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AUTHOR Brown, Ronald T.
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ABSTRACT

Measures designed to test two components of attention (decison making and maintaining attention over time) were studied in 36 educably mentally retarded (EMR) boys at three age levels (10, 13, and 14 years). Multivariate analyses, followed by univariate and paired comparison tests, indicated that both EMR and normal Ss increased in attentional efficiency with age in both attentional processes. Findings suggested that at about 12 years of age, the capacity for most attentional processes has already developed in both EMR and normal children. Lack of difference between EMR and normal Ss on the attention components was interpreted as supporting the developmental position of retardation. Correlations between the two attentional measures were not significant, further supporting the interpretation that the hypothesized components of attention represent independent influence on children's academic performance. (Author)

# A Developmental Analysis of Attentional Processes in Educable Mentally Retarded and Normally Developing Children

Ronald T. Brown[1]

University of Illinois-Chicago



Running Head: Developmental Analysis

Abstract

A series of measures hypothesized to test two components of attention, decision making and maintaining attention over time, were studied in educabley mentally retarded and normally developing boys at three age levels. Multivariate analyses, followed by univariate and paired comparison tests, indicated that both the educabley mentally retarded and normally developing boys increased in attentional efficiency with age in both attentional processes. The findings of the present study were interpreted to suggest that at about 12 years of age, the capacity for most attentional processes has already developed in both educabley mentally retarded and normally developing children. The finding that educabley mentally retarded children did not differ from their normally developing peers on the hypothesized components of attention was interpreted to support the developmental position of retardation. Correlations between the two attentional measures were not found to be significant. These findings were further consistent with the interpretation that the hypothesized components of attention represent independent processes and thus may have differential influence on children's academic performance.

# A Developmental Analysis of Attentional Processes in Educable Mentally Retarded and Normally Developing Children

In the study of exceptionality, there has been a popular view as to the importance of attentional problems in children with educational handicaps. In the classroom and in clinical practice, the pervasiveness of the diagnosis "attentional problems" as described in psychological reports has been particularly characteristic of mentally retarded children. A prodigious amount of empirical research with mentally retarded children has indicated that this characteristic is manifested in a number of ways including slow reaction times (Baumeister & Kellas, 1968), poor inhibitory control (Denny, 1964; Krupski, 1975) and general deficits in attentional performance (Leibert & Baumeister, 1973; Zeaman & House, 1963). It has been further suggested that deficits in attention may contribute to the mentally retarded child's inadequacy in obtaining relevant information from the environment to perform competently (Porges, 1980) and may cumulatively result in deficient cognitive development (Weisz & Achenbach, 1975). According to Douglas (1972, 1974) deficits in attention permeate and impair the functioning of children with a wide range of learning disorders and impede their academic functioning. In fact, the ability to regulate attention has been found to be as important a factor in school success as intelligence (Margolis, 1972).

Although there is widespread agreement as to the importance of attentional problems in children with educational handicaps, there has been a burgeoning concern regarding the lack of clarity or specificity as to what attentional deficits distinguish handicapped learners from their normally achieving peers (Keogh & Margolis, 1976). For example, Keogh and Margolis have noted that

clinical observations of attentional deficits by teachers and psychologists may mean that a child has tendencies toward perseveration while in other children it may signify that he moves about frequently and quickly. Keogh and Margolis (1976) have further insisted that more powerful remediation programs are most likely to emerge when there is precision regarding the nature of the attentional disturbance.

Recently, Keogh and her associates (Keogh, 1971; Keogh & Donlon, 1972; Keogh & Margolis, 1976) have suggested how psychological theories of attention which had previously been specific to adult populations, might serve useful in the diagnosis and treatment of children with learning disorders. Attacking the concept of a global attentional deficit with handicapped learners, Keogh and Margolis (1976) have suggested that there are important separate unitary processes which contribute to the total attentional problem of these children. Keogh and her colleagues (Keogh, 1971; Keogh & Donlon, 1972; Keogh & Margolis, 1976) have subdivided these attentional deficits into three distinct processes: (1) coming to attention, (2) decision making, and (3) sustained attention to a task over time. Most importantly these unitary processes of attention have been related to various types of academic learning. For example, it has been found that "coming to attention" and "decision making" are attentional components which are primarily related to problem solving abilities (Keogh & Margolis, 1976). Thus, remediation efforts in modifying these attentional deficits are apt to result in correlated improvements in a number of very important related areas such as reading.

One related aspect of attention which has been investigated extensively with children from retarded populations is "coming to attention" or more

specifically the selective and organization of the salient and critical attributes of a task. Hagen and Huntsman (1971) compared normal and mildly retarded children on a task which measured selective attention. Attentional performance was found to improve with mental age, and mildly retarded children performed as well as normally developing children of equivalent mental age. Attentional performance was found to be independent of memory (Hagen & Huntsman, 1971). Hagen and Huntsman (1971) have interpreted their data to suggest that mildly retarded children lag behind their normal peers in their ability to selectively attend. For educabley mentally retarded children, the relationship between mental age and other components of attention has not yet been investigated. Although there is extensive research on mentally retarded children's attention (Zeaman & House, 1963), most studies have focused on a single component of attention, such as selectivity (Hagen & Huntsman, 1971), rather than on several components of attention representing a comprehensive model of the attentional process.

For normally developing children, it has been demonstrated that the ability to organize and sustain attention develops with age (Gale & Lynn, 1972). Consequently, it has been suggested that children who have been identified as handicapped in learning may well develop the ability to process attention at a slower developmental rate than their normally achieving peers (Ross, 1976). Empirical data on the relationship between various types of attentional processing and mental age for educabley mentally retarded children, however, have not been found. Since there is a developmental trend toward attentional processing in normally developing children, the same developmental trend would be expected in educabley mentally retarded children, but that educabley mentally retarded children would lag behind their normal peers in this development.

One purpose of the present study was to compare the attentional processing performance of educabley mentally retarded and normally developing children at three age levels. Specifically, the attentional components of decision making and sustained attention were investigated. Because the same developmental trend was expected in educabley mentally retarded and normal children, it was hypothesized that attentional performance would increase with mental age in both groups but that educabley mentally retarded children would lag behind the normal children in these two attentional processes.

Another purpose of this study was to investigate the relationship between the two attentional components so as to ascertain whether a commonality exists between the two hypothesized attentional processes.

## Method

Subjects. Thirty-six educabley mentally retarded (EMR) and 36 normally developing boys, from each of three age groups, participated in this research. Because of the prevalence of attentional problems in males, only boys were included in the present research. The educabley mentally retarded boys were selected from special education classes in a large metropolitan school system. No children with other major diseases and obvious physical defects were included in the sample. The normal sample was selected from a representative school in the same county school system. All schools served a predominately middle-class population. The composition of the resulting three groups (Normally Achieving, 1-3 and EMR 1-3) is presented in Table 1. Subjects were group matched at three levels of MA with the resulting IQ variations. IQ scores were obtained from the Slosson Intelligence Test (Slosson, 1963).

Insert Table 1 about here

One experimenter conducted all testing. No subjects were eliminated during the actual testing.

Procedures. All boys in both regular status and EMR samples were administered two tests hypothesized to tap differing aspects of attention. Decision making was assessed with the Matching Familiar Figures Test (MFF) (Kagan, Rosman, Day, Albert, & Phillips, 1964), a widely used measure of decision speed and accuracy under conditions of response uncertainty. Latency scores (the time required to make the first response to each of the 12 tasks) and error scores (the total number of errors made on the 12 tasks) were obtained for each child. Sustained attention was measured with the Children's Checking Task (CCT) (Margolis, 1972). Tests were administered in the child's home schools.

The CCT was given as a group test to all children in both regular and EMR classes, followed by individual administration of the MFF. Standard procedures and scoring systems for the MFF and CCT were followed. The CCT was developed as a technique for measuring ability to maintain attention to a task and has been shown to be appropriate for use with children in grades one through eight (Margolis, 1972). The CCT has been demonstrated to be reliable when administered as a group technique (Margolis, 1972).

The CCT includes a five page booklet with rows of printed numbers and a tape recording of a series of numbers recorded in random order at the rate of one number per second. The recordings were professionally made with decibel levels controlled. The numbers in the booklet were arranged in 16 rows per page with 14 digits per row. Rows were identified by letters in alphabetical order. The child was required to listen to the numbers on the tape recorder while checking them against an almost identical series in the booklet. The tape and

booklet were prepared so that there were fourteen audio-discrepancies for each page where the digit presented auditorially did not match the corresponding digit in the booklet. The test was scored on two types of errors, omissions (missed discrepancies) and commissions (correct numbers marked as incorrect). Total administration time for the CCT was 30 minutes. In the present study the CCT was administered to the entire classroom of approximately 25 regular class pupils and to special classrooms containing 8-12 educabley mentally retarded pupils.

## Results

Table 2 presents the means and standard deviations for the total scores on the CCT and MFF for mentally retarded and normal children according to age groups.

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Insert Table 2 about here

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A 3(age) x 2(type of child) multivariate analysis of variance was carried out, with the dependent measures being CCT omission, CCT commission error scores, MFF error and MFF latency scores. This analysis indicated that significant differences occurred between age groups $F(4, 63) = 4.41$, $p < .0001$. No differences occurred between the educabley mentally retarded and normally developing children $F(4, 63) = .49$. No significant interactions occurred in the analysis.

Separate univariate analyses of variance were carried out to examine the differences between age groups. These analyses indicated that significant differences occurred for the MFF error measure ($F = 3.43$, $p < .04$), the MFF latency measure ($F = 2.98$, $p < .05$), and the CCT omissions error measure ($F = 9.34$, $p < .0003$).

A Duncan's Multiple Range post-hoc test was used to further indicate where age differences occurred for the MFF error and latency scores and the CCT omissions error measure. This analysis indicated that MFF error scores were significantly greater for the youngest group of subjects (Group 1) than they were for the other two groups of children ($p < .05$). This analysis further indicated that MFF latency scores were significantly higher for the nine-year-old children (Group 2) than they were for the other two age groups ($p < .05$). The oldest group (Group 3) obtained fewest errors on the CCT omissions error measure ($p < .05$).

The mean errors and latency measure of the attentional task are presented in Figure 1.

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Insert Figure 1 about here

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To ascertain whether the attentional components were related, correlations were calculated between both MFF error scores and MFF latency scores and sustained attention scores for both normally developing and educabley mentally retarded children at each of the three age levels. Relationships among the attentional measures were in general of low to moderate magnitude. It can be seen from Table 3 that none of the 54 correlation coefficients were significant.

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Insert Table 3 about here

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## Discussion

The findings support the results of other studies in demonstrating that there is a difference between younger and older children in their ability to

perform on each of the tasks measuring the hypothesized attentional components. Thus, the findings from the present study further indicate that the ability to process attention develops with age. Capacity for sustained attention as measured by the CCT improved with age in both normally developing and educable mentally retarded children with an acceleration in performance by the age of eleven years. Also, capacity for decision making as measured by the MFF improved with age in both normal and educable mentally retarded children with an acceleration in performance between the age of 9 and 10 years. The findings of the present study taken together with the research presented by Hagen and his associates (Hagen & Drucker, 1969; Hagen & Huntsman, 1971), which examined the hypothesized attentional component of coming to attention, suggest that at about the age of 11 or 12 years, the capacity for most attentional processes has already developed.

Contrary to the expectations based on that research which suggests that general deficits in attention are particularly characteristic of mentally retarded children (Baumeister & Kellas, 1968; Denny, 1964; Krupski, 1975; Zeaman & House, 1963), no significant differences occurred between educable retarded and normal children on any of the attentional measures. The data obtained from this present research, however, is consonant with the findings presented by Hagen and Huntsman (1971) who found that mildly retarded children performed as well as normal subjects of equivalent mental age on a selective attention task. The findings of the present study in combination with the results presented by Hagen and his colleagues lend direct support to the developmental position of retardation as set forth by Zigler (1969). According to Zigler, retarded children without organic etiology should receive equivalent scores on cognitive tasks as MA

matched normally developing children. For the present study, the finding that educabley mentally retarded and non-retarded subjects, matched on mental age, did not differ on the tasks measuring the hypothesized attentional components is clearly supportive of the developmental position. Although the theoretical question of component independence cannot be answered definitively from the present data, the assessment and intervention implications appear to be clear. For educabley mentally retarded children, curriculum emphasizing attentional demands should be presented at the child's level of mental age.

Overall, the magnitude of the coefficient of correlations was simply not large enough to allow for the interpretation that there is some commonality among the two hypothesized attentional components. None of the correlation coefficients between the various attentional measures were significant for the mentally retarded or normal children. However, the present findings of no clear relationship between these two attentional processes might further be interpreted to suggest that the hypothesized attentional components did indeed represent differing aspects of ability and/ or task requirements, a point of particular importance when planning curriculum approaches.

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## Footnotes

[1] Address all correspondence to Ronald T. Brown, Ph.D., Department of Special Education, University of Illinois- Chicago, P.O. Box 4348, Chicago, Illinois, 60680.

Table 1

Composition of the Experimental Groups

| Subjects | N | MA (in years and months) | CA (in years and months) | IQ |
|---|---|---|---|---|
| Regular 1 | 12 | 8-1 | 7-10 | 103.2 |
| EMR 1 | 12 | 7-10 | 10-8 | 73.4 |
| Regular 2 | 12 | 9-11 | 9-10 | 100.9 |
| EMR 2 | 12 | 9-8 | 13-1 | 73.9 |
| Regular 3 | 12 | 11-1 | 10-11 | 101.5 |
| EMR 3 | 12 | 11-0 | 14-1 | 78.1 |

Table 2

Means and Standard Deviations of Normally Developing (ND) and Educabley Mentally Retarded Children (EMR) on Attentional Measures

| | Group 1 | | Group 2 | | Group 3 | |
|---|---|---|---|---|---|---|
| | M | SD | M | SD | M | SD |
| CCT Omission | | | | | | |
| ND | 33.33 | 10.02 | 24.67 | 16.53 | 12.67 | 9.27 |
| EMR | 29.67 | 10.87 | 27.50 | 20.62 | 17.00 | 10.52 |
| CCT Commission | | | | | | |
| ND | 39.58 | 29.09 | 23.58 | 28.34 | 11.17 | 5.86 |
| EMR | 18.33 | 8.46 | 14.58 | 9.19 | 16.33 | 15.55 |
| CCT Total Errors | | | | | | |
| ND | 62.92 | 33.72 | 48.25 | 40.06 | 23.00 | 10.75 |
| EMR | 48.00 | 12.04 | 37.92 | 16.71 | 32.50 | 22.93 |
| MFF Errors | | | | | | |
| ND | 18.42 | 5.26 | 14.00 | 4.97 | 10.92 | 5.32 |
| EMR | 15.33 | 7.58 | 13.25 | 5.83 | 14.58 | 5.12 |
| MFF Latency | | | | | | |
| ND | 85.42 | 30.89 | 109.50 | 51.77 | 87.92 | 54.51 |
| EMR | 110.50 | 48.19 | 121.00 | 73.75 | 69.92 | 40.13 |

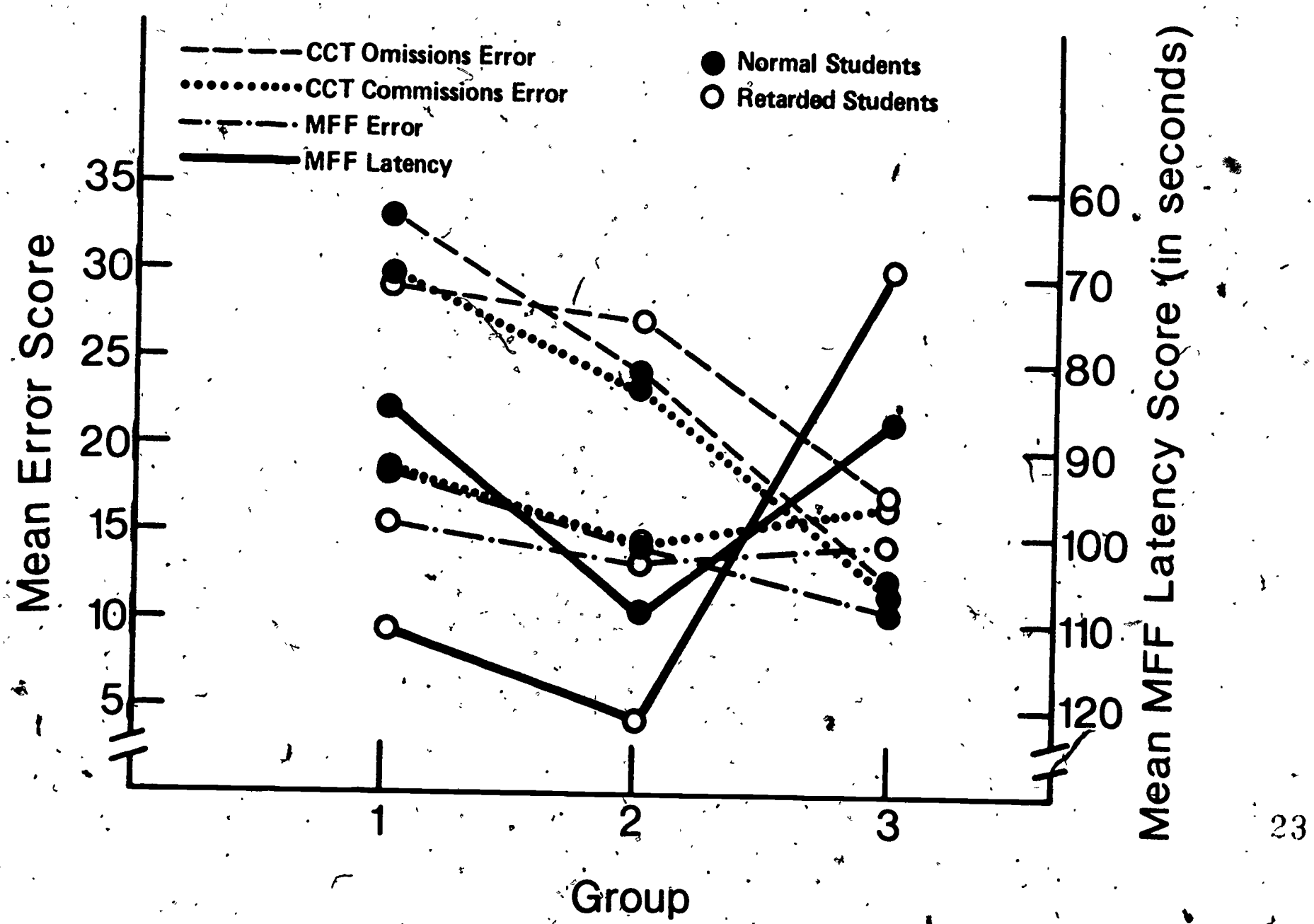
Table 3

Coefficients of Correlation Among Attentional Measures

| Group | MFFT Error | | | MFFT Latency | | |
|---|---|---|---|---|---|---|
| | CCT Omissions | CCT Commissions | CCT Total Errors | CCT Omissions | CCT Commissions | CCT Total Errors |
| EMR Group | | | | | | |
| 1 | .29 | -.08 | .20 | -.05 | .28 | .15 |
| 2 | -.14 | .30 | .19 | -.15 | .03 | -.04 |
| 3 | .38 | .08 | .21 | -.38 | -.19 | -.32 |
| Combined n=36 | .27 | .15 | .20 | -.19 | .15 | -.17 |
| Regular Group | | | | | | |
| 1 | -.11 | .11 | .07 | -.25 | -.26 | -.30 |
| 2 | .04 | -.30 | -.19 | -.31 | -.37 | -.39 |
| 3 | .28 | -.21 | -.02 | -.15 | .01 | -.04 |
| Combined n=36 | .14 | -.21 | -.09 | -.24 | -.21 | -.24 |
| Combined N=72 | .21 | .09 | .19 | -.09 | -.12 | -.12 |

Figure Caption

Figure 1. Mean errors and latency of attention measures for educableY mentally retarded and normally developing children as a function of mean MA.


CCT Omissions Error
CCT Commissions Error
MFF Error
MFF Latency
Normal Students
Retarded Students
Mean Error Score
35
30
25
20
15
10
5
Mean MFF Latency Score (in seconds)
60
70
80
90
100
110
120
1
2
3
Group