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ABSTRACT

The present report covers five studies conducted on the development of impulse control and its role in the academic achievement of lower socioeconomic status (SES) children. The studies were performed on nursery school children and first graders. Results suggested that there are several different types of impulsivity, and that only one of these is related to academic achievement. In general, the research findings from the project show that lower SES children develop verbal control over impulsive behavior more slowly than middle SES children. Furthermore, it was found that lack of impulse control was significantly related to poor academic achievement in the lower SES first graders, even though IQ was controlled. Finally, an attempt was made to train lower SES children in techniques that would lead to increased verbal control over their impulsive behavior. The training techniques developed in this research were found to lead to greater impulse control on specially devised experimental tasks. However, the data were not clear on whether these improvements in impulse control resulted in better academic achievement. Further research is needed on this topic. (Author/SE)

FINAL REPORT

National Institute of Education Project No. 0-0808

VERBAL CONTROL OF IMPULSIVE BEHAVIOR IN THE CLASSROOM

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Abstract

The present report covers five studies that were conducted on the development of impulse control in lower SES children, and the role of impulse control in the academic achievement of such children. These studies were supported by National Institute of Education Project No. 0-0808.

In general, the research findings from this project show that lower SES children develop verbal control over impulsive behavior more slowly than middle SES children. Further, we found that lack of impulse control was significantly related to poor academic achievement in the lower SES first graders. This was true even when IQ was controlled.

Finally, an attempt was made to train lower SES children in techniques that would lead to increased verbal control over their impulsive behavior. The training techniques developed in this program of research were found to lead to greater impulse control on specially devised experimental tasks. However, the data were not clear on whether these improvements in impulse control resulted in better academic achievement. Further research is needed on this topic.

More specifically, the results found in each of the five studies can be summarized as follows.

STUDIES 1 and 2. These studies involved factor analyses of various types of impulsivity measures and also included measures of IQ and of academic achievement. Analyses were performed for nursery school children and for first graders; at each age level the data for lower- and middle-SES children were analyzed separately.

Results suggested that there are several different types of impulsivity, and that only one of these is related to academic achievement. One type of measure of impulsivity (the Kagan MFF) indicates the tendency of children to respond hastily on difficult problems. A second measure is the teachers' ratings of the extent to which the children engage in activity like speaking-out without being called on, etc. The

third measure indicates the tendency of children to continue making some type of ongoing response, even when verbally instructed that under certain circumstances this response is to be inhibited; this task (taken from Luria) is one involving simple problems where there is no question that the children understand the task requirements and are capable of making the relevant responses. It is only the Luria task that is related to academic achievement in lower SES first graders. It should be noted that by first grade middle SES children no longer display this type of impulsive behavior in a systematic fashion.

STUDY 3. This study examined more closely classroom impulsivity in lower SES children. The primary behaviors examined were speaking-out without permission and standing-up and walking around without permission. In contrast to studies 1 and 2, this study involved behavior observations of such impulsivity rather than teachers' ratings. The data were consistent with those of the first two studies in indicating that this type of impulsivity is not related to poor academic achievement. In fact, the opposite relationship was often observed with better students often showing this type of behavior.

STUDIES 4 and 5. These studies were concerned with the development of training techniques which, it was hoped, would reduce impulsive behavior of the sort measured by the Luria tests, and with relating the results of these techniques vis a vis academic achievement of the trained children.

The results indicated significant effects of these training techniques on error scores on Kagan's MFF test of impulsivity, and also on the Porteus Maze test, a test which is considered to be highly sensitive to impulsive tendencies and which is also related to IQ performance.

The training techniques also led to trends toward superior academic achievement; however, these trends did not reach statistical significance.

It was concluded that the major contribution of studies 4 and 5 was in the development of training techniques and materials. Future studies should shed more

light on the effectiveness of these techniques for improving scholastic performance of impulsive children.

Studies 1 and 2

FACTORS IN THE VERBAL CONTROL OF BEHAVIOR BY LOWER AND MIDDLE SES CHILDREN

The problem of impulse control has been stressed in a number of intervention programs (see e.g. Klaus and Gray, 1968; Hertiz, Birch, Thomas and Mendez, 1968; Hooper and Marshall, 1968). On the other hand there is little systematic evidence indicating that children from lower socioeconomic status (SES) backgrounds are particularly prone towards impulsive behavior. Nor is there clear evidence that such a control problem contributes to lower SES childrens difficulties in the classroom. Luria's research (1961, 1965) on the verbal regulation of behavior provides a systematic conceptualization of the role that impulsive behavior plays in the development of the child, and in so doing provides a useful framework from which the problem of lower SES impulsivity may be viewed.

Luria (1961) makes a critical postulation with regard to the development of an individual's ability to control his own behavior in accordance with some understood verbalization. He maintains that there is a fundamental distinction between the processes basic to the management of the inhibition and initiation of responses. In a series of investigations involving a standard task in which the child was instructed to respond by squeezing (or refraining from squeezing) a rubber bulb in accordance with the onset of either of the two different stimulus lights, Luria obtained

results which appeared to support his position. Children between 2 and 5 years of age had consistently greater difficulties in withholding the bulb pressing response when this response was inappropriate (thus producing impulsive errors), than in initiating this response when it was appropriate. Replication of these demonstrations has been attempted by Miller, Shelton, and Flavell (1970), and Jarvis (1968). The children in these studies also appeared to have had the greatest difficulty when instructed to withhold their responses to the light signifying "Don't Press." Miller et. al. and Jarvis did not evaluate this difference statistically.

Luria proposed that this acquisition of impulse control is based on the fact that the child no longer responds to the initial instructions just in terms of their physical, stimulus nature. Rather, the older child is able to respond to the semantic intent of the instructions. He is therefore capable of appropriate behavior to the stimuli signifying "Don't Press." There appears to be support for this interpretation in the psycholinguistic literature. McNeill (1970) cited evidence which indicated early development is a period in which children often respond to verbalizations as though they were "occasions for action." This, McNeill stated, leads to difficulties in withholding responses.

Clearly, then, there is a great deal of evidence which suggests that children gain control over the ability to initiate behavior at an earlier age than that required for the control over the ability to inhibit behavior. On the other hand, this difference in the age at which control is attained for the two types of activities does not permit the generalization that initiation and inhibition of behavior involve different mechanisms. Both might involve the same basic processes, but the verbal discriminations involved in inhibitory behavior might simply be somewhat more difficult

for the child.

What type of evidence would be relevant to Luria's assumption that the ability to follow verbal instructions involves different processes when the instructions demand initiation of a response as opposed to when they demand its inhibition? One type of evidence would involve examination of individual differences in performance. Using this procedure, one might then determine whether initiatory and inhibitory behavior correlate together so highly that they appear to constitute a single factor of behavior, and thus stem from a single underlying process. On the other hand, it might be found that various conditions of initiatory behavior prove to be intercorrelated, and various conditions of inhibitory behavior also prove to be intercorrelated, but initiatory and inhibitory behavior are unrelated. In the latter case, the two independent factors would suggest that Luria is correct and different underlying processes are at work for the two types of behavior. In short, factor analysis would assist as in determining the number of basic processes involved in the verbal control of behavior.

If a basic distinction between initiatory and inhibitory tendencies can be shown, it would become realistic to investigate a second issue: The relationship between socioeconomic status (SES) and the development of verbal control over impulsive behavior. Evidence has indicated that lower SES children experience relatively great difficulties in language proficiency (Bernstein, 1962; Hess and Shipman, 1965), in communication abilities (Krauss and Rotter, 1968) and in verbal ability (John and Goldstein, 1967; Deutsch, 1968). The particular question remains, however, as to whether these difficulties are related to difficulties in the verbal control of behavior.

The third issue to be examined is the generality of an impulsive

disposition. It is important to know whether impulsive behavior reflected on the Luria task is correlated with impulsive behavior in the classroom and on other tests of impulsivity such as Kagan's (1964, 1965a, 1965b) Matching Familiar Figures test (MFF).

The fourth and final question involves a practical issue: Are problems in impulse control related to difficulties in the child's ability to profit from his classroom experience, or is impulsive behavior something that may irritate a teacher but does not necessarily lead to poorer grades and achievement? If impulsive behavior and classroom grades are, in fact, related, it is imperative to know if this relationship is independent of the child's IQ. There is evidence that some forms of behavior which have been described as impulsive do relate significantly with IQ (Maccoby, Dowley, Hagen, and Degerman 1965; Massari, Hayweiser and Meyer, 1969).

The present paper reports the results of two related studies. The primary purpose of the first study (involving both nursery and first grade Ss) was to determine what evidence there is of two distinct processes basic to the control over the initiation and inhibition of inappropriate behavior on the Luria task. In the second study the focus of interest was in the relationship between impulsive behavior and the child's success with the academic work presented in the first grade. Other than the fact that the interstimulus interval in the Luria task was shortened to increase the difficulty level to one more appropriate for the first graders, the inclusion of indices of school learning constituted the only departure from the procedure used in the first study. Hence the results of study 2 permits an important check on the reliability of the initial findings.

METHOD

Subjects

The Ss were 165 nursery school and first grade children drawn from Detroit and suburban area schools. In study 1, within the nursery school level, 15 white middle SES Ss were drawn from a suburban nursery while 18 black lower SES Ss were drawn from an inner city nursery. In the middle SES, 11 Ss were male and 4 female; while in the lower SES, 10 were male and 8 were female. At the first grade level all 45 Ss (23 middle and 22 lower SES black children) were drawn from the same four classrooms, in three schools which bordered the Detroit inner city. In the middle SES, 15 Ss were male and 8 female; while in the lower SES 11 were male and 11 were female. The split between SES classifications of these first grade Ss was made on the basis of their parents level of income (above or below $8,000) and their occupation (white or blue collar worker).

In study 2 the first grade sample included 45 white middle SES Ss from a school located in a middle SES suburb of Detroit, while 42 black lower SES Ss were drawn from a Detroit inner city school. In the middle SES, 24 Ss were male and 21 female; while in the lower SES 21 were male and 21 female.

Materials

The materials included in both phases of the experiment included:

Luria double light task. The display consisted of a blue and green 7.5 watt light bulb mounted in the position of the eyes of a clown whose face was painted on a white circular piece of plywood, 19 inches in diameter. A response button, requiring 1/4 of an inch depression for contact, served as the clown's nose. Controls for the stimuli were separate from the apparatus, enabling E to sit some distance from S during experimentation.

Housed on the same unit as the controls was a four-pen Rustrac even recorder permitting permanent recording of the Ss responses.

Peabody Picture Vocabulary Test (PPVT). The PPVT, consisting of a series of plates representing the vocabulary items on which the S is being tested, was administered as a basis for estimating the child's verbal IQ.

Kagan's Matching Familiar Figures Test (MFF). The younger child's version of the MFF test consists of a series of standard pictures along with four pictures for each standard, three of which are variants of the standard. The S is instructed to pick out from among the variants the picture which is identical to the standard. The time taken to make the first choice and the average number of errors committed on each standard are scored by the E. Kagan et. al. (1964, 1965a, 1965b) holds that individuals who respond relatively quickly on their first choice for each standard and who also tend to have a higher number of errors are more impulsive than those individuals who have slower reaction times and a lower number of errors. With respect to these differences Kagan (1964) has reported that they reflect a more general tendency (cognitive style) for some children to reflect over alternative solution possibilities in situations involving high response uncertainty, in contrast with others for whom there is a tendency to make quick, impulsive responses in these situations.

Teacher questionnaire. This consisted of eight statements which focused on the topic of difficulties in impulse control observed by teachers in their classrooms. Items selected were chosen so as to have maximum face validity. Each of the children tested was rated on the general issue of classroom impulse control by means of their teachers indicating on a six-point scale whether they strongly agreed or strongly disagreed

with the following statements: "(1) This individual has difficulty following instructions; (2) This individual could be considered a behavior problem; (3) This individual has difficulty listening to directions; (4) This individual shows little tolerance for frustrating situations; (5) This individual shows difficulties in self-control; (6) This individual has difficulty completing any task he (or she) starts; (7) This individual has difficulty stopping most kinds of activity when told to do so; (8) This individual has difficulty sitting still most of the time." Individuals obtaining relatively high scores were considered more generally impulsive in the classroom.

In the second study, grades for the first grade Ss were obtained. Teachers were asked to rate the S's schoolwork on a four-point scale: 4--very good; 3--good; 2--fair; 1--poor. It was hoped that a four-point scale would provide enough variance to allow meaningful distinctions between Ss, while on the other hand being similar enough to the teachers' own grading scale to provide a reliable score. Stanford Achievement Scores were also available for the lower SES sample, thus permitting their inclusion in the analysis. The scores of one of the individuals were not available.

Procedure

Each S was tested individually. At the start of the session the children were tested on the PPVT. The PPVT was presented as a "picture game." Since S had no way of knowing for certain whether he was making a mistake (on the PPVT), it was hoped that this test might minimize the child's uneasiness in the experimental situation. Following this, the Luria task was administered. The Luria task was also presented to the child as a game in which E stated that he was going to see whether S could press the

clown's nose when his blue eye lit up, but not press when his green eye lit up. The game was played under the following three conditions: First, a non-verbal condition in which S responded silently. Second, an intervening verbal condition in which S was instructed to verbally accompany his responses to the appropriate lights by saying "press" or "don't press." Following this, a second non-verbal condition was administered in which S was again instructed to respond silently.

In each condition the two stimulus lights were randomly presented in a series of 48 trials. There were 24 trials for each of the lights. In study one each trial consisted of an approximate .5 second presentation of the stimulus followed by an interstimulus interval ranging from 2 to 2.5 seconds. An interval of this length was used in the first study in order to insure that all Ss had enough time to both observe and respond to the stimulus lights. After preliminary instructions were given, E had each S carry out ten practice trials for each condition in order to ascertain whether S understood the task. In the few situations where S could not, preliminary instructions were given again. Following the Luria task, the MFF test was administered to the child, after which the child was informed that there were no more games to be played. Teacher ratings were collected after the administration of the foregoing task.

In the second study, the procedure was the same as that of the first, with the exception of a decreased interstimulus interval. Pilot work with a 1 to 1.5 second interstimulus interval indicated that this produced a more appropriate level of difficulty for the first graders. In addition to teacher ratings of impulsivity, a rating of each S's grade in school was also obtained after completion of testing.

Experimental Analysis

Luria task errors were scored as either one of two distinct types. Omission errors were recorded when the S failed to perform the press response during the trials which began with the onset of the stimulus light signifying "Press," and terminated with the onset of the light signifying the beginning of the next trial. Impulsive errors were recorded when the S failed to withhold the press response during those trials which began with the onset of the light signifying "Don't Press," and terminated with the onset of the light signifying the beginning of the next trial. Therefore, impulsive and omission errors were experimentally independent. There were three conditions in the Luria task: (a) the first non-verbal condition (NV1), (b) the verbal condition (V) in which Ss were instructed to verbalize "press" or "don't press" before making the appropriate motor response, and (c) the second non-verbal condition (NV2). Each of these conditions permitted calculation of both impulsive errors and omission errors.

Correlation matrices, containing Pearson product moment correlations, were generated on the basis of the errors committed on the six observations made on the Luria "Press" and "Don't Press" tasks, along with the other measures included in this study.[1] Factor matrices were derived using the method of principle axis determination, and rotated in accordance with the Varimax criterion. Only those factors having unrotated eigenvalues greater than 1.00 were included in the rotation.

RESULTS

Analyses of Score Means

As has already been pointed out, the issues of major concern in this paper are not readily solvable by analyses of the differences between means of impulsive and omission errors for the various SES and age conditions. However, there are some informative aspects of these data and thus they are presented in Table 1. Let us first consider performance on the Luria

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Insert Table 1 about here

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subtasks. Since the three Luria subtasks that measured impulsive errors often proved to be very highly intercorrelated, as were the three subtasks that measured omission errors, the data for these subtasks were summed to obtain the means presented in Table 1. Note that with the rates of presentation used in the nursery group in study 1 and in the first grade group in study 2, lower SES children made more of both types of errors, on the Luria task, than did the middle SES. In both groups these SES effects were statistically significant, F (1,27) = 5.9, $p < .01$, and F (1,85) = 23.1, $p < .01$, respectively. The lack of such a difference between SES levels on the Luria task for the first graders of study 1 is due to the fact (noted in the procedure section) that the interstimulus interval used in study 1 was relatively long for these older children, and they made very few errors. (It will be seen later that, despite this small number of errors, the factor structure for this group proved to be very similar to that of the first graders of study 2, where a more appropriate interstimulus interval led to a larger number of errors.)

While we see that the lower SES groups make more errors than the

Table 1

Group means on measures included in both studies

GROUPS	Luria Task Errors		MFF		Teacher Ratings	IQ
	Impulsive	Omission	Rt	E		
Nursery:						
Middle SES (N=15)	3.1	3.6	5.04	6.13	1.84	122.4
Lower SES (N=18)	8.4	5.6	5.16	8.55	2.36	86.9
Study 1, First Grade:						
Middle SES (N=23)	0.9	0.9	5.66	1.56	2.64	106.8
Lower SES (N=22)	1.0	1.4	6.04	1.95	3.64	88.1
Study 2, First Grade						
Middle SES (N=45)	1.8	3.9	5.11	1.84	2.21	107.3
Lower SES (N=42)	6.2	7.4	5.40	3.33	3.11	88.8

middle SES on the Luria tasks, it is not clear from Table 1 that these lower SES children have a particular problem with impulsive errors as opposed to omission errors. The analyses of variance of these data indicated that none of the interactions between SES and type of error approach statistical significance. However, the analyses of the next section shall show that these conclusions, based on the means of errors, are not completely justified. While the lower SES children, as a group, make approximately as many omission errors as impulsive errors, the tendency to make either of these two types of errors proved to be independent. The child who makes many impulsive errors does not necessarily make many omission errors. Further, it will be seen that the tendency to make impulsive errors on the Luria tasks was diagnostic of scholastic difficulties, while the tendency toward omission errors was not.

Turning briefly to the other variables summarized in Table 1, it is interesting to note that response time means on the MFF test were not related to either SES or grade level. An analysis of variance conducted on the reaction time scores showed that the effect of SES and grade level did not approach significance. On the other hand, mean errors on the MFF test were greater for the lower SES groups than for the middle SES; however, only the difference at the first grade in study 2 was significant, t (85) = 3.04, $p < .01$. Also, the first graders made fewer errors than the nursery children.

The teacher ratings of impulsivity show that the lower SES children were rated more impulsive in class than the middle SES at each of the three comparisons; however, this difference was statistically significant only for the first graders of study 1, t (43) = 2.86, $p < .01$.

As might be expected, differences in intellectual ability measured by

verbal IQ were all highly significant (beyond the .01 level by t test) and in favor of the middle SES.

Study 1

Nursery School

Factor matrices based on the data from the middle and lower SES children of study 1 are presented in Table 2a and 2b. In the middle SES the eigenvalues for the first three unrotated factors were 2.9684, 2.3716, and 1.4710. In the lower SES the corresponding values were 2.9701, 1.4319, and 1.1876.

Insert Table 2 about here

Impulsive and omission errors. Factor 1 for each SES was characterized by high loadings from the impulsive errors committed in all three phases of the Luria "Don't Press" task. These loadings reflected significant correlation coefficients ($p < .05$) between the impulsive errors in these conditions, with values ranging from $r = .72$ to $r = .90$. On the other hand, the omission error loadings were negligible on Factor 1.

Conversely, impulsive errors did not produce any loadings on factors on which omission error loadings appeared (note Factor 2 in the middle SES, Table 2a, and Factors 2 and 3 in the lower SES, Table 2b). Thus in the nursery school the production of impulsive and omission errors led to clearly distinguishable, orthogonal factors in both the lower and middle SES samples. It should be pointed out that verbal IQ as measured by the PPVT failed to yield loadings on the Lurian impulsivity factors in either SES. Not entirely unexpected, the sex of the subject, entered as a

Table 2

Nursery School: Varimax Factor Loading Matrices

for the Middle- and Lower- SES Subjects

TASK	FACTORS					
	(a) Middle SES			(b) Lower SES		
	1	2	3	1	2	3
Impulsive Errors (NV1)	0.9091	0.0209	0.2410	0.8496	-0.0839	-0.1328
Impulsive Errors (V)	0.7652	0.0485	0.1400	0.8928	0.0392	-0.0333
Impulsive Errors (NV2)	0.9621	-0.1871	0.0457	0.8797	-0.0440	0.0455
Omission Errors (NV1)	-0.0489	0.9105	0.0969	-0.0907	0.8168	0.0689
Omission Errors (V)	-0.0389	0.6095	0.3850	0.0052	-0.2187	0.5916
Omission Errors (NV2)	0.1502	0.8253	0.1345	-0.0896	-0.0422	0.4614
Kagan MFF (Rt)	-0.0740	-0.0688	0.7328	-0.3988	-0.3090	-0.3722
Kagan MFF (E)	-0.1102	0.6054	-0.5179	0.1775	-0.0057	-0.1098
Teacher Rating	0.5241	-0.1072	-0.3800	0.0920	0.6995	-0.1087
PPVT	0.0010	-0.0951	0.0491	0.1691	-0.2262	-0.5092
Sex	-0.5339	-0.1731	0.2041	-0.4924	-0.2833	0.2221
Total variance accounts for	26.5%	21.6%	13.3%	25.7%	13.1%	10.6%

dichotomous variable, loaded on the impulsivity factor in both groups. Boys were more impulsive than girls.

Comparison of impulsive indices. In going beyond the pattern of omission and impulsive error loadings, some divergence appeared in the structure of the matrices for lower and middle SES. In the middle SES (Table 2a), observe that the scores from Kagan's MFF test of impulsivity appeared in Factor 3. Since the MFF impulsivity and Luria impulsivity loaded on different factors for the middle SES children, it appears that they are independent variables for these Ss. Apparently, Factor 3 reflects an independent "cognitive style" variable, thus replicating those results obtained by Kagan (1964, 1965a, 1965b).

The structure present in the lower SES (Table 2b) stands in striking contrast to that of the middle SES. In the lower SES there was no evidence of a discrete factor indicating an impulsive cognitive style. Rather, the MFF response-times score produced a relatively high negative loading on Factor 1 along with impulsive errors on the Luria task. Thus Lurian impulsive errors were associated with shorter response-times on the MFF.

Hence, it appears that impulsive behavior in the middle SES can be manifested in either one of two distinct, unrelated forms: that of Luria task impulsivity, or that of an impulsive cognitive style. In the lower SES there was no evidence of a distinct cognitive style of impulsive behavior.

The teacher ratings of classroom impulsivity produced a substantial loading on the Luria impulsivity factor in the middle SES (Factor 1, Table 2a). This indicates that impulsivity in the classroom is related to Lurian impulsivity. On the other hand, classroom impulsivity in the lower SES loaded on Factor 2 (Table 2b). Thus in the lower SES, impulsivity in the classroom did not appear to be strongly related to either Luria task

impulsivity or to that measured by the MFF.

First Grade

The middle and lower SES factor matrices for first graders in study 1 are presented in Tables 3a and 3b. In the middle SES the eigenvalues for the first three unrotated factors were 3.0696, 1.7309, and 1.0677. In the lower SES the corresponding values were 2.7627, 1.3598, and 1.0762.

Insert Table 3 about here

Impulsive and Omission Errors. Examination of the lower SES factor matrix presented in Table 3b reveals a pattern of loadings which is quite similar to that found in both nursery school factor matrices (Table 2). In the lower SES notably high loadings for impulsive errors on all conditions on the "Don't Press" Luria task occurred on the first factor; these loadings reflected significant correlations between these conditions ($p < .05$) ranging from $r = .49$ to $r = .73$. Loadings for omission errors were minimal on Factor 1. In a fashion reminiscent of the lower SES nursery children, omission errors (Table 3b) loaded predominately on two factors (Factors 3 and 4).

For the lower SES first graders, as in the nursery, verbal IQ had little relationship with Lurian impulsivity factor. Unlike the nursery group, sex was not strongly related to impulsivity.

In turning to the factor matrix for the middle SES children (Table 3a) it can be seen that the pattern of impulsive and omission errors is substantially different than that found in all previous matrices. Factor 1 was defined by very high loadings from both omission and impulsive errors in the last non-verbal condition of the task. Impulsive errors from NV1 and

Table 3

Study One, First Grade: Varimax Factor Loading Matrices

for the Middle- and Lower- SES Subjects

TASKS	FACTORS					
	(a) Middle SES			(b) Lower SES		
	1	2	3	1	2	3
Impulsive Errors (NV1)	0.0963	0.5081	-0.0892	0.8277	-0.3456	0.1033
Impulsive Errors (V)	0.2670	0.7869	0.1278	0.6511	-0.4259	0.4411
Impulsive Errors (NV2)	0.8868	0.0310	-0.3439	0.7968	0.1816	0.0233
Omission Errors (NV1)	0.4753	0.4450	0.4321	0.2758	0.1224	-0.5619
Omission Errors (V)	0.1295	0.3749	-0.1203	0.0933	-0.4133	0.0190
Omission Errors (NV2)	0.9119	-0.0340	-0.1429	0.2298	-0.6131	0.2333
Kagan MFF (Rt)	0.0218	-0.1271	-0.0467	0.3329	-0.0386	-0.1584
Kagan MFF (E)	0.7605	0.1607	0.0083	-0.0610	-0.3493	-0.0099
Teacher Rating	-0.2331	0.3473	0.1117	0.0868	-0.3901	0.6054
PPVT	0.2369	0.5027	-0.5089	-0.1232	0.5221	0.4627
Sex	0.3580	-0.5528	0.2580	-0.0127	0.6755	0.0092
Total variance accounts for	25.4%	15.2%	10.2%	18.5%	12.3%	11.6%

and V loaded on Factor 2, but impulsive errors from NV2 did not. The absence of a loading from NV2 suggests an impulsivity factor which may be viewed as a residual of the one observed in the nursery. Moreover this "residual" impulsivity factor was contaminated by the presence of omission error loadings from two response conditions. (It will be seen in study 2 that this residual factor fails to occur with the larger sample employed.) Hence these factor loadings did not present a pattern indicating a discrete Lurian impulsivity factor in the form that it has been previously observed. We see instead what appears to be only a residual of the impulsivity factor seen in the nursery, and a notable tendency towards the merging of the impulsive and omission error factors.

Comparison of Impulsivity Indices. Recall that in the nursery school, middle SES children showed different factors for Lurian and Kagan impulsivity. In first grade this separation persisted. Thus if Factor 2 (Table 3a) reflects the "residual" element of Lurian impulsivity remaining at this age, this residual is independent of MFF impulsivity. The MFF errors loaded only on Factor 1 along with both types of Luria task errors. The structure presented by the pattern of Luria task impulsivity loadings on Factor 2 coupled with the absence of MFF loadings, indicates that the behavior measured by the two tasks is independent in the middle SES.

In contrast to this picture, the lower SES factor matrix (Table 3b) is similar to that of the lower SES nursery children. There was again evidence that Lurian and Kagan task impulsivity were related. Here the only loadings of noticeable magnitude on Factor 1 (apart from Lurian impulsive errors) were from MFF response times. It should also be noted that these were the largest MFF response time loadings in the matrix.

To summarize, some consistency therefore did appear across age, even

though the structure of loadings for the Luria and MFF task in the first grade samples was not the unequivocal one presented in the nursery.

The teacher ratings of impulsive behavior in the lower SES (Table 3b) yielded notable positive loadings on Factor 3 along with Lurian impulsive errors and intelligence. Note that Lurian omission errors loaded negatively on this factor.

Study 2

Recall that other than the inclusion of indices of academic performance and the decrease in interstimulus interval in the Luria tasks, the measures used in this phase were identical to those just discussed. The effect of the decreased interstimulus interval in the Luria task was to increase the production of errors to a level comparable to the nursery.

The middle and lower SES factor matrices are presented in Table 4a and 4b. In the middle SES the eigenvalues for the first two unrotated factors were 2.1362 and 1.2009. In the lower SES the eigenvalues for the first three unrotated factors were 3.1556, 1.6062, and 1.0054.

Insert Table 4 about here

Impulsive and Omission Errors. The factor structures for the first grade samples of study 2 (Table 4) were quite similar to those obtained in the first grade in study 1. For the lower SES matrix (Table 4b), it can be seen that Factor 1 was characterized by high impulsive error loadings from all three conditions of response and negligible loadings from omission errors. Omission errors, on the other hand, loaded substantially on Factor 3, where there are negligible loadings from impulsive errors. It is crucial to note

Table 4

Study Two, First Grade: Varimax Factor Loading Matrices

for the Middle- and Lower- SES Subjects

TASKS	FACTORS				
	(a) Middle SES		(b) Lower SES		
	1	2	1	2	3
Impulsive Errors (NV1)	-0.4785	-0.2354	0.8801	-0.1944	-0.0441
Impulsive Errors (V)	0.0561	-0.4500	0.8018	0.0330	0.0495
Impulsive Errors (NV2)	0.0091	-0.4728	0.4942	-0.3787	-0.1375
Omission Errors (NV1)	0.0607	0.5470	-0.0844	-0.1873	0.6906
Omission Errors (V)	-0.5128	0.2412	0.0640	-0.0351	0.6927
Omission Errors (NV2)	0.0572	0.7509	-0.1001	0.0987	0.6355
Kagan MFF (Rt)	0.0366	-0.1629	-0.1197	0.1415	-0.1045
Kagan MFF (E)	-0.5873	0.0348	0.5878	-0.4177	0.0251
Teacher Rating	-0.7164	0.0789	0.1498	-0.7089	0.2336
PPVT	0.0762	-0.1870	-0.0997	-0.6605	0.1302
Sex	0.3504	0.3502	-0.3032	0.2511	0.1414
Classroom Grades	0.8484	-0.1807	-0.2569	0.6955	0.0163
Total variance accounts for	18.5%	13.4%	26.3%	13.4%	8.4%

that there was no evidence of any overlap or merging of any of the factors representing impulsive and omission errors, as in the case of the middle SES.

In the middle SES factor matrix (Table 4a), loadings from both omission and impulsive errors again fell on the first factor, as occurred in study 1. In looking further it can be seen that loadings from the remaining impulsive and omission error conditions defined Factor 2, thus indicating substantial overlap between errors on the two tasks.

The data in both studies are quite consistent in indicating that the processes basic to the generation of omission and impulsive errors were unequivocally independent of each other only for those first graders who were from the lower SES.

It should be mentioned that verbal IQ failed to load on the Lurian impulsivity factor in the lower SES (Factor 1, Table 4b). Further, the subject's sex did produce a measurable loading along with Lurian impulsive behavior in the lower SES.

Comparison of Impulsive Indices. In the lower SES (Table 4b) it can be seen that the Lurian impulsivity factor (Factor 1) was further characterized by a high loading from errors on the Kagan MFF test. This loading reflected relatively strong and significant correlations between MFF errors and Lurian impulsive errors in all three conditions of response. The values ranged from $r = .36$ to $r = .59$.

Interestingly enough this pattern did not occur in the middle SES. Here, MFF errors loaded only on Factor 1 along with both omission and impulsive errors. Thus for the middle SES first graders in both studies, there was no evidence of the combined Lurian impulsive and MFF error factor.

The teacher ratings produced predominant loadings on those factors

containing loadings from classroom grades: Factor 2 (Table 4b) in the lower SES, and Factor 1 (Table 4a) in the middle SES. Note, however, that it was only in the case of the lower SES that impulsive error loadings were represented along with teacher ratings without the presence of omission error loadings. In the middle SES there were no significant correlations between Luria task impulsive errors and the teacher ratings.

Impulsivity, Classroom Grades, and IQ. Recall that a question of central interest was that of the relationship between impulsive behavior and that of grades in school; viz., is difficulty with impulse control a predictor of poor grades in school? Looking initially at the first grade matrix in the lower SES (Table 4b), it can be seen that the highest loadings from grades occurred on Factor 2, along with teacher ratings and verbal IQ (i.e., teacher ratings which indicated greater impulsivity were associated with low IQ and poorer grades). However, grades also loaded on Factor 1 with Luria task impulsive errors (i.e., high impulsive errors with poorer grades), with no loadings from IQ. This pattern reflected significant correlations between grades and Lurian impulsive errors for both non-verbal Lurian tasks (r's approximately - .40), while the correlation with the verbal condition ($r = -.27$) approached significance. Turning briefly to the middle SES children for purposes of comparison, there was no indication of a relationship between grades and a Luria task impulsivity factor. Moreover, there were no significant correlations between grades and the Luria task in the correlation matrix. Thus only in the lower SES did grades comprise a significant part of the Lurian impulsivity factor.

One interesting aspect of the relationship between Luria task impulsivity and grades in the lower SES were the essentially zero loadings from Peabody IQ on Factor 1 (Table 4b). This structure was reflected in

the correlation matrix for impulsivity scores, but not for MFF errors. The correlations between the Luria task and PPVT were not significant, ranging from r = -.14 (V) to r = -.22 (NV1). The correlation between MFF errors and IQ was significant, r = -.35 ($p < .05$).

The correlation between classroom grades and Lurian impulsive errors, using a pooled score over all three Luria tasks was r = -.43 ($p < .05$). An even more objective index of school performance was obtained in the form of Stanford Achievement scores. Two of the three subtests administered to all children correlated significantly ($p < .05$) with impulsivity as measured by the pooled Luria task errors: Word Reading (r = -.43) and Arithmetic (r = -.33). Thus, lower impulsive errors were associated with higher achievement scores. The remaining correlation, between impulsivity and Vocabulary (r = -.22), was not significant and was in the range expected from the obtained correlations between impulsive errors and PPVT scores (i.e., from a low of r = -.14 to a high of r = -.22). Interestingly neither of the two measures of the MFF impulsivity test correlated significantly with any of the Stanford scores. The Peabody IQ scores, however, related significantly ($p < .05$) to each of the Stanford subtests, i.e., PPVT with Word Reading (r = .42), with Vocabulary (r = .59), and with Arithmetic (r = .63). Since IQ related so strongly to the achievement test scores, it was important to determine more precisely to what extent it influenced the Luria task impulsivity, achievement score relationship.

Using the Ss' pooled Luria task impulsivity scores, the lower SES Ss were divided at the median into low ($\bar{X}$ = 1.0) and high ($\bar{X}$ = 11.5) impulsive error groups; these groups were then compared on classroom grades and Stanford Achievement scores. Classroom grades of the high impulsive group were significantly poorer than those of the low impulsive group, F (1,40) =

11.5, $p < .01$. The average grade for the high impulsive Ss was 2.1 (where 4 was the best possible grade and 1 the poorest), while the average grade for the low impulsive Ss was 3.1. On the Stanford Achievement Test, the high impulsive Ss scored significantly more poorly than the low impulsive on both Word Reading and Arithmetic, F (1,39) = 14.8, $p < .01$ and F (1,39) = 9.2, $p < .01$, respectively. In converting these scores to grade level equivalents, low impulsive Ss performance was found to be approximately at grade level, whereas the high impulsive Ss were approximately one-half year behind. Since these tests were administered at the end of the first year of school, it can be appreciated that a one-half year lag is relatively very great.

Differences between the IQ's of the two impulsivity groups were also significant , F (1,39) = 4.7, $p < .05$. In order to determine the role of verbal intelligence in these differences, analyses of covariance were performed on the data using the Ss Peabody IQ score as a covariate. With the effect of IQ removed, the differences between the means of both groups remained significant on all academic indices. The relevant values were F (1,39) = 6.6, $p < .01$ for grades; F (1,38) = 9.0, $p < .01$ for Word Reading; and F (1,38) = 4.2, $p < .05$ for Arithmetic. In short, it appears that high impulsive, lower SES children are having substantial difficulties in school related academic work, irrespective of their intellectual ability.

DISCUSSION

The present study was designed to give us a more complete understanding of the mechanisms involved in impulsive behavior and to explore the relationship between development of impulse control and socioeconomic class. In returning to the questions posed in the Introduction, four major points can

be made. First, in the nursery school the processes basic to the production of impulsive and omission errors on the Luria task were always represented by two different factors, irrespective of the SES of the child. In first grade there was some tendency towards the merging of the impulsive and omission error factors, indicating a developmental attenuation of the importance of the impulsivity factor. Second, the data were consistent in indicating that distinct impulse control problems on the Luria task persist longer in the development of the lower SES child than the child of middle SES. Third, the evidence consistently indicated that impulsive behavior is a more general phenomenon in the lower SES than in the middle SES. There is also reason to believe that this general control problem, in the lower SES, was related to the sorts of impulsive behavior observed by their teachers in the classroom. Fourth, when intelligence was controlled, lower SES Ss obtained significantly poorer classroom grades and Stanford Achievement scores. There was no evidence of this relationship between Luria task impulsivity and grades in the middle SES.

Previous studies (Jarvis, 1968; Luria, 1961; Miller, et. al., 1970) have shown that ability to correctly initiate behavior is acquired earlier than the ability to correctly inhibit responses. Data of this sort are ambiguous with regard to the issue of whether or not two different sets of mechanisms must be postulated. Inhibition of response could conceivably involve the same mechanisms as initiation of response, but particular task requirements (e.g., the time permitted for response) might make inhibition more difficult. The data of the present experiments were more conclusive on this issue. The factor structure for nursery school children clearly showed an orthogonal relationship between impulsive errors and omission errors. This finding is particularly critical in Study 1 since with the

interstimulus interval used in this study, the two types of errors occurred with approximately equal frequency. Therefore, the two orthogonal factors cannot be attributed to differences in difficulty level.

The orthogonal relationship between these types of errors suggests that Luria may have been correct in his analysis of the control of behavior with regard to its initiation and inhibition. Further evidence for Luria's position, regarding the development of discrete control processes, was seen in the merging of impulsive and omission error factors in middle SES children by the time they reached first grade. If the inability to respond to the semantic content of the instructions is basic to impulsive responses in the young child, then as the child acquires the capability of responding to the semantic inhibitory content, evidence for discrete problems in the impulse control mechanism should diminish.

The present data suggest that the development of control over impulsiv errors on the Luria task proceeds more slowly in the lower than in the middle SES. For the lower SES children there was a striking similarity between the factor structures obtained in nursery school and in first grade. At both grade levels, the Lurian impulsivity scores defined a single, unique factor.

In contrast, for the middle SES children there was a marked change in the patterning of impulsive error loadings, between nursery school and first grade. By first grade the unique impulsivity factor had disappeared and a relatively stable general error factor appeared which included both impulsive and omission errors.

It should be mentioned here that the data in the present study suggests that the overriding variable in the group differences is the child's SES and not race. Recall that one of the middle class matrices (Study 1) was generated

on the basis of data collected from Black middle SES children while the other (Study 2) involved middle SES children who were White. Yet in both cases there was evidence of a breakdown in the unitary nature of the impulsivity factor. Moreover, in the nursery similar problems in the control of impulsive behavior were found to be in evidence in both races irrespective of the SES of the children.

Another striking feature of the data lies in the contrast between the impulsive behavior indexed by the Luria and MFF task. Kagan conceptualizes the MFF test as a measure of a cognitive style; the Luria task, on the other hand, appears to tap a more basic ability to control impulsive behavior. Two contrasting pictures of the relations between Ss responses to these tasks are observed depending upon the SES in question.

In the middle SES, impulsive behavior measured by the Luria and MFF task was always represented by different factors of behavior. This picture was quite clear in the nursery, where Kagan's cognitive style appeared as one discrete factor, and the Lurian impulsive errors appeared as another. In contrast, in the lower SES there was no evidence, at either grade level, of two distinct factors of impulsive behavior. The data were consistent in showing that one of the scores of the MFF test was always represented on the Lurian impulsivity factor. The implication appears to be that in the lower SES we are dealing with a more basic behavioral control ability rather than one based upon a preferred cognitive style.

With regard to the practical issue of the relationships between impulsive behavior and academic work, the evidence is straight-forward. For lower SES children, the effect of high Luria task impulsivity was lower grades and poorer achievement scores. This effect cannot be accounted for on the basis of the childrens' IQ's. Since the ability to control impulsive

behavior relates to achievement on arithmetic and reading skills, as well as class work in general, it is strongly suggested that verbal control problems do in fact impede scholastic development.

One could, of course, argue that it is difficult to impute the causal direction of these obtained relationships. Thus, it might be contended that these children who experience failure in their efforts to achieve begin to behave impulsively or "act out" as a consequence of their "frustration" or "anger" at failure. While one cannot say definitely that this is not the case, the evidence suggests that this is quite unlikely. If academic failure in the lower SES was the mechanism basic to impulse control problems on the Luria task, then we should not expect to find a factor reflecting impulse control problems in the nursery. That this factor appeared in both lower and middle SES nursery classes suggests that its genesis is not related to scholastic failure since these situations preceded academic failure.

In conclusion, the practical significance of the Lurian impulsivity factor in the lower SES lies, in part, with the ties which exist between it and impulsive behavior in the classroom. But even more crucial than this is its relationship to grades and school achievement. Having strong evidence of the contribution of poor verbal impulse control to the lower SES child's educational achievement, one is now better able to select a type of compensatory training which is relevant to the features of this particular type of impulse control problem.

Study 3

Classroom Impulsivity and School Performance

In study 1 we saw that impulsivity, as measured in the Luria task, is negatively related to classroom performance. Note, however, that the Luria task is a measure of performance in a laboratory situation.

The present study was concerned with measuring aspects of classroom behavior which are often considered indices of impulsivity. There were three reasons for this.

(a) If a laboratory task like Luria's is related to school performance, a more immediately relevant measure might be even more highly related.

(b) The problem of identifying children with impulse problems would be much simpler if measures could be taken in the classroom rather than in the laboratory.

(c) A number of educational researchers have identified certain classroom behaviors as impulsive (e.g., getting out of seat without permission, talking without permission); these researchers have then tried to eliminate such behavior by behavior-modification techniques. Yet no attempt was made to relate such behavior to academic success. In the present study, the spontaneous occurrence of such behaviors will be related to academic achievement.

Background

One of the more provacative investigations of the relationship between the activity level of children and their intellectual functioning was undertaken by Maccoby, Dowley, Hagen, and Degerman (1965). Maccoby et al. make a distinction between an individual's general level of activity and his ability to inhibit movement in specific task situations. Following a review of the relevant research, the authors maintained that there is good reason to suppose that both the level of gross motor activity and the ability to inhibit motor activity when required are positively related to intellectual functioning. Yet, while the results of the investigation indicated that the ability to inhibit movement is related to intelligence measured by the Stanford-Binet, a higher total activity level was not. It was concluded that the lack of a relationship between the activity level and intelligence may have been due either to the relatively high average IQ of the nursery school children included ($\bar{X}$ = 135), or to the fact that there was no provision for distinguishing between activity which is instrumental from that which is expressive or unorganized.

Following Maccoby et al.'s work, a number of investigators have continued this line of investigation but have confined themselves to the relationship between the ability to inhibit motoric movement and intellectual ability. Thus, for example, Massari, Hayweiser and Meyer (1969) using tasks similar to those of Maccoby, observed the responses of white "deprived" preschool children. Here it was found that the ability to inhibit motoric movement when instructed to walk as slowly as possible along a line (WAL) inscribed on the floor was positively related to IQ. In another task which required the child to draw a line (DAL) across a paper as slowly as possible, a positive relationship was found between the ability to retard movement and intellectual ability. Importantly, Massari et al. further obtained

evidence which suggests that the foregoing relationships are not based upon the inability of these lower IQ children ($\bar{X}$ = 90) to understand the instructions, rather the author's conclude that "motor control per se contributes to variation on the Stanford-Binet."

There is some evidence that this relationship extends beyond the population of white subjects. Harrison and Nadelman (1972) evaluated middle socioeconomic black children on both the DAL and WAL motoric inhibition tasks and found that inhibition of movement was significantly related to intelligence in the case of boys but not girls. It should be noted that this relationship was based on Peabody Picture Vocabulary IQ test scores, and thus suggests that the previous correlations are not particular to the Binet test of intelligence. On the other hand, when Mumbauer and Miller (1970) employed a heterogeneous grouping of black and white preschoolers they failed to obtain a relationship between the motoric inhibition tasks and Binet IQ scores.

In contrast to the several studies which have explored the relationship between motoric inhibition and intelligence there has been little investigation of the problem of whether this gross activity level of a child can be partitioned in a way that one can determine those behaviors which are relevant or irrelevant to intellectual functioning. Maccoby et al. measured activity level with the use of a device which was strapped to the wrist and ankle of their subjects and indexed the amount of movement of each extremity. Clearly this sort of measure constitutes a grossly indiscriminate gauge of behavior. It would seem that a more reasonable approach to determining the relevancy (or the nature of behaviors which might be instrumental for a child) would be in the specification of particular sorts of prevalent activity and then assessing whether their frequency of occurrence predicts intellectual ability.

One practical way of dealing with the problem of reducing the large number of potentially relevant activities is to confine one's observations to a more

structured environment. An obvious example would be that of the first grade classroom where the presence of certain behavioral guidelines would reduce the sampling of observed behavior to more manageable proportions. In pilot work conducted by the authors, talking-out and getting-out of seat behavior were the two activities which clearly predominated in those classes in which strict sanctions were not involved when they occurred. This is to say that in those cases where the children were involved in some sort of academic seat work, as opposed to recess or play periods, the two major countable responses were either getting up to leave their seats or talking to a neighbor.

Interestingly the significance of the two aforementioned activities extends beyond just their prevalence in the classroom. Since these behaviors can be so frequent and can be so easily pinpointed they have become the target of recent attempts at classroom behavior modification. For example, Barrish, Sanders, and Wolf (1969) have focused on out-of-seat behavior and talking in the classroom in a successful attempt at reducing their frequency by using reinforcement techniques. Although Barrish et al. (1969) worked with these two classes of activity because they were considered "disruptive", no attempt was made to determine what potential value these activities may have for the growth of the child. Indeed there is little evidence in the literature relating to the significance of these activities. If, as Maccoby et al. (1965) have suggested, brighter children should be more active on measures of activity, it is not unreasonable to assume that this might be reflected in either of these two particular activities. To the extent that these sorts of behaviors are tied in some fashion to intellectual ability it raises rather important questions for a strict functional behaviorist position.

A number of behavioral studies have focused their attention on reducing the occurrence of a range of "inappropriate" behaviors observed in the classroom. For example, there has been success demonstrated in the area of reducing isolate play (Allen, Hart, Buell, Harris, and Wolf, 1964), crying (Hart, Allen Buell, Harris,

and Wolf, 1964) and crawling (Harris, Johnston, Kelly, and Wolf, 1964), as well as numerous others. Although the behaviors attacked by these studies are quite diverse, in all cases (including Barrish et al., 1969) the inappropriateness of the target behavior is defined solely by intuitive judgements, i.e., does the behavior appear to be bad for the child or the classroom. Investigations of this sort have supported the contentions of the behavioral engineers who claim that even the most intractible of classroom behaviors is amenable to modification. However, the case for the supposed inappropriateness of these behaviors has not even begun.

In the present investigation both the amount of out-of-seat and talking behaviors were measured for first grade, predominantly lower socioeconomic black subjects. These measures have been related to a measure of intellectual ability and academic achievement. There was also an attempt to investigate the association between these classroom behaviors and the teacher's rating of impulsive behavior as well as a standard index of impulsive behavior.

Method

Subjects

The subjects were 25 boys and 19 girls attending first grade in a Detroit "inner-city" school. The Ss were all black and were randomly drawn from all three classrooms of the school's first grade. The average IQ of the Ss was 96, with a standard deviation of 13.4. The average age was 6.7 with a standard deviation of .30.

Test evaluation

The Peabody Picture Vocabulary Test (PPVT) was administered to all subjects. Previous work with black Ss (Harrison and Nadelman, 1972) indicated that the PPVT is a useful instrument for obtaining an estimate of an S's intellectual functioning. Since previous work mentioned has focused almost exclusively on ability measures, three subtests of the Standord Achievement Test were included for the purposes of delineating those particular academic areas most strongly involved with classroom activity. The three skills measured were word meaning, paragraph meaning, and arithmetic.

The present study included a standard index of impulsive behavior, Kagan's Matching Familiar Figures Test (MFF). The younger child's version of the MFF consists of a series of standard pictures along with four pictures for each standard, three of which are variants of the standard. The child is instructed to pick out from among variants, the picture which is identical to the standard. Kagan et al. (1964, 1965a, 1965b) have found that individual's who respond relatively quickly on their first choice for each standard, and who also tend to have a higher number of errors are more impulsive than those individuals who have slower response times and lower number of errors. Also included was a teacher questionnaire which consisted of eight statements which focused on their perceptions of impulse control problems in the classrooms. Each of the children tested were rated on a six-point scale as to whether they strongly agreed or strongly disagreed with the following statements: (1) This individual has difficulty following instructions; (2) This individual could be considered a behavior problem; (3) This individual has difficulty listening to directions; (4) This individual shows little tolerance for frustrating situations; (5) This individual shows difficulties in self-control; (6) This individual has difficulty completing any task he (or she) starts; (7) This individual has difficulty stopping most kinds of activity when told to do so; (8) This individual has difficulty sitting still most of the time. The reliability of this measure was found to be high (r = .85) in a test re-test situation.

Behavioral Evaluation

The measurements of out-of-seat and talking-out behavior were obtained through time sampling in the classrooms. Two individuals were always used in observing the frequency of these behaviors in each room. Talking-out behavior was defined as talking to another person in the room. Talking to the teacher after obtaining permission to do so, usually by raising of a hand, and talking to oneself were not included in this category. Out-of-seat behavior was counted in those instances in which a S physically left his seat, in a situation in which he did not

ask for permission. The behaviors were only recorded in those instances in which some amount of seat or blackboard work had been given and the Ss were to finish their work at their seats. Therefore, recording focused on those times in which the Ss had been instructed to engage in academic work.

The observers used recording sheets lined with columns and rows. At each recording session the name of those Ss observed were written across the top of each column while the rows were marked off at 30-second time intervals. During the session the observers watched each S for a 30-second period noting whether either of the two target behaviors occurred. At the termination of this period, the S listed in the next column was observed for 30 seconds, and so on until the last S listed had been observed. Following this the observer returned to the first column and continuted this pattern usually until each S had been observed at least four times. The observers were instructed to begin the session observing a different person so that at any given time each observer was looking at a different S. The use of such a procedure necessarily lowers the correlation between the two observers' ratings; however, it was felt that dividing up the observations in this fashion would make those measures obtained more representative of what each child is usually doing during the session.

The observations were conducted on 28 different days during the school year. The period of time during which the observations were collected extended from February 21 to June 6. The predominant number of observation sessions were undertaken during the months of April and May. Inter-rater reliability figures for the five months of observations were as follows: The overall reliability of both categories pooled was $r = .78$; the reliability of talking-out behavior was $r = .65$; while the figure for out-of-seat behavior was $r = .64$. Recall that these figures reflect the agreement between the two observers' ratings for each complete session, thus in effect reflecting the degree to which the Ss behaved consistently during the observation period.

Results

Table 1 lists the correlations between the time sampling measures and the indices of intellectual ability for academic achievement for all Ss and boys and girls separately. Looking at both sexes it can be seen that the incidence of

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Insert Table 5 about here
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talking behavior is clearly unrelated to both the IQ measure and achievement measures. In other words, there is no grounds for predicting whether an individual who talks often in class is of high or low intellectual ability. On the other hand, all the correlations between out-of-seat behavior and the intellectual and academic indices are significant beyond the .05 level. Here there is a strong indication that those individuals who spend most time out of their seats are the same ones who experience the most success in academic achievement and, to a lesser extent, also have higher IQ's.

In considering the breakdown by sex it can be seen that there is a significant relationship between the academic achievement indices and out-of-seat behavior for girls. While on the other hand, there is a significant positive relationship between IQ and talking behavior for boys. Thus those girls out of their seats most often inhibit the highest levels of achievement and those boys who talk most often in class score the highest or the Peabody Picture IQ test.

Table 2 lists the correlations between the time-sampling data and the impulsivity

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Insert Table 6 about here
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measures for all Ss and boys and girls separately. Not first that there is no direct relationship between the overall amount of talking the Ss engaged in and their scores on the Kagan MFF test when considering both sexes combined. While there is a slight negative relationship between the teacher ratings and talking (greater talking associated with impulsive ratings) it is not significant. On the

Table 5

(a) Intercorrelations Among Time-Sampling and Ability and Achievement Measures for Boys and Girls

Time-Sampling	Achievement Tests			
	PPVT	Arithmetic	Word Read	Paragraph Meaning
Talking	.08	-.02	.10	.10
Out-of-seat	.30*	.33*	.37*	.29*

(b) Intercorrelations Among Time-Sampling and Ability and Achievement Measures for Boys

Time-Sampling	Achievement Tests			
	PPVT	Arithmetic	Word Read	Paragraph Meaning
Talking	.37*	.17	.25	.17
Out-of-seat	.23	.25	.28	.20

(c) Intercorrelations Among Time-Sampling and Ability and Achievement Measures for Girls

Time-Sampling	Achievement Tests			
	PPVT	Arithmetic	Word Read	Paragraph Meaning
Talking	-.15	-.29	-.08	-.01
Out-of-seat	.37	.46*	.50*	.45*

*$p < .05$

Table 6

(a) Intercorrelations Among Time-Sampling and Impulsivity Measures

Time-Sampling	Impulsivity Measures		
	MFF:R.t.	MFF:E	Teacher Ratings
Talking	.06	.02	-.16
Out-of-seat	.19	-.31*	-.03

(b) Intercorrelations Among Boys

Time-Sampling	Impulsivity Measures		
	MFF:R.t.	MFF:E	Teacher Ratings
Talking	.27	-.16	-.19
Out-of-seat	.36*	-.41*	.11

(c) Intercorrelations Among Girls

Time-Sampling	Impulsivity Measures		
	MFF:R.t.	MFF:E	Teacher Ratings
Talking	-.16	.24	-.15
Out-of-seat	-.03	-.18	-.21

*$p < .05$

other hand, the relationship between out-of-seat behavior and errors on the MFF test (r = -.31) is significant at the .05 level. Thus, those individuals who spend more time out of their seats make the fewest errors on Kagan's impulsivity test. Correspondingly there is some tendency for out-of-seat behavior to relate to longer R.T.'s (meaning less impulsive) r = .19, although it is not significant. In the case of the teacher ratings of impulsive behavior, these judgments prove to be independent of out-of-seat behavior.

In looking at the breakdown by sex a more precise picture emerges. Although there is no relationship between the impulsivity and behavioral measures for girls, impulsivity indexed on the MFF bears a striking relationship to the behavioral measures in boys. For boys being out of their seat often is significantly related to longer response times and fewer errors on the MFF test. Thus, the most active boys in terms of being out of their seats, are the least impulsive on Kagan's cognitive style test.

Discussion

The results of the present study indicate that girls who are most active in terms of being out of their seats have higher academic achievement scores, while boys who talk more often score higher on an IQ test. Further, those boys who are out of the seats most often are significantly less impulsive on a test indexing an impulsive cognitive style. On the other hand, neither of the two behavioral indices demonstrated any relationship to the teachers' ratings of impulsive behavior in the classroom. Perhaps the most straight foreward implication of these findings is that in an academic setting the brighter boys are much noisier group than the lower IQ boys, and the higher achieving girls are a much less sedentary group than the lower achieving girls.

Although it is difficult to determine precisely what utility this behavior has for these individuals, some speculation is possible on the nature of their activity. For one thing there is reason to believe that it is not random or chaotic. Note

that the more active boys in the class were also able, when instructed, to best modulate their behavior to the requirements of the MFF impulsivity task. If the behavior of these Ss characteristically had no pattern in the class, one should not expect to see them perform in such a reflective fashion on the MFF.

Another aspect of the data which implies that either talking or out-of-seat behavior is of an organized nature relates to the teacher ratings. In spite of the fact that getting out of one's seat and talking out would appear to be two of the more obtrusive activities in which the child could engage, their teachers failed to rate those engaging in them as being more of a behavior problem or more impulsive than their classmates. Thus although it is reasonable to expect that these activities would be noticed, they are apparently conducted largely in a way that fails to produce noticeable concern on the part of the teachers. Since this is the case it is tempting to conclude that these behaviors are instrumentally related to academic work at hand, however as to what the specific nature of this activity may be, a definite conclusion must await another investigation. Here the focus must be on a more precise description of what transpires subsequent to the S's leaving his seat.

Taken together, these findings appear to be particularly relevant for those who focus on talking or out-of-seat behavior as a target of a behavior modification. If either of these is at the very least an innocuous activity (i.e., those boys who talk most often and those girls who are more active appear to be more able children and generally do not disturbe their teachers) why then would one want to modify them? One might suggest that although the gross amount of verbalization or activity is not a concern, the particular context in which they occur or their particular context leads to the desire to reduce their frequency. Yet inspite of this possibility, most behavioral procedures focus only on the gross level of incidence and not on the manner in which they are offered or on their specific content (see Barrish et.al.,1969). This could easily be a case of the usage of a

behavioral technique which is not attuned to the relevant problem. In the end, those specific aspects of the children's behavior which lead to behavior modification may have been reduced only by virtue of the fact that the general output has been reduced. One wonders, however, whether this end result is precisely what the functional behaviorist had in mind.

In considering the psychological significance of reducing either of these behaviors which have been shown to relate closely to intellectual, academic and impulse control functions, the implications are more serious. The effect of such a behavioral reduction of either activity may indeed produce damaging consequences. What is needed at this point is more evidence on both the specific nature of either activity and why they bear a differential relationship to sex. If these activities can be shown to functioning in an instrumental fashion, then the reduction of their incidence would surely not be a desirable way to deal with these behaviors.

Studies 4 and 5

Modification of Impulsivity

In studies 1 and 2 of this report, we saw that lower SES first graders exhibited particular impulse control problems which appear to be resolved by middle SES children of the same age. Moreover, lower SES children with greater numbers of impulse errors on the Luria task obtained significantly lower grades and achievement scores than those who performed with fewer impulse errors on the task. It should be recalled that this effect was found even when the effects of verbal IQ was controlled. Studies 4 and 5 are concerned with the evaluation of procedures designed to train children to control their impulsive tendencies.

Before we describe the particular procedure that we used in thse studies, let us consider some of the possibilities for controlling impulsive behavior. In the past, several studies have been conducted which dealt with attempts to modify impulsive cognitive styles. Impulsive cognitive style has been described by Kagan (1964, 1965). In the task used by Kagan, children were given relatively difficult problems to solve and their speed of response was measured. It was found that many children responded quickly and erroneously. Kagan, Pearson, and Welch (1966) reasoned that if the children could be slowed down in their responses they would spend more time trying to find the correct answer to the problem and perform better. While they succeeded in making the children slow down, performance did not improve.

Palkes, Stewart and Kahana (1968) also attempted to induce children to slow-down in the responses to the Kagan MFF task. The subjects in this experiment were hyperactive children. They were instructed not to respond hastily and to consider their responses more carefully. Following this they were tested on another test thought to be affected by impulsive responding, the Porteus Maze test (see Porteus, 1942). Palkes, Stewart and Kahana found a significant improvement in Porteus maze performance following verbal training on the Kagan MFF.

In a more extensive study, Meichenbaum and Goodman (1971) had second grade children from a remedial class observe the performance of a task by an individual who explicitly described the effective manner he used in dealing with the materials. Then the S performed the task himself a number of times during which he was first instructed and then had to describe to himself his manner of working on the task in a fashion similar to the original model. This training procedure was carried out on simple sensory motor tasks, parts of the Stanford-Binet IQ test, tasks such as those found in the Raven's Matrices test and the Primary Mental Abilities test. Following this "cognitive self-guidance" treatment the individuals were evaluated on the Porteus Maze test, the MFF test, and three performance subtests (measuring activity level) on the Wechsler Intelligence test. Meichenbaum and Goodman found that the training improved performance on the Porteus Maze test, on the combined performance on the WISC, and on the response time score on the MFF. The authors also looked at the possible classroom effects of their training in the form of behavioral observations of attentiveness towards work and a teacher questionnaire of the students' behavior. Neither of these two indices, however, revealed a treatment effect.

It should be noted that the studies reported above appear to start with the assumption that impulsive problems are due to the fact that the children react too hastily, do not take time to consider the correct response. This conceptualization of impulsivity arises largely from the research of Kagan, cited above. In Kagan's work, the task used to define impulsivity was a difficult one for the children, and hasty responses were likely to result in errors. The conceptualization of impulsivity was in terms of a cognitive tempo of response.

While the type of impulsivity studied by Kagan is no doubt an important characteristic of behavior in many situations, it does not appear to be central to the issues under consideration in the present program of research. This conclusion is based on several factors. First, it should be recalled that in study 1 we examined the Kagan tests for impulsivity and found that they were not correlated with either the Luria task for impulsivity or with the school performance of first graders.

Our results in studies 1 and 2, on this issue, are consistent with those reported by Kagan (1965). Kagan found that, for first graders with lower verbal ability, the relationship between impulsive cognitive style (as measured by the Kagan MFF) and reading ability is minimal. In the present research we are concerned with just such low-verbal children -- children who came predominantly from relatively non-verbal homes and who test relatively poorly on tests of verbal ability.

The type of impulsivity that correlates with the academic problems of the first graders in studies 1 and 2 can be characterized as follows. The situation in which the child is placed is one in which some ongoing responses are correct. At certain times, however, it is necessary for the child to inhibit these responses -- that is, to refrain from responding. However, the tendency to make these ongoing responses is so strong, that the child has little control over himself and continues responding even though he should not.

The measures of impulsivity referred to above, which related to academic performance, were based on the research of Luria (1961, 1965). Luria suggests that the child's verbal control of behavior is first gained over the initiation of responses. At this early stage, the verbal message is just another physical stimulus to respond. If the child receives a message not to respond, this is reacted to as another physical stimulus, and will increase the likelihood of releasing whatever response is dominant at the moment. Only later does the semantic component of the message begin to play a part and permit the inhibition of inappropriate behavior.

From this point of view, training in the control of impulsive behavior should have the following characteristics. There should be a strong tendency to perform some particular response; the child should then be trained to use verbal self-instruction to inhibit this response. For example, if an impulsive child is told to count rapidly to 30, then to stop counting, the self-instructions to stop at 30 must inhibit the dominant counting response. At first, the impulsive child is likely to continue counting, and to have difficulty stopping at 30. With practice, it is hoped

that the child will acquire the ability to follow his own self-instructions over a variety of tasks.

Three principle sorts of conditions were employed in studies 4 and 5. The Internal Control condition was trained to inhibit behavior by being given an instruction which the child had to remember and use when appropriate (e.g., as in the "count to 30 then stop count" example given above). The External Control condition was given the same tasks as the Internal Control children, but the EC children were not told beforehad when to stop responding; instead, they were trained to inhibit their responses upon an external signal. The third condition involved reinforcing children for staying in their seats and working -- in short, this involved attempting to reduce behavior such as getting out of the seat and talking -- behavior that is so often characterized as "impulsive" by criteria other that those of the present studies.

In studies 4 and 5, tasks were designed which bore no outward resemblance to the Luria task (or to any of the other impulsivity tasks reported in the previous studies herein), yet which incorporated similar requirements for the regulation of behavior in accordance with some initial verbal instructions. The studies attempted to employ tasks using materials which were readily obtainable in the regular classroom.

The primary purpose of study 4 was to determine the relative value of the verbal control (or planning) techniques in contrast to a more traditional behavior modification procedure. Several tasks were employed in the verbal control groups which were designed to meet the requirements embodied in the rationale provided by Luria.

In study 5, a set of tasks were used which represented refinements of those from study 4. These tasks were obtained by correlating the errors of the various study 4 tasks with Luria task errors. Those tasks which correlated most highly with performance on the Luria task were considered better measures of the processes under investigation. Using these refined tasks, study 5 investigated the relative effects of training for internal control versus training for external control.

General Method for Studies 4 and 5

Subjects

The Ss were 67 black first grade children drawn from two inner-city Detroit schools. In study 4, there were a total of 44 Ss drawn from the three different first grade rooms in the school. This group was composed of 25 males and 19 females. These Ss were randomly selected from the total first grade population in the school.

In study 5, 23 pupils were randomly selected from among those considered as having academic problems by their teachers. Pupils in this phase were drawn from two of the three first grade units and included 13 males and 10 females. The class not used was held in a "portable" room outside the school proper.

Materials

The materials included in both training studies included:

Peabody Picture Vocabulary Test (PPVT).

Kagan's Matching Familiar Figures Test (MFF).

Teacher rating questionnaire. This consisted of eight statements focusing on the topic of difficulties in impulse control observed by teachers in their classrooms. Teachers' responses were rated on a six-point scale whether they strongly agreed or strongly disagreed with the following statements: (1) This individual has difficulty following instructions; (2) This individual could be considered a behavior problem; (3) This individual has difficulty listening to directions; (4) This individual shows little tolerance for frustrating situations; (5) This individual shows difficulties in self-control; (6) This individual has difficulty completing any task he (or she) starts; (7) This individual has difficulty stopping most kinds of activity when told to do so; (8) This individual has difficulty sitting still most of the time. Individuals obtaining relatively high scores were considered more generally impulsive in the classroom. Test-retest reliability of this measure was found to equal $r = .85$.

Teacher grades. Teachers were asked to rate the S's school work on a four-point scale: 4 = very good; 3 = good; 2 = fair; 1 = poor.

In study 4, Standard Achievement scores were obtained in the areas of word reading, paragraph meaning, and arithmetic. Scores were also obtained on the Luria double light task which consisted of a two-bulb light display and a response button. Housed on the same unit as the controls was a four-pen Rustrac event recorder permitting permanent recording of the Ss responses.

In study 5, spelling, word reading, and arithmetic scores were obtained on the Wide Range Achievement test. Scores on a Draw-A-Line (DAL) test similar to that one employed by Maccoby, Donley, Hagen and Degerman (1965) were also obtained as an index of motoric inhibition, and the Porteus maze was included as another index of impulsivity (Palkes, Stewart and Kahana, 1968).

Procedure

Study 4

The Ss in this study were matched on intelligence and divided into four different groups. They were seen in eight one-half hour to 45 minute sessions over the course of four months. The internal verbal control (IC) groups were instructed to work on a series of school related tasks requiring the incorporation of the initial instructions in order to deal successfully with the tasks. Before starting the activity they were instructed to procede working up to some prearranged point in the tasks sequence, and stop working when reaching this point. In more advanced tasks another dimension was added in the form of requiring that the Ss carry out the tasks in a predetermined order as well as having them stop at a prearragned point. The external verbal control groups (EC) engaged in the same series of tasks, but were not told the stopping point beforehand. Here they were instructed to stop when they worked up to a certain predetermined point (which corresponded to that one used in the internal groups). Thus the external procedure contrasted with the internal in that it did not require that the Ss incorporate the instructions and plan their subsequent behavior in accordance with them.

A more straightforward behavior modification group (BM) was included which roughly paralleled the "Good behavior game" described by Barrish, Saunders, and

Wolf (1969). In this condition Ss were instructed that they had a certain amount of a task to complete and when it was completed they were free to leave the work area and engage in behavior of their choice. Some toys and other materials were provided in another area of the room. The Ss were further informed that each pair of individuals in the group had a different amount of work to complete and consequently each would take longer to complete his work. Since the choice of who would receive the small, medium or heavy work load was predicated on each S being subjected to each of the loads an equal number of times, all Ss had to engage in roughly equal amounts of work across the eight sessions. The Ss were also advised that there were two rules to the game, viz., before completing the assigned task there was to be no talking or getting up out of one's seat. With this arrangement each S underwent a sort of deconditioning during the course of training. This would appear to be the case since each S was required to remain silent and in his seat in the presence of stimuli (others talking and getting out of their seats) which would normally tend to evolve out-of-seat and talking behavior. To the extent possible all tasks included in the BM condition were the same as those included in both the EC and IC conditions.

Those Ss in the control group (C) generally participated in the same tasks using identical materials without, however, being subjected to any of the preceding stipulations.

All of the training tasks focused on, or included materials drawn from, school work that the Ss had already covered or were in the process of covering in the classroom. As a general incentive for participating in the study all Ss were told that they would be able to select a small prize upon successful completion of the series of "games" that they would be playing.

Training Tasks: Verbal Control Conditions. The following sets of training tasks emphasized the Ss' need to plan ahead when dealing with these materials. The particular gross behaviors in question involved talking and out-of-seat behaviors.

The tasks were alternately conducted in such a way that to comply with them, the Ss were required to either stop talking or return to or sit in their seats at some point depending upon the particular training conditions in question. The particular tasks included:

(1) Counting in Unison. Groups of Ss either counted or wrote numbers together each stopping at a different number which was known through pretesting to be within the Ss capability. This task was also used with writing and naming the letters of the alphabet. Here Ss had to stop counting or naming (talking) or had to return to seats after completing a certain number of words or letters written either on a blackboard or at a desk placed away from their original seats.

(2) Successive Counting in Unison. Similar to the above task but now requiring that the S recount to a different word or letter after completing their first count.

(3) Sequential Counting (and letter naming). Each S in a group counted in sequence. For example, with a group of six Ss the first individual would say the number one with the individual on his right stating "two", the next individual "three" until the particular number of interest (depending on condition) had been reached. This task included letters as well as numbers and involved out-of-seat behavior in the manner of requiring the Ss to also leave their seats to write the appropriate letter or number in the sequence on a blackboard placed about ten feet from their seats.

(4) Filling in Appropriate Letters and Numbers. Ss were provided with a paper marked off with boxes filled either with the letters of the alphabet or numbers in the proper sequence. On each sheet a number of boxes contained no letters or numbers. The Ss were instructed to read the written letters or numbers silently and provide the letter or number appropriate to the blank space orally. Each S, depending upon the condition, was also required to carry out this procedure until a particular point was reached. This procedure was also carried out by having the S write in the correct letter or number.

(5) Connecting Dots. Ss were provided with connect the numbers or letters dot drawings which depicted familiar objects or shapes of numbers and letters when completed. Depending on their conditions, Ss were required to connect the dots in the correct sequence and terminate their performance at a particular point.

Training Tasks: BM and C conditions. In order to comply with the rules of the BM condition, Ss worked quietly on the same materials employed in the preceding conditions. Here, written exercises were substituted for the oral ones. Exercises used in the C group were both written and oral and included those of the preceding three groups.

Study 5

In study 5 a smaller number of training tasks and treatment groups were included. The Ss were matched on intelligence and divided into three treatment groups and were seen in five one-half hour to 45 minute sessions over the course of three months. The three groups included an Internal verbal group (IC) and External verbal control group (EC) and a control group (C). The training sessions were conducted in a manner similar to study 4 with minor exceptions. Of the five tasks included in training, four were the same as those included in study 4. These four tasks were those on which the errors obtained by the Ss in training produced the highest correlation with errors on the Luria task. The rationale was that those tasks producing the highest correlation correspondingly should tap the kind of process measured by the Luria task. The fifth task included a map tracing exercise in which Ss had to find their way from one room to another in through the hallways of a schematic drawing of the inside of their school. Another map was a reproduction of small neighborhoods in which the individual had to find his way from one house to another. In the more difficult exercises using this task, the individual had to visit a series of 2 or 3 houses or rooms in a particular order. Prior to working on the task, all of the groups discussed the particulars of the drawings; however, in only the case of the IC was stress laid to preplanning and verbalizing by the S of how he was going to perform on the task.

Results

Study 4

Pre-test scores were analyzed comparing the various groups of this study. These pre-test scores indicated no significant differences between groups and so we can assume that the various groups were equivalent before the onset of the training.

Turning to the results of the training, Table 7 presents the relevant post-test means. Several noteworthy trends are suggested by these data. With regard

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Insert Table 7 about here

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to the MFF scores, the two verbal control groups (IC and EC) responded more quickly than the behavior modification and control groups. On the other hand, Ss in the verbal control groups made fewer errors than the behavior modification and control groups. Neither of these differences are significant and the .05 level using a one-way analysis of variance.

The means of teacher ratings indicate less impulsivity for the verbal control groups than for the behavior modification and control groups, however, the differences are not significant at the .05 level. The teachers' grades are fairly uniform with the exception of a lower, but non-significant grade for the behavior modification group. The IQ scores reveal little variation and are not significantly different.

In considering the achievement scores, note that a fairly consistent, although non-significant trend is evident. Here the grade level equivalents of the verbal control groups are without exception, higher than those of the behavior modification and control groups. On the Luria task impulsivity scores, the verbal control groups made more errors than the behavior modification or the control groups, but this difference is not significant. With regard then to the non-significant trends in the data, the following are suggested:

Table 7

Post-Test Means on Test Measures

		MFF					Stanford Achievement			
		Reaction Time	Errors	Teacher Ratings*	Teacher Grades	PPVT	Word Read	Paragraph Meaning	Arith	Luria
Treatment Groups	EC	5.9	1.1	4.4	2.3	101.9	2.0	2.2	2.2	6.3
	IC	5.6	1.8	4.3	2.2	99.5	1.9	2.3	2.2	7.0
	BM	6.0	2.2	4.0	2.8	101.2	1.8	1.9	2.0	4.5
	C	6.7	2.1	3.9	2.2	99.0	1.8	1.8	1.7	5.6

* High score means less impulsive behavior

(1) The verbal control groups are consistently associated with better performance in all achievement test scores, teacher grades, and impulsive errors on the MFF test.

(2) The behavior modification and control groups are consistently associated with more optimal performance on the Luria impulsivity measure and the response latency score of the MFF.

Because of the relatively small number of subjects included in the study, it was decided that some manner of controlling the variability of the scores was needed to provide more power for the analysis. Since pre-test scores were already available it was decided to use the pre-test scores as a covariate in an analysis of covariance. In the case of the achievement scores where no pre-test score was available, the pre-test IQ score was used as a covariate. Along with the inclusion of a covariate, the scores were broken down by sex to check for the potential of differential treatment effects based on the sex of the subject. With this covariance analysis, a significant sex by treatment interaction was revealed on MFF errors ($F = 4.01$, df, 3,35).

Figure 1 presents a graph of the treatment means for the MFF test errors. Note that there is essentially no treatment effect for the girls (the zero errors

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Insert Figure 1 about here

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indicated for the control girls is based on an N of 2). While for the boys, the verbal control conditions are associated with less MFF errors.

Study 5

Pre-test scores were analyzed comparing the various groups of this study. These pre-test scores indicated no signficant differences between groups and so we can assume that the various groups were equivalent before the onset of the training.

Table 8 presents the post-test means on the test measures included in this

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Insert Table 8 about here

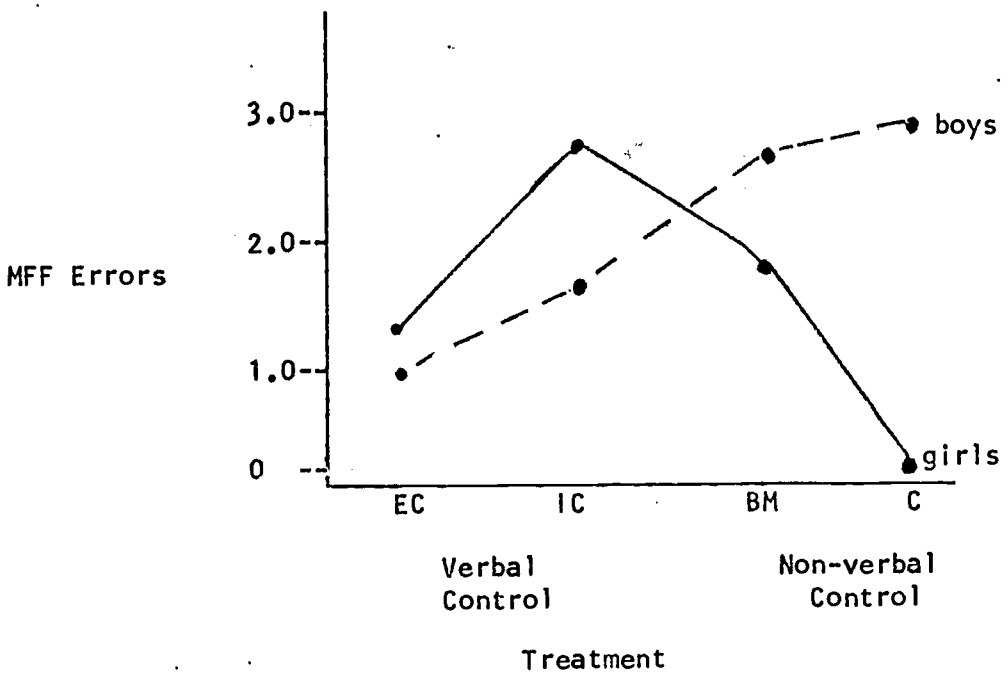

Figure 1. MFF errors X treatments broken down according to the sex of the subject.

Table 8

Post-Test Means on Test Measures for Study 5

		MFF						Stanford Achievement			
		Reaction Time	Errors	Teacher Ratings*	Teacher Grades	PPVT	DAL	Word Read	Spell	Arith	Porteus Maze
Treatment Groups	EC	6.5	20.6	3.7	2.6	88.1	10.0	1.9	1.5	1.8	7.9
	IC	6.9	20.8	4.3	2.4	87.7	16.7	1.7	1.6	1.9	8.6
	C	9.2	16.3	3.9	2.9	85.5	12.1	1.7	1.4	1.7	6.7

*High score means less impulsive behavior

study. Analysis of variance performed on the post-test means revealed a significant treatment effect on the Porteus maze test, (F = 3.6, df 2,20). Here the Ss in the IC group obtained a mental age equivalent of 8.6 years, while the EC and control groups obtained age equivalents of 7.9 and 6.7 years respectively. An analysis of covariance was also conducted using pre-test scores as a covariate and produced essentially similar results. A more precise determination of the nature of this difference between treatments was investigated through the use of the Newman-Keuls method (Winer, 1962). Using this procedure, it was found that only the difference between the IC and control groups were significant beyond the .05 level when the treatment means were evaluated individually. Because of the limited number of Ss available for this study, a breakdown by sex was not included.

Looking at the other means, some noteworthy trends are indicated. With regard to achievement scores, the verbal control groups again surpass the control group on achievement scores (with the exception of word reading where the IC and control means are equal). The teachers' grades of the verbal control groups exceed the grades for the control group. In both the Draw-A-Line test and teacher grades, the IC group achieved the optimal score; however, in each case the control group fares better than the EC group. With regard to PPVT scores, the differences are negligible, but in favor of the verbal control groups. On the other hand, the control Ss exhibited fewer errors and longer reaction times on the MFF, a finding which is in a direction opposite from that expected.

Discussion

The results of studies 4 and 5 reveal only spotty effects due to the types of training for impulsivity that were used. The significant effects reveal a reduction in impulse errors for boys on the MFF and reduced errors for both sexes on the Porteus maze task. Most other effects were not significant.

While the verbal control groups performed consistently better than control groups on the achievement tests, none of these results reach an acceptable level

of significance. The verbal control groups were from 1 to 5 months superior to the control groups in achievement grade levels. These results are relatively encouraging considering the fact that the training used in the present studies was relatively short and the studies involved a relatively small number of students. At this point the writers believe that the primary contributions of studies 4 and 5 involved the rather essential development of training materials and that a great deal more work is required in order to evaluate the effectiveness of these training materials.

The writers believe that greater amounts of training than were used in the present studies are required in order to evaluate the procedures developed in this study. It is felt that many of these procedures could be incorporated in the normal curriculum employed by the teachers. Thus, in working with the children within such a framework, at least as much emphasis would be given to following the teacher's directions as in learning the particular cognitive material being presented by the teacher. For example, in teaching children to count, the teacher would emphasize having the child count to a particular number and stop counting; this emphasis would be as great as having the children learn the particular numbers.

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APPENDICES

Studies 1 and 2

Appendix 1

Nursery School: Lower SES Correlation Matrix

	Impulsive (NV1)	Impulsive (V)	Impulsive (NV2)	Omission (NV1)	Omission (V)	Omission (NV2)	Kagan MFF (Rt)	Kagan MFF (Errors)	Teacher Rating	PPVT (IQ)	Sex
Impulsive Errors (NV1)		.72*	.81*	-.14	.00	-.14	-.18	.14	.12	.22	-.34
Impulsive Errors (V)			.80*	-.08	.00	-.21	-.41	.23	.10	.08	-.46
Impulsive Errors (NV2)				-.18	-.04	-.05	-.27	.15	.14	-.03	-.30
Omission Errors (NV1)					.18	.06	-.26	.19	.58*	-.33	-.25
Omission Errors (V)						.21	-.21	-.10	-.18	-.27	.31
Omission Errors (NV2)							-.21	-.21	-.27	-.28	.03
Kagan MFF (Rt)								-.09	-.16	.09	.35
Kagan MFF (Errors)									-.25	.20	-.19
Teacher Rating										-.19	-.07
PPVT IQ											-.32
Sex											

* ($P < .05$)

Appendix 2

Nursery School: Middle SES Correlation Matrix

	Impulsive (NV1)	Impulsive (V)	Impulsive (NV2)	Omission (NV1)	Omission (V)	Omission (NV2)	Kagan MFF (Rt)	Kagan MFF (Errors)	Teacher Rating	PPVT (IQ)	Sex
Impulsive Errors (NV1)		.76*	.90*	.00	.04	.20	.04	-.22	.36	-.15	-.34
Impulsive Errors (V)			.72*	.03	.06	.22	.18	-.06	.19	-.03	-.34
Impulsive Errors (NV2)				-.22	.11	-.03	-.09	-.26	.56*	-.01	-.50
Omission Errors (NV1)					.56*	.80*	.10	.57*	-.06	-.09	-.03
Omission Errors (V)						.47	.21	.23	-.23	.02	-.18
Omission Errors (NV2)							.07	.32	-.10	-.11	-.18
Kagan MFF (Rt)								-.54*	-.27	.24	.20
Kagan MFF (Errors)									.02	-.09	-.16
Teacher Rating										.05	-.39
PPVT IQ											-.35
Sex											

* ($P < .05$)

Appendix 3

First Grade: Lower SES Correlation Matrix

	Impulsive (NV1)	Impulsive (V)	Impulsive (NV2)	Omission (NV1)	Omission (V)	Omission (NV2)	Kagan MFF (Rt)	Kagan MFF (Errors)	Teacher Rating	PPVT (IQ)	Sex
Impulsive Errors (NV1)		.73*	.64*	.22	.25	.57*	.21	.01	.27	-.23	-.21
Impulsive Errors (V)			.49*	-.21	.25	.47*	.33	.14	.52*	-.08	-.34
Impulsive Errors (NV2)				.23	-.04	-.06	.21	-.07	.07	-.08	.13
Omission Errors (NV1)					-.09	-.06	.06	-.07	-.41	-.19	.13
Omission Errors (V)						.47*	-.24	-.12	.13	-.18	-.13
Omission Errors (NV2)							.00	.20	.33	-.13	-.29
Kagan MFF (Rt)								.02	-.13	-.12	-.16
Kagan MFF (Errors)									.13	-.28	-.26
Teacher Rating										.25	-.33
PPVT IQ											.48*
Sex											

* ($P < .05$)

Appendix 4

First Grade: Middle SES Correlation Matrix

	Impulsive (NV1)	Impulsive (V)	Impulsive (NV2)	Omission (NV1)	Omission (V)	Omission (NV2)	Kagan MFF (Rt)	Kagan MFF (Errors)	Teacher Rating	PPVT (IQ)	Sex
Impulsive Errors (NV1)		.45*	.14	.19	.16	-.12	.15	.26	-.19	.43*	-.24
Impulsive Errors (V)			.19	.61*	.31	.22	-.21	.26	.20	.52*	-.26
Impulsive Errors (NV2)				.32	.27	.87*	.03	.66*	-.21	.37	.26
Omission Errors (NV1)					-.03	.41*	-.02	.40	.20	.10	-.01
Omission Errors (V)						.20	-.16	.19	.42*	.10	-.16
Omission Errors (NV2)							.12	.67*	-.08	.24	.29
Kagan MFF (Rt)								-.04	.19	-.08	.09
Kagan MFF (Errors)									.20	.26	.16
Teacher Rating										-.19	-.43*
PPVT IQ											-.36
Sex											

* ($P < .05$)

Appendix 5

Study Two: First Grade/Lower SES Correlation Matrix

	Impulsive (NV1)	Impulsive (V)	Impulsive (NV2)	Omission (NV1)	Omission (V)	Omission (NV2)	Kagan MFF (Rt)	Kagan MFF (Errors)	Teacher Rating	PPVT (IQ)	Sex	Classroom Grades
Impulsive Errors (NV1)		.75*	.57*	-.09	.04	-.13	-.10	.59*	.24	-.22	-.27	-.39*
Impulsive Errors (V)			.24	-.04	.03	-.02	-.16	.36*	.11	-.14	-.10	-.27
Impulsive Errors (NV2)				-.04	-.07	-.14	.04	.49*	.34*	-.21	-.22	-.39*
Omission Errors (NV1)					.50*	.46*	.00	.07	.24	-.01	.11	-.20
Omission Errors (V)						.37*	-.17	.13	.26	.05	-.03	.14
Omission Errors (NV2)							.12	-.11	.05	.21	.19	.02
Kagan MFF (Rt)								-.18	-.23	.10	-.02	.00
Kagan MFF (Errors)									.35*	-.35*	-.45*	-.33*
Teacher Rating										-.46*	-.18	-.56*
PPVT IQ											.04	.53*
Sex												.27
Classroom Grades												

* ($P < .05$)

Appendix 6

Study Two: First Grade/Middle SES Correlation Matrix

	Impulsive (NV1)	Impulsive (V)	Impulsive (NV2)	Omission (NV1)	Omission (V)	Omission (NV2)	Kagan MFF (Rt)	Kagan MFF (Errors)	Teacher Rating	PPVT (IQ)	Sex	Classroom Grades
Impulsive Errors (NV1)		.09	.03	-.03	.15	-.21	-.17	.40*	.20	.09	-.40	-.27
Impulsive Errors (V)			.51*	-.13	-.24	-.17	-.06	-.08	-.01	-.11	-.02	.04
Impulsive Errors (NV2)				-.05	.02	-.18	.23	-.03	-.07	-.01	-.22	.08
Omission Errors (NV1)					.16	.58*	-.13	.01	-.11	.07	.02	.02
Omission Errors (V)						.17	.23	.21	.26	-.07	-.19	-.52*
Omission Errors (NV2)							-.20	-.05	.08	-.25	.31	-.08
Kagan MFF (Rt)								-.07	-.15	.16	.03	-.03
Kagan MFF (Errors)									.23	-.18	-.12	-.53*
Teacher Rating										.03	-.22	-.72*
PPVT IQ											-.20	.20
Sex												-.09
Classroom Grades												

* ($p < .05$)