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AN INVESTIGATION OF COGNITIVE SELF-CONTROL IN FEMALE YOUNG OFFENDERS

by

ELIZABETH D. BANNERMAN

B.A.(Hons.), McGill University, 1985

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ABSTRACT

Self-instructional training procedures appear to offer considerable treatment potential in helping impulsive children learn to delay their impulsive behaviors. Although the central role of impaired impulse control in delinquency has often been acknowledged, the efficacy of self-instructional procedures with this population has been only minimally explored. If internalized control of behavior develops as a function of age, delinquent adolescents may possess more self-directing behaviors in their repertoire than the impulsive children for whom self-instructional training was developed, but fail to deploy such behavior in problem-solving situations. The present study attempted to determine whether the delinquent's impulsive behavior is a result of deficits in verbal mediation, or merely a consequence of an under-utilization of existing self-control mechanisms. A group of 21 incarcerated female young offenders and a group of 22 nondelinquent controls were compared on self-report measures of impulsivity, monotony avoidance, and delinquency. A modified version of the Matching Familiar Figures Test (MFFT) which allowed for the observation of the search and scan strategies of subjects was administered. This served as an indirect measure of the spontaneous employment of self-control mechanisms. The capacity to employ verbal mediation strategies was investigated by requesting subjects to follow the experimenter's lead, and "talk to themselves", as they performed several MFFT items. The results were not supportive of the use

of self-instructional training procedures with a female young offender population. These adolescents were not significantly more impulsive than a group of nondelinquent controls equated for age, intelligence, and socioeconomic status. This finding is clearly discrepant with the consistent reports in the literature of a relationship between impulsivity and delinquency in male subjects. However, delinquent females were found to avoid monotonous situations. It appears that, in contrast to their male counterparts, the behavior of female young offenders represents a deliberate attempt to seek stimulation, and is not the result of a failure to stop and consider the consequences of their actions. The results point to a qualitative difference between the female delinquent profile and that of the male, and suggest that the current practice of generalizing the findings from research with males to the female offender population may not be justified.

DEDICATION

To my family, whose love and encouragement have enabled me to endure through the hardest of times.

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INTRODUCTION

Societal demand for individual self-control increases inexorably as the child develops. In adolescence, serious consequences often follow a young person's failure to adequately control his/her behavior. This increased societal pressure for self-control coincides with the maturational development of cognitive self-guiding private speech. Theoretically, the inhibition of impulsive responses is said to be related to the internalization of language (White, 1965). The development of speech as a regulator of behavior has been extensively studied (Luria, 1961; Vygotsky, 1962). A growing internalization of self-directing speech which proceeds from responding to other's speech to overt self-directives to covert self-direction (inner speech) has been proposed. As well, there is an increasing capacity to use speech to guide or discriminate alternative actions (rather than to directly trigger responses) and to plan or precede action (rather than to accompany it). This development has since been documented by several American studies (Flavell et al., 1966; Kohlberg et al., 1968; Lovaas, 1964) and has become a fairly well established tenet. The lack of inhibitory behavioral controls in certain individuals may be a manifestation of a mediational deficiency. An investigation of the role of individual differences as they relate to the development of verbal control, therefore, appears warranted.

The role of self-verbalizations in children lacking control over their behavior has been examined. An absence of self-control is evidenced by an impulsive child's hasty responding without first delaying and evaluating all possible alternatives. Such an impulsive problem-solving approach is in contrast to a reflective child's demonstration of self-control by delaying a response until all of the alternatives are examined carefully. Meichenbaum and Goodman (1969) found that the self-verbalizations of impulsive children were less directive of their actions than were those of reflectives on a tapping task. Whereas reflectives responded to the semantic aspects of their self-instructions by tapping several times to each utterance, the impulsive children used self-instructions in a motoric manner - that is, they tapped each time they uttered a word. Furthermore, impulsive children showed significantly less verbal control over behavior under the covert condition of self-instruction (lip movement only) than did the reflective children. This relationship between verbal control of behavior and cognitive impulsivity, is consistent with findings reported by Soviet investigators (Wozniak, 1972). The results are suggestive of the potential benefits to be derived through the use of self-directed speech, and the developmental sequence proposed by the Vygotsky-Luria model, within treatment paradigms for impulsive individuals.

Attempts at remediation of the deficits in verbal self-control have been largely successful at eliciting increased

control over motor behavior. Meichenbaum and Goodman (1971) compared modeling with a combination of modeling and training in self-instruction. Results indicated that both conditions resulted in a significant increase in latencies to respond on the Matching Familiar Figures Test (MFF), but only the self-instructional training resulted in a decrease in errors on the task.

Bender (1976) included conditions similar to Meichenbaum and Goodman's (1971) "model plus strategy training (verbal self-instructional-strategy training)", "model (strategy training)", and "attentional control (attentional-materials control)" conditions. In addition, Bender (1976) included a condition in which subjects were trained to "self-instruct about the general task (i.e. to go slowly and find a match), but not any specific strategies (the verbal self-instruction condition)". Covert self-verbalization by the impulsive children in the two self-verbalization conditions increased latencies on a matching task and decreased errors relative to nonverbalizing subjects. Strategy training per se increased latency, but did not decrease errors. As well, self-verbalization of specific strategies elicited superior performance (longer latencies) compared with general self-instructions.

In a study by Palkes et al. (1968) training in self-directed verbal commands significantly improved the qualitative scores of hyperactive boys on the Porteus Maze Test. Research has shown this test to measure an aspect of impulsive behavior.

Finch et al. (1975) selected impulsive boys on the basis of their performance on the MFF. Subjects were assigned to one of three groups: cognitive training, imposed delay, and test-retest control. The results indicated that the cognitive verbal self-instructional training procedure resulted in a significant increase in latencies and a decrease in errors. In the imposed delay group, only an increase in latencies was obtained.

As well, the findings of the Douglas et al. (1976) project provide supportive evidence for the effectiveness of cognitive training procedures with hyperactive children. Hyperactive boys were trained via modeling, self-verbalization, and self-reinforcement techniques to use more effective and less impulsive strategies for approaching cognitive tasks, academic problems, and social situations. Though some measures did not evidence desired changes, changes in both latency and error measures on the MFF, improvements on measures of reading ability, and beneficial changes on the Porteus Maze test were evident following the training.

More recently, Kendall and Finch (1978) conducted a group comparison investigation in which impulsive children were randomly assigned to either a treatment or a control group. The treatment group received six sessions of verbal self-instruction via modeling and practice, with response-cost contingent upon errors during training. The children in the control group received similar exposure to the training tasks and similar experiences with the trainer, but without the specifics of the

intervention. The results of this investigation indicated that treated impulsive children performed significantly less impulsively on the MFF test at post-treatment and at follow up. These performance differences were evident on both the latency-to-respond measure and the error-rate measure of the MFF. In addition, the treated impulsives were rated by their teachers as significantly less impulsive in the classroom following treatment.

Since self-instructional training focuses specifically upon the development of verbally mediated self-control, one wonders whether its beneficial effects are actually achieved in this manner. In other words, does the treated child actually increase his or her effective use of language? Kendall and Finch (1979) have made an attempt to evaluate the impact of self-instructional training on verbal behavior. When treated impulsives were compared to impulsive controls, total-on-task verbal behavior did result in significant improvement for treated children. A comparison of the verbalizations of the treated impulsives with those of children who were originally reflective found that the impulsive children had significantly reduced their off-task behavior while, at the same time, increasing their on-task verbal behavior. Although there are problems with any attempt to infer internalization of language, this pattern of results provides support for the positive effects of the intervention.

The verbal self-instruction procedures appear to offer considerable treatment potential in helping impulsive children to learn to delay their impulsive behaviors. This line of research offers indirect support for the role of verbal mediation in eliciting self-control.

The research on self-instructional training reviewed thus far has focused on the remediation of impulsivity in youngsters. Children displaying such a lack of self-control are frequently described in terms of the symptom pattern known as hyperactivity, or what is currently referred to as Attention Deficit Hyperactivity Disorder (ADHD) (DSM-III-R, 1987). The prominent role of deficient impulse control in the ADHD syndrome is now generally agreed upon. Studies using the Matching Familiar Figures Test (Brown, 1982; Juliano, 1974) have uniformly reported impulsive responding in hyperactive children relative to normal peers. Douglas and Peters (1979) describe the nature of the hyperactive child's deficits as involving

> "an inability to sustain attention and to inhibit impulsive responding on tasks or in social situations that require focused, reflective, organized, and self-directed effort" (pg. 173).

Although a deficit in the inhibition of impulsive responding is by no means the sole criterion characterizing hyperactivity, it is this deficit that is reported to persist into adolescence. ADHD adolescents tend to employ impulsive rather than more reflective approaches to cognitive tasks (Cohen et al., 1972; Weiss and Hechtman, 1979). In contrast, the evidence points to the diminution of overactivity with age (Ackerman et al., 1977;

August et al., 1983; Weiss et al., 1971; Weiss and Hechtman, 1979).

Suggestion has been made that ADHD may continue into adulthood with symptomatic transformations. In adolescence, deficient impulse control may be manifest in antisocial behavior. Outcome research on ADHD probands followed into adolescence and early adulthood report a marked increase in antisocial symptoms and delinquent acts found at follow-up (Satterfield, 1978; Satterfield et al., 1982; Thorley, 1984). The mediative role of impulsivity in explaining this poor outcome was supported by Resnick (1985). Impulsivity was found to be a robust predictor of antisocial behavior, whereas hyperactivity was only weakly associated. As a result, a developmental association has been inferred (August et al., 1983; Freeman and Resnick, in press; Gorenstein et al., 1980), in which hyperactivity and antisocial behavior are viewed as differing behavioral manifestations of the same general mode of functioning, an impulsive cognitive style.

The clinical view of antisocial behavior supports the central role of impaired impulse control (McCord and McCord, 1964; Ross, 1979; Wolfgang and Ferracuti, 1967). The work of several researchers has corroborated this perspective. Paper-and-pencil measures of impulsivity, such as the Marke-Nyman Temperment Inventory's Solidity Scale (MNT), and the impulsivity component of the Extraversion scale in the Eysenck Personality Inventory (EPI), have been consistently found to be

associated with ratings of delinquency (Schalling, 1978, 1986; Schalling et al., 1970). Investigations of cognitive tempo in delinquents and psychopathic populations have found more carelessness and impulsiveness in decision making as compared to controls. Several studies have reported that the qualitative performance score of the Porteus Maze test significantly differentiates delinquents from nondelinquents (Docter and Winder, 1954; Fooks and Thomas, 1957; Porteus, 1945; Schalling and Rosen, 1968; Sutker and Allain, 1983). This score can be considered a measure of impulsive responding. As well, Rotenberg and Nachshon (1979) investigated the relationship between delinquency and impulsivity. Using the MFF test as their measure of impulsiveness, they found delinquents to be significantly more impulsive than nondelinquents. The groups differed on both speed and accuracy measures. Similarly, Zern et al. (1974) found adolescent patients who presented with symptoms involving assault or other delinquent behaviors to be more impulsive on the MFF test than did adolescent patients characterized by withdrawal, fear, or depression.

Mangold (1966) and Saunders et al. (1973) have failed to confirm the relationship between delinquency and impulsivity. This appears to be a result of the use of a different definition of impulsiveness. The cognitive tempo dimension (hasty responding) is merely one of several that comprise the impulsivity construct. For example, Eysenck and Eysenck (1977) found that while impulsiveness, according to their broad

definition, was highly correlated with sociability, a narrow definition of impulsiveness, referring mainly to hasty responsiveness, was correlated with pathological variables. When the cognitive tempo dimension is examined, correlations with delinquency are consistently found.

Although the research with male subjects has been largely confirmatory, the little that exists with female delinquents is rather equivocal. Kenel (1976) found that female offenders were not significantly more impulsive, as measured by the MFF test, than controls. In contrast, Fooks and Thomas (1957), using the Porteus Maze Test, found both male and female delinquents to be more impulsive than a matched group of nondelinquents. Offer et al. (1979) found female delinquents to be more careless than control subjects on the Size Estimation Test, a finding which is suggestive of impulsiveness.

The scarcity of studies prevents the drawing of definitive conclusions. The term "forgotten offender" has frequently been used to indicate the fact that in the criminological literature, female offenders have been systematically ignored. One is reminded of the appropriateness of this designation as the paucity of research on impulsivity in female delinquents is revealed. Empirical research is needed in the area.

Despite the lack of clear support provided by the research findings, the descriptive literature advocates a relationship between female delinquency and impulsiveness. In a United States

task force survey, Glick and Neto (1977) reported that inadequacies in cognitive functions represent an important aspect of the female offender profile. They described difficulties in planning and in decision making, and a tendency to act impulsively without adequate consideration of the consequences. However, a formal assessment of impulsivity was not undertaken. Ross and Fabiano (1986) also depict female offenders as manifesting deficiencies in impulse control.

The exploration of speech as a source of self-regulation for delinquents appears warranted on the basis of theory and data. In light of the posited developmental link, and the central role of impulsivity as a mediator, central to both hyperactivity and antisocial behavior, the efficacy of self-instructional training with a delinquent population is suggested. Unfortunately, little research has been conducted. Verbal self-instruction is contained in some problem-solving programs with delinquents (Gendreau & Ross, 1987; Ross & Fabiano, 1985; Ross et al., 1987), but the teaching of self-guiding speech as the major focus of treatment has been only minimally explored in this population.

Camp (1977) proposed that maintaining response inhibition may depend on an effective linguistic control system. Difficulty in inhibiting aggressive behavior could involve a weak response to covert commands as well as a high threshold for activating self-regulating verbalizations. She and her collegues, therefore, designed a training program, "Think Aloud", to

improve self-control in young aggressive boys (Camp et al., 1977). It involved modeling and verbalization of cognitive activity to foster the use of verbal mediation skills in dealing with both cognitive and interpersonal problems. The program elicited significant improvement in both test performance, including measures of impulsiveness, and classroom behavior.

Similarly, Ellis (1976) examined the effectiveness of self-instructional training in developing self-control in aggressive boys. Statistical analysis of the data did not support the hypothesis that training in covert self-instructions would reduce aggressive behavior. However, their was a clear trend in the predicted direction, suggesting a possible treatment effect despite the lack of statistical significance. The author qualified the findings by pointing out a number of characteristics in the study that may be responsible for the lack of positive findings, and suggested that the hypothesis may be supported in future studies.

Of perhaps greater relevance, because of its employment of delinquents as subjects, is a study by Huntsinger, cited in Little and Kendall (1979). Incarcerated male juvenile delinquents received training in self-control. During four individual sessions over a period of one month, subjects learned to recognize both internal and external cues that accompanied their anger and were taught to interrupt their behavioral sequence using thought stopping, muscle relaxation, and breath control. Role playing and videotaped feedback were used to teach

new ways of handling anger. Although the treatment included training in verbal mediation, systematic instruction in self-verbalizations was not implemented. The training failed to produce differences between self-control treatment subjects, a discussion-only group, and a nontreated control group on the dependent measures, which included aggressive behavior. These negative results may have been a result of the lack of a specific focus on self-instructional training and/or the brevity of the training.

More encouraging results were obtained by Williams et al. (1978). Delinquent subjects received a cognitive self-guidance procedure in which appropriate self-instructions for MFF behaviors were initially modeled by the experimenter. Subsequently, subjects were trained to emit the verbalizations themselves, and then overt statements were gradually faded out. An attention control group practiced MFF items after being told to work slowly and carefully. Both of these groups performed better than an assessment-only control group on the post-assessment administration of the MFF. However, only the self-instructional group showed generalization of training effects to the WISC-R Picture Arrangement subtest. The interpersonal nature of this task suggests the particular importance of this result for delinquents who often display social deficits.

Despite the popularity of recent assertions that correctional education and treatment programs, to be effective,

must recognize and improve those under-developed or faulty cognitive patterns which are supposed to engender irresponsible behavior and to characterize the "criminal personality" (Ayers, 1981; Ross and Fabiano, 1981; Yochelson et al., 1976), little research attention has been focused upon testing this assertion. The few studies herein reviewed have employed male subjects. To date, there are no published studies examining the efficacy of self-instructional training with a female young offender population.

The studies reviewed above are based on the assumption of a general skills deficiency. Impulsive children are believed to lack the verbal mediation skills that are present in reflective children. Although the importance of motivation to employ self-controlling responses is not denied, the rationale adopted is that if an individual lacks self-controlling mechanisms, addressing the problem of motivation offers little promise of success. Thus, remediation of deficits has preceded motivational issues. Ross and Fabiano (1983) state that research on the cognitive functioning of offenders suggests that their problem is not that they simply do not practice good reasoning. Rather, it appears that they have not developed cognitive skills which they could practice, even if they chose to do so. However, this finding has not been demonstrated with respect to self-verbalization skills, and the posited developmental maturation of these skills suggests otherwise.

A surprising aspect of the self-instructional literature is that although it was originally derived from a developmental model, developmental factors have not been relied upon in applying and evaluating training. If internalized control of behavior develops as a function of age, delinquent adolescents may possess more self-directing behaviors in their repetoire than the impulsive children for whom self-instructional training was developed, but fail to deploy such behavior in problem-solving situations. Flavell, Beech, and Chinsky (1966) introduced the term "production deficiency" to describe a situation in which individuals fail to use a skill that is in their possession. The impulsive behavior of delinquent adolescents may then be due either to an absence of self-directing speech or a failure to deploy existing skills. There has been no direct attempt to determine whether the delinquent's impulsive behavior is a result of deficits in verbal mediation, or merely a consequence of an under-utilisation of existing self-controlling mechanisms. The present study seeks to test these alternatives.

If the value of self-instructional training lies in the remediation of self-control skills which are developmentally delayed, evidence of this deficiency should be provided prior to treatment. In the present study, a performance versus competence dimension will be examined. The purpose of the assessment will be twofold: (1) to determine how much cognitive ability an individual has (her competence), as well as, (2) to determine

the extent to which she is likely to apply her ability in her everyday life (her performance).

An attempt to infer the internalization of language, and thus the existence of some self-controlling mechanisms, will be undertaken. In order to accomplish this, the search and scan strategies of subjects will be studied. Previous research has demonstrated that in addition to spending less time viewing the stimuli, impulsives base their decisions on less information gathered in a less systematic fashion than do reflectives (Drake, 1970; Siegelman, 1969). These search and scan strategies will serve as an indirect measure of the employment of existing self-control mechanisms - the performance dimension.

The capacity to employ verbal mediation strategies (competence) will be investigated by modeling verbalizations evidencing such strategies, and subsequently examining the performance of subjects. Should impulsive adolescents be capable of adopting effective verbal mediation strategies, after being cued to do so, but not spontaneously evidence them, the modification of existing self-instructional procedures for use with this age group would be warranted. Emphasis would have to be placed not only upon improving verbal mediational skills, but also on the inducement for using these skills and sensitization to cues in the environment that should elicit them.

It was hypothesized that female delinquents would exhibit a greater degree of impulsivity than a group of nondelinquent

controls. This outcome would be concordant with existing research on males. These impulsive female delinquents would then be eligible candidates for a training program designed to elicit self-control. Second, it was hypothesized that impulsive adolescents, whether delinquent or not, would demonstrate poorer self-verbalization ability than their reflective counterparts. However, the major deficit would be their failure to employ verbal mediation strategies spontaneously in problem-solving situations. Verbalization would therefore aid their performance.

METHOD

Subjects

Twenty-one young offenders living in a correctional institution, and twenty-two non-delinquent controls participated in the study. All subjects were females between the ages of 14 and 18 years. The Willingdon Youth Detention Centre, from which the experimental subjects were obtained, is the sole institution in British Columbia, Canada that houses female delinquents. An average of 10 females reside there at any one time. Control subjects were obtained from a grade 10 class at William Beagle Junior Secondary and from a combined grade 11 and 12 class at Port Moody Senior Secondary. In the selection of these particular classes, an attempt was made to equate the groups for age, intelligence, and socioeconomic status, since there has been some suggestion in the literature that these variables may be moderately related to impulsivity (Heider, 1971; Messer, 1976; Mumbauer and Miller, 1972; Schwebel, 1972; Weintraub, 1973).

Apparatus

The Delinquency Check List (Kulik et al., 1968) was used to confirm the nondelinquent status of the controls and to provide an indication of the extent of delinquency among the incarcerated subjects. It is a self-report instrument. Each item is a rule that the subject scores on a scale from 0 to 4 as

having been more or less frequently broken by them (0 means never broken). The total score for each subject is the sum of scale values checked for each item. The use of a self-report measure has been recommended as a means of correcting known biases in the determination of whether or not a given antisocial act is ever officially recorded (Arnold, 1971; Short and Nye, 1957). The Delinquency Check List's reliability and validity have been well established (Kulik et al., 1968). It has proven to be a useful instrument for distinguishing between delinquent and nondelinquent groups.

The Quick Test (QT) of Ammons and Ammons (1962a, 1962b) was employed to determine the intelligence of subjects. It is a verbal-perceptual test wherein a plate containing four line drawings is presented to subjects. A list of 50 words, arranged in order of their level of difficulty, is read aloud. The examinee is asked to point to the picture that is most closely associated with each word, and when the subject has passed and failed six consecutive words, the test is terminated. The validity of this instrument has been demonstrated using both delinquent and nondelinquent samples (Davis et al., 1970; Gendreau et al., 1975; Joesting et al., 1972).

Impulsivity was measured by Schalling's (1975) Impulsiveness Scale. This scale consists of 10 items scored on a four point response format, from 'Does not apply at all' to 'Applies completely'. Item analysis of the content results in three clusters:

1. Acting on the spur of the moment, "impulsively" without previous planning or experience of intention.
2. Rapid decision-making, without consideration of alternative action, preference for speed rather than accuracy.
3. Carefreeness, "rhathymia", taking each day as it comes.

Thus, the instrument predominantly measures hastiness, the cognitive tempo dimension of impulsivity. The scale has been shown to have a moderate correlation with a behavioral measure of impulsivity (Edman et al., 1983). This is encouraging, since in the literature, questionnaire measures usually have low, and often insignificant, correlations with the nonquestionnaire measures of impulsivity (Barratt et al., 1983). The scale has been employed extensively in research studies with criminal groups, frequently in conjunction with the Monotony Avoidance Scale (MA). Results have supported their usefulness (Schalling, 1975).

Schalling's Monotony Avoidance Scale (1975) is similar in format to the Impulsiveness Scale, and is also comprised of 10 items. Content analysis reveals two factors:

1. Need for change and novelty, avoiding routine.
2. Seeking thrill and strong stimuli, preferring unusual activities and people.

A dimension of sensation seeking (see Zuckerman, 1971, 1979) is clearly tapped by the items in this scale.

The development of both the Impulsivity and Monotony Avoidance scales was predicated on Sjobring's (1973) model of

personality, which includes a factor called 'solidity', which is akin to a general impulsiveness (see Eysenck and Eysenck, 1977). Cluster and content analysis of items in the Solidity Scale suggest two main traits, those of impulsiveness and sensation seeking, and are represented in the two separate scales employed here. Further justification for the inclusion of the Monotony Avoidance Scale is found in the criminological literature. The characteristics of impulsiveness and sensation seeking have been brought together in a psychopathy subgroup identified by Maher-Gross et al (1954) as "Unstable Drifters". In addition, impulsivity has been postulated to be part of a more inclusive class of action-oriented personality predispositions that include extraversion, sensation-seeking, and in general, a lack of "inhibitory" behavioral controls (Barrett and Patton, 1983). Such a conceptualization is consistent with the views of Twain (1957) and Eysenck et al. (1977) who found that despite the practice of regarding impulsivity as a unitary trait, factor analyses revealed the operation of more than one factor. It appears that impulsiveness, in this broad sense, may be related to delinquent behavior.

Modified children's and the adult version of Kagan's (1966) Matching Familiar Figures Test (MFF) were administered. The subject's task on the MFF test is to select from a visual array of variants, the one picture which is identical to a standard picture. The dependent measures derived from this test were the traditional ones of latency to first response and total number

of errors on the test, as well as several other measures aimed at examining the scanning strategies of subjects:

a) the sequence of exploration of the stimuli

b) the duration of time spent scanning each alternative

c) the number of alternatives scanned.

During the final phase of MFF administration a small portable tape recorder, equipped with a blank tape, was used to record the verbalizations of the subjects. A total-on-task verbal score was obtained from these recordings. The coding criteria were those provided by Kendall and Finch (1979) and are listed in Appendix A.

The administration of the MFF test differed from the standard method. A wooden panel was constructed containing nine openings to accommodate the standard stimulus and the 8 alternatives used in the adult version of the MFF. The MFF pictures were mounted on masonite boards; one trial, consisting of the standard centered above two rows of four alternatives, appeared on each board. For each trial, the experimenter inserted the appropriate board into a slot behind the panel. A sheet of smoked glass in front of the openings prevented subjects from viewing the stimuli, until the experimenter switched on a light, allowing the standard stimulus to come into focus, and alloting the subject control of a display panel. This was comprised of eight buttons which allowed subjects to control the display of each alternative. The buttons activated a light

in each of the corresponding chambers, causing the picture to come into clear focus. The picture remained in focus only as long as the corresponding button was depressed. Viewing of more than one alternative simultaneously with the standard was not possible.

An Apple IIe computer, equipped with a Mountain Hardware real-time clock and a CCS model 7720A parallel interface, was used to record the frequency, duration, and sequencing of the subjects' button presses. The experimenter controlled the beginning and end of each trial by switching on and off a light allowing the standard stimulus to come into focus.

Procedure

Subjects were asked to participate in a study on the influence of personality on a matching-to-sample task. They were told about the study approximately one week in advance of being tested, and confidentiality, as well as their right to withdraw from the study at any time, was assured. In addition, control subjects were given a letter for their parents describing the study, and a consent form to sign, allowing their daughter to participate.

Each subject was tested individually by the experimenter. The test session began with the subject reading a description of the study, the experimenter answering any questions that were presented, and the subject signing a consent form. Next, the

Quick Test was administered. Subjects were then asked to complete the Delinquency Check List, and the Monotony Avoidance and Impulsiveness scales.

Upon completion of these questionnaires, subjects were administered the child's form of the MFF. The use of a repeated measures design poses potential practice effect problems. However the design of this study did not permit the employment of counterbalancing procedures due to the import of order of administration. Should the self-verbalization condition be administered first it would contaminate efforts to obtain a spontaneous, unsolicited sample of scanning behavior; subjects would be provided with a strategy via the experimenter's modeling. The children's version of the MFF test was utilised as an alternative method to minimize the influence of any potential practice effects. It was believed that after the completion of the 12 trials, practice effects would plateau and their impact upon any further test items would be negligible. The practice items also provided subjects the opportunity to become acquainted with the task and the equipment. Subjects were told that they were going to play a matching picture game. They were shown how to bring pictures into focus by pressing the appropriate buttons and attention was called to the fact that it was possible to view only one variant at a time.

After completing the 12 practice trials, the 6 odd-numbered items from the adult version of the MFF test were administered in the same manner. Finally, subjects' completed the 6

even-numbered items. In this phase of the experiment however, subjects were instructed to describe their thought processes aloud as they performed the task. To facilitate the procedural transition and ensure that each subject understood the new task requirements, the experimenter modeled a set of verbalizations characteristic of each of the reflective and impulsive strategies (Drake, 1970; Siegelman, 1969) by performing two practice items. The intention here was not to teach the subject a cognitive strategy, but merely to provide a cue for the employment of an existing capacity. However, the potential influence of modeling effects might alter the cognitive stategies typically employed by subjects. In the majority of studies which have examined the effects of modeled cognitive strategies on the control of impulsivity, modeling of reflective strategies did not decrease impulsive responding (Bender, 1976; Debus, 1970; Denney, 1972; Ridberg et al., 1972). This was found despite extensive exposure to the modeling influence. In contrast, Cohen and Przybycien (1974) and Kagen (1976) have reported that observation of reflective models by impulsive children both increases latencies and reduces errors in perceptual tasks such as the MFF. The results point to a limited effect of modeling on the cognitive strategies employed by subjects. Therefore it seems unlikely that the modeling of two practice trials in this experiment would significantly effect the behavior of subjects. Despite this, the prudent course of employing dual modeling stategies was adopted to ensure that subjects' cognitive strategies remained unbiased. A

counter-balancing procedure was employed so that the effects of the latter modeled verbalization did not persist in later trials.

The following is a script of the experimenter's modeled verbalizations demonstrating the reflective strategy:

"I'm to find the picture that matches this one on top. Now, is this one different? Yes, the front of the boat is rounded. Good, I can eliminate this one. Now lets look at this one. The shape is the same, the anchor is the same. I think it is this one, but let me first check the others. This one has square smoke stacks, and they are too tall on this one. The anchor is in the wrong position on this one, it should be at the front of the boat. This one's mast is bent. Okay, the others are all different. I think it is this one."

The passage demonstrates a strategy to search for differences that allow the successive elimination of incorrect variants. The experimenter modeled verbal statements to conduct detailed comparisons across figures, looking at all variants before offering an answer.

In contrast, the set of verbalizations characteristic of the impulsive strategy demonstrates a brief, undetailed examination of the alternatives, choosing the variant which appears to correspond without considering all possible choices. The script employed follows:

"Okay, I'm to find the picture that matches this one on top. Now, is this one different? Yes, his belt is hanging downward, and on this one the buckle isn't the same. This buckle is alright but his hat is too small. The hat is alright, the belt is also. This fourth one looks right; I can't see a difference. It is this one."

In addition to the phrasing employed, the two sets of modeled verbalizations differed in the time the experimenter spent examining each variant (aproximately 8 to 10 seconds in the case of the reflective stategy, and no more than 5 seconds during the impulsive passage). This was intended to mirror the differential latencies on the MFF traditionally produced by the respective cognitive styles.

RESULTS

Each subject's total score on the Delinquency Check List was examined in order to confirm the nondelinquent status of the control group. An analysis of variance between the two groups' scores was significant ($F = 55.70$, $p < .0001$), with only one control subject's score coming within one standard deviation of the mean of the delinquent group. A boxplot of the data indicated that this subject was an outlier, resulting in the exclusion of this subject's data in subsequent analyses of experimental versus control group differences.

Separate one-way analyses of variance were conducted for the pencil-and-paper measures of impulsivity and monotony avoidance. No significant group difference was found for impulsivity. The lack of significant differences was confirmed when behavioral indices of impulsivity, errors and response latencies on the MFFT, were examined. The group means are depicted in Table 1. Monotony avoidance, however, was significantly greater in the delinquent group compared to controls ($F = 5.46$, $p < .02$).

To establish that the two groups did not differ on the demographic variables of age, socioeconomic status, and intelligence, one-way analyses of variance were conducted. The means for these variables are presented in Table 2. Although the variables of socioeconomic status and intelligence were not significantly different, the analysis revealed a significant difference between the delinquent and control groups for age.

Table 1.

Mean group differences on impulsivity measures.

	Delinquents	Controls
Impulsivity Scale		
Mean	27.238	25.545
SD	3.780	3.826
Errors on the children's version of the MFFT		
Mean	3.857	4.682
SD	3.941	3.123
Errors on the adult version of the MFFT		
Mean	10.381	9.091
SD	7.046	5.450
Response latencies on children's version of the MFFT		
Mean	28.834	23.803
SD	10.578	9.368
Response latencies on the adult version of the MFFT		
Mean	59.579	53.306
SD	29.756	23.875

Table 2.

Mean scores on demographic variables.

	Delinquents	Controls
Age		
Mean	15.762	16.864
SD	1.221	.839
Socioeconomic Status		
Mean	2.143	2.136
SD	.655	.468
IQ		
Mean	87.524	91.318
SD	13.706	10.101

Control subjects were, on average, older than those from the experimental group. Due to the reports of a moderate correlation between age and impulsivity in the literature, an analysis of covariance was performed, using age as the covariate, to reassess group differences on the questionnaire measures of impulsivity and monotony avoidance. Age was not found to exhibit an effect. As was revealed in the original analysis of variance, the groups differed with respect to monotony avoidance, and no significant difference was found for impulsivity. Therefore, controlling for the effect of age in subsequent analyses was not deemed necessary.

Further analyses, examining the MFFT data, collapsed the delinquent and control groups, and were based upon a median split of subjects on the impulsivity measure. In this way, the hypothesis that impulsive adolescents, whether delinquent or not, would differ from their reflective counterparts, was examined. Fisher's Exact test (2-tail) revealed no significant difference in the proportion of subjects in each subject group who were either reflective or impulsive as measured by both the Impulsiveness Scale, and MFFT response latencies and errors. The results of subsequent analyses can, therefore, be attributed to impulsive-reflective differences, and not to delinquency.

Although only one rater performed the blind coding of subjects' verbalizations that are being reported, the audiotaped data from 15 randomly selected subjects was recoded by a second independent rater. The judgements of the raters were highly

concordant. Inter-rater reliability coefficients for the six verbalized trials were .99, .97, .98, .99, .99, and .99. The correlation over all trials was .99. Because quantity, as well as directionality, was important, a comparison of the mean ratings of raters one and two was undertaken. Visual inspection of the means revealed only slight discrepancies (see Table 3). Analyses of variance testing the significance of the differences was not significant. The two raters not only rated in the same direction, but also at the same level.

A one-way analysis of variance was conducted on the total-on-task verbalization scores. The other verbal codes were omitted from the analysis due to their low frequency of occurence. Results indicated a nonsignificant difference between low and high impulsive groups. However, when the effect of verbalization on the number of MFFT errors was examined, using a two-way analysis of variance with repeated measures, there was a significant interaction effect ($F = 5.33$, $p < .0001$). Verbalization reduced the number of errors that were made. To examine this interaction in more detail, planned comparisons of within group differences between verbalized and nonverbalized trials were analyzed by tests of simple main effects. Verbalization significantly reduced the number of MFFT errors for both low and high impulsive subjects. The results are depicted in Figure 1.

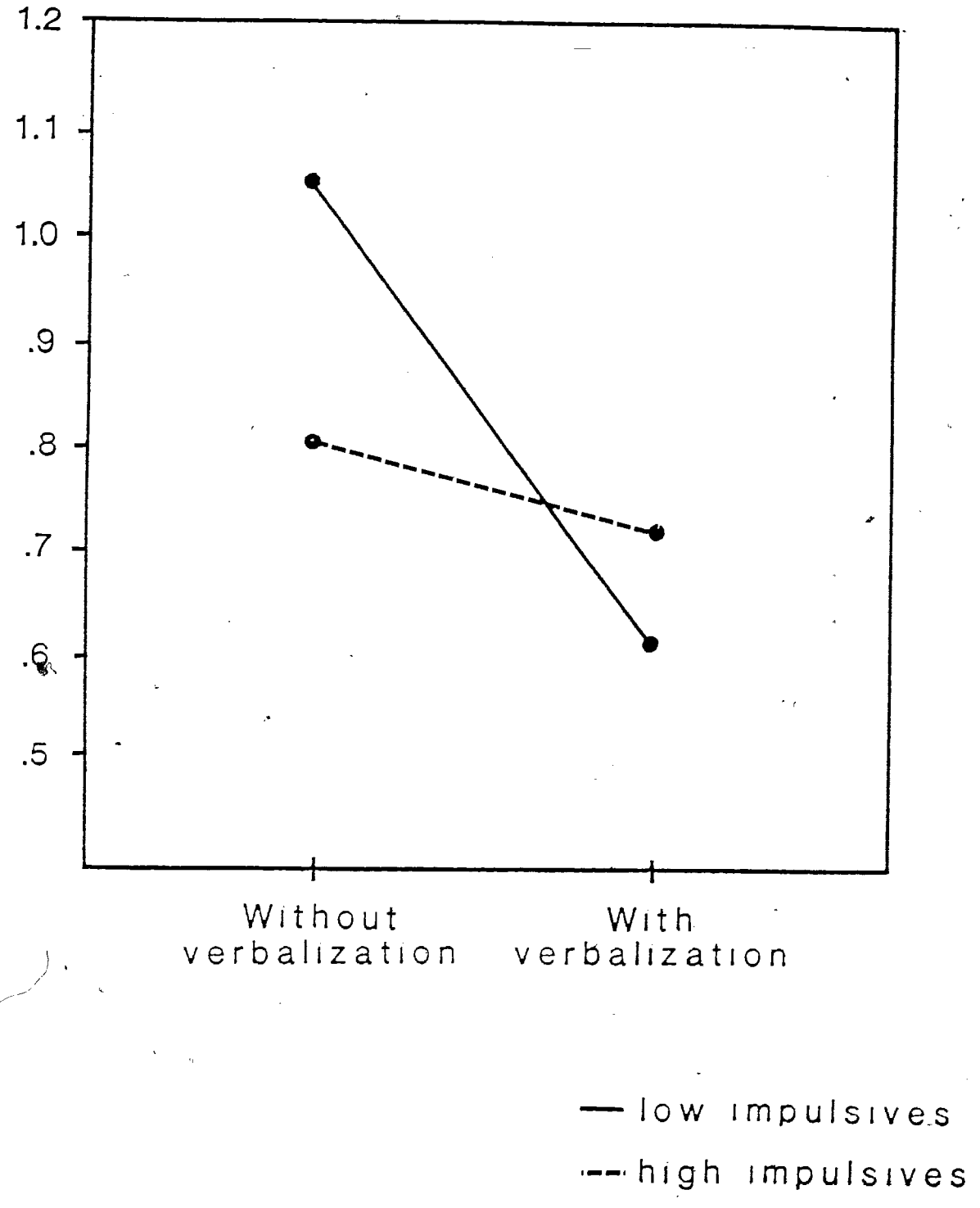
Low and high impulsive groups were compared further using one-way analyses of variance with repeated measures (over

Table 3.

Mean total-on-task verbalization scores generated by two independent raters

TRIAL	RATER 1	RATER 2
1	10.400	10.533
2	9.087	9.200
3	8.200	8.000
4	13.733	13.133
5	8.733	8.933
6	10.333	10.067

Figure 1. Mean number of errors on the MFFT



trials). These groups did not differ significantly on the number of alternatives scanned, and the average duration of time spent scanning each alternative. There was a tendency, however, toward impulsive subjects scanning fewer alternatives, each for a longer period of time.

Performance on trials when subjects were required to verbalize their thoughts aloud was compared with that on the six trials of the adult version of the MFFT employing the standard administration. A 2x2 analysis of variance with repeated measures, although not statistically significant, pointed to an increase in the number of alternatives scanned during the verbalized trials. Therefore, further analyses using tests of simple effects were carried out. The number of alternatives scanned increased on verbalized trials for low impulsive subjects, with this difference approaching significance ($p < .08$). High impulsive subjects did not appear to benefit from verbalization on this dependent measure.

In order to compare the verbalized and nonverbalized trials on the time spent scanning each alternative, the data were converted into proportions of total trial time. This corrected for the longer period of observation as a consequence of the time required to verbalize thoughts. The proportions of viewing time spent on alternatives for verbalized and nonverbalized trials were then subject to a 2x2 analysis of variance with repeated measures. The results indicated nonsignificant effects for groups, for trials, and for the groups x trials interaction.

The sequence of exploration of the MFFT stimuli were coded as sequential, mixed (or partially sequential), and random. A list of the criteria used to classify the scanning patterns is presented in Appendix B. A reliability check on the accuracy of coding was performed by an independent rater who coded the scanning patterns of 15 subjects' data. The judgements of the two raters were highly concordant; perfect agreement was obtained for 10 of 24 trials, with kappa statistics ranging from .63 to .86 on the remaining 14.

An analysis of variance with repeated measures was conducted comparing the low and high impulsive groups' scanning behavior. Results indicated a significant difference between groups ($F = 4.91$, $p < .05$) when the twelve trials of the child version of the MFFT were examined. The sequence of exploration of the stimuli was significantly more random, and less systematic, for high impulsive subjects. The results pointed in the same direction for the first six trials of the adult version, but were not statistically significant.

The effect of requiring subjects to verbalize their thoughts, on scanning behavior, was assessed by comparing it to behavior on nonverbalized trials. A 2x2 analysis of variance with repeated measures on this data revealed a nonsignificant interaction when verbalized versus nonverbalized trials were examined. However, the results point toward a tendency for verbalization to have a positive effect, resulting in a movement toward a sequential response pattern. Further analysis, using

tests of simple effects, elicited a significant difference for the low impulsive group. These subjects demonstrated an increase in systematic scanning with verbalization. Verbalization did not significantly effect the high impulsive group's scanning pattern.

As a consequence of the scoring requirement that a minimum of four button presses be made in order to code the scanning pattern, there was missing data for some of the more impulsive subjects' trials. The repeated measures analyses omitted subjects who did not have complete data. The results may have been attenuated as a consequence. To correct for this, the average scanning pattern was computed for each subject, and a one-way analysis of variance conducted. Again, a significant between groups difference ($F = 11.56$, $p < .001$) was obtained for the 12 practice trials of the MFFT. The scanning pattern on subsequent trials failed to demonstrate this difference. When the verbalized and nonverbalized trials were compared, the scanning patterns were not found to differ. The hypothesis that verbalization would produce beneficial results, in this case an increase in systematic scanning, was not confirmed.

The model proposed by Salkind and Wright (1977) was employed to obtain a behavioral measure of impulsivity for the 12 practice trials of the MFFT. An impulsivity score was generated from raw latency and error scores by the following formula:

$$I_i = z_{ei} - z_{li}$$

where I_i = impulsivity for the ith individual; z_{ei} = a standard score for the ith individual's total errors, and z_{li} = a standard score for the ith individual's mean latency. Large positive I scores are indicative of impulsivity, and large negative I scores indicate reflectivity.

The correlation between the questionnaire measure of impulsivity and this behavioral measure was -.15 (see table 4). There was virtually no relationship between the two measures of impulsivity. Bentler and McClain (1976) obtained similar results, and concluded that this demonstrated a lack of meaningfulness for the self-report measure of impulsivity that they used, since the behavioral measure perfectly discriminated impulsive from reflective children. Although no such measure of construct validity was available in this study, a decision to analyze the data from the adult version of the MFFT, using behavioral impulsivity as the grouping variable, was made post hoc. The results mirrored those obtained when a median split on Schalling's Impulsiveness Scale was used to classify subjects.

The significant difference between the delinquent and control groups on the monotony avoidance measure led to the hypothesis that individuals who scored high on monotony avoidance would make more shifts in scanning patterns throughout the 24 trials as they became bored with the task. These shifts would represent an attempt to seek stimulation and monotony avoidance. The number of shifts from one sequential strategy to another, and from a sequential to a less sequential (code 2 or

Table 4.

Correlations between questionnaire and MFFT measures of impulsivity.

	Impulsiveness Scale
Mean Latencies	.1021
Number of Errors	-.1514
Composite Score	-.1483

(Salkind & Wright, 1977)

3) strategy, were coded. The data were then subject to a one-way analysis of variance comparing low and high monotony avoiders. No significant difference was observed.

The analyses on scanning behavior which had been conducted for the low and high impulsive groups also were replicated using monotony avoidance as the grouping variable. Results of the analyses of variance approached significance ($F = 3.75$, $p < .06$) only when the verbalized trials were examined. The pattern of results suggest that, for these trials, individuals who scored high on monotony avoidance explored the alternatives in a more random manner than those who scored low on the scale. Whether this effect is due to verbalization, or is a consequence of boredom generated as a function of having completed 18 trials up to this point, remains unanswered.

DISCUSSION

The hypothesis that female delinquents are more impulsive than a group of nondelinquent female adolescents was not supported. Both questionnaire and behavioral indices (latencies and errors on the MFFT) failed to distinguish the experimental and control groups. This is clearly discrepant with the reports in the literature of a relationship between impulsivity and delinquency in male subjects. Barratt and Patton's (1983) factor analysis of selected personality questionnaires provides a bases for explaining this discrepancy. The factor analysis for male medical students indicated that impulsivity, anxiety, and socialization are orthogonal factors. For female medical students, on the other hand, anxiety was defined as a separate factor, but impulsivity and socialization were a combined factor. The differences in male and female factor profiles may indicate a sex difference in the influence of impulsivity in everyday life. The presence of an impulsive cognitive style in females may be beneficial, allowing for greater prosocial behavior. In males, however, a positive effect may not become manifest. Consistent with this are reports by Eysenck and Eysenck (1977) of higher correlations between their impulsive and sociability scores for women than for men.

The results raise a question as to the relevance of correctional programs and services that have been employed with females in recent years. Traditionally, programs proven

effective with male offenders have been adopted in female correctional institutions. Berzins and Cooper (1982) describe the situation with disdain:

> "... their [female offenders] needs have never been documented. Their facilities and programs have not been designed for them. It has been assumed that a smaller-scale version of what was available for men would suit them, and, when that smaller version proved to be uneconomical, even that was no longer considered."(pg. 405)

Certainly, this study suggests that, within the cognitive model of crime and delinquency, the application of techniques, such as self-instructional training, designed to reduce impulsivity in the offender population are not appropriate for females. It is important to note, however, that the cognitive model of offender rehabilitation does not assume that all youngsters categorized as delinquents are deficient in particular cognitive skills. Self-instructional training, with its emphasis on the development of self-control, is recommended for the treatment of certain delinquents, those with a high degree of impulsivity, not delinquency. Although the results of this study were not supportive of the use of self-instructional training on a large scale with female offenders, the approach may be of value with subsets of this delinquent population. Heilbrun (1982) found greater impulsiveness in only those female offenders who committed crimes involving physical violence. The type of offense, therefore, may be useful in classifying female delinquents who could potentially benefit from self-instructional training.

Impulsive children have been found to display specific search and scan deficits. These are postulated to be a source of their poor performance on match-to-sample tasks, and may be regarded as an indirect measure of the spontaneous employment of self-control mechanisms. Therefore, it was hypothesized that individuals lacking in self-control (i.e. impulsives) would exhibit search and scan deficits. In contrast to reports in the literature, this was not confirmed. This study failed to find differences between low and high impulsive subjects for the variables of number of alternatives scanned, and the average duration spent scanning each alternative. The results pointed to a tendency for impulsive subjects to scan fewer alternatives. This is consistent with the search and scan strategies observed by Siegelman (1969), Drake (1970), and Ault et al. (1972). However, the tendency in this study for these subjects to scan each alternative for a longer period of time, compared to more reflective individuals, is not substantiated by other reports. Characteristics of the apparatus employed and the subject sample may help to explain the lack of significant results.

The apparatus employed in this study to examine search and scan strategies obtained dependent measures in a markedly different manner from Drake (1970) and Ault et al.'s (1972) use of recorded eye movements and the number of eye fixations. When a subject has to push a button in order to see a figure, she may feel that it is more feasible to scan a greater area of a single figure at any one time than would be the case under free

viewing. The button-pressing apparatus would therefore tend to slow down shifts of visual regard from one figure to another. It may be that it does not always slow down shifting in a way that is proportional to the free viewing encountered in the eye movement studies.

The use of older subjects in this study, in contrast to the traditional use of children, may also have had an impact on the results. Adolescents may possess, and employ, efficient search and scan strategies, irrespective of cognitive style. A study by Drake (1970) lends credence to this supposition. When reflectives and impulsives were studied cross-sectionally at two different ages - children versus adults - the scanning differences between younger and older subjects resembled the differences between impulsives and reflectives. Furthermore, although reflective children and impulsive adults differed, because of age, in the efficiency, speed, and detail with which perceptual acts were executed, these two groups of subjects were alike in some qualitative aspects of task strategy. Reflective adults approached the task in a similar manner, but they were more efficient at doing so. These findings suggest that impulsive-reflective differences in search and scan strategies, if they exist, may vary with the age of the subject.

The finding that the scanning strategies of impulsives are less systematic than those of reflectives has been alluded to in the literature. However, a systematic strategy has been defined as a greater number of comparisons of each alternative with the

standard, before progressing to the next alternative. In contrast, this study measured systematicity in terms of the progression through a series of alternatives in a sequential fashion. The significant between group difference on this measure, to the exclusion of differences on other more traditional ones, suggests that this may be a useful variable to study in subsequent research with different age groups.

Impulsive adolescents in this study were no worse than their reflective counterparts in their ability to produce relevant, on-task verbalizations. Notwithstanding, similar verbalizations appear to have a differential effect on the performance of low and high impulsive groups. Verbalization reduced the number of MFFT errors for all subjects. However, an increase in the number of alternatives scanned and a movement toward a more systematic, less random, scanning pattern, occured only in low impulsives. This finding was unexpected and is difficult to explain. Vygotsky's (1962) suggestion that once verbalization goes "underground" it is best to leave it there as it will interfere with performance if uncovered, is at odds with the results. It leads to the prediction that low impulsive subjects, for whom effective covert mediation strategies are in place, would demonstrate poorer performance, not superior, on verbalized trials. Klein (1963) and Kendler et al. (1966) have confirmed this prediction.

It appears that despite the production of the potential verbal mediators at the appropriate point in the task situation,

these verbalizations, for one reason or another, fail to have their expected mediational effects on overt behavior for high impulsive subjects. Their operant verbalizations seem to be deficient in mediational power. A plausible explanation may be that all adolescents, as a consequence of their developmental level, possess verbal mediation strategies, but that the quality of these differ for low and high impulsives. The employment of any strategy may result in improvements on global measures such as MFFT errors, but that in order for beneficial effects, on more subtle measures of search and scan strategies, to be observed, a certain quality of verbalization must be present. Low impulsive subjects may have in their possession this type of verbal mediation. This explanation appears plausible in light of the research findings contrasting the efficacy of concrete versus conceptual self-instructions. The relative superiority of the conceptual approach has been demonstrated by Kendall and Wilcox (1980), and Cohen and Myers (1984), suggesting that the qualitative composition of verbal mediation strategies is important. An assessment of between group differences in the quality of verbal self-instructions was not undertaken in this study. Such an analysis is suggested for future research with this age group.

The delinquent and control groups in this study were found to differ significantly on a questionnaire measure of monotony avoidance. This finding is consistent with research on sensation seeking. Farley and Farley (1972) have documented behavioral

differences among groups of incarcerated female delinquents that seem to be related to the sensation seeking motive. High scorers on the Sensation-Seeking Scale made more escape attempts, were punished more often for disobeying supervisors, and engaged in fighting more than low scorers. The authors suggest that these delinquent behaviors represent an attempt to provide temporary stimulation and arousal in an environment of low stimulus variability (i.e. monotony avoidance).

Zuckerman et al. (1972) found all of the subscales of the Sensation-Seeking Scale to correlate with the psychopathic deviate (Pd) scale of the MMPI in females. However, significant correlations with the Pd scale, in males, were obtained for only those sensation-seeking scales containing items reflecting impulsivity and nonconformity. Thorne (1971) found female delinquents to score significantly higher than mentally ill female patients on sensation seeking. The level of sensation seeking in male patients and male delinquents, on the other hand, did not differ. This, together with the MMPI results, suggests that sensation-seeking is more likely associated with delinquency and psychopathy in females than in males. It is likely that the environment influences the means by which sensation-seeking is redressed. Delinquents, particularly females, often come from an environment where socially acceptable modes of arousal seeking are limited and antisocial modes are abundant (Sarason, 1978). Therefore, the channeling of sensation-seeking into more socially acceptable behavior may

facilitate treatment.

Self-instructional training is directed toward the remediation of deficient verbal mediation strategies in impulsive individuals. Analyses of the search and scan strategies of impulsive adolescents revealed that although mediational strategies are present, they may be deficient in their capacity to direct behavior. There was little evidence of a production deficiency in which impulsive individuals fail to deploy self-directing behaviors that exist in their repertoires. The results suggest that training in appropriate search and scan behavior, along the lines of that conducted by Zelniker et al. (1972) and Egeland (1974), along with an emphasis on the quality of verbalization, may have potential for therapeutic programming.

A replication of the current study with male delinquents is warranted. Although the results suggest that the female offender profile may not include impulsivity, and therefore is qualitatively different from that of the male, the questionnaire measures and apparatus used differs from that employed in the literature with males. A more powerful affirmation of the sex difference could be made if, upon replication, male delinquents were found to be significantly more impulsive than controls.

The developmental course of impulsivity, from hyperactivity in children to delinquency in adolescence, is only now beginning to be understood. Outcome research on males has suggested that

there is a developmental association between the two disorders. However, little is even known about impulsivity in female children, let alone its manifestation in adulthood. There is no evidence, to date, of a developmental progression in females, where deficient impulse control in ADHD children continues into adolescence and adulthood manifest as antisocial behavior. Neither follow-back nor prospective studies have been done with a female subject population. Research of this nature is warranted.

As well, future studies should be directed toward the exploration of variables that may moderate treatment effects. Age, sex, and cognitive skills and strategies are only a few such variables. The results of the current study point to the existence of verbal mediation strategies in impulsive adolescents, in contrast to the lack thereof in impulsive children. The deficit appears to be in the capacity of verbalizations to control behavior. The discrepancy in the findings among the two age groups illustrates the necessity of taking developmental status into account when designing cognitive interventions.

APPENDIX A

Audiotaped verbal behavior was categorized by a trained coder into six verbal codes as follows:

Task-Related Questions. This code included all those inquires made by subjects that were related to the task itself. Both direct questions and questions determined by an inflection of the voice were included.

Statements of Task Difficulty. Verbalizations regarding the level of difficulty (e.g., "This is easy", "I can't. They are all the same.") were coded in this category. This code included both direct statements of difficulty and verbalizations such as "Oh man, Phew!" which, in the testing context, were exclamations of task difficulty.

Thinking Out Loud. This category included such verbalizations as naming the parts of the figures in the task, noting small differences or similarities in the figures, and stating the adoption of a task strategy (e.g., Humh, I better look at all of them").

Verbalizing the answer. This code included statements such as "It's this one," "Right here," or "Is it this one here?".

Off Task. Any verbal behavior that occured during the task but that did not pertain directly to the matching task was coded in this category.

Total On-Task Verbalizations. This code represents a total of the other codes except off task.

APPENDIX B

The scanning patterns of subjects were categorized by a trained rater into three codes. Only those trials for which a minimum of four button presses were made were coded. The criteria for each of the three strategies appear below:

1. Systematic: A sequential pattern of eight consecutive button presses. Movement through the two rows of buttons in a systematic fashion could be achieved in several ways:

a) A left to right strategy employed on each of the two rows, regardless of the row that the subject started on. (e.g. buttons 1...4, 5...8).

b) Movement from right to left through the two rows, regardless of the commencement point (e.g. buttons 8...5, 4...1).

c) Scanning from right to left on one row, and left to right on another (e.g. buttons 1...4,8...5).

d) Use of an up and down strategy, or the reverse (e.g. buttons 1,5,2,6,3,7,4,8).

e) An up, down, and over strategy employed throughout (e.g. buttons 1,5,6,2,3,7,8,4).

2. Mixed: Systematic sequencing of at least three button presses with a break in this patterning occuring during the first eight presses. Potential "breaks" include skipping a button, going back to a previously viewed button, and changing from one systematic scanning strategy to another.

3. Random: No sequence of three button presses in a systematic fashion present when the first eight presses were examined.

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