Bulletin of Special Education 1994, 10, 191 – 208
National Taiwan Normal University, Taipei, Taiwan, R.O.C.

A COMPARISON OF THE LONG-TERM RECOGNITION OF PICTURES OF PLACES BY ADULTS WITH AND WITHOUT MENTAL RETARDATION

Jengjyh Duh
National Taiwan Normal University

H. Earl Knowlton
The University of Kansas, Kansas, USA

ABSTRACT

The purpose of the present study was to compare the performances on the long-term retention of pictures of places by adults with and without mental retardation (MR) . The study consists of two phases: the study task and the assessment task. During the study task, participants of both the control and the experimental groups were divided into three subgroups. Each subgroup was presented with a certain number of presentation of stimuli, ranging from 1 to 3. The stimuli were composed of 90 color slides randomly selected from the pool of 180 slides of places. Following the study task, participants were assessed across such levels of retention intervals as zero delay, 1-day delay, 1-week delay, and 1-month delay.

Comparisons are made between groups of participants across varying retention intervals and presentation conditions. The obtained results indicated that overall adults without mental retardation (NR) outperformed participants with mental retardation. The group difference between adults with and without MR decreased as the retention intervals increased. Consequently, as the retention interval extended to the 1-month interval, the difference failed to reach the significance level.

The automatic-effortful processing model may shed light on the differential performance in memory tasks between individuals with and without MR. Hasher and Zacks (1979, 1984) proposed a continuum encoding operations that ranges from those that require minimal cognitive potential (i.e., automatic processes) to those that require considerable capacity for their operations (i.e., effortful processes). Stated differently,

according to this model, cognition can be viewed as consisting of automatic and effortful processes and a limited capacity attention system. Automatic processes require little or no attentional allocation, are not under voluntary control, function at a constant level under all circumstances, and serve to free attentional resources for effortful processing. In contrast, effortful processes (e.g., rehearsal and mnemonic strategies) are attention-demanding, working within conscious awareness, controlled intentionally, and developed through learning. Further, while effortful processing appears to be an an index of developmental age (O'Conner and Hermelim, 1978), automatic processes can be acquired through extensive practice. It is well-documented that extended training leads to familiarity with the task such that processing can occur without attention allocation. Hasher and Zacks (1979) also pointed out that memory for spatial location and memory for frequency of occurrence as automatic processes are biologically based. As well, some automatic processes are determined genetically, whereas others develop after considerable practice.

The above position has been supported by a significant body of literature. In reading theories, for example, investigators (Lesgold & Perfetti, 1978; Stanovich, 1980) have emphasized the concept of automaticity. More clearly, it is the idea that the more basic processing operations that can be carried out automatically, without demanding cognitive resources, the more capacity is freed for allocation to attention-demanding comprehension processes. Many studies with readers have employed the Stroop test, in which participants are instructed to name the word's color or the picture surrounding it in order to test for possible structural differences in the semantic memory of persons with and without MR. The results indicated a tendency for better readers to show more potential for automatic processing. The relationship, however, is not particularly strong, and it is only present at the earliest stages of reading acquisition, usually prior to third grade (Schadler & Thissen, 1981; Stanovich, Cunningham, & West, 1981). Little work on automatic lexical access has been done with individuals labeled MR. The studies that have been reported do not suggest a severe deficit in this process. Das (1970) studied the developmental trends in automaticity by administering the Stroop test to groups of individuals with and without MR. Those labeled MR with a mental age (MA) of 7 did not show color-word interference, but subjects at higher MA levels did display interference. In general, the performance of the subjects with MR was similar to that of individuals of the same MA. Similarly, McFarland and Sandy (1982) documented that a group of adolescents labeled MR and an equal-CA control group displayed equal interference effects across a number of different Stroop conditions, including Semantic, Rhyme, and No Strategy. The results indicated that individuals with MR automatically accessed semantic information from words. It suggests, however, that more active processes of semantic elaboration are deficient among individuals with MR.

To lend further support to Hasher and Zacks' theory (1979, 1984), Ellis and his colleagues (Ellis, Katz, & Williams, 1987) used picture books to investigate performances in memory for spatial locations in children and adults. They found no differences among first, second, and sixth graders, college students, and elderly persons in memory for spatial location. There were also no differences between individuals with mild mental retardation (EMR) and college students. More recently, Ellis and his colleagues (Ellis, Woodley-Zanthos, & Dulaney, 1989) replicated their previous study (Ellis, et al., 1987) by adding individuals with Down syndrome and, apart from the picture books, using photographs of familiar objects (e.g., an umbrella, a canoe). The results confirmed and extended earlier findings. That is, memory for spatial location was unrelated to developmental age, intelligence, and type of instruction. Merrill & McCauler (1988) used photographic slides of black and white line drawings of common objects and nonsense forms (i.e., random shapes without names) to assess the differences in encoding speed between individuals with and without MR. The results showed that both groups performed comparably in picture encoding speed. The authors concluded that encoding pictures of common objects were more automatic than effortful for both groups of subjects.

O'Conner and Hermelin (1973) conducted a study on spatial and temporal sequencing of signs and words. The authors found that individuals labeled deaf and autistic structured their recall spatially in contrast to individuals without MR who presented the material temporally. In an extended study, O'Conner and Hermelin (1978) reported that the use of a spatial strategy in structuring recall is associated with an IQ of less than 60, whereas the temporal sequencing is often employed by individuals with an IQ of greater than 60. The authors replicated the previous study with individuals without MR using Roman letters and Arabic letters. They found that these individuals learned Arabic letters better than Roman letters. Further, the authors reported that these participants sequenced Roman letters temporally, but processed Arabic letters spatially. The authors concluded that individuals with severe MR found spatial sequences easier to code than temporal sequences. This suggests that, compared to temporal sequences, spatial sequences are more likely to be automatically processed.

Although individuals with MR are intact in automatic processing, they do demonstrate deficits in effortful processing. This can be attributed to the research finding (i.e., Winters and Semchuk, 1986) that these individuals do not rehearse information as adequately as do persons without MR. Additionally, they use strategies and organizational schemes less effectively.

In summary, Hasher and Zacks (1979, 1984) proposed a model specifying a continuum of encoding operations that range from automatic processing to effortful processing. Several variables are potentially influential in aforementioned categorization of information processing. These include, among others, the presentation of stimuli, the topography of stimuli, and the mode with which individuals sequence stimuli. In terms of the presentation of stimuli, the effects contributed by primacy, recency, and isolation play an important role. With regard to the sequencing of stimuli, the spatial rather than temporal mode facilitates automatic processing. Finally, while symbols

are more associated with temporal sequencing and, accordingly, effortful processing, pictures and signs are more likely to involve automatic processing.

Memory is essential in the application of learning to problem solving. There is clear empirical evidence that individuals with MR demonstrate significant deficits in memory. While a large body of literature indicated that individuals with MR were often outperformed by their NR counterparts in STM, they may perform comparably in LTM. The mode of stimuli is key to performance in memory tasks. Where the stimuli were nonverbal, the LTM capacity of individuals with MR was often reported to be intact. Other potential variables include retention intervals, exposure duration, and rehearsal strategies.

A large body of literature indicated that persons with MR demonstrated a deficit in overall information processing, which has been termed 'everything deficit.' (Detterman, 1979). Alternatively, a few studies (e.g., Ellis, Woodley-Zanthos, & Dulaney, 1989) showed that, while individuals with MR evidenced significant impairment in short-term memory (STM), their LTM capacity was intact. However, compared to research on STM, to date studies on LTM by individuals with MR have been relatively few and, thus, their LTM capacity has not been well-documented. At this point, there is a need to further explore the long-term retention of these persons.

Although a host of previous studies suggest that individuals with no mental retardation (NR) outperformed their MR counterparts in LTM tasks, questions remain regarding: (1) whether individuals with MR differ significantly from NR groups when other topographies of stimuli (e.g., pictures of places) are used; (2) whether presentation conditions (e.g., number of stimulus presentations) contributes to LTM performance; (3) whether there is a significant difference between female and male individuals with MR; and (4) whether the curve of retention by MR group is similar to that of the NR group. The present study was designed to answer the above questions.

The present study centered on the comparison of performances on LTM of pictures of places by individuals with and without MR. To obtain data required for analyses, a researcher-developed instrument was employed. The instrument consists of two sets of slides. One set was employed during the study task, including 90 color pictures of places randomly selected from a pool of 180 pictures, whereas the other was used in the assessment tasks, consisting of 120 pictures, with some pictures overlapped with the first set. Assessment phases were conducted over 4 retention intervals. The study was designed to examine whether adult individuals with MR differ from their NR counterparts in recognition of pictures of places across varying retention intervals.

Based on the theoretical framework to be discussed below, three assumptions are plausible. First, it is assumed that individuals with MR will perform as well as do their counterparts in NR group. Second, it is assumed that. as the retention interval increases, the proportions of pictures correctly recognized by both groups decrease. Finally, it is assumed that the recognition rate comes in direct relation to the number of presentation of stimuli.

METHOD

Subjects

Subjects consisted of 103 adult individuals with and without MR. Fifty-two individuals with MR participated in the study as the MR group. Among them, 2 exhibited secondary handicaps. One was hearing impaired, but was included in the study because one of the participants volunteered to serve as an interpreter. The other had difficulty writing with either hand. With peer assistance, she was able to take a part in the study. Additionally, two subjects were labeled moderately MR (i.e., IQ's between 35 and 50). The rest, as indicated in their individualized transition program, had IQ's in the mild range (i.e., between 50 and 70). All the subjects in the MR group were currently employed at local sheltered workshops.

Fifty-one adult individuals without MR participated in the study as the NR group. The group consisted of (a) college students at the graduate level, (b). employees at a local plastic factory, (c) host families to college students and (d) regular church goers. Among them, one graduate student had mild brain injury. None of the other subjects exhibited any other handicapping conditions.

Subjects of both groups were randomly assigned to three subgroups by throwing the dice. Subgroup 1 received Presentation Level 1 (i.e., presented once with a set of stimuli), whereas Subgroup 2 received Presentation Level 2 (i.e., presented twice) and Subgroup 3 received Level 3. A written consent by the subject was required for participating in the study. For the MR group, the consent was signed by either parents or residential managers. Where needed, each subject was paid US$10. 00 for participation. Several other characteristics of the sample, including sex, age, and ethnicity, are summarized in Table 1.

Materials

The instrument was designed to measure an individual's capacity of memory of places. The material consisted of 180 color slides of places, taken in various areas across the country (except in states such as Kansas and Missouri). To minimize the familiarity difference among participants, none of the pictures contained such popular landmarks as the Statue of Liberty, Sears Tower, Golden Gate Bridge, Walt Disney World, White House, World Trade Center, Niagara Falls, and the like. Care was taken not to incorpo-

Table 1. Selected Characteristics of Study Sample

Group	Sex	Number	Chronological Age			Ethnicity		
			Range	Mean	SD	White	Black	Others
MR	Male	22	19-47	34.47	2.68	17	4	1
	Female	30	18-40	31.60	2.13	24	6	0
NR	Male	25	21-43	33.76	1.92	18	3	4
	Female	26	23-39	32.38	2.36	21	3	2

rate confounding stimuli, including verbal cues (e.g., names of street, stores, building, etc.), signs and symbols (e.g., traffic lights and signs), and human faces in the pictures.

Typically, each picture was composed of elements in a natural environment such as trees, hills, buildings, streets, highways, farms, lamp posts, to name a few. The pictures were designed in such a way that each provided some important environmental cues (e.g., flag, mailbox, tombstone), which enabled the participants to associate the picture with a specific place rather than a landscape, people, animals, buildings, or objects. The pictures were mounted onto slides, and projected onto a screen through a Kodak carousel projector.

Procedures

The procedure consisted of a study task and an assessment task. In the study task, 90 color slides were randomly selected by the researcher from the pool of 180 slides. The selected 90 slides were presented one by one, at the rate of 5 seconds each, with a 1-second interslide interval. For subjects in Subgroup 1, the selected slides were presented just once. For subjects in Subgroup 2, the 90 slides were shown twice in like manner. For Subgroup 3, the slides were presented three times, all in the same fashion. Stated differently, subjects in Subgroup 1 viewed the stimuli just one time, members of Subgroup 2 viewed the stimuli twice, and those in Subgroup 3 watched the stimuli 3 three times. Therefore, in terms of presentation levels, the Subgroup 1 was referred to as Presentation 1, Subgroup 2 was referred to as Presentation 2, and Subgroup 3 was referred to as Presentation 3.

The assessment tasks included four phases: Zero Delay, 1-Day Delay, 1-Week Delay, and 1-Month Delay. Following the study task, all the three subgroups were asked to participate in all four assessment phases. In each assessment phase, participants were presented with 30 pictures, showed one by one, at the rate of 10 seconds each, with a 1-second interslide interval. Participants were instructed to examine if each picture was presented in the study tasks or not. If the answer was "Yes," the participant was instructed to circle "Y" under the appropriate item on the answer sheet. If the answer was "No," the "N" was to be circled. The assessment task for Zero Delay was delivered about three minutes following completion of the study task. The 1-Day Delay assessment took place approximately 24 hours after the study task, whereas the 1-Week Delay and 1-Month Delay were scheduled 7 and 30 days, respectively, from the study task.

Measures. The dependent variable was the proportion of the test items on which the target item was correctly recognized. In the case where both letters Y and N were simultaneously circled or where neither was circled, the item was counted as incorrect. Care was taken to ensure that circling either the letter Y or N did not pose difficulty to any of the subjects. If subjects had difficulty writing, assistance was provided.

Experimental Design

The present study involved repeated measures on retention intervals, which could be best analyzed by the split-plot factorial design (Kirk, 1982, P. 523). The design incorporated three between-blocks treatments (i.e., intelligence, sex, and number of presentations) and one within-block treatment (i.e., retention interval). The overall statistical design was a 2 X 2 X 3 X 4 mixed analysis of variance.

Variables. The independent variables consisted of (1) intelligence level (i.e., MR and NR), (2) sex (i.e., male and female), (3) the number of presentation (i.e., 1 presentation, 2 presentations, and 3 presentations), and (4) the retention interval (i.e., zero delay, 1-day delay, 1-week delay, and 1-month delay). The dependent variable was the proportions of pictures correctly recognized by each participant measured at each retention interval.

Data Analysis. All statistical analyses were carried out either using Statview (BrainPower, 1986) or the Statistical Package for Social Sciences (SPSS) program (SPSS, 1990) on an Apple Macintosh SE computer. The analysis of variance (ANOVA) was performed. A p value equal or less than .01 was set as priori significance level.

The sources of variance included between blocks and within blocks components. The between blocks section consisted of the main effects of intelligence, sex, and presentation, and intelligence by sex, intelligence by presentation, sex by presentation, and intelligence by presentation by retention interval interactions. The within block effects included the main effects of retention interval (RI) and the intelligence by RI, sex by RI, presentation by RI, intelligence by sex by RI, intelligence by presentation by RI, sex by presentation by RI, and the intelligence by sex by presentation by RI interactions. Scheffé post hoc comparisons were performed to identify the source of significant interactions and main effects.

Reliability

An attempt was made to establish the reliability of the researcher-developed instrument. First, backup copies of the pictures were developed so that the damages, if any, to pictures would not result in the change of the test content and the quality of the pictures. Second, to obtain interrater reliability, a second person volunteered to observe and check the time of presentation for some of the pictures presented and score the answer sheet. Finally, the Kuder-Richardson reliability coefficient was calculated to determine the internal consistency of experimenter-designed instrument.

An agreement on timing and scoring was established in this experiment. An agreement on timing was defined as an occasion when two observers measured the same exposure duration of the slide and the following interslide interval. An agreement on scoring was defined as an occasion when two observers checked the same item on the same answer sheet as "correct" or "incorrect."

Reliability checks and sessions were randomly conducted. A total of 42 checks on scoring and 18 sessions on timing were made. The results indicated that agreements of 100% were obtained for all checks in scoring. In terms of timing, the interobserver agreement on exposure duration was 96% and on interslide interval, 99%.

RESULTS

The experimental design consisted of three between-subject variables (intelligence, sex, and number of presentation) and one

within-subject variable (retention interval). The overall design was a 2 X 2 X 3 X 4 mixed analysis of variance. The dependent measure was the proportion of items (out of 30 items) correctly recognized. To minimize the probability of Type I error, significance levels were set at the .01 level.

A total of 103 adult individuals volunteered to participate in the present study. Among them, 4 persons did not complete the study, whereas another 3 either circled all Y's or N's. Consequently, only 96 cases remained for data analysis. The analysis of variance is summarized in Table 2.

Main Effects

The main effects of intelligence, sex, presentation, and retention interval are discussed and delineated below.

Intelligence. Hypothesis 1 stated that there would be no statistically significant differences between the mean proportions of pictures correctly recognized by MR and NR subjects. The results are summarized in Table 2. The mean proportion of pictures correctly recognized by MR group was lower than that of NR group, with mean proportions of .567 and .689, respectively. As indicated in Table 2, there was statistically significant difference between the means of the MR and NR groups, F(1, 84)=81.18, p=.000. Therefore, Hypothesis 1 was rejected.

Sex. Hypothesis 2 stated that there would be no statistically significant difference between the mean proportions of pictures correctly recognized by males and females. The overall means for males and females were .616 and .638, respectively. As indicated in Table 2, no statistically significant main effect for sex was found, F(1, 84)=3.59, p=.063. Hypothesis 2 was retained.

Presentation. Hypothesis 3 stated that there would be no statistically significant differences between the overall mean proportions of pictures correctly recognized due to number of presentations. The overall means of pictures correctly recognized at each presentation level are as follows: Presentation 1, .592; Presentation 2, ,637; Presentation 3, .656. As indicated in Table 2, the main effect for presentation was statistically significant, F(2, 284)=8.24, p=.001. Hypothesis 3 was rejected. This suggests that the overall mean proportions of pictures correctly recognized at some presentation levels significantly differed from those recognized at other presentation levels.

In order to determine the source of significant main effect for presentation levels, the Scheff'e post hoc comparison was conducted. As indicated in Table 3, the overall mean proportions of pictures correctly recognized at presentation level 1 was significantly lower from those recognized at presentation level 3. No statistically significant difference was found between the overall mean proportions of pictures correctly recognized at presentation level 1 vs. level 2. Also, no statistically significant differences were found between the overall means at presentation level 2 vs. level 3.

Retention interval. Hypothesis 4 stated that there would be no statistically significant differences between the overall mean proportions of pictures correctly recognized due to length of elapsed time from presentation. The overall means of pictures correctly recognized at each retention interval were as follows: Zero Delay, .730; 1-Day Delay, .669; 1-Week Delay, .580; 1-Month Delay, .535. As Indicated in Table 2, the main effects for retention interval were statistically significant, F(3, 252)=130.36, p=.000. Therefore, Hypothesis 4 was rejected.

In order to determine the source of significant effect for retention interval, the Scheffé post hoc contrast was conducted and summarized in Table 4. The results indicated that all the post hoc comparisons were statistically significant. Thus, the means declined significantly at each delay from the previous level.

Table 2. Summary of Analysis of Variance on the Overall Means of Correct Recognition of Pictures by Group

Sources	SS	df	MS	F
Intelligence (A)	1.38	1	1.38	81.18*
Sex (B)	.061	1	.061	3.59
Presentation (C)	.28	2	.14	8.24*
A X B	.0005	1	.0005	.29
A X C	.046	2	.023	1.35
B X C	.012	2	.006	.35
A X B X C	.014	2	.007	.41
subjects w. cells	1.44	84	.017	
Retention Interval (D)	2.20	3	.73	130.36*
A X D	.32	3	.11	19.64*
B X D	.012	3	.004	.71
C X D	.028	6	.0047	.84
A X B X D	.033	3	.011	1.96
A X C X D	.032	6	.0053	.95
B X C X D	.014	6	.0023	.41
A X B X C X D	.026	6	.0043	.77
D x subjects w. cells	1.42	52	.0056	
Total	7.32	383		

*p<.01

Table 3. The Scheffé Post Hoc Comparisons of the Mean Proportions of Pictures Correctly Recognized between Presentation Levels

	Presentation 1	Presentation 2	Presentation 3
Presentation 1	——		
Presentation 2	1.97	——	
Presentation 3	3.96*	.034	——

p<.01

Table 4. The Scheffé Post Hoc Comparisons of the Mean Proportions of Pictures Recognized between Retention Intervals

	Zero D.	1- Day D.	1-Week D.	1-Month D.
Zero D.	———			
1-Day	5.19*	———		
1-Week	12.80*	7.62*	———	
!-Month	16.66*	11.47*	3.85*	———

*p<.01

Interaction Effects

Hypothesis 5 stated that there would be no statistically significant interactions among such variables as intelligence, sex, presentation, and retention interval. There were 12 possible interactions involved in the present study. As indicated in Table 2, only one interaction effect reached significance level, namely, the interaction of intelligence with retention interval, $F(3, 252)=19.64$, $p=.000$. Hypothesis 5 was rejected.

Figure 1 describes graphically the mean proportions of pictures by both NR and MR groups as a function of retention intervals. Interestingly, as shown in Figure 1, similar patterns of picture recognition across retention intervals was found between MR and NR groups. Recognition proportions for both groups collapsed along retention intervals. It should be noted, however, that as the retention interval increased, the disparity between group performances appeared to be diminishing. Consequently, as the retention interval extended to 1-Month Delay, the group difference did not reach the significance level set for the study.

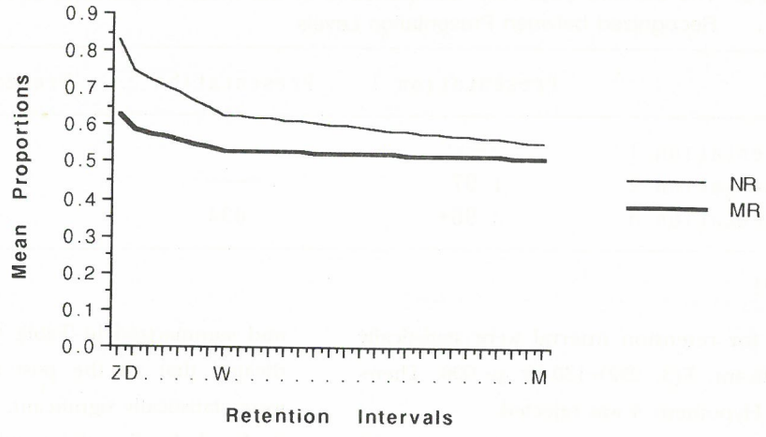

Figure 1. Mean proportions of pictures correctly recognized by NR and MR groups as a function of retention intervals.

With respect to recognition proportions across presentation levels, patterns of performance for both groups were totally different. For the NR group, recognition proportions increased with the numbers of presentation. This trend, however, was not present for the MR group. While an increase was observed from presentation level 1 to presentation 2, the change between presentation levels 2 and 3 was minimal. Figure 2 displayed in graphics the summary of mean proportions of recognition by group as a function of presentation conditions.

In order to determine the source of the significant interaction, the Scheffé post hoc comparison was performed and summarized in Table 5. The results indicated that the NR group outperformed significantly the MR group at Zero Delay, 1-Day Delay, and 1-Week Delay. At the 1-Month Delay, however, both groups did not differ significantly.

Within-Group Findings

The data obtained by each group were analyzed below. The separate performances of data analysis was conducted for two pur-

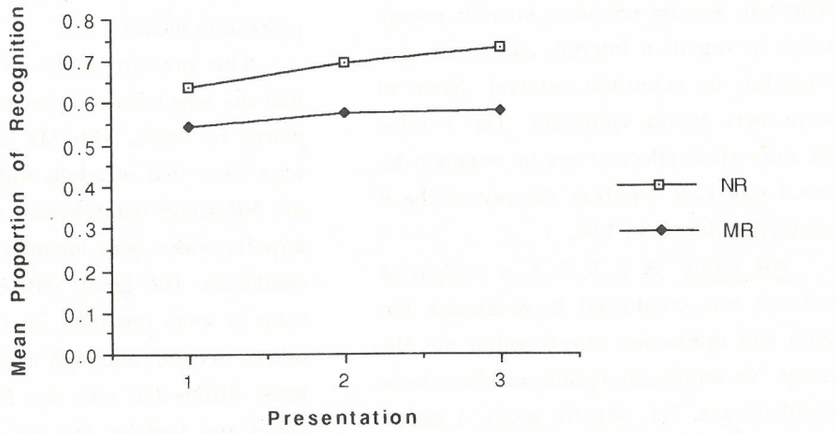

Figure 2. The mean proportions of picture correctly recognized by NR and MR groups as a function of presentation levels.

Table 5. The Scheffé Post Hoc Comparisons between Mean Proportions of Pictures Correctly Recognized by NR Group vs. MR Group at Each Retention Interval

Retention Interval	Mean Difference	Scheffé Test
Zero Delay	.201	105.638*
1-Day D.	.155	47.032*
1-Week D.	.094	22.895*
1-Month D.	.038	6.45

*p<.01

poses. First, it further explores the capacity of long-term recognition for each group. Second, it serves to confirm the findings presented in Table 2.

MR group. A 2 X 3 X 4 analysis of variance was conducted to determine the main and interaction effects within the MR group. No statistically significant effect was found for sex, $F(1, 42)=3.29$, $p=.077$. No statistically significant effect was found for presentation, $F(2, 42)=2.32$, $p=.11$. A statistically significant effect was found for retention interval, $F(3, 126)=23.17$, $p=.00$. There were 4 possible interactions involved in the MR group, including interactions of sex by presentation, sex by retention interval, presentation by retention interval, and sex by presentation by retention interval. None of them were found significant. The F value for interaction effect of sex by retention interval was 1.29, whereas the rest of the F values were less than 1.00.

NR group. A 2 X 3 X 4 analysis of variance was conducted to determine the main and interaction effects within the NR group. No statistically significant effects were found for sex, $F(1, 42)=.97$, $p=.33$. A statistically significant effect was found for presentation, $F(2, 42)=6.23$, $p=.004$. A statistically significant effect was found for retention interval, $F(3, 126)=135.89$, $p=.00$. There were 4 possible interactions involved in the group, including interactions of sex by presentation, sex by retention interval, presentation by retention interval, and sex by presentation by retention interval. None of them were found significant.

DISCUSSION

In the present study, comparisons of performances in LTM by NR and MR subjects were made across several dimensions, including intelligence status, sex, presentation levels, and retention intervals. The paradigm of recognition memory of places was employed because (a) verbal processing can be isolated from nonverbal processing, (b) difference in familiarity with stimuli can be reduced to the minimum, (c) task requirements were relatively simple, and, most importantly, (d) the paradigm can be used to attest to Hasher and Zacks' (1979, 1984) processing model.

The present study provides evidence that the long-term recognition of pictures of places by adults with MR differs in some ways from that of adults without MR. First, the NR group outperformed their MR counterparts under both immediate and delayed conditions. The group difference was significant at some retention intervals but not at others. Second, although a statistically significant difference was not found between males and females, the sex difference was greater in MR group than in NR group. For both NR and MR groups female subjects demonstrated better STM and LTM than did male subjects. Third, the presentation level had a significant impact on performance by the NR group, whereas a similar effect was not found in the MR group. Specifically, while the recognition rate by NR individuals increased with the number of presentation of stimuli, the MR group appeared to be insensitive to presentation variations. Finally, while both groups demonstrated collapse over time, their retention curves varied. The retention curve of the NR group appeared to be more precipitous than that of the MR group.

The effect of delay is intriguing. More clearly, compared to the MR group, the NR group showed a higher rate of decline in recognition of pictures under all presentation conditions and retention intervals. Consequently, at the 1-month delay, the group was no longer significantly different from the MR group. Stated differently, despite the differential performance between adults with and without MR during the first three retention intervals, participants with MR performed comparably after 1-month delay. This finding was similar to those reported by McCartney (1987), who documented an absence of a significant interaction of group by retention interval at extended intervals. This suggested that there was no significant difference in LTM between groups with and without MR.

There are several plausible interpretations for the above findings. First, the difference between the overall performances by both groups may be attributed to the employment of strategies. Some of the pictures provide prominent cues or prompts such as the overpass, road signs, water tower, peculiar building or car, etc. A close look at the scoring patterns indicated that the majority of the individuals without MR were able to capitalize on these cues, whereas few participants with MR groups took advantage of it. The above finding was corroborated by casual observations and talks with participants, in which many subjects without MR stated that mnemonics and strategies were used to facilitate their performance. Second, the nonsignificant difference between males and females could have been caused by characteristics of the study sample, including the small number of subjects, the wide range of IQ's, and the variation of ethnicity. The superior performance by females, as expected from their lower age means, may have been compromised by the heterogeneity of participants. The alpha level, which was set at .01, may have also played a part in the insignificant sex difference.

Third, unlike McCartney's (1987) finding which indicated that participants with and without MR performed comparably when the MR subjects were provided with more presentations of stimuli than were their NR group, the performance by MR group did not appear to be directly correlated with presentation levels. This may have been caused by a lack of sustained attention. The attention deficits, in turn, may have further been attributed to the large number of pictures as stimuli. Fatigue may be another factor causing the MR group to be irresponsive to presentation conditions. For some subjects, the experiment was conducted in the afternoon, during the break from routine workload. For the others, the experiment was carried out in the evening after supper.

With respect to the comparable performances by both groups at the extended retention interval, several interpretations are plausible. First, the nonsignificant, between-group difference can be explained in terms of Hasher & Zacks' (1979) automatic-effortful paradigm. Hasher and Zacks' model suggested that many factors affected the type of processing (i.e., automatic or effortful). These include the presentation of stimuli, the topography of stimuli, and the

mode with which individuals sequence stimuli. The present findings offered empirical support for this processing model. To illustrate, the obtained results indicated primacy and recency effects in light of presentation of stimuli. The results also showed that individuals with MR are inferior to their NR counterparts where processing involved pictures with verbal cues (e.g., street signs). While symbols (e.g., words) are more associated with temporal sequencing and, accordingly, effortful processing, pictures are more likely to end up in automatic processing. The present findings suggested that processing color pictures of places is automatic. It is insensitive to capacity, intelligence, and developmental age. Individuals with MR appeared to be intact in automatic processing.

Second, the above result could be interpreted within the framework of the multiprocess model. The memory theory assumed that, among others, the probability of successful retention is directly associated with the depth of processing for that memory set (Gutowski & Chechile, 1987). Given that participants with MR had fewer items in their LTM, they could give more attention to them and thus process them in greater depth. Thus, as indicated in the results of the present study, the MR group had fewer items in their STM than did the NR group. Further, as delay extended, the NR group forgot items at a greater rate than did the MR group.

A third likely explanation involves the etiologies of mental retardation. A recent study (Burack & Zigler, 1990) indicated that individuals with organic retardation may differ from their familial counterparts in cognitive functioning. More specifically, children in the familial group labeled MR scored higher than the children in the organic group on both the central recall and memory span tasks. These data lend empirical support to the perspective that in the MR population significant differences in cognitive functioning may be attributable to etiological difference. In the present study, the vast majority of subjects in the MR group involved familial retardation rather than organic retardation. This may account in part for the finding that no significant differences during the 1-month delay phase were found between adults with and without MR.

A final interpretation of the above findings addresses extracognitive variables. Information-processing tasks may be affected not only by the type of tasks but by differences in task-related motivation and other personality characteristics (Weiss, Weisz, & Broomfield, 1986). This position was based primarily on Zigler and his colleagues' (Zigler & Hodapp, 1986) extensive work on the effects of motivational characteristics on the task performances of individuals with MR. Within this framework, people with MR would perform optimally when the task is similar to or highly relevant with everyday activities and most inhibited by artificial or laboratory tasks, such as the tasks that assess information-processing skills. In the present study, the tasks involved information-processing; as a result, the overall performance by the NR group was superior to that of the MR group. The nonsignificant difference of performances between both groups, however, could be attributed to the nature of stimuli and the motivation of subjects. In the present study, stimuli were pictures of places taken in a variety of places, including the shopping mall, parking lots, streets, playground, and such. Given its high relevancy to everyday living, the tasks may have raised the motivation of participants and facilitated performance by persons with MR.

The present findings raised questions to several long-held beliefs. The general public tend to regard individuals with MR as ones with deficits in all respects. Accordingly, people may ignore or abuse the rights and responsibilities of people with special needs. The present findings may have an impact on changing the public attitudes toward and understanding of individuals with MR.

The present findings may be significant in three ways. First, it may help to improve the public attitude toward and understanding of individuals with MR. Previous research (Bak & Siperstein, 1987) documented that demonstration of competence by children with MR had positive effects on other children's attitudes toward them. Few people attributed MR individuals' success to ability. In fact, they tend to owe it to ability if they witnessed it first hand in a live interaction. Additionally, those who attributed the success of children with MR to ability were more likely to choose them as play partner than who attributed their performance to effort. Being able to recognize MR individuals' ability facilitates interaction. In this context, demonstration of intact LTM has potential for changing the public attitudes toward people with MR.

Additionally, combined with Nigro and Roak's (1987) finding, the results of the present study may enlarge the scope of employment for individuals with MR and increase their job opportunities. The previous study indicates that individuals with MR perform as well as their NR counterparts in recalling of the spatial locations (Nigro & Roak's,1987). It has been concluded that neither instruction nor intelligence affect localization. The present study shows that MR individuals can recognize pictures of places on a long-term basis comparable to NR subjects. This suggests that many jobs involved with localization may be as appropriate for MR people as for NR individuals, including food delivery, mailmen, and bus driver, to name a few.

This study is very limited and raises numerous questions that can only be answered through further research. A broader study is needed which includes more diversity along the parameters of race, intelligence, age, and sex. It would be interesting, for example, to employ other topographies of stimuli.

As shown in Figure 1, trend analysis indicated that, provided with further extended retention intervals, individuals with MR are likely to perform as well as their NR peers in LTM tasks. It is tempting to conduct a series of duplicated and extended studies to explore the following questions: Is it likely that, despite their short-term memory deficits, adults with mild MR perform as well as their counterparts in other LTM tasks? What stimuli most facilitate LTM by persons with MR? To gain a better understanding of LTM by individuals with MR, a wide variety of stimuli should be employed, including physical features of objects and humans such as color, shape, size, length, height, and weight. Others include distance, time, date, and personal information. Studies involving the above variables may help individuals with MR adjust to work envi-

ronment and social setting. Nevertheless, this study casts considerable doubt on the general assumption that individuals are "everything deficit" and suggests that individuals with mild MR are relatively intact in LTM of pictures of places.

The present results lend themselves to several conclusions concerning LTM by persons with MR. To begin with, individuals with MR do not demonstrate deficits in LTM in the memory tasks in which the stimuli were color pictures of places. The results replicated those of McCartney (1987), in which the stimuli were pictures of human faces and the obtained results indicated that individuals with and without MR performed comparably in LTM tasks.

Second, pictures can be automatically processed by individuals with mild MR. This perspective was confirmed by the present author's casual observations and interviews, which indicated that few individuals with MR participating in the present study employed mnemonics or rehearsal strategies. This position lends a strong support to Hasher and Zacks' (1979) theory. More clearly, pictures of places can be processed inattentively, involuntarily, and without effort. Pictures processing is automatic, insensitive to intelligence.

Third, individuals with MR are intact in the LTM capacity. This is especially true when pictures were employed as stimuli in the memory tasks, such as the pictures of human faces in McCartney's study (1987) and the pictures of places in the present study. The present findings and those of McCartney (1987) are inconsistent with the theory proposed by Detterman (1979), who posited that people with MR demonstrated "everything deficit."

REFERENCE

Bak, J. J., & Siperstein, G. (1987). Similarity as a factor effecting change in children's attitudes toward mentally retarded peers. *American Journal of Mental Deficiency, 91*(5), 524-531.

BrainPower, Inc. (1986). *Statview 512+*. Calabasas, CA: BrainPower, Inc.

Burack, J. A., & Zigler, E. (1990). Intentional and incidental memory in organically mentally retarded, familial retarded, and nonretarded individuals. *American Journal on Mental Retardation, 94*(5), 532-540.

Das, J. (1970). Changes in Stroop-test responses as a function of mental age. *British Journal of Social and Clinical Psychology, 9*, 68-73.

Detterman, D. K. (1979). Memory in the mentally retarded. In N. R. Ellis (Ed.), *Handbook of mental deficiency* (2nd ed. pp.729-760). Hillsdale, NJ: Erlbaum.

Ellis, N. R., Katz, E., & Williams, J. E. (1987). Developmental aspects of memory for spatial location. *Journal of Experimental Child Psychology, 44*, 401-412.

Ellis, N. R., Woodley-Zanthos, P, & Dulaney, C.L. (1989). Memory for spatial location in children, adults, and mentally retarded persons. *American Journal of Mental Retardation, 93*(5), 521-527.

Gutowski, W. E., & Chechile, R. A. (1987). Encoding, storage, and retrieval components of associative memory deficits of mildly retarded adults. *American Journal of Mental Deficiency, 92*(1), 85-93.

Hasher, L., & Zacks, R. T. (1979). Automatic and effortful processes in memory. *Journal of Experimental Psychology: General, 108*, 356-388.

Hasher, L., & Zacks, R.T. (1984). Automatic processing of fundamental information: The case of frequency of occurrence. *American Psychologist, 39*, 1372-1388.

Kirk, R.E. (1982). Experimental design. Belmont, California: Wadsworth, Inc.

Lesgold, A., & Perfetti, C. (1978). Interactive processes in reading comprehension. *Discourse Processes, 1*, 323-336.

McCartney, J. R. (1987). Mentally retarded and non-retarded subjects' long-term recognition memory. *American Journal on Mental Retardation, 92*(3), 312-317.

McFarland, C., & Sandy, J. (1982). Automatic and conscious processing in retarded and nonretarded adolescents. *Journal of Experimental Child Psychology, 33*, 20-38.

Merrill, E. C., & McCauler, C. (1988). Phasic alertness and differences in picture encoding speed. *American Journal on Mental Retardation, 93*(3), 245-249.

Nigro, G. N., & Roak, R. M. (1987). Mentally retarded and non-retarded adults' memory for spatial location. *American Journal on Mental Retardation, 91*(4), 392-397.

O'Conner, N., & Hermelin, B. (1973). The spatial or temporal organization of short-term memory. *Quarterly Journal of Experimental Psychology, 25*, 335-343.

O'Conner, N., & Hermelin, B. (1978). *Seeing and hearing and space and time.* London: Academic Press.

Schadler, M., & Thissen, D. (1981). The development of automatic word recognition and reading skill. *Memory and Cognition, 9*, 132-141.

SPSS. (1990). *Statistical package for the social sciences for the Macintosh: Operations Guide*. Chicago: SPSS Inc.

Stanovich, K. (1980). Toward an interactive-compensatory model of individual differences in the development of reading fluency. *Reading Research Quarterly, 16*, 32-71.

Stanovich, K., Cunningham, A., & West, R. (1981). A longitudinal study of the development of automatic recognition skills in first graders. *Journal of Reading Behavior, 13*, 57-74.

Weiss, B., Weisz, J.R., & Broomfield, R. (1986). Performance of retarded and nonretarded persons on information-processing tasks: Further tests of the similar structure hypothesis. *Psychological Bulletin, 100*, 157-175.

Winters, J. J., Jr., & Semchuk, M. T. (1986). Retrieval from long-term store as a function of mental age and intelligence. *American Journal of Mental Deficiency, 90*, 440-448.

Zigler, E., & Hodapp, R. M. (1986). *Understanding mental retardation.* New York: Cambridge University Press.

國立臺灣師範大學特殊教育系、所，特殊教育中心
特殊教育研究學刊，民 83 ， 10 期， 191 － 208 頁

成年智障者與非智障者對地方性圖片的長期記憶之比較研究

杜正治　　H. Earl Knowlton
國立台灣師範大學　The University of Kansas, Kansas, USA

這項研究旨在比較智障者與非智障者對於地方性圖片的長期記憶，在實驗程序上包含二部份：一爲學習階段，另一爲評量階段。在學習階段中，實驗組與控制組各再分爲三小組，每一小組呈現不同次數的圖片。記憶內容是從 180 張幻燈片中隨機抽取的 90 張圖片。在學習階段後，受試者分別在下列時間間距中接受評量：零時距、 1 天時距、 1 週時距、以及 1 個月時距。

根據不同的時距與呈現次數比較各組之記憶量。結果顯示，整體而言非智障者的表現優於智障者，然而二組的差異隨時距的延長而縮小。因此，當時距延長到 1 個月時，智障組與非智障組的差異已縮小至未達顯著水準。

國立臺灣師範大學特殊教育系、所，特殊教育中心
特殊教育研究學刊，民 83 ， 10 期， 209 － 227 頁

台灣地區聽覺障礙學生句型理解能力

張蓓莉
國立台灣師範大學

本研究以句型理解能力測驗爲工具調查了台灣地區 1308 名國小三年級至國中三年級聽覺障礙學生之句型理解能力。結果發現聽覺障礙學生之年級、社經地位、失聰時期、配戴助聽器時期、佩戴助聽器情形、學前訓練及教育安置等因素與其句型理解能力有明顯相關。其中年級最能預測此項能力。聽覺障礙學生句型理解能力雖低，但隨年級而遞增，且呈直線成長趨勢。聽覺障礙學生並未顯現不懂句型之特性。

緒論

一、研究動機與目的

閱讀是屬於視覺性及接受性語言。人們藉著它可以吸取文字中的訊息。它與聽覺性接受性語言（聽取）不同的是人們可依照自己的速度閱讀，吸取更細密的資料，使人們獲取事件或概念的基礎知識；而這些概念則有助於溝通的深度與變通性（ Bench, 1993 ）。對於失聰者而言，若具備了良好的閱讀能力，則可彌補許多“聽不到”的訊息。因此對聽覺障礙者而言，閱讀能力十分重要，尤其置身於電腦時代中，無論是學習或日常生活，都有許多與機器對答的機會，如果沒有起碼的閱讀能力，生活適應將大受影響。

＊本文承教育部社教司補助經費，接受測驗各校校長，行政人員支持，教師施測，聽覺障礙學生合作，研究助理蘇芳柳老師協助協調及處理資料，得以完成。謹致由衷之謝意。

很不幸的是國內外有關聽覺障礙學生閱讀能力的研究結果均顯示，平均而言聽覺障礙學生的閱讀能力比同輩落後（林寶貴，民 76 ；張蓓莉，民 78 ；民 80 ； Allen, 1986; Bennett, Ragosta, & Stricker, 1984; Holt, 1993; Karchmer, Milone, & Wolk, 1979; King & Quigley, 1985; Levitt, 1987; Trybus & Karchmer, 1977 ）。閱讀是一項相當複雜，有彈性且微妙的認知活動，它包括了認字及瞭解語意與句法的訊息（ Leybaert, 1993 ）。 LaSasso （ 1993 ）認爲學生在閱讀的過程中讀者可能遭遇的問題是 (1) 生字詞及標點符號； (2) 句法； (3) 內容； (4) 老師所要求的閱讀的目的爲何？ (5) 如何表達自己對文章內容的瞭解。筆者（民 76 ，民 78 ）所作研究結果均顯示聽覺障礙學生的字形義辨別能力是其語文能力中較佳者。 Hatch 與 Robbins （ 1978 ）在深入研究了 6 名小學及中學聽覺障礙學生閱讀能力的發展後認爲學習閱讀最重要的是了解標準英文句法。 3 年後他們又研究了 36 名 9 至 12 歲聽覺障礙學生之閱讀能力，結果依舊如