

CHAPTER III

PRESENTATION OF RESULTS

The results of this present study are presented in the following order, firstly, analysis of performance on the central memory scores, next analysis of performance on the incidental memory scores, and lastly, correlations between central and incidental memory scores .

Central Memory Performance

Performance on the central memory task was assessed for two scores: total number of correct responses, and number of correct responses for each serial position over the fourteen trials. Means, standard deviation and proportion correct of each age were computed from total number of correct responses on central memory task. The results are presented in Table II.

Insert Table II

Table II
Means, Standard Deviation and Proportion Correct on
Central Memory Scores by Age Group and by Sex

	age 4 - 5			age 7 - 8			age 10 - 11			age 14 - 15			age 20 - 21		
	male	female	total	male	female	total	male	female	total	male	female	total	male	female	total
\bar{X}	5.8	5.7	5.75	6.5	6.3	6.4	7.7	7.1	7.4	8.4	8.8	8.6	9.4	10.5	9.95
S.D.	1.47	0.94	1.20	1.43	2.31	1.87	2.90	2.92	2.85	1.07	0.78	0.94	1.34	1.35	1.43
Prop. Corr.	0.41	0.40	0.41	0.46	0.45	0.45	0.55	0.50	0.52	0.60	0.62	0.61	0.67	0.75	0.71

The results in Table II show that the mean number and the proportion of correct responses on central memory increase with age.

The proportion of correct responses on central memory scores are presented in a chart form in Figure I.

Figure I

CENTRAL TASK SCORES OVER AGE

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△ - Male
△ - female
x - Total

4-5 7-8 10-11 14-15 20-21

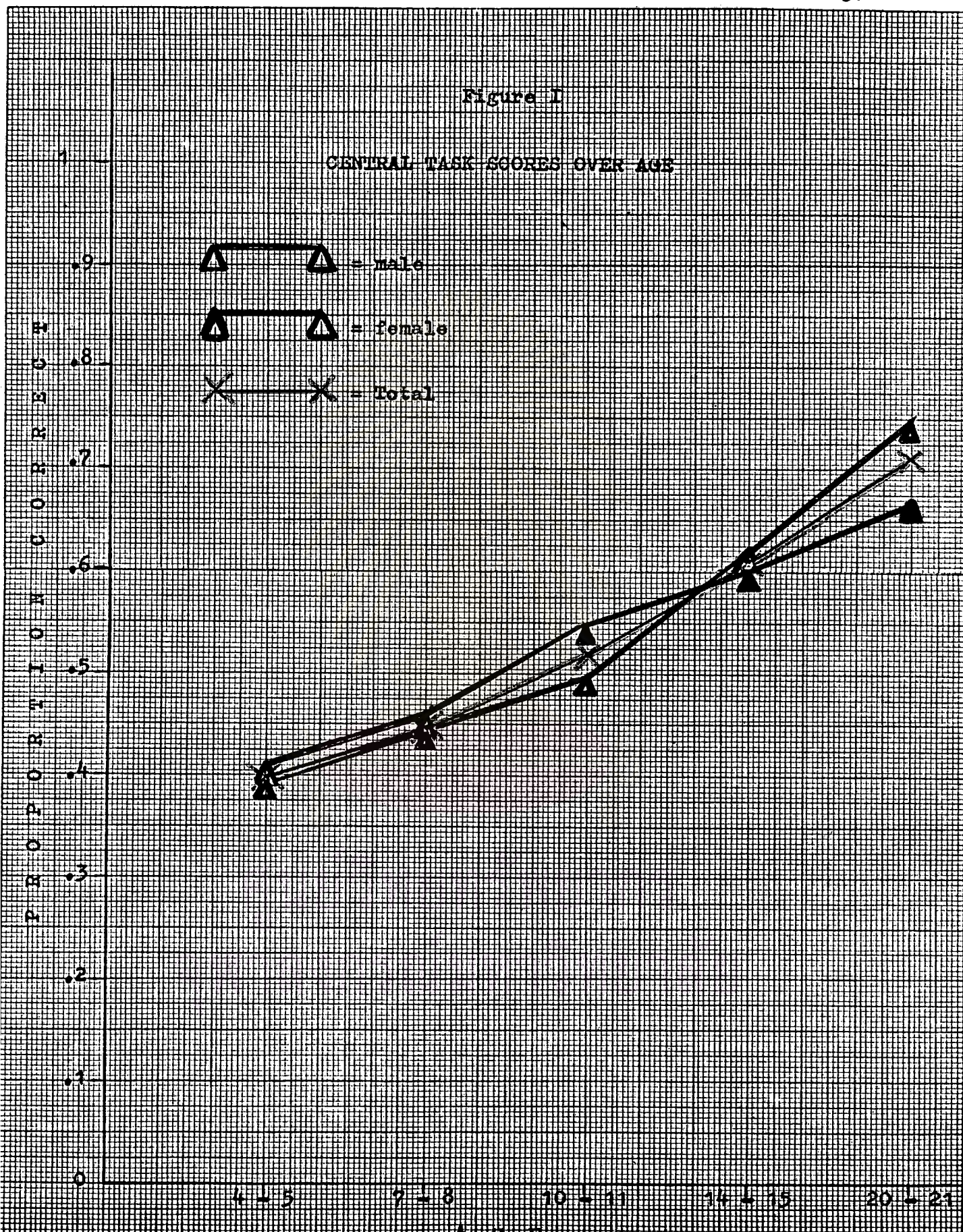


Figure I shows that proportion correct of the central memory generally increased with age from 4 to 21 years.

Correct responses of each serial position were computed in order to find means, standard deviation and proportions corrects.

The results are presented in Table III.

Insert Table III



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Table III
Means, Standard Deviation, and Proportion Correct
on Central Memory Scores by Serial Position

Serial Position	AGE GROUP																	
	4 - 5			7 - 8			10 - 11			14 - 15			20 - 21			Total		
	\bar{X}	S.D.	Prop. Corr.	\bar{X}	S.D.	Prop. Corr.	\bar{X}	S.D.	Prop. Corr.	\bar{X}	S.D.	Prop. Corr.	\bar{X}	S.D.	Prop. Corr.	\bar{X}	S.D.	Prop. Corr.
1	0.25	0.55	0.12	0.65	1.11	0.32	0.70	0.73	0.35	1.55	0.75	0.77	1.20	0.68	0.60	0.87	0.87	0.43
2	0.35	0.23	0.17	0.40	0.50	0.20	0.70	0.76	0.35	0.65	0.67	0.32	1.20	0.76	0.60	0.66	0.72	0.33
3	0.65	0.44	0.05	0.35	0.44	0.17	0.45	1.09	0.22	0.50	1.33	0.25	0.95	0.75	0.47	0.47	0.70	0.23
4	0.50	0.60	0.25	0.35	0.58	0.17	0.80	1.08	0.40	0.50	0.51	0.25	0.95	0.75	0.47	0.62	0.67	0.31
5	0.85	0.81	0.42	1.05	0.82	0.52	1.05	0.82	0.52	1.60	0.50	0.80	1.65	0.23	0.82	1.24	0.76	0.62
6	1.75	0.44	0.87	1.65	0.58	0.82	1.70	0.14	0.85	1.85	0.36	0.92	2	0	1	1.79	0.43	0.89
7	1.95	0.49	0.97	1.95	0.49	0.97	2	0	1	1.95	0.49	0.97	2	0	1	1.97	0.17	0.98

The proportion of correct responses for each serial position by age group are presented in a chart form in Figure II.

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Figure 2

CENTRAL MEMORY SCORES BY SERIAL POSITION AT DIFFERENT AGE

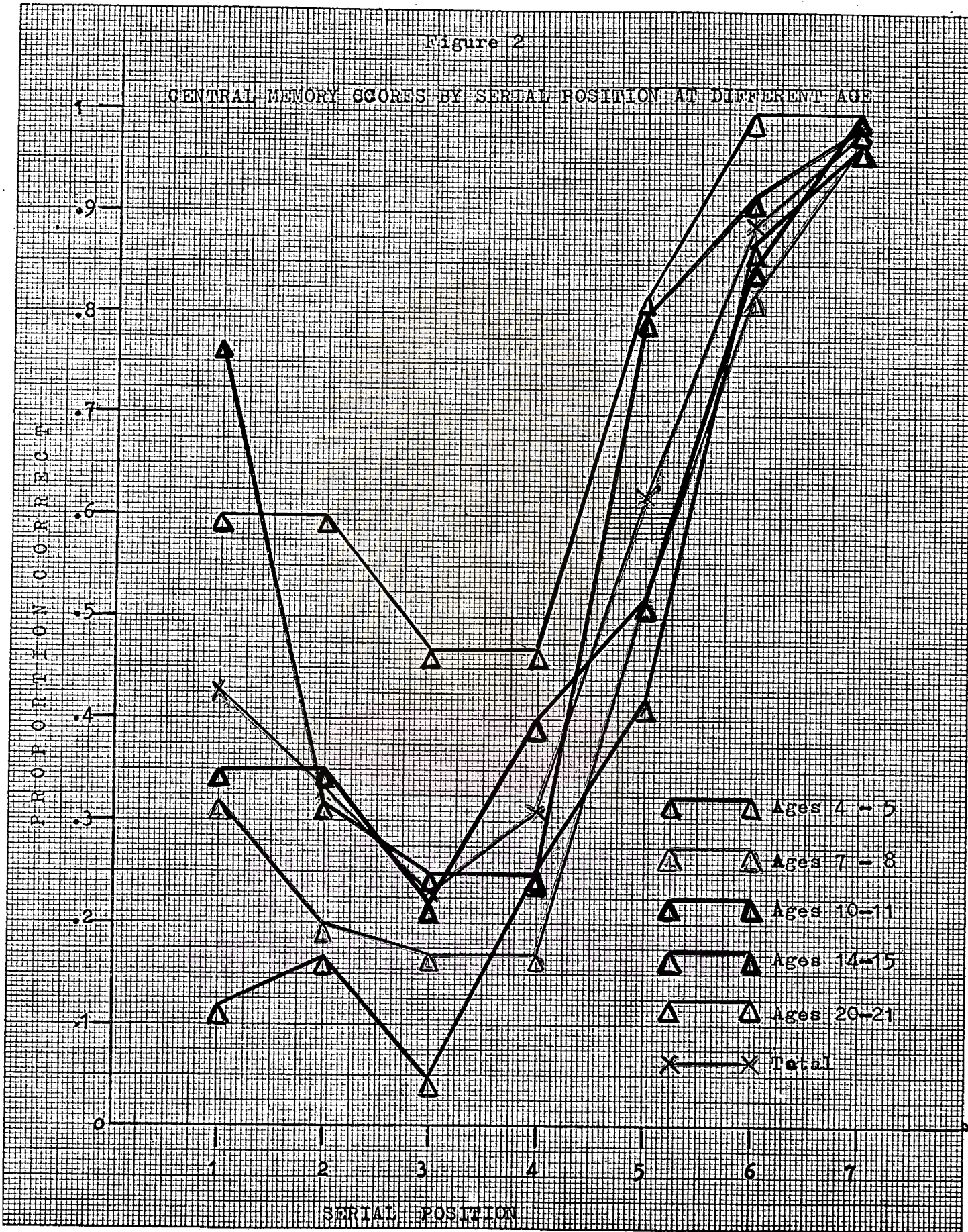


Figure II shows that generally primacy increased with age more than recency or performance in the middle positions. The highest performance for each age group was at recency, the last stimulus presented.

A two way analysis of variance was performed on central memory scores between scores of different age groups (5) and serial position (7) by defining the variation in row as a function of serial position and the variation in column as a function of age groups to explore the differences among all age groups and serial positions, and the interaction between age and serial position. The results are presented in Table IV

Table IV

A Two Way Analysis of Variance on Central Memory Scores
between Age and Serial Position

Source of Variance	S.S.	df	M.S.	F
Between subject	84.908	99	0.857	
A (age groups)	31.908	4	7.977	14.299 *
Subjects within group	53.000	95	0.557	
Within subjects	420.285	600	0.700	
B (serial position)	213.654	6	35.609	21.926 *
A x B	21.531	24	0.897	2.762 *
B x subject within group	185.100	570	0.324	

*

P .01

The results showed that there were significant differences among age groups ($F = 14.29, P < .01$) and serial positions ($F = 21.29, P < .01$). There was interaction between age groups and serial positions.

T - test comparisons were made among age groups for central memory scores to find the differences among age groups. The results are presented in Table V.

Table V

T-Test Comparisons among Age Groups on Central Memory Scores

Age Groups	4-5	7-8	10-11	14-15	20-21
	$\bar{X} = 5.75$	$\bar{X} = 6.4$	$\bar{X} = 7.4$	$\bar{X} = 8.6$	$\bar{X} = 9.95$
4-5 ($\bar{X} = 5.75$)	-	1.32	2.4626	8.3823	10.24
7-8 ($\bar{X} = 6.4$)	-	-	1.3157	4.7826	5.00
10-11 ($\bar{X} = 7.4$)	-	-	-	1.7910	3.12
14-15 ($\bar{X} = 8.6$)	-	-	-	-	3.55
20-21 ($\bar{X} = 9.95$)	-	-	-	-	-

*
 $P < .01$

The results of T-test showed that performance on central memory at ages 4-5 was not significantly different from the performance on central memory at ages 7-8 and 10-11 (N.S.), but there were significant differences for the performance on central memory between ages 4-5 and 14-15 ($t = 8.8328, P < .01$), and between age 4-5 and 20-21 ($t = 10.24, P < .01$). Their performance on central memory at

age 7 - 8 was not significantly different from that at age 10 - 11 (N.S.). There were significant differences on the performance of central memory between age 7 - 8 and 14 - 15 ($t = 4.78, P < .01$) and between age 7 - 8 and 20 - 21 ($t = 5.00, P < .01$). The performance on central memory at age 10 - 11 was not significantly different from that at age 14 - 15 (N.S.). There were significant differences on the performance of central memory between age 10 - 11 and age 20 - 21 ($t = 3.12, P < .01$), and between age 14 - 15 and age 20 - 21 ($t = 3.55, P < .01$).

T-test comparisons were also made to find out the differences on central memory task scores between males and females. The results are presented in Table VI.

Table VI

T-test Comparisons between Sexes on Central Memory Scores.

age group	\bar{X} of male	\bar{X} of female	T Values
4 - 5	5.8	5.7	0.1788 (N.S.)
7 - 8	6.5	6.3	0.2325 (N.S.)
10 - 11	7.7	7.1	0.4602 (N.S.)
14 - 15	8.4	8.8	0.9487 (N.S.)
20 - 21	9.4	10.5	1.8129 (N.S.)

$P < .01$

T-test values showed that there were no significant differences between males and females at any age level (N.S.).

The seven serial positions were condensed into three positions: primacy, recency and middle positions. Primacy position effect was represented by the scores in the first stimuli presented to each subject while recency position effect was represented by the scores in the last stimuli. The middle positions effect was represented by the average of the third, the fourth and the fifth stimuli.

One way analysis of variance was performed for each age group to investigate the differences of performance on the three serial positions. The results are presented in Table VII for age 4-5, Table VIII for age 7-8, Table IX for age 10-11, Table X for age 14-15 and Table XI for age 20-21.

Table VII

One Way Analysis of Variance of Three Serial Positions for
Central Memory Scores at Age 4-5

Source of Variance	S.S.	df	M.S.	F
Between people	3.9643	19	0.2086	
within people	100.5715	120	0.8380	
Treatments	66.1858	6	11.0309	36.5746 *
Residual	34.3857	114	0.3016	
Total	104.5358	139	0.7520	

* $P < .01$

The result of the analysis showed that the performance on central memory scores was significantly different for three serial positions ($F = 36.57$, $P < .01$) at age 4-5.

Table VIII
One Way Analysis of Variance of Three Serial Positions for
Central Memory Scores at Age 7 - 8

Source of Variance	S.S.	df	M.S.	F
Between people	22.1143	19	1.1639	
within people	77.4286	120	0.6452	
Treatments	39.8429	6	0.6404	20.1468*
Residual	37.5857	114	0.3296	
Total	99.5429	139	0.7161	

* $P < .01$

The results of the analysis showed that the performance on central memory scores was significantly different for three serial positions ($F = 20.14$, $P < .01$) at age 7 - 8 .

Table IX
One Way Analysis of Variance of Three Serial Positions for
Central Memory Scores at Age 10 - 11

Source of Variance	S.S.	df	M.S.	F
Between people	9.5429	19	0.5022	
within people	93.4286	120	0.7785	
Treatments	52.0715	6	8.6785	23.9234*
Residual	41.3571	114	0.3627	
Total	102.9715	139	0.7408	

* $P < .01$

The results of the analysis showed that the performance on central memory scores was significantly different for three serial positions ($F = 23.92$, $P < .01$) at age 10 - 11 .

Table X
One Way Analysis of Variance of Three Serial Positions for
Central Memory Scores at Age 14 - 15

Source of Variance	S.S.	df	M.S.	F
Between people	2.4000	19	0.1263	
within people	92.2853	120	0.7690	
Treatments	50.8858	16	3.1809	23.3569*
Residual	41.4000	114	0.3631	
Total	94.6853	139	0.6811	

* $P < .01$

The results of the analysis showed that the performance on central memory scores was significantly different for three serial positions ($F = 23.35$, $P < .01$) at age 14 - 15.

Table XI

One Way Analysis of Variance of Three Serial Positions for
Central Memory Scores at Age 20 - 21

Source of Variance	S.S.	df	M.S.	F
Between people	6.0000	19	0.3157	
within people	66.5715	120	0.5547	
Treatments	25.2858	6	4.2143	11.6384*
Residual	41.2857	114	0.3621	
Total	72.1235	139	0.5189	

* $P < .01$

The results of the analysis showed that the performance on central memory scores was significantly different for three serial positions($F = 11.63$, $P < .01$).

Proportion correct at different serial position on central memory scores can be presented in a different way to clarify the locus of inter-group differences within a trial. The performance of subjects of different age group on primacy, middle positions, and recency was presented separately in Figure III. The first panel of Figure III shows the primacy effect (position 1), the second panel shows the average of position 3, 4, 5 and the third panel shows the recency effect (position 7).

Insert Figure III

Figure 3

(PRIMACY, MIDDLE, and REGENCY POSITION SCORES by AGE)

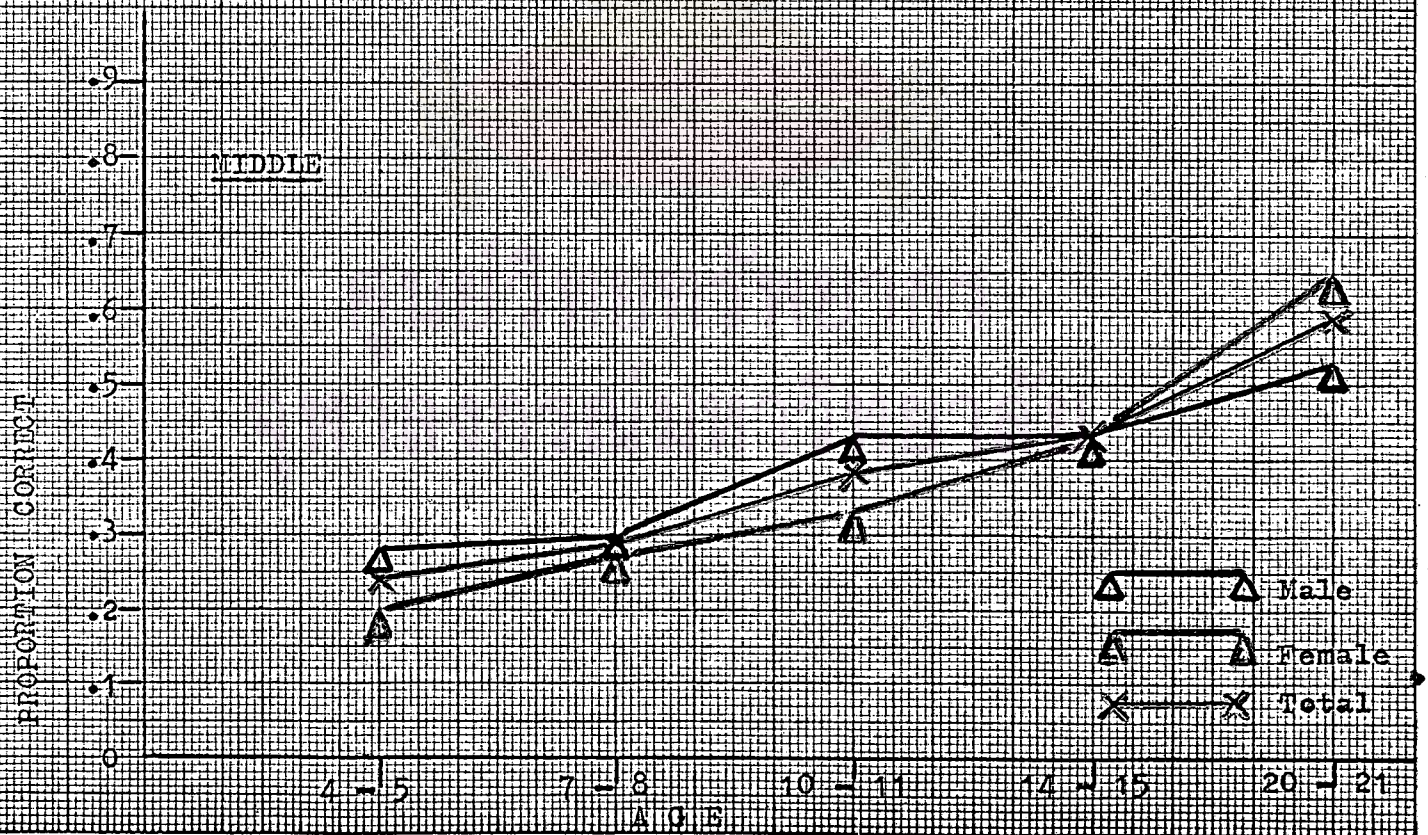
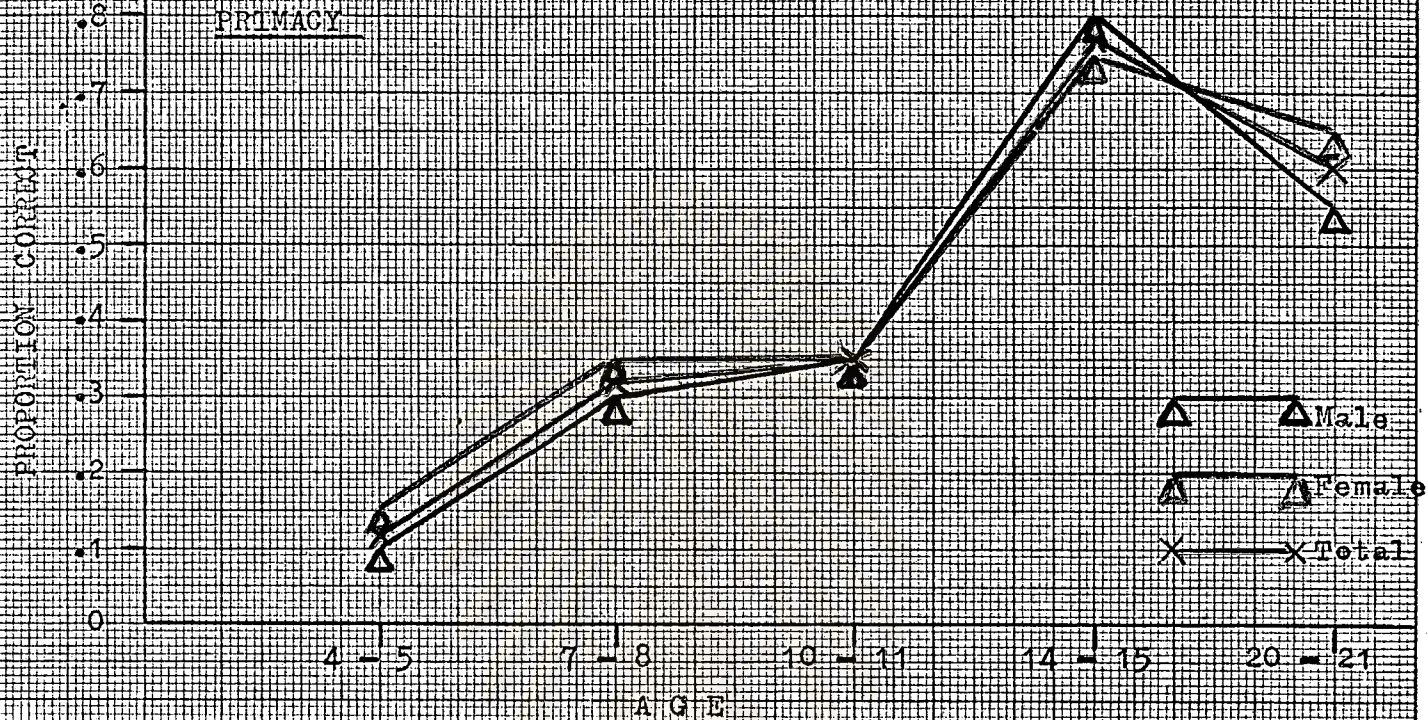


Figure 3 (Continued)

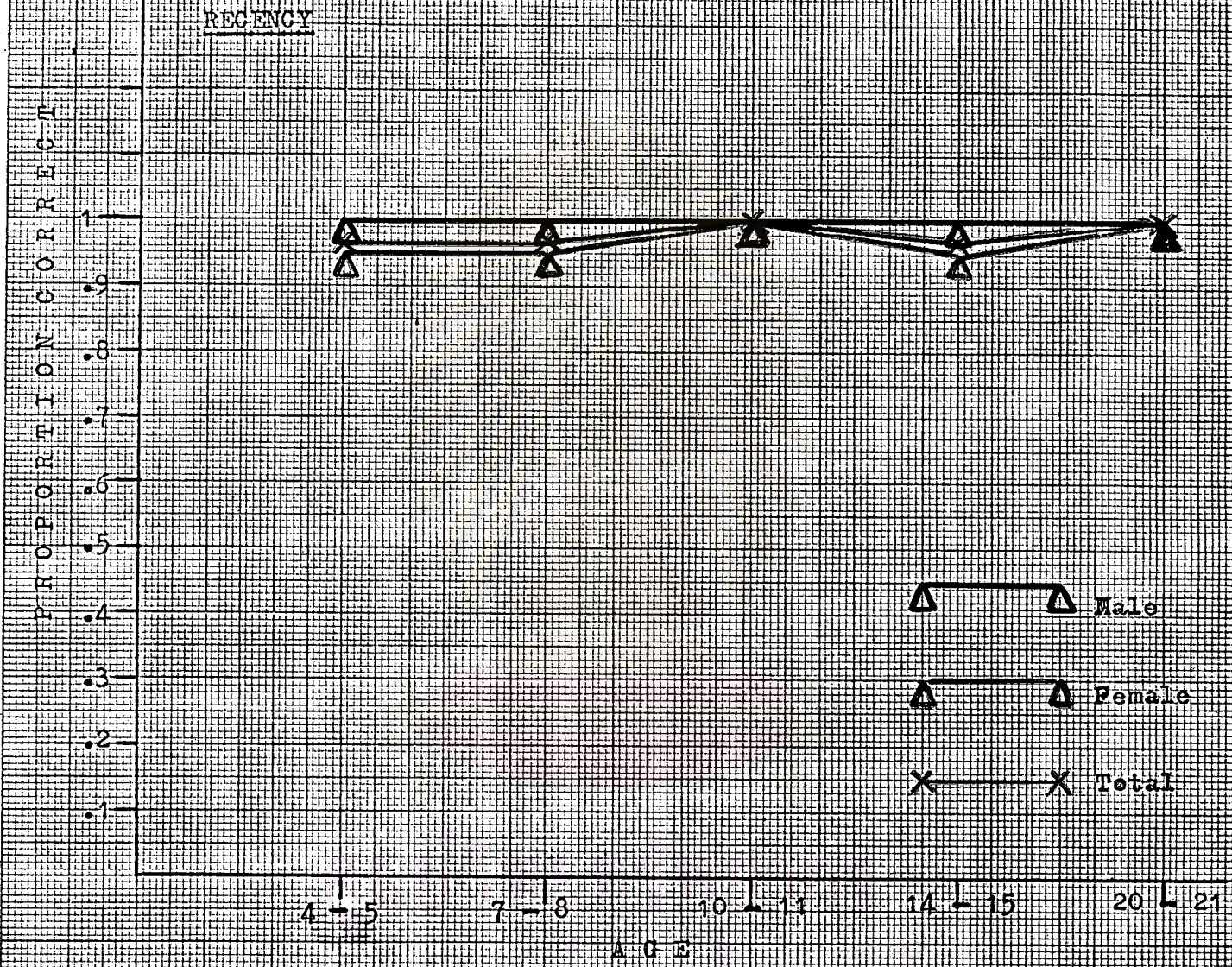


Figure III shows an increase in performance of primacy and middle positions with age, but the recency remained almost constant for all age groups, and at a very high level.

One way analysis of variance calculations were done on central memory scores separately for each serial position: primacy, recency, and middle positions to examine the differences in performance among the age groups. The results are presented in Table XII for primacy effect, Table XIII for recency effect, and Table XIV for middle positions effect.

Table XII

One Way Analysis of Variance of the Primacy Effect
among the Five Age Groups

Source of Variance	S.S.	df	M.S.	F
Between groups	20.66	4	5.1650	10.9893*
within groups	45.65	95	0.4700	
Total	65.31	99	0.6595	

* $P < .01$

Table XII showed that there were significant differences among the five age groups on primacy recall ($F = 10.98$, $P < .01$).

Table XIII

One Way Analysis of Variance of the Recency Effect
among the Five Age Groups

Source of Variance	S.S.	df	M.S.	F
Between groups	0.06	4	0.0150	0.5000
within groups	2.85	95	0.0300	
Total	2.91	99	0.0293	

* $P < .01$

Table XIII showed that there were no significant differences among the five age groups on recency recall.

Table XIV

One Way Analysis of Variance of the Middle Effect
among the Five Age groups

Source of Variance	S.S.	df	M.S.	F
Between groups	33.06	4	8.2650	3.5911*
within groups	218.65	95	2.3015	
Total	251.71	99	2.5425	

* $P < .01$

Table XIV showed that there were significant differences among the five age groups on middle positions recall ($F = 3.59, P < .01$)

T-test comparisons were made on central memory scores to find differences among the primacy effect, recency effect, and middle positions effect for all age groups. The results are presented in Table XV.

Table XV

Comparisons among Primacy Effect, Recency Effect, and Middle Positions Effect for All Age Groups

Serial Position	Primacy effect	Recency effect	Middle effect
	$\bar{X} = 0.87$	$\bar{X} = 1.97$	$\bar{X} = 2.33$
Primacy effect ($\bar{X} = 0.87$)	-	$t=13.095^*$	$t=1.073$
Recency effect ($\bar{X} = 1.97$)	-	-	$t=10.777^*$
Middle effect ($\bar{X} = 2.33$)	-	-	-

* $P < .01$

The results showed that there were significant differences between the primacy effect and the recency effect ($t = 13.095$, $P < .01$), and between the recency effect and middle positions effect ($t = 10.77$, $P < .01$), but there were no significant differences between primacy effect and the middle positions effect

Incidental Memory Performance

The incidental memory scores were the number of correct pairings of animals and objects recalled following completion of the central memory. Means, standard deviation, and proportion correct of each age group were computed from total number of correct responses on incidental memory scores. The results are presented in Table XVI.

Table XVI

Means, Standard Deviation, and Proportion Correct on
Incidental Memory Scores by Age Group and by Sex

	age 4 - 5			age 7 - 8			age 10 - 11			age 14 - 15			age 20 - 21		
	male	female	Total	male	female	Total	male	female	Total	male	female	Total	male	female	Total
X	1.9	1.5	1.7	2.5	1.9	2.2	3	1.8	2.4	1.3	1.7	1.5	.7	.7	.7
S.D	1.85	1.26	1.55	1.50	1.44	1.47	0.81	1.68	1.42	1.41	1.75	1.31	0.67	0.94	0.80
Prop. Corr.	0.27	0.21	0.24	0.35	0.27	0.31	0.42	0.25	0.34	0.18	0.24	0.21	0.10	0.10	0.10

The proportion of correct responses on incidental memory are presented in a chart form in

Figure IV.

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Figure 4

(INCIDENTAL MEMORY SCORES OVER AGE AND BETWEEN SEX)

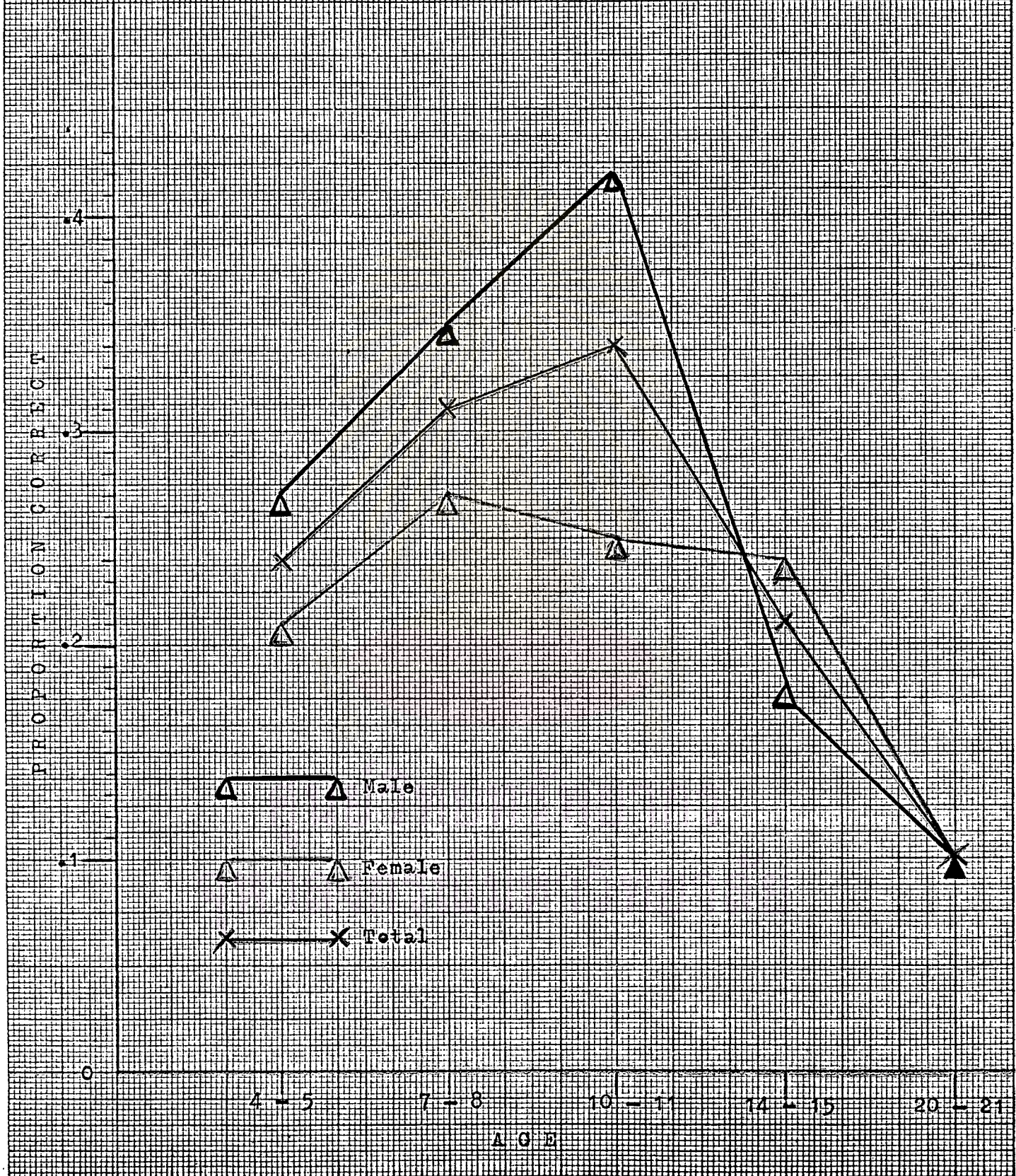


Figure IV showed clearly that the proportion correct of incidental memory performance increased with age, and then declined. The highest performance was at the 10 - 11 years of age while the lowest was at 20 - 21 years of age.

A one way analysis of variance was performed on incidental memory scores in order to investigate the differences among different age groups. The results are presented in Table XVII.

Table XVII

One Way Analysis of Variance on Incidental
Memory Scores among Age Groups

Source of Variance	S.S.	df	M.S.	F
Between groups	84.35	4	20.0875	11.6880*
within groups	171.40	95	1.8042	
Total	255.75	99		

* $P < .01$

The results showed that there were significant differences in incidental memory scores among five age groups($F = 11.68, P < .01$).

T-test comparisons were made between age groups for incidental memory scores to find the differences between age groups. The results are presented in Table XVIII.

Table XVIII

T-test Comparisons among Age Groups on Incidental Memory Scores

Age groups	4 - 5	7 - 8	10-11	14-15	20-21
	$\bar{X}=1.7$	$\bar{X}=2.2$	$\bar{X}=2.4$	$\bar{X}=1.5$	$\bar{X}=0.7$
4 - 5 ($\bar{X} = 1.7$)	-	1.042	1.480	0.438	2.777
7 - 8 ($\bar{X} = 2.2$)	-	-	0.435	1.587	5.336*
10-11 ($\bar{X} = 2.4$)	-	-	-	2.070	4.641*
14-15 ($\bar{X} = 1.5$)	-	-	-	-	2.320
20-21 ($\bar{X} = 0.7$)	-	-	-	-	-

* $P < .01$

The results showed that the performance on incidental memory at age 4 - 5 was not significantly different from the performance at age 7 - 8 (N.S.), age 10 - 11 (N.S.), age 14 - 15 (N.S.), and age 20 - 21 (N.S.). The performance on incidental memory at age 7 - 8 was not significantly different from the performance at age 10 - 11, and age 14 - 15 (N.S.), but was significantly different from that at age 20 - 21 ($t = 5.33, P < .01$). There were no significant differences between the performance at age 10 - 11, and age 14 - 15, but the incidental memory performance at age 10 - 11 was significantly different from the performance at age 20 - 21 ($t = 5.33, P < .01$). The performance at age 14 - 15 was not significantly different from the performance at age 20 - 21 (N.S.).

T-test comparisons were also made to find sex differences on incidental memory scores between males and females. The results are presented in Table XIX.

Table XIX

T-test Comparisons between Sexes on Incidental Memory Scores

Age	\bar{X} of male	\bar{X} of female	t Values
4 - 5	1.9	1.5	0.9372
7 - 8	2.5	1.9	0.9070
10 - 11	3	1.8	2.0321
14 - 15	1.3	1.7	0.3343
20 - 21	.7	.7	0

* $P < .01$



The results showed that there were no **statistical** differences between sexes on incidental memory scores at any age level (N.S.).

Relationship between Central and Incidental Memory Scores

Individual correlations of central and incidental memory scores were calculated for all age groups in order to find the relationship between the central and incidental memory scores. The results are presented in Table XX.

Table XX
Correlations between Central and Incidental Memory
Scores for All Age Groups

Age groups	\bar{X} of central memory scores	\bar{X} of incidental memory scores	R_{XY}
4 - 5	5.75	1.7	0.1773(N.S.)
7 - 8	6.40	2.2	0.0265(N.S.)
10 - 11	7.40	2.4	0.0971(N.S.)
14 - 15	8.60	1.5	0.2097(N.S.)
20 - 21	9.95	0.7	0.0077(N.S.)

* $P < .01$

The results showed that there were no statistically significant relationship between central and incidental memory scores at any age group (N.S.).

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