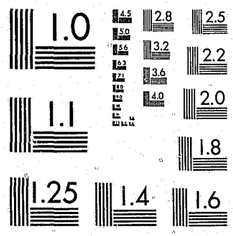

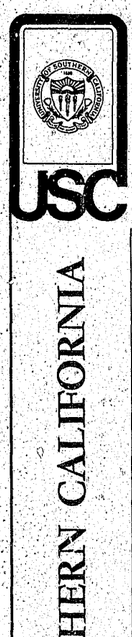

UNIVERSITY OF SOUTHERN CALIFORNIA

social science research institute

Relevance to Delinquency/Deterrence of the Learning Theory Model of Punishment

by
Terrie Moffit

Section II of the Final Report of Grant 80-IJ-CX-0055-*: Exploring Guidelines for Specific Deterrence Theory: Early Sanctions in the Juvenile Justice System

Malcolm W. Klein and Sarnoff A. Mednick
University of Southern California
Los Angeles
April, 1982

*This research was supported under this grant from the National Institute of Justice. Points of view are those of its authors and do not necessarily reflect the position of the U.S. Department of Justice.

Relevance to Delinquency/Deterrence of the Learning Theory Model of Punishment

by
Terrie Moffitt

Section II of the Final Report
of Grant 80-IJ-CX-0055-*:
Exploring Guidelines for Specific
Deterrence Theory: Early Sanctions
in the Juvenile Justice System

Malcolm W. Klein and Sarnoff A. Mednick
University of Southern California

Los Angeles
April, 1982

*This research was supported under this grant from the National Institute of Justice. Points of view are those of its authors and do not necessarily reflect the position of the U.S. Department of Justice.

Abstract

Both the experimental laboratory model of punishment and the juvenile justice system's negative sanctioning process have a common goal of suppressing undesired behavior. The psychological literature on the experimental model of punishment contains a number of principles which have been demonstrated to improve the effectiveness of punishment in suppressing behaviors under controlled study. This paper presents five of these principles which yield predictions about deterrence of illegal acts by the use of negative sanctions in the form of testable hypotheses.

The paper begins with a discussion of the objections voiced by some authors to the practice of extrapolating from an experimental model to the actions of the juvenile justice system. Objections have been made on two grounds: that the paradigms used in laboratory studies of punishment are too dissimilar from the process of justice system sanctioning, and that the subjects used in experimental studies of punishment are not representative of the human adolescents sanctioned by the juvenile justice system. Although these objections are serious, it is proposed that research is needed which addresses the questions of generalizability of the experimental findings to the juvenile justice system, before the possible benefits of such an extrapolation approach are forgone.

The first principle discussed is the principle of intensity of aversive stimulus. When shock is used, more severe punishment suppresses behavior more thoroughly. Some problems in application of this finding to junvenile sanctioning are considered, and studies are reviewed in which the effects of severity of sanctions on juvenile's reoffending were examined.

The second principle, temporal proximity of the punishment to the behavior, asserts that punishment is more effective when less time is allowed to pass between act and sanction. Several reasons for this delay effect are noted. The possibility is presented that the juvenile's special human cognitive and language capacities may be used to help overcome the effects of delay of punishment.

The third principle, availability of reward for the behavior, explains how past rewards strengthen behaviors, and rewards concurrent with punishment serve to maintain the behavior, yielding only a temporary suppressive punishment effect. These points are treated as suggesting a need for detection of delinquency early in a juvenile's career and reducing the opportunities available for reward from illegal acts.

The schedule of delivery of punishment is the fourth principle. Punishment of every instance of a behavior is more effective than intermittent punishment delivery. Indeed, some studies show that intermittent punishment may actually serve to strengthen behavior. These results are interpreted in the context of perceived uncertainty of punishment, which may increase juveniles' willingness to commit illegal acts.

The final principle considered is the need for available alternatives to the punished response. This principle seems to imply the rehabilitation efforts must be combined with punishment. However, several problems exist in extrapolating

form the laboratory paradigm used to develop this principle to the real-life world of the juvenile offender.

Following discussion of these five principles of punishment and then implications for juvenile sanctioning, two cautionary comments are made. It is noted that the interprinciple relationships have not been systematically explored, and it is possible that less than optimal application of one principle may be compensated for by maximizing of another. This aspect of the approach will be important in overcoming practical, legal, and ethical constraints in the application of negative sanctions. It is also pointed out that there are individual differences in responsiveness to punishment caused by the social, psychological, and physiological background and status of each juvenile. Application of any of the principles of punishment cannot be expected to have uniform results across all juveniles.

The paper concludes with the reminder that application of any of the principles of punishment would be premature without extensive research aimed at exploration of the numerous issues brought up in the course of this exploratory paper.

Cautions Concerning the Appropriateness for Juvenile Deterrence of the Learning Theory Model of Punishment.*

A number of authors have espoused the relevance of a learning theory model of punishment for application in official negative sanctioning of illegal behaviors. Chopra (1969, p. 150) has asserted that we have "now probably reached the stage where extrapolations of findings to the human condition could have some meaning" and presents suggestions for ways in which findings from laboratory studies of punishment "may be applied to the actual problem of controlling illegal behavior." Because of its exlusive concern with suppressing behavior, Singer (1970) proposed that the experimental model of punishment is even more relevant to deterrence of criminal behavior than to animal training and child rearing, two areas in which laboratory-derived punishment principals are frequently applied. Jeffrey (1965) inferred from learning experiments that it is the certainty of punishment, not the severity, that deters persons from committing illegal behaviors.

Assertions of the pertinence of principles derived from an experimental model of punishment for the effective application of negative sanctions to illegal behaviors have not gone unchallenged by writers in deterrence theory. Objections have been made on two grounds: that the procedural paradigms used in

---

*Although the authors cited in this section have discussed primarily the adult criminal justice system, the present paper focuses on the juvenile justice system and will refer specifically to the juvenile system hereafter.

laboratory studies of punishment effectiveness are too dissimilar from the process of negative sanctioning as it occurs in the juvenile justice system, and that the subjects used in experimental studies of punishment are not representative of the human adolescents who are the recipients of negative sanctions from the juvenile justice system.

Questions about laboratory paradigms. In regard to the first objection, a brief description of a typical laboratory punishment procedure is in order. The experimenter uses a reward, such as food, to train a food-deprived animal to perform a single, well-defined behavior, such as pressing a bar. When the behavior is being performed at a stable rate, the experimenter begins to deliver an aversive stimulus instead of the reward contingent on performance of the animal's behavior. He measures the frequency of performance of the behavior, and if it decreases he infers that punishment has occurred. Zimring and Hawkins (1973) have discussed some of the important ways in which this sort of laboratory procedure differs from the judicial process of negative sanctioning.

> One of the major criticisms made by experimental psychologists of "the punishment of crime" is that it is deficient as a form of aversive conditioning. It is, as Professor Eysenck says, "a very haphazard affair." Both Mr. Chopra and Professor Singer speak of the necessity for increasing the certainty and diminishing the delay involved in institutional punishment...but is is clear that the basic difference is not merely quantitative but qualitative.
>
> Another critical aspect of the experimental studies of punishment which does not apply to the penal system is that aversive conditioning is based on repeatedly punishing repeated behaviors in a relatively short period of time. We know of no

> research in punishment that demonstrates a habital act being punished only once and the habit being thus extinquished (p. 240).
>
> And finally, almost the entire literature on punishment is based on the electric shock. These considerations place a substantial barrier in the way of deriving penological principles from what are called "the basic laws of punishment" (p. 240).

Singer (1970) has provided a response to concerns about the dissimilarity of shock to judicial sanctions.

> We do know that different types of punishment generally do not alter the laboratory laws of punishment: Punishing stimili such as slaps, buzzers, confinement in a box, shocks of different durations and intensities, and removal from the vicinity of reward, which include some fair analogues of incarceration, all produce the same experimental results even when more than one punishment is used for the same organism in the same experiment (p. 411).

Despite Singer's assurances about electric shock, Zimring and Hawkins' other concerns remain unanswered, and it is important to keep them in mind when discussing the relationship of learning theory and deterrence.

Another point of dissimilarity which may be important is suggested by Zimring and Hawkins' use of the term "habitual act." In the paradigmatic laboratory procedure, the same behavior is punished a number of times and the punishment effects are assessed by measuring the decreasing frequency of performance of that same behavior. The practical situation of juvenile sanctioning deviates from this laboratory procedure, because, as Zimring and Hawkins point out, the juvenile justice system usually has only one opportunity to punish an illegal behavior, and if the behavior is detected a second or third time, the occasions for punishment may be separated by long periods of

time. It is well known that there are no successful demonstrations of behavioral supression after a single punishment with animals (except in the special case of consummatory behaviors (Garcia, 1974)). However, a single application of punishment may be expected to have a more rapid suppressive effect with humans than with animals because animal subjects require several trials to learn the nature of the continguency between their behavior and the punishment. The special cognitive capabilities of human adolescents allows them to develop an understanding of the 'rules' for punishment even before punishment is applied, perhaps thus preparing them to be especially receptive to learning in a single trial (Grings, 1965). These cognitive capabilities will be discussed in greater detail in a later section.

There is a second point of deviation from the model: the behavior which is used as a measure of punishment effects. To reiterate, the laboratory research assesses the suppressive effects of punishment by measuring a decreasing frequency of performance of the same behavior that was punished. If other similar behaviors also are observed to decrease in frequency, 'generalization' of punishment effects across a class of behaviors is said to have occurred. Instead of measuring the frequency of recurrence of behavior identical to the punished behavior, studies of deterrence effects predominantly assess for simple rearrest or further self-reported delinquency. If we view the recidivism situation from the perspective of a laboratory model of punishment effects, theft is not recidivism for a

juvenile who has been punished for public consumption of alcohol. The appearance of theft behavior cannot be taken as evidence that punishment did not effectively suppress alcohol consumption. It can however, be taken as evidence that 'delinquent behavior' was not suppressed, that is, that punishment effects did not generalize across responses in the class of illegal behaviors. Clearly, it is generalization of punishment effects that the juvenile justice system desires as a result of its interventions. This generalization becomes even more crucial when we understand that the popular assumption that delinquents tend to specialize in one career offense type is unsupported. In a review of the literature Klein (1980) concludes "The clear direction....is predominantly toward randomness, versatility, or cafeteria-style delinquency. The evidence is extremely weak for offense specialization as well as for seriousness progression" (p. 5). Given this lack of specialization, the use of any further delinquency as a global measure of the outcome of punishment of a single specific offense seems justified as well as necessary. Unfortunately, this author discovered no studies, using animals or humans, of punishment generalization. The question of the effectiveness of punishment in supppressing a large class of behaviors as a "habitual act" thus remains unanswered.

Questions about experimental subjects. The second area of objection to the application of an experimental punishment model to negative sanctioning is the dissimilarity of research subjects to juvenile offenders. It is possible that the laws of learning

may not predict the behaviors of humans as accurately as the behaviors of the animal subjects upon which the laws were developed. Zimring and Hawkins (1973) noted, "... the vast majority of the experimental subjects are rats, cats, dogs, monkeys, goldfish, and pigeons rather than human beings" (p. 239). Aronfreed, who has conducted a number of studies of punishment with human children, cautioned, "...this extrapolation from animals to humans is a limited one. The socialization of the child takes place through stimulus channels and cognitive processes which are inherently socially oriented. The effects of this social transmission may not be entirely predictable from the effects of the nonsocial medium that is generally used to study learning in animals" (1968, p. 21).

Andenaes (1974) explained one implication of this human social transmission (or language) for an animal-derived model of punishment; pre-punishment awareness of the behavioral contingencies.

> The application of legal punishment is the result of the violation of a general norm which prescribes punishment and which the offender normally will know in advance. The whole experience derives its meaning from this relationship between the general norm and the application of punishment in the individual case. The situation is very different from the situation of a confused rat or pigeon who is desperately trying to adapt its behavior to the incomprehensible manipulations of the psychologist (1974, p. 185). How does the experience of actual punishment influence the deterrent effect of the threat--a deterrent effect which has proved, in this case, insufficient to prevent the offense? (1968, p. 88).

Thus, Andenaes' general concern is that punishment will not eliminate the behavior of humans as effectively as it eliminates

the behavior of animals, and he suggests specifically that pre-punishment awareness of the threat of punishment may influence the responses of humans to punishment.

In answer to these concerns, a number of studies of the effects of punishment on human subjects have demonstrated that the principles derived with animal subjects are very effective with humans (see Aronfreed, 1968; Johnston, 1972; Rimm and Masters, 1979; for reviews). In addition, awareness of the contingency between behavior and punishment has been shown to facilitate human subjects' learning to suppress behavior (Aronfreed, 1968; Grings, 1965; Spielberger, Southard, and Hodges, 1966). However, very few of the human studies used normal adolescents or juvenile offenders specifically, and most studied very young children, college students, institutionalized psychotics, and mentally retarded individuals (Johnston, 1972). Also, Aronfreed cautions, "most of the experiments which have shown punishment can make a contribution to normal children's learning employ discrimination paradigms (e.g. choice between a 'correct' toy and a 'forbidden' toy) or other tasks of a type which are not well suited to a demonstration of behavioral suppression... there has been little empirical work on the use of punishment to suppress the overt manifestations of a motivated behavioral disposition in children" (1968, p. 163).

Conclusions about extrapolations from the learning theory model of punishment to juvenile deterrence. In summary, although some authors have advocated the application of principles derived

from an experimental model of punishment to improve the deterrent effects of negatively sanctioning juvenile offenders, others have raised objections concerning the relevance of the experimentally-derived model to juvenile justice procedure. Concerns are that laboratory procedures and research subjects are so dissimilar to sanctioning procedures and human adolescents that any principles derived from the experimental study of punishment by psychologists are of doubtful predictive value for the deterrent effects of sanctions applied by the juvenile justice system. These objections have not been satisfactorily addressed to date, so it is advisable to proceed with caution when extrapolating from the experimental punishment model to the juvenile justice system sanctioning procedures.

Nevertheless, awareness of the principles of punishment may be useful to the deterrence theoretician. There are some important similarities in the experimental model of punishment and juvenile justice sanctioning. The goal of each is to suppress undesired behavior, and each attempts to reach the goal by providing unpleasant consequences for such behavior (although the juvenile justice system also employs others means such as incapacitation and diversion). The literature on the experimental model of punishment contains a list of principles which have been demonstrated to improve the effectiveness of punishment in suppressing behaviors under controlled study. It is not known to what extent any of these principles might also improve the effectiveness of 'punishment' as meted out by the juvenile justice system, but it is possible that application of

some of the principles might be advantageous in improving specific deterrence effects. All of the principles yield predictions about deterrence of illegal acts by the use of negative sanctions in the form of hypotheses which may be tested. Before the offerings of the experimental model of punishment are dismissed, research is needed to evaluate the possible usefulness of application of the principles on a system scale.

This review will define each of the principles which have been demonstrated to maximize the effects of punishment in suppressing the behavior of animals in the laboratory, with reference to hallmark studies from the animal learning literature. These principles are, (1) the intensity of an aversive stimulus, (2) the temporal proximity of the aversive stimulus to behavior, (3) the availability of reward for the behavior, (4) the schedule of delivery of the aversive stimulus, and (5) the availability of alternate rewarded behaviors. Studies demonstrating the use of each principle with human subjects will be cited, when available. Also, deterrence studies from the criminological literature which may be relevant will be discussed.

1. The Intensity of the Aversive Stimulus.

In a thorough review of the animal literature, Azrin and Holz (1966) stated, "the intensity of punishment has been found to be a major determinant of the degree of response reduction by punishment. All studies of the intensity of punishment have found that the greater the intensity of the punishing stimulus,

the greater is the reduction of the punished responses. When electric shock has been used, suppression has been virtually complete at high intensities" (p. 396). Johnston (1972) noted that although there are no studies of punishment intensity using human subjects, "laboratory studies have shown reliably that introduction of the punishing stimulus at lower intensities resulted in less response reduction than if higher initial intensities were used." (p. 1041). It is not known whether this effect is due to the absolute greater intensity of the initial punisher, or to the contrast between the initial and later punishers. Clearly, the implication is that deterrence might be increased if first offenders were punished severely*, rather than leniently.

There are problems in applying the principle of severity to juvenile sanctioning. It is difficult to extend the model of electric shock to the application of negative sanctions. The controllable strength and clear, rapid onset and offset of the shock have been found to contribute significantly to response suppression (Fromer and Berkowitz, 1964; Mowrer, 1960) and it is not at all clear at what point in apprehending and processing a juvenile the 'punishment' begins, or ends. In fact 'punishment' is not officially meted out at all to a large number of first offenders or minor offenders.

---

*The term 'intensity' seems more descriptive of electric shock. 'Severity' will be used to describe the intensity concept in relation to juvenile sanctioning.

Perception of intensity. We are often reminded in the punishment literature (Azrin and Holz, 1966; Johnston, 1972) that an aversive stimulus is not defined as a punisher unless it suppresses behavior, and that it suppresses behavior only if it is perceived as aversive by the subject. Thus, increasing the intensities of punishment in the juvenile justice system must be defined as increasingly effective in deterring recidivism. This author found no studies of juveniles' perceptions of sanction severity. However, Rydelius (1980) found that boys who reported feeling afraid when they were apprehended were less likely to reoffend than were boys who reported no fear.

Studies of severity with juvenile offenders. Results are contradictory among studies which have attempted to examine recidivism rates for treatment of varying severity applied to juvenile offenders. Labelling theorists have proposed that "apprehension itself encourages rather than deters further delinquency" (Gold and Williams, 1969, p. 11). In addition to the Gold and Williams study, Klein, Teilmann, Lincoln, and Labin (1982, forthcoming) reported that, after a 27 month followup, the further a juvenile had been processed within the juvenile justice system, the greater the chance for rearrest, with juveniles who had been counseled and released rearrested 25% less often than juveniles who had been petitioned. In the Klein et al. study, juveniles were randomly assigned to treatment groups. In direct contrast, McCord (1980) has recently reported that among apprehended juvenile first offenders "those who had been released without official processing for their first arrests were more

likely to commit subsequent crimes, to commit index crimes, and to commit crimes against persons" (p. 1). The small number of boys who were fined, put on probation, or discharged after a court hearing committed significantly fewer subsequent crimes. Murray (1980) has results similar to those of McCord. In his study, increasing severity of sanction was related to longer time until next arrest. It is possible that conflicting results in these studies are the effects of differential attention paid to factors (such as local law enforcement policies, seriousness of offense, number of prior offenses, and age of the juvenile) which may influence decisions concerning the disposition of sanction severity in individual cases.

Research is needed on juveniles' perceptions of the severity of the various sanctions available to the juvenile justice system, and the differential deterrent effectiveness of these sanctioning options, before it will be known whether the principle of punishment intensity can be useful within the juvenile justice system.

The Temporal Proximity of the Punishment to the Behavior. 2. J. B. Watson, who has been called the father of behaviorism, once wrote "The idea that a child's future bad behavior will be prevented by giving him a licking in the evening for something he did in the morning is ridiculous" (1924, p. 183). A multitude of animal studies have proven Watson's common sense adage correct. Church (1969) reviewed a number of animal studies that discovered that the effectiveness of punishment adminstration diminishes

rapidly from zero to five seconds following a behavior. Azrin (1966) reviewed animal studies of longer delays and concluded, "immediate punishment was no more effective than non-immediate punishment during the first hour. After that time, however, the responses recovered substantially and often completely with non-immediate punishment, whereas the responses were reduced indefinitely and often completely during immediate punishment. For enduring effectiveness, the punishing stimulus should be delivered immediately" (p. 394). Delays of punishment have also been shown to reduce the effectiveness of behavior-contingent learning in human children (Penny and Lupton, 1961; Walters, 1964).

The discrepancy between application of negative sanctions and the experimental principle of immediacy of punishment is not difficult to discern. It is difficult to arrange to inflict official penalties within five seconds of an illegal act. Zimring and Hawkins (1973) have pointed out that the only experience in the sanctioning process that might fit the immediacy requirements of the experimental model of punishment is apprehension. Gold and Williams (1969), in their national study of apprehension of juveniles, concluded that apprehension itself encourages rather than deters further delinquency. Research is needed to determine if juveniles perceive apprehension by an officer as aversive, and to illuminate any differential deterrent effects of different modes of apprehension and police contact. Some clinical researchers have found that, in the case of the complex response chains composed of numerous discrete behaviors

which charactize many undesirable human behaviors (e.g. stealing), delivery of punishment as early as possible in the sequence is much more effective than punishing after the act is completed (Aronfreed and Reber, 1965; Berecz, 1976; Birnbrauer, 1968). This effect is probably important in sanctioning illegal behavior, because the material rewards for illegal behavior often have immediate effects which will be more influential than the effects of punishment delivered much later (Eysenck, 1964). This author found no studies of the likelihood of recidivism among juveniles caught in the act, as opposed to juveniles apprehended later. A study designed to elucidate the effects of immediate apprehension should, of course,control for the possibility that juveniles who are caught in their acts may be different from juveniles who evade apprehension for a longer time, especially on such characteristics as social class, intelligence, or physical clumsiness; characteristics which may also influence juveniles' susceptibility to punishment effects.

The act-punishment interval. In addition to the problem of immediate rewards, another problem is likely to arise when delayed punishment is used in an applied setting: the occurrence of behaviors in the interval between the undesirable behavior and the punishment. This may result in the punishment's suppressive effects being applied to behavior other than the illegal act. Between the illegal act and receipt of an official sanction a juvenile may perform the behaviors that facilitated his apprehension, or perhaps cooperative behaviors with the juvenile officer, both of which are closer temporally to the official

sanction than is the delinquent behavior. For example, a boy steals a car, has a good deal of fun with it, drives on a busy street with high police surveillance, is apprehended but cooperates with the officer, and then is fined. The act of theft is closely followed by a reward (fun), while the later behaviors of driving in a policed area and cooperating are followed by punishment. The principle of immediacy of punishment predicts that the boy will be less likely to cooperate with police, and less likely to drive on a busy street, when he steals another car.

Cognitive mediation of delay effects. The principle of immediacy of punishment seems, at this point, to predict a pessimistic outcome for juvenile deterrence. However, it is advisable to remember Aronfreed's caution that human social communication abilities may mitigate relationships demonstrated in laboratory research. He stated, "it may be that the most crucial function of cognitive representation in the socialization process is the mediation of the temporal gap between the child's behavior and its rewarding or punitive consequences" (1968, p. 72). Aronfreed suggests that delay of punishment can be compensated for if, at the time of punishment delivery, the child's "cognitive representation" of the act is elicited. The affective value of the punishment may become attached to the cognitive representation, or verbal description, of the act, rather than only to the act itself. Aronfreed maintains that this process is one of the means by which internalized control over behavior is developed in humans.

An inverse technique useful in compensating for delay would consist of creating a cognitive representation for the child of the punishment to come, at the time of the act. Aronfreed (1966), Fagan and Witryol (1966) and Maher (1956) have demonstrated that the suppressive effects of a delayed punishment can be increased by verbally administered instructions that increase the salience and certainty of delivery of the punishment. There is some suggestion that verbal and cognitive factors may be playing a role in juvenile deterrence. Moffitt, Gabrielli, Mednick and Schulsinger (1981) found that recidivistic juvenile offenders had lower scores on verbal intelligence tests than did one time offenders. One explanation could be that the one time offenders formed cognitive representations of their acts and punishments more easily, and thus benefitted more from their negative sanctions, despite any delays which occurred between the sanctions and their acts. The implication of Aronfreed's suggestions is clear: the sanctioning process might profit from having the juvenile, or the police officer or judge, verbally describe the juvenile's transgression and the contingency between the act and its punishment, at the time the sanction is delivered. It is not unreasonable to doubt whether a child's cognitive representation of a punishment which has followed his delinquent act can actually be effective in suppressing further commissions of the delinquent act. After all, cognitive representation is simply "imagining" the punishment taking place. There are some data which suggest that imaginary (covert) punishment can suppress behavior. Epstein and Peterson (1973)

reported a laboratory study in which imagined aversive stimuli served as well as tangible punishers in a typical operant conditioning paradigm. Two clinical case reports provide instances where covert punishment has been used in the suppression of delinquent-type behaviors specifically. Davison (1969) induced a child to vividly imagine his father's angry mood each time he contemplated a forbidden act. Guidry(1975) utilized covert punishment in treating a case of compulsive stealing. When the client felt an urge to steal, he was to imagine being caught and disgraced. The client's thefts were reduced by 90 per cent during a ten month follow-up period. It seems that, when individuals are aided in establishing a robust cognitive representation of the contingency between act and punishment, the representation can have suppressive effects on behaviors.

In summary, the importance of immediacy of delivery of punishment is well established. While practical (and constitutional) constraints prevent the juvenile justice system from delivering immediate punishment, avenues are available for overcoming delay effects. One such avenue is investigation of apprehension as a punishment experience, since it is the component of the sanctioning procedure which is temporally closest to a juvenile's act. Another is examining the possible ways in which the cognitive and language abilities of a juvenile could be used to strengthen the connection between his act and the delayed punishment. The explicit use of verbal instructions during the sanctioning may also be found to diminish the problem of punishing the wrong behavior, which often occurs with long

punishment delays in applied settings.

3. The Availability of Reward for Behavior.

Recall the laboratory procedure above for studying punishment effects with animals. The animal is first taught to emit the behavior of interest by being rewarded for performing it, before the punishment phase begins. Johnston (1972, p. 1044) has pointed out that the need for the use of punishment in applied settings "unavoidably means that there have been and probably still are reinforcement procedures concurrently in progress with respect to the punished response." In this situation two factors are operating which can serve to decrease the effectiveness of a punisher: the strength of the response, which is a function of past reward, and the maintenance of the response by rewards occurring concurrently with punishment.

Response strength. In regard to the first factor, a number of animal studies have demonstrated that the effectiveness of punishment is inversely related to the magnitude, frequency, and immediacy of reward delivered prior to the onset of punishment (Church and Raymond, 1967; Evans, 1970; Ferraro, 1966; and Martin, 1963). Although studies of response strength in humans are not available, this principle implies that if an apprehended juvenile has committed illegal acts previously with success and payoff, negative sanctioning will probably be less successful in deterring him from further illegal behavior than if he had been apprehended following his first illegal act. A study of this implication might be executed by comparing recidivism rates among

juveniles who self-report many delinquent acts prior to their first apprehension, with those who self-report relatively few deliquent acts prior to apprehension.

Response maintenance. In regard to the second factor, Johnston (172, p. 1045) has suggested that "to obtain the maximum effect from a punishing stimulus, the frequency of reinforcement for the response should be minimized." The condition under which no reinforcement is available for a behavior is called extinction. The frequency of performance of a behavior during extinction decreases as in punishment; indeed, if extinction is maintained long enough, punishment is not needed. Animal studies show that when both punishment and extinction are used simultaneously, the elimination of a behavior is more rapid than when either procedure is used alone (Azrin, 1960; Estes, 1944), but that if punishment is attempted while reinforcement is still available, and is maintaining the response, suppresssion of behavior is incomplete and transitory (Azrin and Holz, 1966; Boe, 1964). Singer (1970, p. 415) has commented, "since criminal behavior is almost always rewarded, this suggests that we give some attention to extinguishing criminal behavior as well as punishing it, by withdrawing the rewards or making them inaccessible." Shah (1966, p. 32) writes, "...the form and frequency of certain criminal acts bears some connection to the environmental structure and opportunities provided... The relative ease with which cars may be broken into and be started without use of ignition keys, clearly affects the frequency of offenses involving joy-riding and automobile theft." If

opportunities for engaging in illegal acts were reduced, the expectations for reward for such acts might diminish, and relative deterrent effects of negative sanctions should increase.

In summary, both the strength of a behavior and the maintenance of a behavior by reinforcers concurrent with punishment serve to mitigate the suppressive effects of punishment. Juveniles who are apprenhended at their first illegal act may be better candidates for deterrence, and measures such as defensive environmental design and victim awareness programs may help decrease the amount of reward expected for illegal behavior.

4. The Schedule of Delivery of the Punisher.

Animal studies have demonstrated that behaviors are much more effectively suppressed when every instance of the act is punished, than when the act is only intermittently punished, allowing some performances of the act to be rewarded (Azrin, Holz, and Hake, 1963; Zimmerman and Ferster, 1963). The discrepancies found between self-report and official records of juvenile offending (Gold, 1966; Short and Nye, 1958) indicate that many of the offenses committed by juveniles go unpunished, and we may assume that most of these unpunished acts are rewarded. Indeed, even many detected and apprehended offenders remain officially unpunished. Thus, the existing situation in juvenile sanctioning parallels most closely an intermittent schedule of punishment delivery. There are no reported studies of schedules of punishment with humans and even few studies which

investigate the effects of intermittent punishment on the behavior of animals. However, some animal studies which are reported have unpleasant implications for an applied system using intermittent punishment. For example, sporadic punishment of an animal's intermittently rewarded behavior will strengthen the subsequent resistence to extinction of the behavior when rewards are withdrawn (Lawrence and Festinger, 1962; Logan and Wagner, 1965; Martin, 1963). Behavior that continues to be rewarded is also made resistant to the effects of frequent punishment if the punishment is introduced gradually on an intermittent schedule (Banks, 1966; 1967). Effects such as these on the behaviors of animals may suggest that juveniles who experience punishment for only a few of their offenses may be likely to develop adult criminal careers as well, and may be especially resistant to deterrent effect of future punishments.

Expected punishment. Two studies of the social control of children's behavior have shown that if children are led to expect that punishment will follow a behavior, but that actual performance of the behavior results in no consequence, then the absence of punishment has the effect of a reward; the rate of behavior is increased (Crandall, Good, and Crandall, 1964; Offenbach, 1966). Thus, it is probable that every failure to negatively sanction aprehended offenders by the juvenile justice system has anti-deterrent effects. There are data which support this notion. Gabrielli and Mednick (in preparation) compared adult offenders who received punishments less severe than the mean punishment meted for their offense with offenders who

received punishments more severe than the mean. The latter group reoffended significantly less often than did the former. If we can assume that the offenders expected to receive the average amount of punishment, then it is possible to infer that the extent to which their actual punishments deviated from this expected amount impacted their rates of reoffending considerably. Results of a study of 1,457 Chicago boys lend support to the idea that punishment delivered at less than the expected level may actually reinforce behavior. Murray (1980) found that failure to take delinquents who were already on probation back to court after an arrest was followed by faster rearrests.

Certainty of punishment. Although data are not available from studies of human subjects to clarify the cognitive impact of differential schedules of punishment, it is probable that differences in suppression effects between continuous and intermittent punishment are attributable to perceptions about the certainty of punishment, not merely the frequency. The classical school of criminology has long maintained that it is the certainity of punishment, not the severity, that deters persons from criminal behavior (Jeffery, 1965). Parker and Grasmick (1979) have demonstrated that persons' personal experiences with crimes and the personal experience of their acquaintances are more important in influencing their estimates of the certainity of arrest than are media reports of official arrest rates. They noted that Walker (1969) reported that criminals had more accurate knowledge of arrest rates than did the general public, and concluded that offenders themselves develop an accurate

assessment of the low probabilty of their apprehension based on personal experience. Offenders are aware that they are on an intermittant punishment schedule.

What are the implications of such awareness? Erickson, Stafford, and Galliher (1980) surveyed juveniles in two Arizona counties to assess the effects of rates of punishment for specific offenses on the juveniles' evaluation of norms concerning the wrongness of engaging in those offenses. Although results depended to some extent on the seriousness of the acts, in general juveniles were more willing to engage in offenses with the lowest probability of punishment. In addition, juveniles who had been personally apprehended for an offense, but treated leniently, perceived the offenses as less serious than even the juveniles who had not been apprehended. This group is similar in some ways to the children in Offenbach's (1966) study who experienced as a reward an expected punishment which was not delivered.

Uncertain punishments. Siegel (1978) compared the performance of sociopathic prisoners, nonsociopathic prisoners, and college students on a card game in which the probability of punishment (losing poker chips which could be redeemed for money) was manipulated by the experimenter. When the probability of punishment was in the midrange (40 - 70 per cent) sociopaths were more willing to risk the loss of poker chips than were members of the two control groups. When questioned following the card games about their perceptions of the probability of punishment, the sociopaths underestimated the likelihood of losing poker chips

chips when the probability of loss was in the midrange, but did not underestimate the probability of loss when loss was actually quite certain.

In summary, animal studies have proven that continuous punishment is more effective than intermitent punishment in suppressing behavior. Indeed, it is possible that sporadic punishment of a rewarded behavior, or failure to deliver an expected punishment, can actually serve to increase the strength of a behavior. These laboratory findings about punishment schedules are interpreted in terms of juveniles' perceptions about the certainty of punishment for illegal behaviors. Criminological studies exist which demonstrate that perceived certainty of punishment is determined by personal experience and that it affects juveniles' willingness to engage in illegal acts. A subgroup of serious multiple offenders may be especially likely to underestimate the likelihood of punishment when punishment is uncertain. Singer (1970, p. 417) wrote, " the moral derived from the basic experimental results concerning certainty is nevertheless straightforward: Catch more criminals more of the time..." Unfortunately, the moral is not as straightforward to implement as it is to understand. However, the data indicate that policy which mandates that punishment must be administered to all first offenders who are apprehended might prove useful in reducing the rewarding effects of lenient treatment of apprehended first offenders. Recall the McCord (1980) study in which first offenders who were released without official processing were more likely to commit subsequent crimes than boys

who received full processing and sentencing. Evaluation research of such a policy mandating punishment of all apprehended offenders is in order.

5. Availability of Alternate Rewarded Responses

Several studies have reported that complete suppression of a behavior can be rapidly achieved using punishment, if animals are offered an opportunity to perform an alternate unpunished behavior which results in delivery of the reward previously provided by the punished behavior (Boe, 1964; Solomon, 1964; Whiting and Mowrer, 1943). In addition, Rachlin (1967) found that manipulation of the severity of punishment has a greater suppressive effect when a rewarded alternate behavior is available. Solomon, Turner, and Lessac (1968) demonstrated that even delayed punishment will suppress behavior when an alternate behavior is available. Karsh and Williams (1964) reported an experiment with children in which no behavioral alternate was available for the punished behavior. They found punishment to be ineffective in suppressing the children's behaviors. In a study in which mental patients were offered both an unpunished and an intermittently punished lever to pull in order to earn cigarettes, the behavior of pulling the intermittently punished lever was totally suppressed as soon as the nonpunished lever was made available (Holz, Azrin and Allyon, 1963). Azrin and Holz (1966) explained that punishment of a behavior for which there is no alternate behavior may be expected to suppress responding by only 30 per cent.

Problems in application of the principle of alternate response. On the basis of studies such as the ones cited here Singer (1970, p. 429) concluded, "this cumulative evidence points directly and overwhelmingly to the importance of combining rehabilitation with punishment. Our correctional system must provide offenders alternative routes and skills to obtain the rewards they formerly obtained only, or much more easily, through crime." There are however, several important dissimilarities between the experimental procedures which produced the principle of alternate responses and the practical situation of the juvenile justice system. In laboratory studies of punishment, the subjects are first deprived of the reward which the experimenter intends to use so as to insure the subjects' motivation to behave. For example rats are starved to 70 per cent of body weight, or children are deprived of social contact for a time (Lovaas and Simons, 1969). Thus, the alternate behavior is necessary for elimination of the punished behavior because the subjects experience strong motivation to obtain the reward (food pellets or encouraging hugs). Although large numbers of juvenile offenders are from low income families, and may be 'property deprived', the nature of the motivation behind many delinquent acts is not clear. Acts not motivated by biological survival needs may not require alternate responses when they are punished.

Johnston (1972) pointed out that all available studies have had the alternate response produce the same kind and amount of reward as the punished reponse. Programs might be suggested to

offer althletic contests as alternates to gang fighting, each of which produce the reward of defeating rival juveniles*. However, it is difficult to imagine an alternate behavior to theft which might also provide a fourteen year old with a color television set in less than fifteen minutes, or an alternate acceptable behavior to drug use which will provide the same high. For many illegal behaviors, it is the unacceptable nature of the reward which makes the behavior a crime. Studies are needed which clarify the effects of rewarding the alternative response with a different class of reinforcers.

Another problem with extrapolation from the experimental studies is that in laboratory procedure the punished and alternate responses are very similar in topography, (for example, pressing a red bar versus pressing a green bar) while in the case of juvenile offenses, the punished and alternate behaviors must be dissimilar. For example, one can offer a juvenile thief a job as an alternate means to obtain a television set, but it will probably require months of effort rather than minutes. Even rats will always choose the behavior requiring the least effort to obtain a reward (Mitchell, Scott and Williams, 1973). Johnston (1972) has also cautioned that it must be anticipated that the schedule of reinforcement for the alternate behavior would affect the proportion of responding with the alternate, as opposed to the punished behavior. If working at a job is reinforced every

---

*It is well to remember that a reward must be defined as rewarding in the perception of the juvenile; an athletic victory may not mean the same as a violent victory to the subjects of the program.

two weeks, and studying for a college degree is reinforced once every four years, many persons with experience in illegally obtaining a less delayed and more frequent reinforcement schedule would prefer the punished behavior to these alternate behaviors, especially if the probability of punishment is low. Juvenile offenders may be especially susceptible to this preference. Mischel (1961) found that children who were identified as delinquent more frequently chose an immediate smaller reward, rather than a delayed larger reward, than did children who had not been identified as delinquent.

Nevertheless, despite the practical difficulties in providing rewarding alternatives to punished behaviors, it is probable that many juveniles who do not engage in delinquent acts refrain from doing so because they prefer alternate behaviors. Some illegal behaviors may be more susceptible to replacement with alternate behaviors and rewards than are others. Programs could be attempted which take advantage of the cognitive abilities of human adolescents by increasing the saliency of longer term rewards and providing instructions for how they are attained with the least effort. Research is also needed to determine whether any tendency to be less able to tolerate delayed rewards is related to delinquent recidivism.

Two Final Comments

Five principles of punishment derived from laboratory research have been discussed in terms of their implications for juvenile deterrence. As is often the case with efforts to

develop principles about human behavior in a social context, the individual principles considered alone do not capture the complexity of what really happens when punishment is used in applied settings; simplistic approaches to sanctioning based on the predictions of these principles may be doomed to less than spectacular deterrence effects. It is important to consider the possibility of mitigating interrelationships, both between the principles themselves and between the principles and the individual psychological characteristics of juvenile offenders to whom they may be applied.

Interprinciple relationships. A good example of ways in which the effects of various principles may be dependent upon their interrelationships is provided by Cohen (1967; cited in Singer 1970, p. 420).

> Criminologists have known for some time that increased severity of punishments has little effect on incidence of crimes. Why does severity have little effect, in view of both common sense and the previously mentioned experimental indications that it ought to? Because the punishments are so uncertain and delayed. The effect of delay is to lessen severity and manipulations of severity have little effect at long delays (Cohen, 1967).

Although it is easy to imagine how relationships between principles may act to decrease the overall effectiveness of punishment, it is equally probable that less than optimal application of one principle may be compensated for by maximization of another. For example, given the humane limitations on severity of punishment for juveniles, the principle of continuous schedule of punishment could be utilized

to assure that each offender at least receives what punishments are available. Or, a combination of high certainty of punishment and shortened delays may preclude the need for increasing severity. No experimental studies of relationships between different principles of punishment are available. Research in this area would be invaluable to designers of juvenile justice sanctioning policy.

Individual differences in response to punishment . References have already been made in this paper to characteristics of individual juveniles which may mitigate the effectiveness of punishment in some ways. Differences in the experiencing of fear (Rydelius, 1981), verbal intelligence (Moffitt, et. al, 1980) and ability to tolerate delay of reward (Mischel, 1961) were mentioned. Additional factors have been posited which may determine the magnitude and direction of the reactions of different individuals to the same experience of being punished; for example, autonomic nervous system responsiveness (Mednick, 1977), cortical arousal (EEG) (Eysenck, 1967), and previous experience with punishment in the family (Becker, 1964). The literature about these individual characteristics will be reviewed in a subsequent paper, but it is important to point out that there is some evidence that we cannot expect all juveniles to respond uniformly to any manipulation of the various principles of punishment discussed in this paper.

Conclusions

Despite cautions about the appropriateness of applying the

experimental model of punishment to the process of negative sanctioning of juvenile offenders, I have asserted that awareness of the principles of punishment may be of use to the deterrence theoretician. Principles of punishment exist which have been shown to augment the suppressive effects of punishment in research settings, and the implicatons of the principles for improving juvenile deterrence merit careful investigation. However, it has become evident during the course of this review that, while consideration of the punishment principles yields a number of testable implications for deterrence, there are also large gaps in the punishment literature itself which call for research efforts before such implications can be confidently evaluated. Examples of such unexplored gaps are: the role of human cognitive and verbal abilities in attenuating delay of punishment, and the possibility of interrelationships between the various principles. Therefore, it is not suggested that policies or programs designed to implement any of the learning theory principles of punishment be adopted immediately, but a call for research is extended.

References

Andenaes, J. Does punishment deter crime? Criminal Law Quarterly, 1968, 11, 78.

Andenaes, J. Punishment and deterrence. Ann Arbor, Mich.: U. of Michigan Press, 1974.

Aronfreed, J. The internalization of social control through punishment. Proceedings of the Eighteenth International Congress of Psychology, Moscow. 1966.

Aronfreed, J. Conduct and conscience. N.Y.: Academic Press, 1968.

Aronfreed, J. and Reber, A. Internalized behavior suppression and the timing of social punishment. J. of Personality and Social Psychology. 1965, 1, 3-16.

Azrin, N. H. Effects of punishment intensity during variable-interval reinforcement. J. of Experimental Analysis of Behavior. 1960, 3, 123-142.

Azrin, N. H. and Holz, W. C. Punishment. In W. K. Honig (ed.) Operant behavior. N.Y.: Appleton-Century-Crofts, 1966.

Azrin, N. H., Holz, W. C. and Hake, D. Fixed-ratio punishment. J. of Experimental Analysis of Behavior, 1963, 6, 141-148.

Banks, R. K. Persistence to continuous punishment following intermittent punishment training. J. of Experimental Psychology, 1966, 71, 373-377.

Banks, R. K. Intermittent punishment effect (IPE) sustained through changed stimulus conditions and through blocks of non-punished trials. J. of Experimental Psychology, 1967, 73, 456-460.

Becker, W. C. Consequences of different kinds of parental discipline. In M. L. Hoffman and L. W. Hoffman (eds.) Review of Child Development Research. Vol. 1 New York: Rusell Sage Foundation, 1964.

Berecz, J. Treatment of smoking with cognitive conditioning therapy: A self-administered aversion technique. Behavior Therapy, 1976, 7, 641-648.

Birnbrauer, J. S. Generalization of punishment effects - a case study. J. of Applied Behavior Analysis, 1968, 1, 201-211.

Boe, E. E. Extinction as a function of intensity of punishment, amount of training, and reinforcement of a competing response. Canadian J. of Psychology, 1964, 18, 328-342.

Chopra, P. Punishment and the control of human behavior. Australian and New Zealand Journal of Criminology, 1969, 2, 150.

Church, R. M. in B. Campbell and R. Church (eds.) Punishment and aversive behavior. App. I, 1969.

Church, R. M. and Raymond, G. A. Influence of schedule of reinforcement on punished behavior. Journal of Comparitive and Physiological Psychology, 1956, 49, 301-308.

Cohen, I. Response suppression as a function of delay and intensity of punishment. Dissertation Abstracts International, 1967, 28, 1704.

Crandall, V., Good, S. and Crandall, V. J. Reinforcement effects of adult reactions and nonreactions on children's achievement expectations: A replication study. Child Development, 1964, 35, 485-497.

Davison, G. C. Self-control through "in.aginal aversive contingency" and "one downmanship". In J. Krumboltz and C. Thoresen (Eds.) Behavioral Counseling: Cases and Techniques. New York: Holt, 1969.

Epstein, L. H. and Peterson, G. L. Differential conditioning using covert stimuli. Behavior Therapy, 1973, 4, 96-99.

Erickson, M. L., Stafford, M. C., and Galliher, J. M. Differences in perceived seriousness of crimes and delinquencies: The normative erosion hypothesis. Unpublished manuscript, 1980.

Estes, W. K. An experimental study of punishment. Psychological Monographs. 1944, 57, number 263.

Evans, D. R. Subjective variables and treatment effects in aversion therapy. Behavior Research and Therapy. 1970, 8, 147-152.

Eysenck, H J. Crime and personality. London: Routledge, 1964.

Eysenck, H. J. The biological basis of personality. Springfield, Ill.: Thomas, 1967.

Fagan, J. F. III, and Witryol, S. L. The effects of instructional set and delay of reward on children's learning in a simultaneous discrimination task. Child Development, 1966, 37, 433-438.

Ferraro, D. P. Persistance to continous punishment as a function of amount of reinforcement. Psychonomic Science, 1966, 6, 233-234.

Garcia, J., Hawkins, W. G. and Rusiniak, K. W. Behavioral regulation of milieu interne in man and rat. Science, 1974, 185, 824-831.

Gold, M. Undetected delinquent behavior. J. of Research in Crime and Delinquency. 1966, 3, 27-46.

Gold, M. and Williams. J. R. National study of the aftermath of apprehension. Prospectus, 1969, 3, 11.

Grings, W. W. Verbal-perceptual factors in the conditioning of autonomic responses. In W. F. Prokasy (ed.) Classical conditioning: A symposium. N.Y.: Appleton-Century-Crofts, 1965.

Holz, W. C., Azrin, N. H., and Allyon, T. Elimination of behavior of mental patients by response-produced extinction. J. of Experimental Analysis of Behavior, 1963, 6, 399-406.

Jeffrey, C. R. Criminal behavior and learning theory. J. of Crim. L. C. & P. S. 1965, 56, 294.

Johnston, J. M. Punishment of human behavior. American Psychologist, 1972, 1033-1054.

Karsh, E. B. and Williams, J. P. Punishment and reward in children's instrumental learning. Psychonomic Science, 1964, 1, 359-360.

Klein, M. Cafeteria style delinquency: Evidence and implications.

Klein, M. W., Teilmann, K. S., Lincoln, S. B., and Labin, S. Diversion as operationalization of labelling theory. Unpublished manuscript (forthcoming, 1982).

Lawrence, D. H. and Festinger, L. Deterrents and reinforcements: The psychology of insufficient reward. Stanford, CA: Stanford U. Press, 1962.

Logan, F. A. and Wagner, A. R. Reward and punishment. Boston: Allyn and Bacon, 1965.

Lovaas, O. I. and Simmons, J. Q. Manipulation of self-destruction in three retarded children. J. of Applied Behavior Analysis, 1969, 2, 143-157.

McCord, J. Myths and realities about criminal sanctions. Paper presented at the American Society of Criminology Annual Meetings, San Francisco, CA, 1980.

Maher, A. R. The role of expectancy in delayed reinforcement. J. of Experimental Psychology, 1956, 52, 101-106.

Martin, B. Reward and punishment associated with the same goal response: A factor in the learning of motives. Psychological Bulletin. 1963, 66, 91-94.

Mednick, S. A. A bio-social theory of the learning of law-abiding behavior. In S. A. Mednick and K. O. Christiansen, Biosocial bases of criminal behavior, N.Y.: Gardner Press, 1977.

Mischel, W. Preference for delayed reinforcement and social responsibility. J. of Abnormal and Social Psychology, 1961, 62, 1-7.

Mitchell, D., Scott, D. and Williams, K. Container neophobia and the rat's preference for earned food. Behavioral Biology, 1973, 9, 613-624.

Moffitt, T. E., Gabrielli, W. F., Mednick, S. A., and Schulsinger, F. Socioeconomic status, I.Q., and delinquency. Journal of Abnormal Psychology, 1981, 90, 152-156.

Murray, C. A. Days in Court. Washington, D. C.: American Institute for Reseach, 1980.

Offenbach, S. I. Reinforcer acquisition in discrimination learning. Psychological Reports, 1966, 19, 843-849.

Parker, J. and Grasmick, H. G. Linking actual and perceived certainity of punishment. Criminology, 1979, 17, 366-379.

Penny, R. K. and Lupton, A. A. Children's discrimination learning as a function of reward and punishment. J. of Comparative and Physiological Psychology, 1961, 54, 449-451.

Rachlin, H. The effect of shock intensity on concurrent and single-key responding in concurrent-chain schedules. J. of Experimental Analysis of Behavior, 1967, 10, 87-95.

Rimm, D. C. and Masters, J. C. Behavior Therapy, N.Y.: Academic Press, 1979.

Rydelius, P. from S. A. Mednick and J. Volavka, Biology and crime. In N. Morris and M. Tonry (eds.) Crime and justice: An annual review of research. Vol II. Chicago: U. of Chicago Press, 1980.

Shah, S. Treatment of offenders: Some behavioral concepts, principles, and approaches. Federal Probation, 1966, 30, 29.

Short, J. F. and Nye, F. I. Extent of unrecorded delinquency, tentative conclusions. J. of Criminal Law, Criminology and Police Science, 1958, 49, 296-302.

Singer, B. F. Psychological studies of punishment. California Law Review, 1970, 58, 405-443.

Solomon, R. L. Punishment. American Psychologist, 1964, 19, 239-253.

Solomon, R. L. Turner, L. H., and Lessac, M. S. Some effects of delay of punishment on resistence to temptation in dogs. J. of Personality and Social Psychology, 1968, 8, 233-238.

Spielberger, C. D., Southard, L. D., and Hodges, W. F. Effects of awareness and threat of shock on verbal conditioning. J. of Experimental Psychology, 1966, 72, 434-438.

Walker, N. Sentencing in a rational society. Harmondsworth, England: Penguin Press, 1969.

Walters, R. H. Delay of reinforcement gradients in children's learning. Psychonomic Science, 1964, 1, 307-308.

Watson, J. B. Behaviorism. N.Y.: Norton, 1924.

Whiting, J. W. M., and Mowrer, O. H. Habit progression and regression: A laboratory study of some factors relevant to human socialization. J. of Comparative Psychology, 1943, 36, 229-253.

Zimring, F. and Hawkins, G. Deterrence: The legal threat in crime control. Chicago: U. of Chicago Press, 1973.

Zimmerman, J. and Ferster, C. B. Intermittent punishment of S responding in matching-to-sample. J. of Experimental Analysis of Behavior, 1963, 6, 349-356.

END