CHILDRENS' PERCEPTION OF COMPETENCE AND OF SUCCESS CRITERION AND THEIR MATCHING FAMILIAR FIGURES TEST PERFORMANCE

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ABSTRACT

CHILDRENS' PERCEPTION OF COMPETENCE AND OF SUCCESS CRITERION AND THEIR MATCHING FAMILIAR FIGURES TEST PERFORMANCE

By

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Kagan, Rosman, Day, Albert, and Phillips (1964) devised the Matching Familiar Figures Test (MFFT) to measure individual differences in cognitive tempo that they labeled as "reflection-impulsivity." The MFFT has recently been criticized by Block, Block, and Harrington (1974) and others on conceptual and methodological bases. One criticism was that MFFT response latency is confounded with MFFT response accuracy in the operationalization of "reflective" and "impulsive" response styles.

The purpose of the present study was to determine whether MFFT response style is a "predispositional" tendency of the child as proposed by Kagan et al. (1964) or whether variables associated with MFFT latency and accuracy, respectively, combine to influence the MFFT response style of the child. On the basis of the literature review, it was expected that the child's perception of the task success criterion would influence MFFT latency and that the child's perception of his MFFT competence would affect his MFFT accuracy. It was predicted that children who believed speed plus accuracy to be the success criterion would show shorter MFFT latencies than would children who believed only accuracy to be the success criterion. It was also predicted that children who believed themselves to be competent on the MFFT, because they were told so by the test administrator, would make fewer MFFT errors than children who were told nothing about their MFFT competence. Furthermore, it was predicted

that the task success criterion would not affect MFFT error scores and that competence perception would not affect MFFT latency.

One hundred twenty-eight second- and third-grade boys were administered the MFFT in two test sessions. The task success criterion and competence manipulations were introduced at the beginning of the posttest session, four weeks after subjects had been given the MFFT for pretest classification purposes.

The results were analyzed with analyses of variance and Scheffe post hoc comparisons. The results indicated that the children who believed the task success criterion to be speed plus accuracy showed shorter latency than did children in the accuracy only and control conditions. The MFFT error scores, however, also increased for the children in the speed plus accuracy condition, which indicated that MFFT errors were indirectly related to the success criterion for these children. Competence perception, as defined in the present study, was unrelated to MFFT performance. Overall, the MFFT response classification categories to which children had been assigned were unaltered after the introduction of the experimental manipulations. Results were discussed in terms of a speed-accuracy tradeoff strategy. Future research should establish whether intellectual and personality factors are related to information processing strategies on the MFFT.

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Renate Mahler

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To my true friends,
who transcend time and space.

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TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

INTRODUCTION

Kagan, Rosman, Day, Albert, and Phillips (1964) devised the Matching Familiar Figures Test (MFFT) to measure individual differences in the problem-solving strategy of children. The MFFT involves a high degree of response uncertainty, since the task of the child is to select, from an array of several alternatives that subtly vary from a standard line drawing, the line drawing of a familiar object that is identical to the standard (Kagan and Kogan, 1970). Children who responded slowly and accurately on the MFFT were labeled "reflective," whereas those who responded quickly and inaccurately were labeled "impulsive." As these labels imply, Kagan et al. (1964) conceptualized the MFFT as a measure of cognitive tempo. Block, Block, and Harrington (1974), however, recently noted that both MFFT latency and MFFT accuracy are used in the operationalization of "reflection-impulsivity." Since they found that personality factors correlated with MFFT accuracy, but not with MFFT latency, they suggested that the MFFT is a confounded measure of cognitive tempo, and it is best to consider MFFT latency and MFFT accuracy as two independent dimensions.

The present study examined MFFT latency and accuracy as independent factors. The literature review suggests that MFFT latency appears to be affected by task factors, whereas MFFT accuracy appears to be related to stable characteristics of the individual. The purpose of the present study was to determine whether this general trend of the literature operates at the individual level to affect the outcome of a child's MFFT classification. In this study, the task factor of the MFFT success criterion perception (i. e., whether speed or accuracy was important) and the personal characteristic of MFFT competence perception (i. e., being told or not told that prior MFFT performance was good) were manipulated. If MFFT latency scores of the child can be explained by task variables and MFFT error scores by the stable characteristics of the individual, then perception of the MFFT success criterion should influence MFFT latency performance and perception of MFFT competence should affect MFFT accuracy performance.

Overview of Literature Review

An abundance of literature that addresses cognitive style as it is defined by the MFFT has appeared since the topic was introduced by Kagan et al. (1964). The literature deals with three basic topics, the trends of which suggest and support the predictions of the present study. The first topic is concerned with factors associated with cognitive tempo, including correlates such as personality factors, attitude, intelligence, and sex and experimental antecedents of MFFT performance such as task structure factors and performance anxiety. Consistent with the predictions of this study, the correlates of MFFT performance (i. e., the stable characteristics of the individual) are primarily related to MFFT error scores, and the experimental antecedents (i. e., those dealing with task structure) affect MFFT latency scores. The second topic deals with the modification of "reflective" and "impulsive" cognitive styles through modeling and verbal training techniques and with the generality of "reflection-impulsivity" as a behavioral measure. Subtopics of the generality issue are motor inhibition, correlation among latency indices, visual scanning and information processing strategies, risk-taking behavior, and the ability to delay gratification. The modification literature reveals that MFFT latency scores are readily changed through instructions, but that MFFT error scores are not. This trend supports the predictions that MFFT latency is affected by task structure variables, whereas MFFT error scores are more stable, perhaps related to characteristics of the individual. Since MFFT latency has generality as a behavioral measure to the degree that the task to which MFFT latency is compared is similar in structure to the MFFT, the trend of this literature review is congruent with the present prediction that MFFT latency is related to task variables. MFFT latency is modifiable and generalizable, whereas MFFT accuracy is not. The third issue that is addressed below, in conjunction with the other two topics, deals with the adequacy of the MFFT as a measure of cognitive tempo.

Correlates and Experimental Antecedents of MFFT Performance

Correlates. Generally, personality factors and intelligence correlate with MFFT accuracy. Studies, however, have produced inconsistant results, in part because of methodological inadequacies. Several investigators have used teacher ratings of personality; such ratings may be methodologically unsound and biased. Furthermore, most investigators did not examine MFFT latency and accuracy performance separately (Ault, Crawford, and Jeffrey, 1972; Bjorklund and Butter, 1973; Nadeau, 1968). Nadeau (1968) found no relationship between teachers' ratings of personality and MFFT performance. Bjorklund and Butter (1973) found no correlation between MFFT response style and the Impulsivity Scale for Children nor between MFFT response style and teacher ratings of preschool-age children. Ault et al. (1972) examined the correlation between teacher ratings of attention, hyperactivity, and motivation of school-age children and MFFT latency and error scores in a design that included the traditionally excluded "fast-accurate" and "slow-inaccurate" MFFT performance groups. Teachers, unaware of the children's MFFT scores, rated "slow-accurate" children as significantly higher on attention than "fast-inaccurate," "fast-accurate," and "slow-inaccurate" children. No significant correlations were obtained for motivation ratings. Ratings of hyperactivity showed that children having high MFFT error scores were rated as more hyperactive than children with low MFFT error scores, irrespective of MFFT latency to first response classification. It is impossible, however, to determine the actual correlation between personality traits and MFFT latency and accuracy scores in the Ault et al. (1972) study, since no boys were classified as "fast-accurate," and thus, teacher ratings were confounded with the sex of the child.

Block et al. (1974) avoided both of the methodological errors mentioned above. They used a standardized personality test, a modified version of the California Q set, in place of teacher ratings. They also defined four MFFT response style quadrants by pairing median splits of MFFT error scores and MFFT latency to first response scores, thus unconfounding the latency and accuracy components of the MFFT. Only two personality attributes were significantly related to MFFT response latency, but thirty-two attributes were significantly related to MFFT response accuracy. Block et al. (1974) commented that it is possible that the "predispositional" differences between "reflective" and "impulsive" response styles of children referred to by Kagan et al. (1964) may be primarily associated with MFFT errors because stable personality traits were found to be associated with MFFT errors rather than with MFFT latency and error-latency interactions.

Generally, the children who displayed few errors on the MFFT showed the following traits: competence, intelligence, perceptiveness, and interpersonal attractiveness. Those children who made many errors (i. e., who were "inaccurate") on the MFFT showed rigidity, oversensitivity, and a lack of self-confidence (Block et al., 1974).

Attitudes also have been found to correlate with MFFT response style. It is impossible, however, to ascertain whether the correlation is stronger for MFFT accuracy or latency. Adams (1972) and Schack and Massari (1971) found that children categorized as "slow-accurate" on the MFFT had a greater expectation for success than children categorized as "fast-inaccurate." Campbell and Douglas (1972) reported that "slow-accurate" children were more optimistic in situations of frustration and potential failure than were "fast-inaccurate" children. These findings may reflect the association between MFFT accuracy and "competence" found by Block et al. (1974), although the confounding of speed and accuracy in these attitude studies makes it impossible to determine whether this is the case.

Whether the sex of the child is correlated with MFFT performance is unresolved, since research results are inconsistent (Lewis et al., 1968; Messer, Note 1). As Egeland and Weinberg (1976) have suggested, the effect of sex differences on MFFT performance is probably best examined with a developmental paradigm. In order to avoid problems which could arise if there are sex differences in MFFT performance, the present study was limited to one sex--males, who show a stronger negative correlation than females between MFFT error and latency scores (Lewis et al., 1968).

<u>Experimental antecedents</u>. Both task structure variables and performance anxiety are experimental antecedents to MFFT latency. Several investigators (Bush and Dweck, 1975; Rhetts, 1974; Ward, 1968; Weiner and Adams, 1974) have suggested that "reflection-impulsivity" may be due to situational task variables. Bush and Dweck (1975) found that children of "slow-accurate" cognitive style exhibited long latency on the MFFT and short latency on speeded tasks according to the situational requirements of the task. They suggest that "fast-inaccurate" children did not attend to or use the situational cues that indicated what constituted an appropriate response to a task. Likewise, Rhetts (1974) suggested that it is possible that learner and task characteristics interact and result in differences in MFFT latency. Weiner and Adams (1974) proposed that MFFT response style may be related to the reinforcement history of the child, since they found that consistent feedback in a failure condition resulted in a latency increase, but inconsistent feedback in a frustration condition did not. Speed task instructions and accuracy task instructions may also interact with an "evaluative" or "permissive" test situation, affecting MFFT response style (Ward, 1968). A conclusion of these studies is that the task structure may interact with the characteristics of the individual to affect MFFT latency.

Task performance anxiety appears to be related to MFFT latency. Kagan et al. (1964) first suggested that anxiety over failure could lead to either "reflective" or "impulsive" MFFT responses. On the one hand, the child who was anxious about possible rejection by the test administrator might behave "reflectively" on the MFFT because he lengthened his time to enhance the possibility of providing a correct answer. On the other hand, anxiety could produce "impulsive" MFFT performance because the child presumably found the silence between himself and the test administrator impossible to bear during problem solving. Kagan et al. (1964, Study 6) found no significant differences between children tested by an "impersonal" silent versus a "reassuring" talkative test administrator, so the performance differences of children on the MFFT were interpreted as reflecting "predispositional" fundamental response tendencies of the child rather than situational anxiety factors.

Since Kagan et al.'s (1964) Study 6, however, other investigators have found anxiety to have a significant affect as a situational antecedent to conceptual tempo. Ward (1968) investigated the effect of failure feedback that followed the individual MFFT test item and found that failure feedback was associated with longer latency on MFFT items that immediately followed such feedback. If it is assumed that the failure feedback provoked anxiety, then Ward's (1968) finding supported Kagan et al.'s (1964) conjecture that anxiety leads to "reflective" responses because the child attempted to investigate all solution hypotheses to avoid failure. Messer (1970) and Weiner and Adams (1974) used failure on an anagrams task as an anxiety provoker with third- and fourth-grade children, and confirmed Ward's (1968) results that anxiety significantly increased MFFT response latency, but did not affect MFFT errors.

Bush and Dweck (1975) administered the Test Anxiety Scale for Children and Lie Scale for Children (Sarason et al., 1960) to fourth-grade children. They found that high-anxious "reflective" children and low-anxious "reflective" children behaved similarly on speeded tasks of increased difficulty and showed longer latency and greater accuracy on the MFFT than did "impulsive" children. The results of the Bush and

Dweck (1975) study can be interpreted in two ways. Instruments used to measure anxiety may have been unrelated to the anxiety of the MFFT task. This possibility was suggested by Kagan and Messer (1975) when they pointed out the importance of operationally defining anxiety. The other explanation is that anxiety had no effect on MFFT performance in the Bush and Dweck (1975) study. It is possible that a psychological characteristic other than anxiety, such as the personality factors suggested by Block et al. (1974), differentiated the MFFT performance of children classified as "reflective" and "impulsive."

This review suggests that MFFT accuracy is related to the competence, perceptiveness, and the intelligence of the individual. Optimism and success expectancy, found to be characteristic of "slow-accurates," may also be associated with the competence characteristic that Block et al. (1974) found correlated with MFFT accuracy. Performance anxiety, feedback conditions, and the perception of task requirements, however, affect MFFT latency independent of MFFT accuracy. Thus in this study, it was expected that manipulated competence perception would affect MFFT error scores, whereas the perception of the task success criterion would affect MFFT latency scores.

Modifiability and Generality of MFFT Response Style

Modifiability of MFFT response style. Research that deals with the modifiability of "impulsive" and "reflective" cognitive styles evolved primarily from the assumptions that "reflective" cognitive style is associated with superior problem-solving ability and that "impulsive" cognitive style is characteristic of children of low socioeconomic background (Kagan, 1967). As noted by Block et al. (1974), MFFT latency can be significantly modified by modeling procedures (Cohen and

Przycien, 1974; Debus, 1970; Meichenbaum and Goodman, 1971); errors, however, are not significantly decreased unless special training procedures are employed. The self-instruction of covert and overt verbalization employed by Meichenbaum and Goodman (1971) was a training procedure that resulted in a significant decrease in MFFT errors.

Since MFFT response latency is signficantly altered through modeling and verbal training procedures, the indication is that MFFT latency is affected by task structure variables. The finding, however, that MFFT errors are not significantly decreased unless the subject gave himself self-instruction as compared to the same instruction provided by another individual (Meichenbaum and Goodman, 1971) tends to support the possibility that such self-instruction results in a heightened sense of competence, usually only characteristic of children making few MFFT errors, and that this heightened sense of competence significantly affected MFFT accuracy. Block et al. (1974) noted that it is difficult to determine the long term effects of self-instruction since no follow-up studies have been conducted.

Generality of MFFT response style. An issue seperate from although related to MFFT response modifiability is whether the MFFT "reflective" and "impulsive" response style of an individual generalizes across situations, which is suggested by ascribing characteristics such as restlessness, distractibility, and hyperactivity to the "impulsive" child as was done by Kagan et al. (1964) and Kagan and Kogan (1970). Variables explored in the study of MFFT response style generalizability are: motor inhibition, correlation among latency indices, visual scanning and information processing strategies, risk-taking behavior, ability to delay gratification, and personality correlates. All but the last of these, which has already been discussed, appear to be unrelated to "reflection-impulsivity" as defined by the MFFT. Literature that deals with each of these variables is presented below.

Motor inhibition. If "reflection-impulsivity" has generality as a behavioral dimension, then it can be expected that there is a correlation between motor activity and cognitive style; studies, however, have not indicated such a correlation. Inhibition of motor response on the Motor Inhibition Test failed to correlate with "reflectivity" on the MFFT (Shipman, 1971). Harrison and Nadelman (1972) reported a negative correlation between motor inhibition on the Motor Inhibition Test and error-per-time scores on the MFFT, though this result appears to be attributable to a confound with intelligence, as noted by Block et al. (1974). Constantini, Corsini, and Davis (1973) found that motor inhibition is inconsistent across age because preschool-age boys labeled as "impulsive" on the MFFT had more difficulty inhibiting motor movement on the Wald-a-Board, Reel-up, and Finger Tap Tests than school-age boys labeled as "reflective" on the MFFT. No relationship was found between cognitive tempo and motor inhibition for girls at any age. Generally, these results do not support the concept that "reflection-impulsivity" is a general measure as indicated by motor response indices.

Latency indices. Block et al. (1974) provided an extensive review of the various latency indices that have been investigated as possible correlates of MFFT performance. Block et al. (1974) noted that correlations are high between MFFT latency to first response scores and other measures when the cognitive tasks are highly similar in structure, require similar motor skills, similar intellectual competence, and elicit similar anxiety reactions. This positive correlation between MFFT latency scores and other indices of latency that are similar in task structure tends to indicate that task structure and situational variables, rather than a stable attribute of the individual, determine MFFT latency.

Visual scanning and information processing strategies. Variables that have received attention in an effort to understand the perceptual and cognitive components associated with conceptual tempo are visual scanning strategy and information processing strategy.

Siegelman (1969) compared children classified as "reflective" and "impulsive" on the MFFT and found that the former group deployed relatively less looking time and less frequent looks to the standard figure of the MFFT. Drake (1970) found, however, just the opposite effect. Ault et al. (1972) found that all children employed a visual scanning strategy of pair comparisons, but that those children with low MFFT error scores employed the strategy more systematically than those children that provided many inaccurate responses on the MFFT, regardless of MFFT latency to first response scores. Thus no consistent relationship was found to exist between cognitive tempo and visual looking time.

Recently, however, Zelniker and Jeffrey (1976) have suggested that "slow-accurate" children attend to the details of visual stimuli while "fast-inaccurate" children attend to the "global" characteristics of visual stimuli. What determines these visual scanning styles was not addressed by Zelniker and Jeffrey (1976). Jones and McIntyre (1976) also have indicated that different responses on the MFFT may be the result of information processing differences. In particular, they suggest that latency and accuracy classification are attributable to "game plans" and speed-accuracy tradeoffs.

Delay of gratification and risk-taking behavior. Other measures that should relate to the "globality" of cognitive style as measured by the MFFT are ability to delay gratification and also risk-taking behavior. These measures, however, fail to correlate with MFFT classification. No relationship was observed between MFFT latency or error scores and the Mischel Delay of Gratification task (Hess, Shipman, Brophy, and Baer, 1969; Shipman, 1971). Risk-taking behavior also was found to be uncorrelated with MFFT latency and error scores (Kopfstein, 1973; Shipman, 1971).

All motor and behavioral variables except personality traits appear to be unrelated to either MFFT error or latency scores. There are three possible explanations for this finding. One explanation is that there is no correlation between the cognitive factors tested by the MFFT and actual behavioral measures. A second explanation is that the correlation between behavioral measures and MFFT scores is low because of a different task structure. This explanation agrees with the general trend of the literature that shows MFFT latency to be related to task structure variables. A third explanation is that the MFFT is scored so that latency is confounded with accuracy and that the MFFT is, therefore, not so simple or direct a measure of latency as are other latency indices. Since it is impossible to determine which of these explanations for the nongenerality of the MFFT to behavioral measures is the case, this area must be disregarded in the attempt to determine the variables related to MFFT latency and accuracy.

Present Study

From the review of the literature, MFFT latency appears to be influenced by task structure variables that are unrelated to MFFT accuracy. Anxiety about performance, consistent feedback about task requirements, and modeling and verbal-training techniques all significantly increased MFFT latency scores, but not MFFT error scores. Thus it seems that MFFT latency is readily influenced by a range of task structure variables. Since the correlation among latency indices depends on a similar task structure, the indication is that MFFT latency is not determined by a "predispostional" response tendency of the child as suggested by Kagan et al. (1964). The child, instead, may be "predisposed" to a MFFT accuracy style. The literature review indicated that MFFT accuracy is related to personality attributes, to competence, and to optimism, and that such factors are independent of MFFT latency.

The question raised in the present study is whether MFFT accuracy and latency scores of individual children are affected by different variables, as the literature review suggests. This possibility seems to have been overlooked because in its traditional conceptualization the MFFT was not considered to be a two-factor classification scheme. Instead the MFFT was conceptualized as a measure of two response styles, "reflectivity" and "impulsivity." That accuracy and latency factors were confounded in this conceptualization was disregarded until it was pointed out by Block et al. (1974). Most studies that have defined MFFT response style by this traditional method have examined the effect of one variable on the MFFT response style. The present study examined whether variables that were found in previous research to affect MFFT latency and accuracy combine to determine the MFFT response classification of the individual child.

Since the MFFT has both a latency and an accuracy component, it seemed reasonable that experimental manipulations directly related to these components would be most influential on them. One attribute of task structure is the success criterion presented to the child, that is, whether accuracy alone or speed plus accuracy is stressed as important for good performance scores. Ward (1968) suggested that instructions about MFFT speed and accuracy could affect MFFT latency. Bush and Dweck's (1975) suggestion that "fast-inaccurate" children were incapable of discerning task requirement cues was supported by Block et al.'s (1974) finding that "accurate" children were more "perceptive" than "inaccurate" children. Thus in the present study, the child's perception of the MFFT success criterion was manipulated by verbally labeling the criterion as either accuracy or speed plus accuracy. In accord with the results found in the literature review, this task structure manipulation was expected to influence MFFT latency scores, but not MFFT error scores. The following predictions were made about the MFFT success criterion manipulation: Prediction 1: Children in the speed plus accuracy criterion conditin will have significantly shorter MFFT posttest latencies to the first response than will children in the accuracy criterion condition. Prediction 2: The MFFT task success criterion will not significantly influence MFFT posttest error scores.

Block et al. (1974) showed competence, intelligence, and other personality attributes to be correlated with MFFT accuracy. Of these attributes, it seemed that competence could be most readily experimentally manipulated; therefore, perceived task competence was selected for study. On the basis of these results, manipulations of perceived task competence were expected to affect MFFT error scores, but not MFFT latency scores.

In the present study, the test administrator told children in the competence condition that their MFFT pretest performance was outstanding. Children in a control condition were told nothing about their MFFT pretest performance. Predictions about the effect of the competence manipulation were: Prediction 3: Children in the MFFT competence perception condition will make significantly fewer MFFT posttest errors than children in the control condition. Prediction 4: The MFFT competence perception of the child will not significantly affect his MFFT posttest latency to first response scores.

An alternative measure of competence is the child's perception of his own competence in relation to that of other children his age. Prediction 5 is that there is a significant relationship between the child's own evaluation of his MFFT competence in relation to that of other children his age, based on an ordinal rating, and his MFFT posttest error scores.

METHOD

Subjects

The subjects were one hundred forty-eight second- and third-grade boys, mean age eight years and two months, who were enrolled at the East Lansing Elementary Schools in East Lansing, Michigan. All were administered the initial MFFT. Of these boys, 59 were "fast-inaccurate," 47 were "slow-accurate," 32 were "fast-accurate," and 10 were "slow-inaccurate" on MFFT pretest classification. One hundred twenty-eight (70 second-grade, 58 third-grade) boys were assigned to experimental success criterion and competence perception groups on the basis of their performance on the initial administration of the MFFT. Of these boys, 48 were "fast-inaccurate," 38 were "slow-accurate," 32 were "fast-accurate," and 10 were "slow-inaccurate" on the MFFT pretest classification. Twenty additional boys from the original population, all classified as either "slow-accurate" or "fast-inaccurate" on the MFFT pretest, constituted a test-retest reliability control group.

Apparatus

The test instrument was Kagan's (1965) Form F Elementary version of the MFFT, consisting of two practice items and twelve test items. Each test item consists of one standard familiar figure and six alternatives--five similar to the standard figure and one identical to it. The child's task was to select the alternative that matched the standard. When the subject selected an incorrect alternative, he was asked to choose again until the correct match was made. The maximum number of errors possible per test item was five, since each incorrect alternative was recorded as an error only the first time it was selected. The child's mean number of errors and the mean number of seconds (to the nearest half second) to the first response on each item, the standard measure of MFFT latency, are the two dependent measures of the MFFT.

On the basis of these two dependent measures, the boys were classified as "slow-accurate" (SA; usually referred to as "reflective"), "fast-inaccurate" (FI; usually referred to as "impulsive"), "fast-accurate" (FA), and "slow-inaccurate" (SI). The boys classified as "slow" and "fast" were those who had scored respectively above and below the subject population mean latency to first response scores (20.15 seconds). "Accurate" and "inaccurate" classifications were based on a mean-split of the total error scores per test of the subject population (8.74 errors). Egeland and Weinberg (1976) have called this classification procedure the "composite standard score" and have suggested that it should replace Kagan's (1965) standard median-split procedure of subject classification in order to avoid the misclassification of subjects.

Since the size of the present population sample is large--N=148--it was assumed that the MFFT scores of the sample were normally distributed rather than skewed, and that the mean was the more stable measure of central tendency on which to split subjects into MFFT pretest classification groups, as compared to the median. Even though the mean-split procedure was more likely to result in unequal pretest group sizes, precedence was given to this procedure because of the greater statistical power of the mean and also for the purpose of establishing "normative" MFFT data.

Since no reliable alternative form of the Elementary version of the MFFT exists (Messer, personal communication, May, 1976), the Kagan (1965) Form F Elementary version of the MFFT was used in both pretest and posttest sessions. Pearson product-moment correlation coefficients, based on the test-retest reliability control group (n=20), indicate that the test-retest reliability of the instrument for the present population was .83 for MFFT error scores and .74 for MFFT latency to first response scores.

Procedure

Each child was individually tested in two sessions seperated by approximately four weeks. The standard MFFT test procedure was used at the pretest session, providing the scores for MFFT pretest classification. Verbal comments about the boys' MFFT competence and the MFFT success criterion were the manipulations presented in the MFFT posttest session.

In both sessions, the MFFT was administered by a young woman in a room free of distractions. The child sat at a table in a right-angle to the test administrator. The MFFT test booklet was placed on a stand in front of the subject so that the standard figure, on one page, and the six alternatives, on the facing page, were nearly at right angles to one another and clearly visible to the child.

Since two test administrators were employed, care was taken so that the same woman administered the MFFT to a particular child in both sessions. Both the test administrators tested children in all the posttest conditions and were unaware of the MFFT pretest classification of the subjects. Interrater reliability for consistency in scoring was

.99 for MFFT error scores and .94 for MFFT latency to first response scores, as established by Pearson product-moment correlation coefficients.

<u>MFFT pretest session</u>. In the MFFT pretest session, the child was told that the task involved looking at pictures and that the test administrator would write down his score. In order to avoid distractions, the scoresheet was below the table surface, on the test administrator's lap. A quiet stopwatch was held beneath the table surface, away from the child's sight. Once the child was seated the test administrator gave the child the standard MFFT instructions (see Appendix A).

When the child selected an incorrect alternative, the test administrator commented, "Good try. Find the one that is just like this one." A correct match received the comment "good."

At the end of the session, the child was not given any information about his pretest performance. He was told only that he would be doing a similar task again in a few weeks.

<u>MFFT posttest session</u>. In the posttest session, the experimental manipulations were introduced. The manipulations consisted of verbal comments by the test administrator at the beginning of the session about the boy's MFFT competence and the MFFT task success criterion. The four experimental conditions were: competence and accuracy comments, competence and speed plus accuracy comments, accuracy comments, and speed plus accuracy comments. The speed condition stressed speed plus accuracy so that the child would not believe speed to be the criterion to the exclusion of accuracy. The visibility of the scoresheet and the verbal comment about the dual criterion before each test item, described below, were precautions taken to assure that speed was not significantly

increased because the subject thought accuracy to be an irrelevant criterion.

After the boys had been classified using MFFT pretest error and latency to first response scores, and grade-level, they were matched and assigned randomly to one of the four experimental groups with the constraint that a proportional number of subjects from each MFFT classification were assigned to each group.

The following verbal comments were given to the boys in each of the respective experimental conditions.

Competence and Accuracy Comments

> I've come back to watch you do this again because you were so good on it the last time I was here. You got most of the pictures right. So this time I will keep your score on my scoresheet and I'd like you to try to find the correct matching picture each time.

Competence and Speed Plus Accuracy Comments

> I've come back to watch you do this task again because you were so good on it the last time I was here. You chose the matching pictures really fast. So this time I brought a stopwatch and I'll keep your score on paper. You are to try to find the correct matching picture as fast as you can each time.

Accuracy Comments

> The reason I've come back to watch you do this task again is because this time I want to keep your score on my scoresheet. You are to try to find the correct matching picture each time.

Speed Plus Accuracy Comments

> The reason I've come back to watch you do this task again is because this time I brought a stopwatch and I want to keep your score on paper. You are to try to find the correct matching picture as fast as you can each time.

Before each of the test items, the test administrator said, "Try to find the correct matching picture as fast as you can" in the speed plus accuracy condition, or "Try to find the correct matching picture" in the accuracy only-condition. In the accuracy conditions, the scoresheet was on the tabletop in front of the test administrator. In the speed plus accuracy conditions, the stopwatch and scoresheet were on the tabletop. The stopwatch could not be seen in the accuracy-only conditions.

Test-retest reliability control group. The posttest session for the test-retest reliability group was identical to the standard MFFT procedure used in the pretest session (see Appendix A). No experimental manipulations were introduced in the posttest session because the major purpose for including the group in the present study was to establish the test-retest reliability coefficient under standard administration conditions on the Form F Elementary version of the MFFT for the present population.

The group also served as a control group in a statistical analysis involving change scores over test sessions. The test-retest reliability control group, and thus the analysis of change scores over sessions, was limited to the SA and FI MFFT pretest classification groups in order not to decrease the sparsely represented FA and SI groups that were included in the major analysis of the predictions.

Postexperimental interview. Following the MFFT posttest, a brief postexperimental interview was conducted in order to determine the boys' perception of their MFFT competence and the experimental manipulations (see Appendix B). The child evaluated his MFFT posttest performance as "better than," "the same as," or "not as good as" that of his peers. These ranked data were correlated with MFFT error and latency scores and also with the experimental group to which the child had been assigned.

Since it was possible that some children in the competence control condition may have interpreted the test administrator's lack of verbal comment about the previous MFFT performance as a negative evaluation, care was taken to assure all children, at the end of the postexperimental interview, that their MFFT performance was adequate.

RESULTS

Analyses

MFFT error and latency to first response scores were analyzed seperately. The major analysis consisted of a 2 x 2 x 4 least squares analysis of variance with Competence, Criterion, and Classification as the factors. Competence refers to whether the child was told he had performed well on the MFFT pretest or whether the child was in a control condition in which he was not given information about the MFFT pretest performance. The two levels of the Criterion factor were accuracy, and speed plus accuracy. The Classification factor had four levels of MFFT pretest classification: slow-accurate (SA), fast-inaccurate (FI), fast-accurate (FA), and slow-inaccurate (SI).

To assess the magnitude and direction of MFFT performance change over test sessions, a 2 x 3 least squares repeated measures analysis of variance was performed with Classification and Criterion as the factors. The Classification factor consisted of SA and FI prettest classification groups. In addition to accuracy, and speed plus accuracy criterion groups, a third group, the test-retest reliability control group, was included in the analysis of the Criterion factor in order to examine whether subjects exposed to experimental manipulations differed significantly from those not exposed to experimental manipulations. Since the means were based on unequal cell frequencies, all post hoc comparisons among the means were analyzed with the Scheffe test. The .05 level of statistical significance was selected for all statistical analyses in the present study.

Latency Scores

The mean MFFT posttest seconds to first response, standard deviations, and the number of observations for the 32 experimental conditions of the 2 x 2 x 4 factorial design analyzed by least squares analysis of variance are presented in Table 1. Unequal cell frequencies were obtained because of the mean-split procedure by which speed and accuracy groups were defined on the pretest. In particular, relatively few children were classified as SI. Since unequal observations were caused by the mean-split procedure, a least squares analysis was performed accordingly (Kirk, 1968, p. 204). The least squares analysis adjusts the error sum of squares as small as possible so that a true test of the effects is obtained.

A summary of the 2 x 2 x 4 least squares analysis of variance is presented in Table 2. Highly significant main effects for Criterion ($F(1,112) = 66.81$, $p < .001$) and for Classification ($F(3,112) = 25.63$, $p < .001$) were obtained. Neither the main effect of Competence nor any of the interactions reached statistical significance.

The main effect of Criterion supported Prediction 1, since the speed plus accuracy group showed a shorter mean latency to first response ($\bar{X} = 9.78$ seconds) than did the accuracy group ($\bar{X} = 19.24$ seconds). Since the pretest mean latency for the two groups is 20.4 seconds for the speed plus accuracy group and 20.6 seconds for the accuracy group, respectively, it appears that children who were told that speed plus accuracy was the MFFT success criterion decreased in MFFT seconds to the first response of a test item compared to the children in the accuracy

Table 1. MFFT Posttest Latency Means and Standard Deviations for Competence, Success Criterion, and Pretest Classification Groups (2 x 2 x 4 ANOVA)

Experimental Condition			Pretest Classification				Success Criterion	
			SA	FA	SI	FI		
Competence	Speed & Accuracy	$\bar{X}$	15.07	7.84	9.18	5.96	Speed & Accuracy	
		SD	9.52	3.25	5.53	2.65		
		n	9	8	3	12		
	Accuracy	$\bar{X}$	29.46	15.51	15.13	15.50	$\bar{X}$	9.77
		SD	9.60	3.75	11.38	5.94	SD	7.07
		n	10	8	2	11	n	65
Control	Speed & Accuracy	$\bar{X}$	16.10	10.76	11.41	5.21	Accuracy	
		SD	9.94	3.96	6.97	1.74		
		n	10	7	3	13		
	Accuracy	$\bar{X}$	26.27	16.11	31.15	12.42	$\bar{X}$	19.24
		SD	7.10	6.30	14.83	6.00	SD	9.38
		n	9	9	2	12	n	63
Classification		$\bar{X}$	21.78	12.72	15.43	9.56		
		SD	10.84	5.59	11.39	6.10		
		n	38	32	10	48		

Note. Data are based on 128 experimental subjects.

Table 2. Summary of 2 x 2 x 4 Least Squares Analysis of Variance of MFFT Posttest Latency (Seconds to First Response) Scores

Source	*SS*	*df*	*MS*	*F*
Competence (A)	1.67	1	1.67	.04
Criterion (B)	2863.20	1	2863.20	66.81**
Classification (C)	3294.74	3	1098.25	25.63**
A x B	26.63	1	26.63	.62
A x C	220.24	3	73.41	1.71
B x C	186.00	3	62.00	1.45
A x B x C	160.80	3	53.60	1.25
Within	4799.77	112	42.86	------

**$p < .001$.

condition who were unaware that speed was a relevant criterion of success.

Scheffe post hoc pairwise comparisons of Classification group latency scores revealed tht the SA group differed significantly from the FA and FI groups in posttest latency (see Table 3). The SA group was significantly slower than the other pretest classification groups ($\bar{X}$ = 21.78; see Table 1).

Since the MFFT competence perception of the child did not significantly affect MFFT latency to first response, the null hypothesis must be accepted with respect to Prediction 4. In accord with Prediction 4, a nonsignificant correlation (r = .05, ns) was found between MFFT posttest seconds to first response on an ordinal rating in which the child compared his MFFT performance to that of his peers.

Table 3. Mean Posttest Latency Differences (in Seconds) for Scheffe Post Hoc Pairwise Comparisons of Classification Levels (2 x 2 x 4 ANOVA)

	Latency			
	SA	FA	SI	FI
SA	-------	9.06*	6.35	12.22*
FA	-------	-------	2.71	3.16
SI	-------	-------	-------	5.87
FI	-------	-------	-------	-------

*$p < .05$.

It was also of interest to determine the effect of experimental factors on the magnitude and direction of MFFT performance change over test sessions. Of particular interest was whether the experimental groups differed significantly from the test-retest control group. Since SA and FI were the only classification groups assigned to the test-retest condition, these were the only MFFT pretest classification groups included in the 2 x 3 (Classification x Criterion) least squares analysis of variance. (Note that SA and FI experimental groups in the original 2 x 2 x 4 analysis, however, constituted 67.3 percent of the population; therefore, the samples of the 2 x 2 x 4 and 2 x 3 analyses were fairly similar).

The analysis of main effects of the 2 x 3 least squares repeated measures analysis of variance was based on pre-posttest composite scores, and the effects across sessions were based on pre-posttest differences.

MFFT pretest and posttest latency to first response means and standard deviations for Classification and Criterion factors are presented in Table 4. A summary of the 2 x 3 least squares repeated measures analysis of variance is presented in Table 5. The analysis of main effects, based on composite pretest-posttest means, revealed highly significant effects of Classification ($\underline{F}(1,100) = 196.01$, $\underline{p} < .001$) and of Criterion ($\underline{F}(2,100) = 9.01$, $\underline{p} < .001$). The results of the analysis also demonstrated highly significant effects of Measures ($\underline{F}(1,100) = 35.77$, $\underline{p} < .001$), Classification x Measures ($\underline{F}(1,100) = 32.48$, $\underline{p} < .001$), and Criterion x Measures ($\underline{F}(2,100) = 28.52$, $\underline{p} < .001$).

The Classification factor showed the same trend as in the 2 x 2 x 4 analysis. The FI group had a shorter composite latency ($\bar{X} = 21.53$) than

Table 4. Latency to First Response Score Means (in Seconds) and Standard Deviations for Measures, Success Criterion, and Pretest Classification Groups (2 x 3 ANOVA)

	Pretest Classification		Success Criterion: Speed & Accuracy	Success Criterion: Accuracy	Success Criterion: Control	
Pretest	SA	$\bar{X}$	32.53	31.95	32.22	32.24
		SD	12.31	8.84	6.37	
		n	19	19	9	
	FI	$\bar{X}$	11.17	11.26	12.37	11.43
		SD	3.91	3.46	3.37	
		n	25	23	11	
		$\bar{X}$	20.39	20.62	21.30	
Posttest	SA	$\bar{X}$	15.61	27.95	29.93	23.34
		SD	9.48	8.43	9.27	
		n	19	19	9	
	FI	$\bar{X}$	5.57	13.89	12.49	10.10
		SD	2.21	6.04	5.98	
		n	25	23	11	
		$\bar{X}$	9.91	20.25	20.34	
Criterion		$\bar{X}$	15.15	20.44	20.82	
		SD	12.29	9.45	11.18	
		n	44	42	20	

Table 5. Summary of 2 x 3 Least Squares Repeated Measures Analysis of Variance for MFFT Seconds to First Response Scores

Source	SS	df	MS	F
Between subjects				
Classification (A)	29954.39	1	29954.39	196.01**
Criterion (B)	2753.72	2	1376.86	9.01**
A x B	131.22	2	65.61	.43
Subj. w. groups	15282.00	100	152.82	-------
Within subjects				
Measures (C)	1737.64	1	1737.64	35.77**
A x C	1578.02	1	1578.02	32.48**
B x C	2770.60	2	1385.30	28.52**
A x B x C	292.66	2	146.33	3.01*
Subj. w. measures x groups	4858.00	100	48.58	-------

*$p < .0537$.
**$p < .001$.

the SA group ($\bar{X}$ = 55.58). Scheffe post hoc pairwise comparisons revealed that the speed plus accuracy criterion group mean (15.15 seconds) differed significantly from the accuracy criterion group mean and the test-retest control group mean ($\bar{X}$ = 20.14 and 20.82 seconds, respectively). The accuracy and test-retest control groups, however, did not differ significantly. Subjects who were told, with emphasis, that it was important to select the correct matching picture did not spend more time selecting a correct match than did subjects who were given a brief description of the MFFT objective on correct matching.

Posttest latency ($\bar{X}$ = 10.38) was less than pretest latency ($\bar{X}$ = 20.65); overall, children responded faster at the second MFFT session than the first. Possibly this is an indication of a practice effect. However, since the Measures factor significantly interacted with the Classification factor and also with the Criterion factor, such a possibility must be qualified.

With regard to the Classification x Measures interaction, Scheffe post hoc comparisons indicated that SA pretest latency scores differed significantly from the FI posttest latency scores and that the FI pretest latency scores differed significantly from the SA posttest scores. The difference between the means for the two comparisons were 22.14 seconds and 11.91 seconds, respectively. It was found that the SA pre- and posttest means were involved in all the significant pairwise comparisons. Figure 1 shows that the SA and FI groups differed substantially on MFFT pretest classification, but that the SA group showed a significant decrease in posttest latency, whereas the FI group did not. It seems that "fast" subjects could not improve on response time because of a 'ceiling effect.' This possibility is supported by the pre-posttest trends for FA and SI groups, depicted in Figure 1 (though not included in the 2 x 3 analysis), that are similar to FI and SA groups, respectively.

Figure 2 shows that the speed plus accuracy group differed significantly on MFFT posttest latency to first response compared to the accuracy and test-retest groups. The mean latency differences of the Criterion x Measures groups of the Scheffe pairwise post hoc comparisons that reached statistical significance involved the speed plus accuracy posttest condition. The mean latency difference between the accuracy group pretest and the speed plus accuracy group posttest was 10.17 seconds and the mean latency difference between the test-retest group pretest and the speed plus accuracy group posttest was 11.39 seconds. Thus those children who were told that speed was a criterion modified their MFFT posttest latency accordingly.

Error Scores

The mean total error scores per test were analyzed in the same way as the mean MFFT latency to first response scores.

A summary of the Competence x Criterion x Classification group means, standard deviations, and frequencies of the groups appears in Table 6. As is shown in Table 7, the 2 x 2 x 4 least squares analysis of variance revealed highly significant effects for Criterion ($\underline{F}(1,112) = 30.75$, $\underline{p} < .001$) and for Classification ($\underline{F}(3,112) = 13.72$, $\underline{p} < .001$). Prediction 2 was that MFFT errors would not be affected by the child's perception of the task success criterion. Children in the speed plus accuracy criterion condition, however, made more errors ($X = 10.43$) than did those in the accuracy condition ($\bar{X} = 5.86$). The children in the speed plus accuracy criterion condition either focused their attention on the speed criterion alone, or they may have been unable to maintain a low

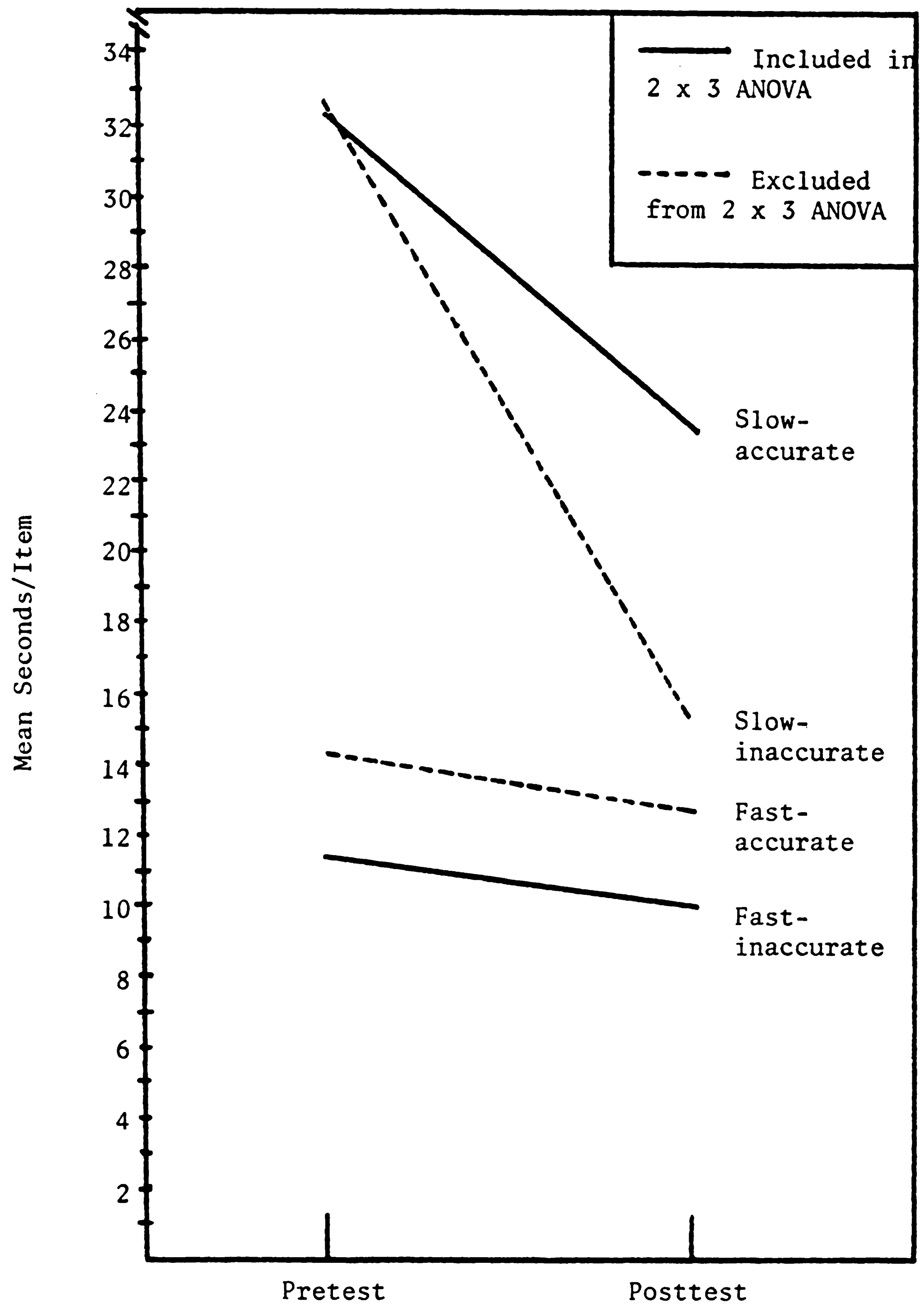

Figure 1. Mean MFFT Latency Scores Per Item for Pre- and Posttest Sessions as a Function of Classification Group

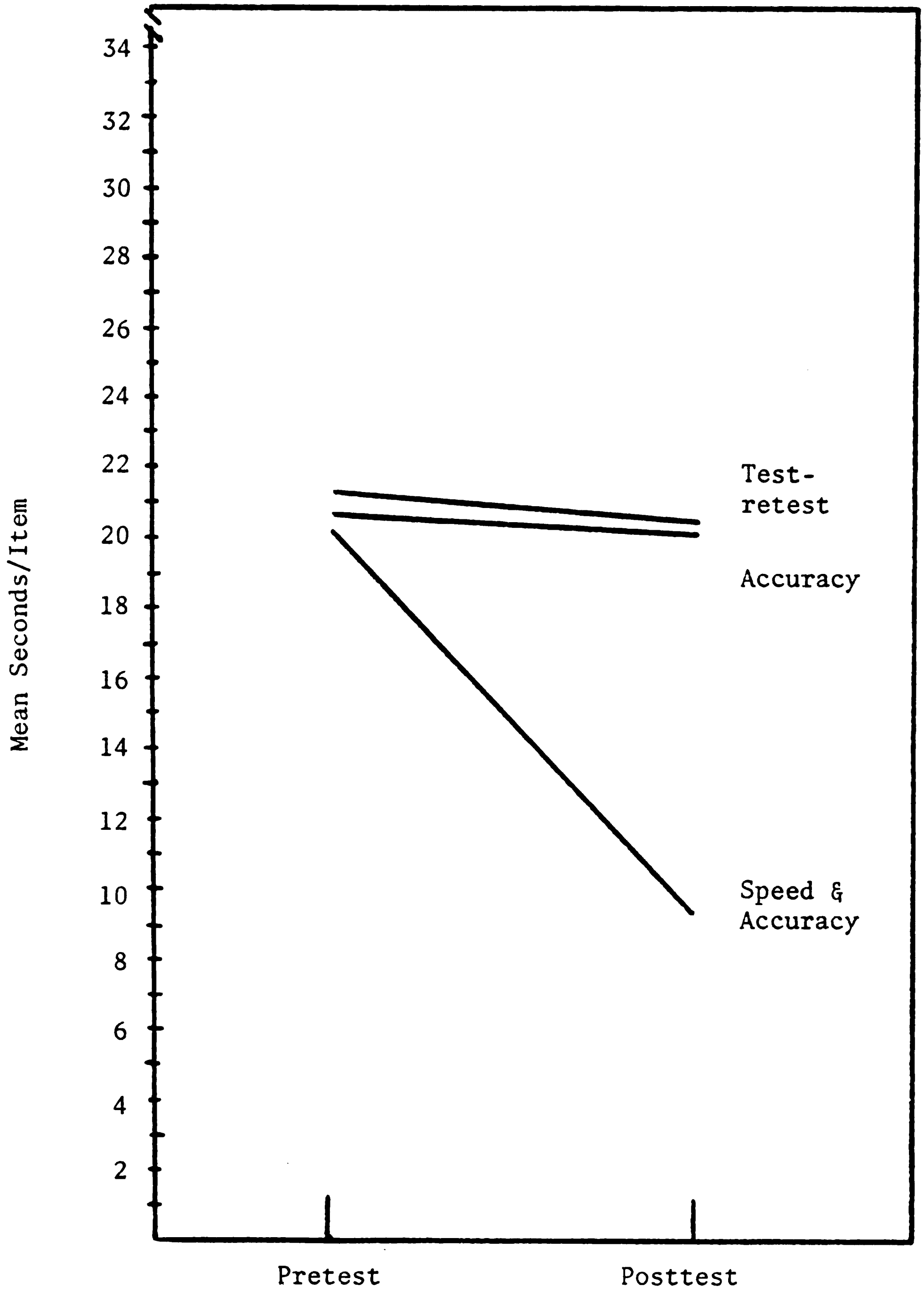

Figure 2. Mean MFFT Latency Scores Per Item for Pre- and Posttest Sessions as a Function of Criterion Group

Table 6. Mean Total Posttest Error Scores Per Test, Standard Deviations, and Frequencies of Competence, Success Criterion, and Pretest Classification Groups (2 x 2 x 4 ANOVA)

Experimental Condition			Pretest Classification				Success Criterion	
			SA	FA	SI	FI		
Competence	Speed & Accuracy	$\bar{X}$	7.11	9.00	12.33	13.92	Speed & Accuracy	
		SD	4.48	7.76	3.51	4.68		
		n	9	8	3	12		
	Accuracy	$\bar{X}$	5.00	6.13	10.00	7.55	$\bar{X}$	10.43
		SD	2.98	3.91	4.24	4.82	SD	6.05
		n	10	8	2	11	n	65
Control	Speed & Accuracy	$\bar{X}$	7.10	7.29	11.33	14.00	Accuracy	
		SD	7.58	1.70	2.52	5.20		
		n	10	7	3	13		
	Accuracy	$\bar{X}$	1.67	4.00	4.00	9.00	$\bar{X}$	5.86
		SD	1.32	3.32	1.41	4.00	SD	4.22
		n	9	9	2	12	n	63
Classification		$\bar{X}$	5.26	6.50	9.90	11.25		
		SD	5.07	4.91	4.09	5.40		
		n	38	32	10	48		

Note 1. Summary data are based on 128 experimental subjects.
Note 2. Sixty was the maximum number of errors possible per subject.

Table 7. Summary of 2 x 2 x 4 Least Squares Analysis of Variance of MFFT Posttest Total Errors

Source	SS	df	MS	F
Competence (A)	22.25	1	22.25	1.02
Criterion (B)	669.21	1	669.21	30.75**
Classification (C)	895.60	3	298.53	13.72**
A x B	8.16	1	8.16	.38
A x C	56.30	3	18.77	.86
B x C	36.27	3	12.09	.56
A x B x C	39.85	3	13.28	.61
Within	2437.07	112	21.76	------

$p < .001$.

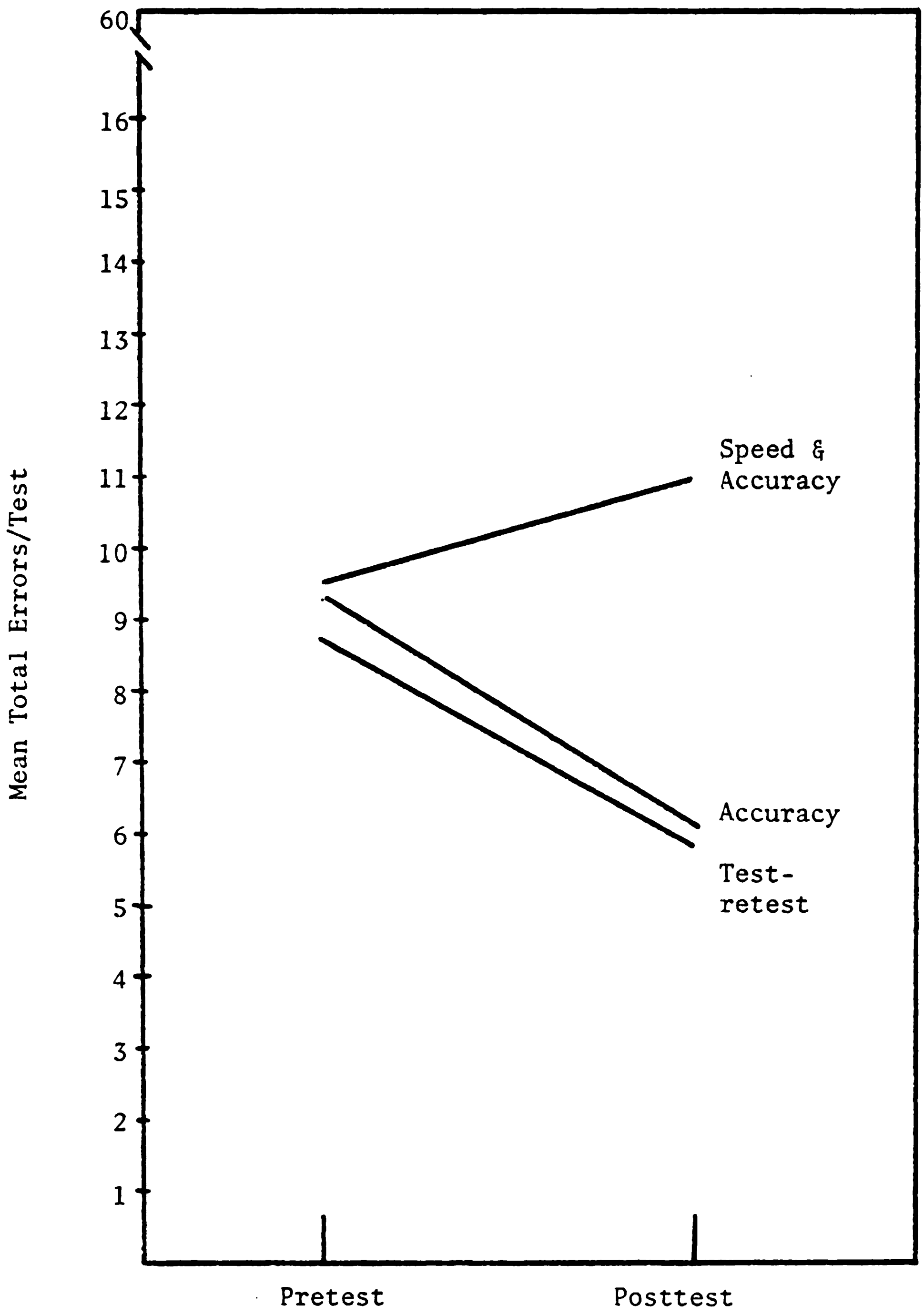

Figure 3. Mean Total Errors Per Test for Pre- and Posttest Sessions as a Function of Criterion Group

error rate because of anxiety or a speed-accuracy tradeoff (see Figure 3).

Scheffe pairwise post hoc contrasts of Classification group means (see Table 8) revealed that the FI group differed significantly from SA and FA groups. The FI group made more errors ($\bar{X} = 11.25$) than did the SA and FA groups. Also significant was the comparison in which "accurate" pretest classification groups were combined and compared to combined "inaccurate" pretest classification groups; the comparison of combined "slow" and combined "fast" groups, however, did not differ significantly. MFFT pretest accuracy groups remained significantly different after the introduction of experimental manipulations. Thus MFFT error scores appear to be stable, that is, they were not affected by the experimental manipulations in the present study.

Table 8. Mean Posttest Error Score Differences for Scheffe Post Hoc Pairwise Comparisons of Classification Levels (2 x 2 x 4 ANOVA)

	Errors			
	SA	FA	SI	FI
SA	-------	1.24	4.64	5.99*
FA	-------	-------	3.40	4.75*
SI	-------	-------	-------	1.35
FI	-------	-------	-------	-------

*$p < .05$.

Since the main effect for Competence was not significant, Prediction 3 was not supported. Children told that they had performed well on the MFFT pretest did not make fewer errors than those children told nothing about their MFFT pretest performance. The possibility that the competence message was ineffective because children did not believe the competence comments of the adult was explored. Of the 50 children who received the competence message, 41 said they believed the adult, six said they did not believe the adult, and three said that they did not remember the competence message. In view of the small number of children who did not believe the competence message, further analyses of these data were not warranted. The relationship between the child's evaluation of his MFFT competence in relation to that of his peers and MFFT posttest error scores was low ($r = .11$, ns). On the ordinal ranking, 57 percent of the children rated their MFFT performance as the same as that of their peers, 28 percent as better than that of their peers, 12 percent as not as good as that of their peers, and three percent refused to judge. Freeman's theta, a coefficient of differentiation between ordinal and nominal categories, was used to examine the relationship between the child's evaluation of his competence and assignment to experimental competence and criterion groups. Theta was low ($\emptyset = .09$, ns), meaning that there was no relationship between the child's evaluation of his competence and the nominal competence-criterion group to which he was assigned. Neither the experimental manipulations that consisted of verbal comments about MFFT competence nor the child's evaluation of his MFFT competence in relation to that of his peers was related to MFFT scores.

The means, standard deviations, and frequencies for MFFT pretest and posttest error scores of the Classification and Criterion groups of the 2 x 3 least squares repeated measures analysis of variance are presented in Table 9. As Table 10 shows, significant effects were found for Classification ($F(1,100) = 171.46$, $p < .001$) and for Criterion ($F(2,100) = 7.88$, $p < .001$). As shown by Table 9, the SA group had fewer errors ($\bar{X} = 8.38$) than the FI group ($\bar{X} = 24.56$), as shown by the pretest-posttest composite mean, on which the analysis of the main effects was based.

A Scheffe pairwise comparison ($p < .05$) of Criterion groups showed that the speed plus accuracy criterion group ($\bar{X} = 10.23$) differed significantly from the accuracy criterion group ($\bar{X} = 7.72$) and the test-retest control group ($\bar{X} = 7.38$); the latter two did not differ significantly from one another. The finding that the speed plus accuracy group made significantly more errors than the other two criterion groups fails to confirm Prediction 2, that the MFFT error scores would not be significantly affected by the Criterion factor.

The 2 x 3 analysis also revealed a significant effect of Measures ($F(1,100) = 7.69$, $p < .01$), the interaction of Classification x Measures ($F(1,100) = 15.47$, $p < .001$), and the interaction of Criterion x Measures ($F(2,100) = 12.40$, $p < .001$). The error rate of the MFFT posttest session ($\bar{X} = 8.09$), on the avearage, was one fewer than that of the MFFT pretest session ($\bar{X} = 9.22$). A slight practice effect may have been present over sessions, though such a conjecture is made with caution in view of the significant interactions of Measures with both Classification and Criterion factors.

Table 9. Total Error Score Means and Standard Deviations for Measures, Success Criterion, and Pretest Classification Groups (2 x 3 ANOVA)

Pretest Classification			Success Criterion			
			Speed & Accuracy	Accuracy	Control	
		$\bar{X}$	4.11	3.89	3.00	3.81
	SA	SD	2.00	2.11	2.00	
		n	19	19	9	
Pretest						
		$\bar{X}$	13.52	13.83	13.64	13.66
	FI	SD	3.97	3.58	3.20	
		n	25	23	11	
		$\bar{X}$	9.45	9.33	8.85	
		$\bar{X}$	7.11	3.42	1.67	4.57
	SA	SD	6.14	2.85	1.87	
		n	19	19	9	
Posttest						
		$\bar{X}$	13.96	8.30	9.36	10.90
	FI	SD	4.85	4.37	5.45	
		n	25	23	11	
		$\bar{X}$	11.00	6.09	5.90	
Criterion		$\bar{X}$	10.23	7.72	7.38	
		SD	6.07	5.40	5.98	
		n	44	42	20	

Table 10. Summary of 2 x 3 Least Squares Repeated Measures Analysis of Variance for MFFT Error Scores

Source	SS	df	MS	F
Between subjects				
Classification (A)	6762.65	1	6762.65	171.46**
Criterion (B)	621.64	2	310.82	7.88**
A x B	42.18	2	21.09	.53
Subj. w. groups	3944.00	100	39.44	-------
Within subjects				
Measures (C)	170.46	1	170.46	7.69*
A x C	343.02	1	343.02	15.47**
B x C	549.92	2	274.96	12.40**
A x B x C	34.64	2	17.82	.80
Subj. w. measures x groups	2217.00	100	22.17	-------

*$p < .01$.
** $p < .001$.

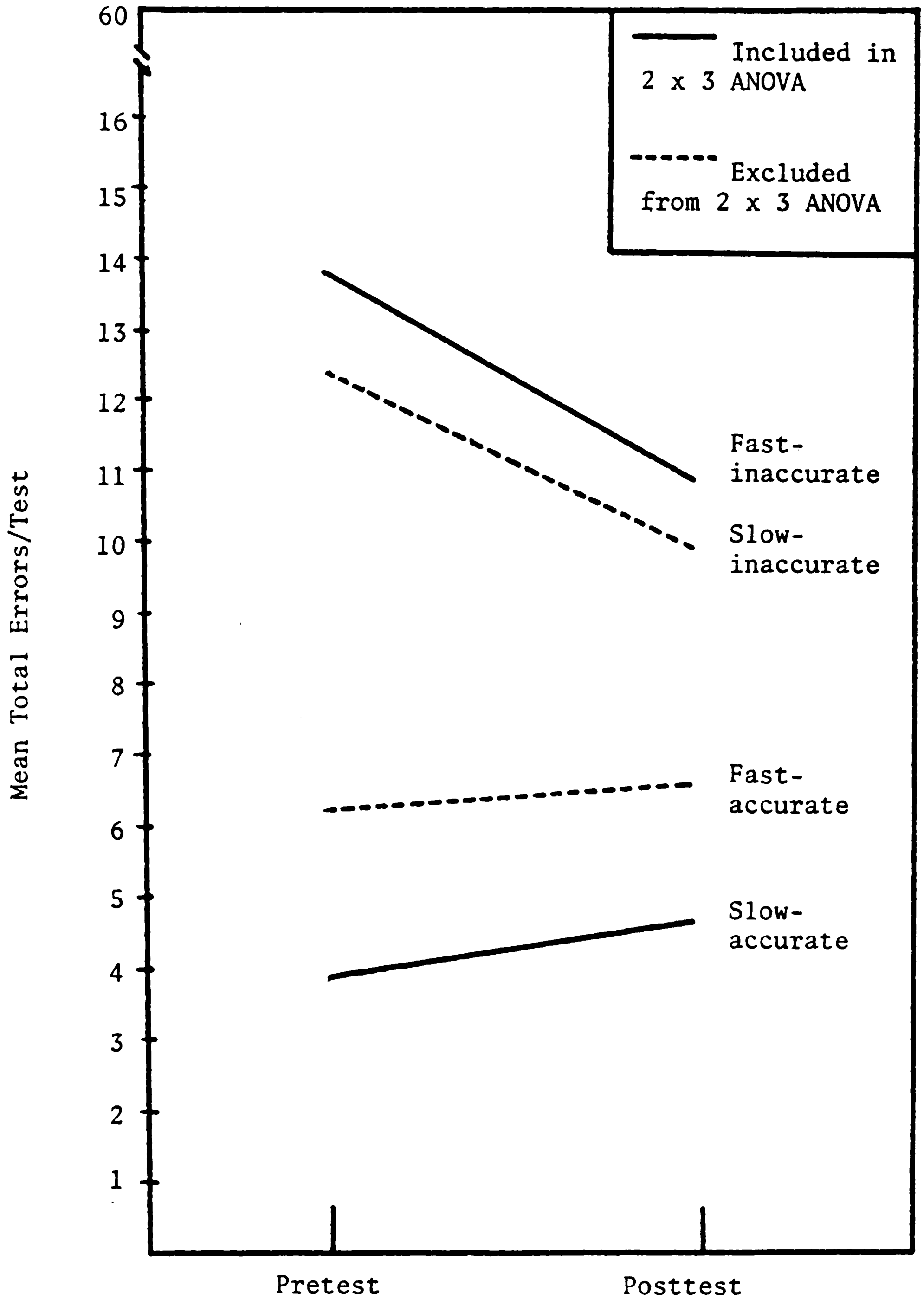

Figure 4. Mean Total Errors Per Test for Pre- and Posttest Sessions as a Function of Classification Group

Scheffe tests of the Measures x Classification means indicated that the SA and FI groups significantly differed from one another in both pretest and posttest sessions. The SA pretest condition differed from the FI posttest condition by 7.09 mean errors. The mean error differences between the FI pretest condition and the SA posttest condition was 9.09. Figure 4 depicts the Classification x Measures interaction. Neither the SA pre-posttest difference nor the FI pre-posttest difference was significant, indicating that posttest performance was consistent with MFFT pretest classification; however, the SA and FI groups differed from one another significantly in both sessions. Although the SA and FI groups did not differ significantly over sessions, the SA group tended to make a greater number of errors in the posttest session and the FI group to make fewer errors (see Figure 4). Perhaps this tendency is indicative of statistical regression toward the mean. The SI and FA groups shown in Figure 4, although not included in the statistical analysis, also showed a similar trend.

The Criterion x Measures interaction ($\underline{F}(2,100) = 12.40$, $\underline{p} < .001$) is shown in Figure 3. The posttest error scores of the accuracy and test-retest groups did not significantly differ from one another, but the posttest error scores of the speed plus accuracy group were greater than those of the other groups. The difference between the speed plus accuracy posttest condition and accuracy only posttest condition was 4.91 mean errors. The differences between mean posttest errors of the speed plus accuracy and test-retest groups was 5.10. A slight, though statistically nonsignificant, 'practice effect' seems to have occurred for the test-retest and accuracy groups, whereas a speed plus accuracy success criterion seems to have interfered with MFFT accuracy, since the group made more errors in the posttest than in the pretest session.

Summary of Statistical Analyses

Predictions. Prediction 1 was that children in the speed plus accuracy condition would have significantly shorter MFFT posttest latencies to first response than children in the accuracy condition. This prediction was supported by the results of the 2 x 2 x 4 least squares analysis of variance as well as by the repeated measures analysis, which also revealed that children in the accuracy criterion group and test-retest control group did not differ significantly on MFFT posttest latency.

Prediction 2, that the criterion manipulation would not affect MFFT posttest errors, was not supported. The 2 x 2 x 4 least squares analysis of variance showed that children in the speed plus accuracy criterion condition made significantly more errors than did those in the accuracy only condition. The results of the 2 x 3 least squares analysis indicated that posttest error scores of children in the accuracy criterion conditon and test-retest condition did not differ significantly.

Prediction 4, that the MFFT competence perception of the child would not significantly affect his MFFT latency to first response scores was not disconfirmed either in the case of the experimental competence perception manipulation or by the nonsignificant correlation between the child's self evaluation of his MFFT competence relative to other children his age and his MFFT posttest latency.

Prediction 5, examined by the correlation between the child's evaluation of his MFFT competence in relation to that of his peers and his actual MFFT posttest error scores, was not supported.

Other findings. No predictions were formulated for the Classification factor that was included in the analyses. The findings for the

Classification factor were: 1) The children classified as SA on the MFFT pretest had significantly longer posttest latencies to first response than did children of the FI and FA pretest classification groups. 2) The 2 x 3 least squares repeated measures analysis of variance showed a significant decrease in MFFT posttest latency for the SA group, but not for the FI group. (Possibly the FI group did not decrease in posttest latency because of a 'ceiling effect.') 3) On the MFFT posttest, the children classified as FI erred significantly more than the children classified as SA according to the results of the 2 x 3 repeated measures analysis. 4) The children of SA pretest classification significantly decreased in latency to first response, but not on mean total errors. The children of FI pretest classification did not change significantly in either errors or latency over sessions.

DISCUSSION

The principle objective of the present study was to determine whether the MFFT classification of the child is attributable to "predispositional" response tendency as Kagan et al. (1964) proposed or whether the MFFT response classification is determined by the child's perception of the task success criterion and his perception of his competence on the MFFT.

Children who were told that speed plus accuracy was the criterion of success on the MFFT had faster first responses than children told that accuracy was the MFFT success criterion; thus Prediction 1 was supported, as discussed below.

Prediction 2, that the MFFT success criterion would not affect MFFT error scores, was only partially supported. The children who were told that speed plus accuracy was the success criterion showed both a decrease in latency and an increase in total errors. Since the children in the accuracy and test-retest control conditions differed nonsignificantly on MFFT error scores, it appears unlikely that MFFT error scores are directly influenced by a verbal message about the success criterion. If it were the case that MFFT error scores were affected by the perception of the success criterion, then children of the accuracy condition should have made fewer errors than the test-retest control group, but this was not the case. It is possible that the verbal accuracy success criterion message should have been supplemented with a gadget, such as a counter, in order to provide children in that success criterion condition with additional incentive to perform accurately. It is also possible, however, that different effects of the experimental manipulations or that 'ceiling effects' might explain why the accuracy criterion group did not show a significant decrease in MFFT error scores. In relation to the preliminary norms of MFFT performance compiled by Messer (Note 1), the boys in the present study tended to be "slower" and more "accurate" on MFFT performance than the normative data on children of a comparable age group. This comparison supports the possibility that 'ceiling effects' may characterize the MFFT posttest accuracy of the present study.

Overall, children were capable of modifying their MFFT latency when so instructed, but could not significantly alter their MFFT error scores. This finding agrees with earlier reports (Cohen and Przycien, 1974; Debus, 1970; Meichenbaum and Goodman, 1971), which show MFFT latency to be modifiable through verbal instruction and behavioral cues, but which show MFFT error scores to be unaltered (even when latency was increased) unless special self-instruction training techniques were employed (Meichenbaum and Goodman, 1971).

The present results for the speed plus accuracy criterion group may be relevant to Jones and McIntyre's (1976) argument that MFFT response style represents an information processing "game plan," at least for children in the speed plus accuracy criterion group. These children apparently responded to the MFFT with what appears to be a speed-accuracy tradeoff "game plan." Whether such a speed-accuracy tradeoff information processing strategy operated for children in the accuracy group, however, is questionable because the accuracy criterion group had stable latencies over sessions while errors decreased over sessions, thus not indicating a tradeoff. The most probable reason for the decline in errors is practice, since identical versions of the MFFT were used in both sessions.

Prediction 3 was that children in the competence perception condition who were told by the test administrator that they had done well on the MFFT pretest would show fewer total MFFT errors than those subjects who were not told anything about the MFFT pretest performance. This prediction was not supported. The test administrator's comments about the child's MFFT competence had no significant effect on MFFT error scores, even though 82 percent of the children said that they believed the competence message. Perhaps the children did not believe the competence message of the test administrator, but were reluctant to acknowledge this. Since the children's own evaluations of their competence on the MFFT in relation to that of other children their age also did not correlate with MFFT accuracy, which disconfirmed Prediction 5, it appears that children may have been arbitrary as to whom they compared themselves with and confused as to whether speed or accuracy performance should be their criterion of judgment in making the comparison.

It is also possible that competence perception is not a singular determinant of MFFT performance or that competence perception cannot be manipulated by verbal comments, especially if the comments are transient and task specific as in the present study. Perhaps perceived competence as defined in this study is unrelated to competence as defined by Block et al. (1974), who defined it in terms of a pervasive personality attribute of the individual. To the degree that the concepts are related, however, the present results are at variance with those of

Block et al. (1974), which showed a relationship between MFFT accuracy and competence.

The finding that the competence manipulation had no significant effect on MFFT latency scores, agrees with Prediction 4 and with the findings reported by Block et al. (1974).

Since one aim of the present study was to determine whether the variables manipulated would significantly alter the MFFT response classification of the child, the pretest classification factor was examined over test sessions to determine whether it had been significantly altered by the introduction of the experimental manipulations. The SA and FI pretest classification groups were the only groups examined statistically in the repeated measures analyses. The result of these analyses was that only the SA group had changed significantly--on MFFT latency--after the introduction of the experimental manipulations. The SA group did not differ on MFFT accuracy over sessions on either dimension. The SA group was able to decrease its latency significantly, whereas a 'ceiling effect' may have been why the FI group did not show such a decrease. Although the Criterion x Classification interaction was nonsignificant, it is possible that SA subjects who were in the speed plus accuracy criterion condition substantially decreased their latency to the first response and that this contributed to the overall decrease in latency of the SA group. The SI and FA groups, though not included in the statistical analyses, also showed the same trends in posttest latency, so the explanation offered for the obtained results is further supported by this supplementary information. In general, the results of this study are in accord with prior studies reviewed in the introduction, which found that MFFT latency scores are modifiable, whereas MFFT error scores are not.

Jones and McIntyre (1976) suggested that a speed-accuracy tradeoff strategy may in part explain MFFT response style. There are some general indications for such a suggestion in the present study. Although not statistically significant, there is an ordinal ranking of pretest classification groups on the posttest latency and error scales (see Figure 4). The means were distributed such that "fast" children of both the "inaccurate" and "accurate" group showed slightly greater mean total errors than did the "slow" subjects in each group. The same trend was evident for the latency dimension. "Accurate" children of the "fast" and "slow" groups showed slightly longer mean latencies than did the "inaccurate" subjects of each latency response group.

Some of the results for the Criterion factor of the present analysis also can be interpreted in a way that corresponds to Jones and McIntyre's (1976) suggestion of a MFFT speed-accuracy tradeoff strategy. The speed plus accuracy criterion group made more MFFT posttest errors than the accuracy criterion group and the test-retest reliability control group. Since the speed plus accuracy group significantly decreased its latency, it may be that the increase in errors was caused by selective attention to the speed criterion that necessitated a tradeoff in information processing accuracy. The statistically nonsignificant trend of the accuracy and test-retest groups to decrease in MFFT errors, probably because of practice, which was not shown by the speed plus accuracy criterion group, which increased its error rate in the posttest, suggests that MFFT errors and latency are functionally related.

The results thus suggest that MFFT response styles reflect a speed-accuracy tradeoff information processing strategy. Such an inverse relationship between speed and accuracy, in fact, seems to characterize approximately two-thirds of the population samples (Messer, Note 1), that is, "slow-accurate" and "fast-inaccurate" response style children. Since this is greater than chance expectancy, it seems that further studies of information processing strategies associated with the MFFT are warrented because Kagan et al.'s (1964) operational definition of "reflective" response style as "slow" and "accurate," and of "impulsive" response style as "fast" and "inaccurate," is not entirely inappropriate. Time is one way of measuring the amount of information and the procedure by which the child processes information on the MFFT. In applying labels such as "cogntive tempo" and conducting studies to determine the generality of the MFFT to behavioral measures of children in the classroom environment, Kagan et al. (1964), and others to follow, however, failed to recognize that time may be related to information processing strategy, but not necessarily. This is apparent when it is noted that one-third of the subject populations do not show an inverse relationship between MFFT latency and MFFT accuracy (i. e., "fast-accurate" and "slow-inaccurate" response style children), so a speed-accuracy tradeoff strategy does not suffice as an explanation for MFFT response style.

Block et al. (1974) have indicated that other measures, other than time, should be devised to measure the quantity and strategy by which children process information on the MFFT. Recently, Zelniker and Jeffrey (1976) have explored such a possibility and found "slow-accurate" children employed a "detail-processing" strategy, whereas "fast-inaccurate" children employed a "global-processing" strategy and that these children performed best on tasks compatible with their respective processing strategies. Although this finding indicates that "slow-accurate" and "fast-inaccurate" children differ in information processing strategy, it does not reveal what causes such differences.

Possibly personality factors and intelligence contribute to such processing strategies, which is suggested by Block et al. (1974). MFFT error scores appear to be the index of the MFFT that shows whether the processing strategy was appropriate, regardless of processing speed. Since MFFT error scores showed stability in the present study, congruent with Block et al.'s (1974) finding that MFFT error scores are stable and related to personality factors, it would be worthwhile to establish how information processing strategies are related to the stable characteristics of the child. It is possible that information processing strategies are characteristic of the problem solving strategies children have observed from parents, teachers, and other significant people that the child recognizes as more "knowledgeable" than himself. Future research, therefore, should address how information processing strategies are related to personality factors, intelligence, and the problem solving strategies to which the child is exposed and for which he is reinforced at an early age. Such an examination would reveal whether MFFT response style is "predispostional" as was proposed by Kagan et al. (1964).

APPENDIX A

APPENDIX A

STANDARD INSTRUCTIONS FOR THE MFFT

I am going to show you a picture of something you know, then some pictures that look like it. You will have to point to the picture on this bottom page that is just like the one on the top page. Let's do some for practice. (The test administrator helps the child find the correct answer on the practice items). Now you are going to do some that are a little harder. Do you think you are ready for them? You will see a picture on top and six on the bottom. Find the one that is just like the one on the top page and point to it.

APPENDIX B

APPENDIX B

POSTEXPERIMENTAL INTERVIEW

1. Now that you've finished the task, did you like the task or not? Why?

2. How well do you think that you did on it when I was here the first time?

3. How well do you think that you did on the task this time?

4. Do you think that you did "better than," "the same as," or "not as good as" other children your age? (The order in which the categories were mentioned was randomized for each child). Here is a piece of paper with a line on it that goes all the way from "very good" to "very bad." Can you mark the place on the line that shows how well you think you did on this task?

5. When you started the task today, what did I tell you to pay special attention to? Do you think you did the task fast? Do you think you picked the right matching pictures?

6. Why do you think I came back and had you do the task again? (Did you believe me when I told you that you did really well on it last time or did you think I was just saying that to be nice?)

7. Did you notice what I was doing when you were doing the task? Did the stopwatch or writing bother you?

8. While you were doing the task, did you try to pick the right matching picture, or go fast, or both? Which did you try to do more?

9. Well, you did very well on this task and so did your classmates. It was really fun doing the task with you. Is there anything that that you would like to say about the task or that you would like to ask me?

REFERENCE NOTES

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