent to which the evidence for operant learning in extant behavioral research applies more generally to deviant behavior.

Finally, I classify an article’s experimental results into one of two categories: those that support operant conditioning/reinforcement learning principles, and those that contradict reinforcement learning principles. It is important to note that many studies do not test explicitly whether a reinforcement learning mechanism is responsible for human behavior; often, this is taken for granted in this literature. Rather, these studies often use “reinforcers” to motivate behavior, and then examine the effects of different reinforcement schedules and contingencies on operant performance (e.g., how much of a particular reinforcer or punisher is required before a subject typically performs an operant response; what is the most effective reinforcement schedule). It seems theoretically possible that any correspondence found between subjects’ behaviors and their experimental reinforcement schedules may be due to mechanisms other than reinforcement learning, such as behavioral learning via verbal instruction or repetition. Nonetheless, given these limitations, if an article successfully demonstrates a “match” or correspondence between subjects’ operant behaviors and their respective reinforcement schedules after repeated trials, I classify the article as presenting support for reinforcement learning for the purposes of this study.

While classifying results in this manner may not offer a detailed or stringent analysis of the evidence for reinforcement learning in experimental psychology, recall that the purpose of this study is to assess the empirical status of differential reinforcement as it
applies to Akers’ social learning theory. As a result, I have chosen to categorize this sample of articles by their use or application of reinforcement, their findings, their samples, and their methods, without going into explicit detail regarding reinforcement schedules and other psychological issues that are less relevant to this research question. Thus, it is important to note that these authors rarely (if ever) offer critical tests of the reinforcement learning mechanism, and overall this literature records drastic differences in the effectiveness of various reinforcement schedules and reinforcer types. However, for the purposes of this study, any research that includes some type of reinforcement to motivate behavior and that finds results consistent with an operant learning interpretation will fall under the support category. On the contrary, results that are not consistent with an operant learning interpretation are categorized as providing no support for reinforcement learning.

Further, in an attempt to assess the robustness of support for the reinforcement mechanism in these results, I catalogue the number of articles that explicitly admit to using written or verbal instructions to describe experimental procedures, operant responses, and reinforcement contingencies to subjects. In essence, I want to find out how much of this research examines subjects’ “operant” responses that are shaped or learned via a history of reinforcement in the experimental setting, as contrasted to research examining subjects’ responses that may have been shaped or learned via information passed on through written or verbal instructions. This distinction is important because theory and research has suggested that some human learning may occur via repetition or information transmission independent from reinforcement processes (Schwartz 1982; Mitropoulos 2001; Weber 2003).
2.3 Evaluation Criteria: Criminology sample

When examining the empirical adequacy of the criminology research pertaining to social learning theory, I will attempt to illustrate which parts of the causal process have been tested, which parts have been empirically established, and which parts have been unexamined. I will focus on three critical independent variables: differential association, definitions, and differential reinforcement.7 First, differential association refers to the amount of exposure an individual has with people who commit deviant behaviors, from intimate others to distant reference groups. Direct measures of differential association would require objective information on the deviance participation rates of people with whom an individual associates (i.e., family, friends, or other salient models). Indirect measures may include self-report approximations of the deviance participation rates of an individual’s associates.

Second, definitions include any subjective measures of “orientations, rationalizations, definitions of the situation, and other attitudes that label the commission of an act as right or wrong, good or bad, desirable or undesirable, justified or unjustified” (Akers 1998:78). As mentioned previously, definitions serve as cognitive discriminative stimuli cuing certain behaviors as rewarding or punishing.

Third, Akers describes differential reinforcement as “the balance of anticipated or actual rewards and punishments that follow or are consequences of behavior” (1998:67). However, Akers’ description here is somewhat misleading, as it appears to merge two distinct concepts. Differential reinforcement should refer to the direct or vicarious process of experiencing rewards or punishments for deviant behaviors over time. It is this prior

7 Measures of imitation typically are subsumed under either the differential association variable, or under the differential reinforcement variable as a vicarious reinforcement process.
experience with reward/punishment schedules for behaviors that presumably leads one to anticipate (via this reinforcement learning process) potential rewards or punishments for committing similar behaviors. Thus, direct measures of the reinforcement process require detailed, individual-level, longitudinal data that identifies multiple sources, content, and contingencies of reinforcement to which an individual is subjected over a substantial period of time (e.g., see Akers discussion of reinforcement schedules and matching functions in 1998:68-70). At the very least, a valid measure of differential reinforcement should include a measure of one’s personal or vicarious experience with a prior behavior and the consequences of that behavior.

In contrast, reward/punishment expectations for deviant behaviors refer to the assumed products of reinforcement, or the balance of anticipated consequences for deviant behaviors that one supposedly learns through a prior reinforcement process. While perhaps used by some researchers as a proxy for differential reinforcement, these cognitive expectations more accurately reflect one form of specific definitions. These cognitive elements, presumably learned via prior behavioral reinforcement, operate to define a particular behavior as desirable (rewarding) or undesirable (punishing). As a result, for this analysis, I will categorize measures of reward/punishment expectations as a measure of definitions; these measures include subjective, or cognitive, perceptions of anticipated behavioral consequences (e.g., anticipated parental or peer reactions).

To avoid being either unfairly strict or overly lenient, I will evaluate a criminology article’s adequacy for social learning theory using a hierarchical assessment system that includes four levels of support: no support, preliminary support, intermediate support, and
advanced support. First, an article will be labeled as providing *no support* if it finds no relationship between any of the above independent variables and deviant behavior, or if it finds a relationship contradicting one hypothesized by the theory. In addition, this category will include studies that demonstrate selection effects (e.g., incorrect causal order among variables) without demonstrating a hypothesized causal relationship, since proper temporal ordering among variables is necessary for causal inference. Some might argue that such results merely offer support for the reciprocal effects arguments provided by Akers’ social learning theory. While this may be true, such results would be equally consistent with competing theoretical explanations that hypothesize individuals with certain deviant propensities select into deviant relationships. On the other hand, if a researcher provides evidence that social learning mechanisms underlie the causal relationships found, articles demonstrating selection effects will be classified here as offering support for social learning theory. In other words, articles that simultaneously demonstrate selection and causation effects will be categorized accordingly as providing support for social learning theory.

Second, an article will be labeled as providing *preliminary support* if it demonstrates a significant hypothesized correlation between any one of the three main independent variables and deviant behavior, or between any two of the independent variables. This includes finding positive correlations between differential association and deviance, between differential reinforcement and deviance, or between definitions and deviance, as well as between differential associations and definitions, for example. These articles may employ indirect measures of theoretical constructs, and may use cross-sectional data to establish correlations.
Findings indicating preliminary support for a theory are important for instigating further scientific inquiry, but they have limited causal relevance, and such results often can be interpreted as supporting competing theories. Empirical articles that provide intermediate support demonstrate part of the theory’s basic causal chain. For example, these articles may show that deviant associations lead to more frequent or consistent deviant reinforcements, that frequent and consistent deviant reinforcement causes favorable definitions for deviance, or that more definitions favorable to deviance lead to increased participation in deviance. Articles establishing intermediate support for social learning theory may use valid indirect measures that tap the theoretical constructs they are intended to represent. Further, these articles will use longitudinal or retrospective data to establish correct temporal analysis, and will likewise provide more empirical support for the theory’s causal arguments than preliminary support articles.

Finally, articles will be judged as providing advanced support if they empirically validate more complex causal chains, such as demonstrating mediating or reciprocal effects consistent with social learning theory. For instance, an article providing advanced support may demonstrate that deviant associations lead to more frequent and consistent deviant reinforcement, which in turn causes favorable definitions for deviance, which leads to increased participation in deviance, which causes further changes in favorable definitions for deviance. Articles establishing advanced support should use valid direct measures of theoretical constructs, and must establish proper temporal order using longitudinal or retrospective data. In addition, these articles may require creative or advanced analytic
techniques to demonstrate the mediating or reciprocal effects outlined in social learning theory.

With this classification scheme, I will be able to assess the empirical status of Akers’ social learning theory. When examining the psychological behaviorism literature, I will briefly attempt to synthesize what is "known" and then examine limits to the scope of this research. My goal is to assess how relevant the available psychological evidence is to complex social behaviors in general and social learning theory in particular. When analyzing the criminology literature, I will assess the overall level of support for social learning theory, as well as illustrate which parts of the causal process have been tested, what has been empirically established, and what remains unexamined.

CHAPTER THREE

RESULTS

3.1 Experimental Psychology Findings

A summary of the results for the JEAB psychology articles examined is presented in Table 1.

First, an examination of sampling characteristics reveals that 95 percent of the applicable articles that were analyzed employed a non-probability sampling technique and subsequently used non-random group assignments, 5 percent used random group assignments with a non-probability sample, and none of the 130 articles analyzed used a probability sampling technique. Additionally, 63 percent of the articles had samples comprised of fewer
than ten subjects, over 80 percent had samples of fewer than twenty subjects, and only four articles (3%) had sample sizes of sixty or more subjects. Further, over half of the articles (52%) sampled college students (typically undergraduate volunteers from introductory psychology courses).

Second, a vast majority of these experimental studies employed social-tangible reinforcements to condition behavior (82%; typically money or points transferable for money), while only 9 percent of these articles employed some form of social-intangible reinforcements (such as interviewer praise). In addition, most of these studies examined simple behaviors as the subject’s operant response (80%), with only twenty percent of these observing complex behaviors.

Finally, on the surface, these studies overwhelmingly appear to support operant learning principles (95%). In fact, only five percent of these studies report results that contradict operant learning principles. However, most of these studies explicitly admit using written or verbal instructions to shape human operant responses.\(^8\)

### 3.2 Criminology Findings

Table 2 presents a summary of findings for the criminology articles examined. The top portion of Table 2 displays the parts of social learning theory’s causal process that have (or have not) been empirically demonstrated in this sample of research. For instance, nearly

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\(^8\) See, for instance, the procedure, results and discussion presented in Baron and Kaufman (1966). Citing prior research, these authors note a practical problem in experimental behavioral research: that is, “exposing the uninstructed, unshaped human directly” to reinforcement schedules may lead to acquisition failures in many subjects (565). Their study suggests that an alternative procedure, “available only with human subjects, is to provide specific instructions about the appropriate response and its consequences” before operant conditioning begins (565). Judging from the literature surveyed, this practice quickly became the common *modus operandi* in the experimental analysis of human behavior.
every study analyzed (94%) has demonstrated a correlation in the predicted direction between some measure of differential association (DA) and some form of deviance. Additionally, 57 percent of these studies have demonstrated the predicted correlation between definitions (DEF) and deviance, while 28 percent have found the predicted correlation between differential associations and definitions. Further, using longitudinal or retrospective data, some studies have demonstrated causal links between DA and deviance (24%), and between DEF and deviance (12%). However, very few studies have demonstrated a correlation between differential reinforcement and any other variable in the theory (DA, DEF, deviance), while only one of the sixty-seven articles analyzed has demonstrated a causal connection between DR and another variable.

The bottom portion of Table 2 elaborates on these results. First, most of these studies have used cross-sectional data and have not attempted to establish causality using retrospective measures; as a result, these studies have demonstrated only correlations among the variables examined. Likewise, the majority of articles analyzed so far offer only preliminary support for social learning theory (70%).

Second, as expected given the sampling design, nearly all articles in this sample demonstrated some support for social learning theory. In fact, only two articles (3%) offer findings that fail to support social learning theory’s predictions; these articles use longitudinal or retrospective data to demonstrate temporal order, and each demonstrates results consistent with a selection interpretation of deviant behavior (cf. Gottfredson and Hirschi 1990:156). While this sample of articles offers nearly unanimous support for social learning theory, only about a quarter of these articles (25%) offer intermediate support by
demonstrating the proper causal order among at least two of the key variables. Further, only one article in this sample offers advanced support for social learning theory by demonstrating a more complex causal chain predicted by social learning theory, compared to two articles which actually demonstrate a complex causal chain that is consistent with a selection interpretation.

Third, while some of the research (21%) analyzed so far has attempted to include differential reinforcement in their models, most of these (11 out of 14) use a measure of self-reported *expected or anticipated consequences* of behavior. Expected consequences are assumed products of a history of reinforcement for specific behaviors that more accurately serve as measures of behavior-specific definitions (i.e., cognitive stimuli cuing certain behaviors as rewarding or punishing; see Akers’ discussion of definitions in 1998:77-87), rather than as proxies for actual consequences of behavior that have been directly or vicariously experienced in the past.

CHAPTER FOUR

DISCUSSION

4.1 Implications of Psychology Sample Findings

At face value, the experimental psychology literature surveyed appears to overwhelming support operant learning principles. However, considering the findings of this study, these results must be qualified. The sampling methods and sample sizes used, and the populations typically sampled calls into question the generalizability of these results.
Additionally, these results may only be applicable to social-tangible reinforcers and punishers, or more specifically to money as a reinforcer for U.S. subjects (particularly undergraduate volunteers). Social-intangible reinforcers and punishers are rarely studied, yet much criminological theory suggests that these are most important in motivating or constraining deviant behaviors (e.g., peer approval, parental bonds, etc.). Further, this literature most frequently examines simple operant responses, yet the processes involved in controlling these simple responses in a laboratory setting may not be equivalent to those governing more complex deviant behaviors that usually occur amongst peer groups and in other social settings.

Finally, there should be a distinction made between research that tests whether behavior is shaped by a reinforcement history and that which assumes this is the case. The experimental psychology literature surveyed here usually falls under the latter category. In fact, the reinforcement learning mechanism appears to be a paradigmatic concept in this field. That is, rather than attempting critical tests of this mechanism, the research surveyed here usually assumes that human behavior is controlled by reinforcement learning mechanisms; subsequently, researchers often present tests of peripheral reinforcement hypotheses. In addition, these researchers typically ignore potential pre-experimental differences in reinforcement histories among individual subjects, and likewise take for granted the motivating or constraining effects of the reinforcers and punishers used in their research. With these assumption in place, researchers then manipulate various reinforcement contingencies and examine differences in behavioral responses; observed variance in subjects’ likelihood of performing operant responses, then, are interpreted as reflecting
differences in the effectiveness of various reinforcement schedules. These researchers make no effort to explain why a particular reinforcer or punisher has the motivating or constraining effect that it does, or whether and why its motivating or constraining potential varies across subjects (e.g., Why does money motivate these subjects? Does money motivate all subjects equally?).

Thus, one might conclude from these results that college students who are willing to volunteer their spare time to participate in a psychological experiment will learn to push buttons, pull levers, and match pictures to syllables on a computer screen in the proper way in exchange for money. Further, these subjects may learn via reinforcement processes; however, this research has not demonstrated convincingly that learning cannot or does not occur via other “learning” mechanisms. For instance, information transfer is likely to occur via verbal instructions, and patterned responses may reflect habitual action caused by behavioral repetition. Thus, while the above assessment may seem overly critical of this research, it is provided here to illustrate a crucial question: exactly how does this literature help us to understand human deviant behaviors?

Of course, these results have been inferred from only a sample of studies taken from a population consisting of all articles published in one psychology journal. Nonetheless, as argued previously, the sample should be representative of the total population it was drawn from, while the journal itself is well-known as the premier journal for the experimental analysis of human behavior. Given this potential limitation, if these findings do accurately represent the larger population of experimental studies on human reinforcement, then one can conclude that the empirical evidence regarding reinforcement learning found in the literature
on human experimental psychology may not be readily applicable to social learning theory’s arguments regarding human deviant behavior.

4.2 Implications of Criminology Sample Findings

One might conclude from the analysis above that criminologists interested in social learning would be better off testing reinforcement learning hypotheses on their own rather than relying on the available evidence from human experimental psychology. Unfortunately, however, the analysis of criminology articles presented here suggests that this has not yet happened. In fact, although differential reinforcement is the theory’s central causal mechanism, rarely are direct measures of this concept tested within social learning models. In addition, this survey of criminology literature has demonstrated major gaps in the empirical research on social learning theory, and has suggested that most research on the theory is still in preliminary stages. For instance, although a dearth of empirical literature exists on the key variables found in Sutherland’s differential association theory, most of this research employs cross-sectional designs to demonstrate correlations among indirect, self-report measures of these variables. Further, among the few studies using longitudinal or retrospective data to examine the causal order of social learning variables, at least some of these demonstrate results that may be consistent with alternative theoretical interpretations.

In comparison, Akers describes in his monograph four different studies from which he and colleagues have tested social learning theory as well as published their results in several journals over the past few decades (see 1998:chapters 7-10). These include the Boys Town study of adolescent substance use (1998:170-201), the Iowa study of adolescent
smoking behavior (202-233), the Florida study of elderly drinking behavior (234-253), and a study of rape and sexual aggression among university students (254-285). In these four studies, Akers and colleagues use a variety of methods and indicators to test social learning theory among various populations and for different dependent variables. In addition to their cross-sectional analyses demonstrating correlations among independent and dependent variables, Akers and colleagues also used longitudinal designs (i.e., the Iowa study) and prospective dependent variables (e.g., likelihood of committing rape or sexual aggression in the future) in an attempt to establish proper temporal ordering among variables. Further, in each study, these authors typically used multiple indicators to tap into each social learning concept, including (but not limited to) both normative and behavioral dimensions for differential associations, one’s positive and negative definitions of deviance, and both actual and anticipated rewards and punishments for behaviors to measure differential reinforcement. Taken as a whole, these four studies demonstrate support for social learning theory (from preliminary to advanced, depending on the specific study or empirical models described).

Thus, Akers (by himself and with colleagues) has published numerous studies over the years that should serve as models for testing social learning theory. However, after comparing some of Akers’ studies with the general trends found in this survey of criminology literature, it seems that few scholars have attempted to follow Akers’ models. For instance, despite differential association and social learning theories’ arguments, which call for multiple indicators of differential associations (i.e., different sources, modalities, and

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9 However, these studies do suggest that social learning theory variables may operate differently (and may explain more or less variance) for different populations, for different deviant behaviors, and at different stages of committing behaviors (e.g., initiation, continuation, escalation, or cessation). Nonetheless, as the point of this review is to compare to the general trends found in the earlier analysis of criminology articles, these details are beyond the scope of this discussion.
normative/behavioral dimensions), and despite the examples offered in Akers’ own work, researchers rarely use more than one indicator of differential associations in their empirical examinations of learning theory (i.e., typically self-reported proportion of deviant peers). In addition, relatively few researchers have attempted to establish temporal order among the variables in their models, despite the criticisms mentioned earlier that cross-sectional correlations among these variables might be interpreted as support for alternative theories of deviance. Further, in spite of years of theoretical specification and several examples provided by Akers himself, researchers still rarely include differential reinforcement, social learning theory’s key explanatory variable, in empirical tests of this theory. No doubt, many of these issues are due to a variety of factors that are out of researchers’ immediate control, primarily including fiscal considerations and the subsequent constraints inherently imposed by using secondary datasets. Nonetheless, given that many of the criminology studies analyzed in this paper claim to test social learning theory (i.e., over half of the authors at least mention social learning theory somewhere in the article and most of these claim to find support for the theory), the results reported here should be somewhat surprising.

Finally, when differential reinforcement is included in tests of this theory, usually it is operationalized as anticipated consequences for behaviors. As mentioned previously, this operationalization of differential reinforcement is conceptually problematic. Of course, including this type of measure as a proxy for differential reinforcement is better than leaving out the crucial variable altogether (as most of the criminology research analyzed in this paper has done), and it is actually supported by Akers’ own theoretical arguments. In fact, Akers does not draw a distinction between actual/experienced and anticipated consequences for
behavior in his conceptualization of differential reinforcement (refer to Akers’ definition of the concept of differential reinforcement as cited earlier, and as found in his discussion in 1998:66-8). As a result, Akers’ own work (as described in 1998:chapters 7-10) often combines both actual or experienced rewards/punishments and anticipated rewards/punishments for behavior when operationalizing differential reinforcement. This lack of conceptual distinction between past rewarding and punishing experiences and anticipated future experiences perhaps is a result of the historically ambiguous, and even tautological, operationalization of the concept of reinforcement in operant psychology (cf., 1998:108-110). However, as argued before, there is a conceptual distinction between the two.

To illustrate, recall social learning theory’s basic theoretical argument. Associations with deviant patterns presumably lead one to experience rewards/punishments favorable to deviance directly or vicariously (differential reinforcement). As a result of these experiences, individuals theoretically learn to anticipate the likelihood of receiving rewards/punishments for deviant behaviors (i.e., they learn cognitive discriminative stimuli, or definitions). Finally, consider an individual who associates with more deviant patterns, who has been differentially rewarded for deviant behavior (or punished for incompatible non-deviant behavior), and who has learned via this reinforcement process to anticipate more rewards for deviant behavior. For this individual, social learning theory states that deviant behavior has been reinforced, that is, the individual is more likely to commit deviant behavior than another individual who does not associate with deviant patterns, who has not experienced rewards/punishments favoring deviance, and who has not learned to anticipate rewards for participating in deviant behavior. It should be clear from the above summary that anticipated
consequences are actually a form of specific cognitive definitions cuing certain behaviors as rewarding or punishing. As such, researchers should make the distinction between actual or experienced consequences (differential reinforcement) and anticipated consequences (definitions) in future tests of social learning theory.

In addition, future research should attempt to include direct measures of differential reinforcement in empirical models of social learning theory. By definition, direct measures must include a measure of one’s personal or vicarious experience with a prior behavior and with the consequences of that behavior. As mentioned previously, direct measures of the reinforcement process ideally would include detailed, individual-level, longitudinal data that identifies multiple sources (both social and nonsocial), content (rewarding and punishing), and contingencies of reinforcement to which an individual is subjected over a period of time. However, this is likely to require substantial data collection efforts and, given the constraints faced by many researchers, may not be feasible. Since most researchers are limited to secondary data analysis and primary data collection using cross-sectional research designs, researchers may consider other plausible alternatives when measuring differential reinforcement. For instance, researchers collecting cross-sectional data may consider including retrospective items that ask respondents about previous experiences (direct or vicarious) with deviant behaviors, and with the observed or experienced consequences (or lack thereof) that accompanied those behaviors. Others may wish to use official and/or self-report cross-sectional measures of one’s prior participation in deviant behavior and the consequences of these behaviors (social and nonsocial rewards and punishments) to predict the future probability of deviant behavior using hypothetical vignettes.
Researchers applying secondary data analysis methods should look for datasets that have retrospective or longitudinal measures of deviant behavior (participation or observation) and their subsequent consequences. These consequences may include formal sanctions (e.g., legal consequences), informal sanctions (e.g., actual parental/peer reactions), or any other official or self-reported emotive (e.g., fear; happiness), physiological (pleasure; pain), or social (approval; rejection) reinforcement or punishment that was directly or vicariously experienced after participating in or observing a deviant behavior. While finding and constructing a valid proxy for differential reinforcement in secondary datasets may prove difficult and likely will require patience and creativity on the part of researchers, it is imperative that researchers make an effort to do so. After all, it is only through systematic examinations that include direct measures of key explanatory variables and that establish causal order among these variables that researchers will be able to validate empirically the core propositions of social learning theory.

CHAPTER FIVE

CONCLUSION

In sum, while decades of empirical research in criminology shows promise for social learning theory, this body of research is nonetheless still in its infancy. First, the empirical evidence supporting human reinforcement learning processes found in the behavioral psychology literature may not be as readily generalizable to deviant behavior in general, or social learning theory in specific, as we would like. Second, rather than measuring
reinforcement processes directly, criminology researchers continue to use indirect measures that do not accurately tap the concept of differential reinforcement – or worse, researchers ignore social learning theory’s hypotheses regarding reinforcement altogether. As a result, many of the hypothesized causal linkages have been left unexamined in social learning literature. Researchers interested in social learning theory should seriously consider attempting to fill these foundational gaps before moving on to expand and test the theory’s macro-level implications.
REFERENCES


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CA: Stanford University Press.


Mitropoulos, Atanasios. 2001. "Learning under Minimal Information: An Experiment on


<table>
<thead>
<tr>
<th>Class Dimensions</th>
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</tr>
<tr>
<td>Non-Probability sample, Random group assignment</td>
<td>4.6</td>
<td>6</td>
</tr>
<tr>
<td>Non-Probability sample, Non-random group assignment</td>
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<td>124</td>
</tr>
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**Note:** N=130. *Categories in this dimension are not mutually exclusive, since some studies use multiple reinforcers and/or punishers. Non-applicable articles (49 out of 179) are not included in this sample (see Appendix 1).
**TABLE 2: General Findings and Causal Linkages Demonstrated in Criminology Sample**

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<td>Intermediate support</td>
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<td>Advanced support</td>
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<td>Article mentions social learning theory (mentions social learning and/or differential association theory)</td>
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<td>38 (57)</td>
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<tr>
<td>Claims to measure reinforcement</td>
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<tr>
<td>(actually measures expected consequences, or definitions)</td>
<td>(16.4)</td>
<td>(11)</td>
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<td>Sample size ≥ 60</td>
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</tr>
<tr>
<td>Establish time-order w/longitudinal or retrospective data</td>
<td>29.9</td>
<td>20</td>
</tr>
<tr>
<td>Dependent variable measured only using self-reports</td>
<td>90.0</td>
<td>60</td>
</tr>
<tr>
<td>Differential Assoc. measured only using self-reports (out of n=63)</td>
<td>87.3</td>
<td>55</td>
</tr>
</tbody>
</table>

**Note:** N=67. Two articles from the original sample are not included in this total (inapplicable review or qualitative article).
APPENDICES
APPENDIX 1: Bibliography of Sample JEAB Articles (N=179)


Only If Correlated with Improvement in Response Efficiency." Journal of the Experimental Analysis of
Behavior 43:289-300.

Experimental Analysis of Behavior 54:185-199.

Catania, A. C. and D. Cutts. 1963. "Experimental Control of Superstitious Responding in Humans." Journal of
the Experimental Analysis of Behavior 6:203.

Catania, A. C., B. A. Matthews, and E. Shimoff. 1982. "Instructed Versus Shaped Human Verbal-Behavior -
Interactions with Nonverbal Responding." Journal of the Experimental Analysis of Behavior 38:233-
248.

Avoidance or Escape from Point Loss." Journal of the Experimental Analysis of Behavior 53:293-303.

Analysis of Behavior 70:203-214.


Crosbie, J. 1993. "The Effects of Response Cost and Response Restriction on a Multiple-Response Repertoire

Procedure: Searching for the Contextual Cues That Control Equivalence Responding." Journal of the
Experimental Analysis of Behavior 76:339-349.

Journal of the Experimental Analysis of Behavior 84:129-145.


8:207-214.

Davidson, N. A. and J. G. Osborne. 1974. "Fixed-Ratio and Fixed-Interval Schedule Control of Matching-to-


## APPENDIX 2: Non-applicable Articles from JEAB Sample on Human Behavior

<table>
<thead>
<tr>
<th>Category</th>
<th>Number of Articles</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Stimulus Control</strong></td>
<td></td>
</tr>
<tr>
<td>Experimental</td>
<td>24</td>
</tr>
<tr>
<td>Review, Methodological</td>
<td>3</td>
</tr>
<tr>
<td><strong>Other Experimental Topics</strong></td>
<td></td>
</tr>
<tr>
<td>Age differences in performance</td>
<td>1</td>
</tr>
<tr>
<td>Biorhythms</td>
<td>1</td>
</tr>
<tr>
<td>Marijuana and memory</td>
<td>1</td>
</tr>
<tr>
<td>Observing behavior</td>
<td>5</td>
</tr>
<tr>
<td>Pharmacology</td>
<td>1</td>
</tr>
<tr>
<td>“Point-based” schedule performance</td>
<td>2</td>
</tr>
<tr>
<td>Reaction time</td>
<td>1</td>
</tr>
<tr>
<td>Self-report bias</td>
<td>2</td>
</tr>
<tr>
<td>Social comparison</td>
<td>1</td>
</tr>
<tr>
<td>Spaceflight and behavior</td>
<td>1</td>
</tr>
<tr>
<td>Superstitious behavior</td>
<td>2</td>
</tr>
<tr>
<td>Verbal behavior</td>
<td>3</td>
</tr>
<tr>
<td>Waiting behavior</td>
<td>1</td>
</tr>
</tbody>
</table>

**Note:** N=49. Articles listed in this table are non-applicable because they meet at least one of the following two criteria: (1) the article does not examine operant behavior; (2) the article includes only “point-based” reinforcers or punishers, where the points were not associated with any other social or non-social, tangible or intangible rewards or punishments as described.
APPENDIX 3: Bibliography of Sample Criminology Articles (N=69)


* indicates article does not include an empirical test and is omitted from the final analysis.


## APPENDIX 4: Article Citations for Causal Linkages Demonstrated in Criminology Research Sample

### Correlation

<table>
<thead>
<tr>
<th>Differential Association / Deviance</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Differential Reinforcement / Deviance</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snyder and Patterson (1995); Skinner and Fream (1997); Ardelt and Day (2002)</td>
</tr>
</tbody>
</table>

### Definitions / Deviance


### Differential Association / Differential Reinforcement

Ardelt and Day (2002)

### Differential Reinforcement / Definitions

(\textit{None})

### Differential Association / Definitions

Burkett and Jensen (1975); Matsueda (1982); Kandel and Adler (1982); Winfree and Griffiths (1983); Massey and Krohn (1986); Marcos et al (1986); Lanza-Kaduce and Klug (1986); Kandel and Andrews (1987); Matsueda and Heimer (1987); Johnson et al (1987); Orcutt (1987); Burkett and Warren (1987); Warr and Stafford (1991); Agnew (1994); Winfree, Backstrom and Mays (1994); Winfree, Mays and Backstrom (1994a); Benda (1994); Elliott (1994); Ardelt and Day (2002)


## APPENDIX 4 (continued)

<table>
<thead>
<tr>
<th>Causality (temporal)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Differential Association $\xrightarrow{}$ Differential Reinforcement</strong></td>
</tr>
<tr>
<td><em>(None)</em></td>
</tr>
<tr>
<td><strong>Differential Association $\xrightarrow{}$ Definitions</strong></td>
</tr>
<tr>
<td>Agnew (1994); Warr and Stafford (1991)</td>
</tr>
<tr>
<td><strong>Differential Association $\xrightarrow{}$ Deviance</strong></td>
</tr>
<tr>
<td><strong>Differential Reinforcement $\xrightarrow{}$ Definitions</strong></td>
</tr>
<tr>
<td><em>(None)</em></td>
</tr>
<tr>
<td><strong>Differential Reinforcement $\xrightarrow{}$ Deviance</strong></td>
</tr>
<tr>
<td>Snyder and Patterson (1995)</td>
</tr>
<tr>
<td><strong>Definitions $\xrightarrow{}$ Deviance</strong></td>
</tr>
<tr>
<td><strong>Selection Effects (e.g., Deviance $\xrightarrow{}$ Diff. Association; Deviance $\xrightarrow{}$ Definitions; Definitions $\xrightarrow{}$ Diff. Assoc.)</strong></td>
</tr>
</tbody>
</table>

### Causal Chain

| Diff. Association $\xrightarrow{}$ Diff. Reinforcement $\xrightarrow{}$ Deviance |
| *(None)* |
| Diff. Association $\xrightarrow{}$ Definitions $\xrightarrow{}$ Deviance |
| Warr and Stafford (1991) |
| Diff. Association $\xrightarrow{}$ Diff. Reinforcement $\xrightarrow{}$ Definitions $\xrightarrow{}$ Deviance |
| *(None)* |
| Diff. Reinforcement $\xrightarrow{}$ Definitions $\xrightarrow{}$ Deviance |
| *(None)* |
| **Selection (or Reciprocal) Effects (e.g., Deviance $\xrightarrow{}$ Definitions $\xrightarrow{}$ Diff. Associations)** |
| Massey and Krohn (1986); Burkett and Warren (1987) |