CHAPTER V

RESULTS AND DISCUSSION

1. Full Raw Data

Tables 47-56 (See Appendix IX) give full data on female subjects used for film Versions 1 to 10. Each table first gives the total number of female subjects for each film version, then their last names, then such information as age, major subject, and the extent of their Russian language background before this experiment. The main data shown in the spanner head is divided into three panels. The first panel is for the data on control version. In the first six columns it gives the S's score for six successive film repetitions, then the S's score on the reversal test (English-Russian) in the seventh column, and in the last or eighth column it gives totals of columns 1-6. The second panel repeats the same procedure for the data on experimental film version assigned to this group. The last panel has only two columns. The first column gives the retention score on the control version for each subject. In the second column of the last panel, the retention score of each subject on the experimental version is given last. For the covariance methods B and C, each of ten groups had to be equalized in size by reducing the number of each group to the required minimum. In case of females, 14 females were selected at random from each group and in case of males, 8 males were selected at random. Tables 47 through 56 star the names of subjects who were selected for the reduced population in each group (N = 14).

Tables 57-66 (See Appendix IX) repeat the same information for ten

male groups in an identical fashion. The covariance methods B and C required the reduction in the size of each male group as well. The names of males who were selected for the reduced population (N = 8) are starred, as before.

2. Improvement in Learning for Every Film Repetition

Table 9 shows the mean score of the ten female groups, for six successive film repetitions. This table is in two parts. The upper part shows the improvement of each group on the control version. There is a definite increment in the number of words rightly answered as the film is repeated again and again. The level of learning finally attained varies between 73.1% to 88.8% for the control version. This not only corroborates the pilot-test findings but reaches a far higher level (the pilot-test level varied between 60% and 74% for women). The lower part of the table gives the performance of each group as a function of successive repetitions of the experimental film versions. Here the level of learning for the female group is still higher (75.83% and 90.07%). This shows that the female groups had reached a very high norm and were probably well-motivated.

Table 10 shows similar data for male groups of subjects. On the control version the range of performance for the last film repetition varied from 57.63% to 72.77%. For the experimental film versions, this ranges between 67.75% to 80.83%. This range corroborates the pilot-test findings and is much higher than the performance of males in the pilot-test (40% to 70%). However, it will be noted that the males do not reach as high a norm as females and may be probably a less motivated group.

3. The Mean Scores for Learning and Retention on Each Film Version

TABLE 9

MEAN SCORES (NO. OF WORDS RIGHT) OF THE TEN FEMALE GROUPS FOR SUCCESSIVE FILM REPETITIONS
MEAN SCORES ON THE CONTROL FILM VERSIONS

# Film Repetition	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10
1	.7778	.7500	1.5882	.8571	2.4118	1.2941	2.3810	2.0000	1.5333	1.3182
2	3.9444	4.1875	4.4118	3.8571	7.7647	4.7059	5.8571	5.4242	4.1429	4.5455
3	7.1667	8.7500	9.4118	8.1428	12.2353	8.2353	9.7619	9.9394	7.8095	8.6364
4	10.5556	11.9375	11.7059	12.0714	14.7059	12.2941	13.2380	13.1818	10.5238	11.1818
5	13.3333	13.3750	14.1765	14.7140	16.7059	13.8235	14.0476	15.0303	13.1429	14.7273
6	15.2778	15.0000	16.2941	16.6428	17.7647	15.9411	17.1000	16.2727	14.6190	16.5909
					Mean scores on the experimental film versions					
1	1.7222	1.8125	2.0000	1.0000	1.7647	2.4706	2.0500	1.6153	2.2857	1.5000
2	5.3889	7.1250	6.9412	5.5714	8.2353	5.9412	7.0952	7.2307	6.5238	5.8182
3	8.8333	11.3125	10.7647	10.1428	12.5882	9.7059	11.5238	10.5384	10.4286	11.2273
4	11.9444	14.6250	13.7647	13.2857	14.2941	13.2353	15.0000	16.0769	14.6190	14.3182
5	13.4444	16.3750	16.0588	15.5000	16.5294	15.4706	16.4286	16.3546	16.5714	16.5000
6	15.1667	17.9375	17.1765	16.8571	17.2353	16.5882	17.5714	16.6923	17.4286	18.1364

TABLE 10

MEAN SCORES (NO. OF WORDS RIGHT) OF THE TEN MALE GROUPS FOR SUCCESSIVE FILM REPETITIONS
MEAN SCORES ON THE CONTROL FILM VERSIONS

Film Repetition #	Group 1	Group 2	Group 3	Group 4	Group 5	Group 6	Group 7	Group 8	Group 9	Group 10
1	1.0909	.5417	.6000	1.0625	.8947	.8947	1.4444	1.4242	.7059	.9000
2	3.0454	2.4583	2.6000	3.3750	3.3684	3.4737	4.7778	4.3333	2.3824	3.3000
3	6.4091	5.9583	4.7333	6.4375	6.3158	5.4211	8.3889	7.4848	6.2353	7.7000
4	9.3636	8.8333	7.2000	8.8750	9.4737	8.2631	11.5000	10.6364	9.0000	9.5000
5	12.0909	11.7083	9.3333	12.0625	11.5789	10.4737	11.6667	12.6970	11.1765	11.4000
6	13.9091	13.7917	11.4000	12.7500	12.8947	11.5263	14.5556	13.5152	13.4706	13.8000
					Mean scores on the experimental film versions					
1	1.4545	1.4167	1.3333	1.6250	.8889	1.5263	2.2222	1.7777	.9412	1.1000
2	4.7273	5.6250	4.4000	4.6875	4.4444	4.3685	7.1667	6.0555	4.5882	5.3000
3	7.6364	9.6250	8.0667	8.8750	7.9444	8.1579	10.7222	9.7777	8.3529	8.2000
4	10.9091	12.0000	11.0000	12.2500	10.8889	10.1579	13.9444	13.3838	11.5882	10.9000
5	13.0455	14.7500	12.4000	13.6250	13.0000	12.0526	14.2222	14.6666	13.7647	13.7000
6	14.9091	16.1667	13.3000	15.3125	13.5556	14.1579	15.2222	15.6666	15.0588	16.0000

(a) Learning. Table 11 gives the means and standard deviations of totals of columns 1-6 (in Tables 47-56) for females, both for control and experimental versions. Due to the proposed method of analysis, which is covariance, mere means and standard deviations data do not enable us to compare the different film-versions. These are unadjusted for individual differences among subjects. Table 12 gives similar data for male groups on both control and experimental versions. Means and standard deviations for males are of the totals of columns 1-6 (in Tables 57-66). The data of Tables 11 and 12 is shown by bar-graphs in Figures 1, 2, 3, and 4.

(b) Retention. Table 13 shows the means and standard deviations of retention scores for females and males on both control and experimental versions. There is a difference between the retention scores of Table 13 and the retention scores of Tables 47-66. The former are derived by the square-root transformations of the original retention scores. One requirement of the analysis of variance and covariance is that the traits to be studied should be normally distributed. A chi-square test for the scores on control versions and learning scores on experimental versions for female groups revealed that in both the control version and experimental version scores the chi-square was not significant (P between .30 and .50 for df = 10, for control version; P between .20 and .10 for df = 9, on experimental version). But the same is not the case for the retention scores. The data of the retention scores was found to be highly skewed in the positive direction. Therefore, it was decided to use the square-root transformation for the original scores, as recommended by Edwards (22, pp. 199-202). The retention data for males is also derived

TABLE 11

MEAN AND SIGMA VALUES OF THE SCORES OF TEN FEMALE GROUPS ON THE CONTROL AND THE EXPERIMENTAL FILM VERSIONS

		Control Version		Experimental Version	
Film Version	N	M*	S.D.	M*	S.D.
1	18	51.0555	19.7526	56.5000	16.4326
2	16	54.0000	18.8481	69.6875	14.1718
3	17	57.5882	24.0345	66.7058	20.2769
4	14	55.6428	15.0647	62.3571	13.5046
5	17	71.5882	22.6068	70.6470	22.2999
6	17	56.2941	19.4718	63.4117	22.4082
7	21	62.0000	22.9741	69.0476	22.8839
8	33	61.6363	21.4262	71.0606	19.5618
9	21	51.5714	21.5110	68.4762	19.4831
10	22	57.7272	19.6288	67.5000	16.8705

TABLE 12

MEAN AND SIGMA VALUES OF THE SCORES OF TEN MALE GROUPS ON THE CONTROL AND THE EXPERIMENTAL FILM VERSIONS

		Control Version		Experimental Version	
Film Version	N	M*	S.D.	M*	S.D.
1	22	45.9090	17.9593	53.8636	19.2101
2	24	43.2916	20.5984	59.6250	18.4161
3	15	35.8686	22.3872	51.0000	24.7629
4	16	45.0625	18.8232	56.3750	20.2266
5	19	44.5263	23.4910	49.4210	21.6803
6	19	41.3157	22.5066	50.4210	26.3884
7	18	53.3333	27.2969	64.6111	26.6880
8	33	49.7272	24.0559	61.8484	22.7185
9	17	43.3705	15.2088	54.2941	17.9633
10	10	46.6000	20.8864	55.2000	16.7680

*Each mean represents an average of the total scores made by all the subjects in that group for six film repetitions. This holds for Table 11 also.

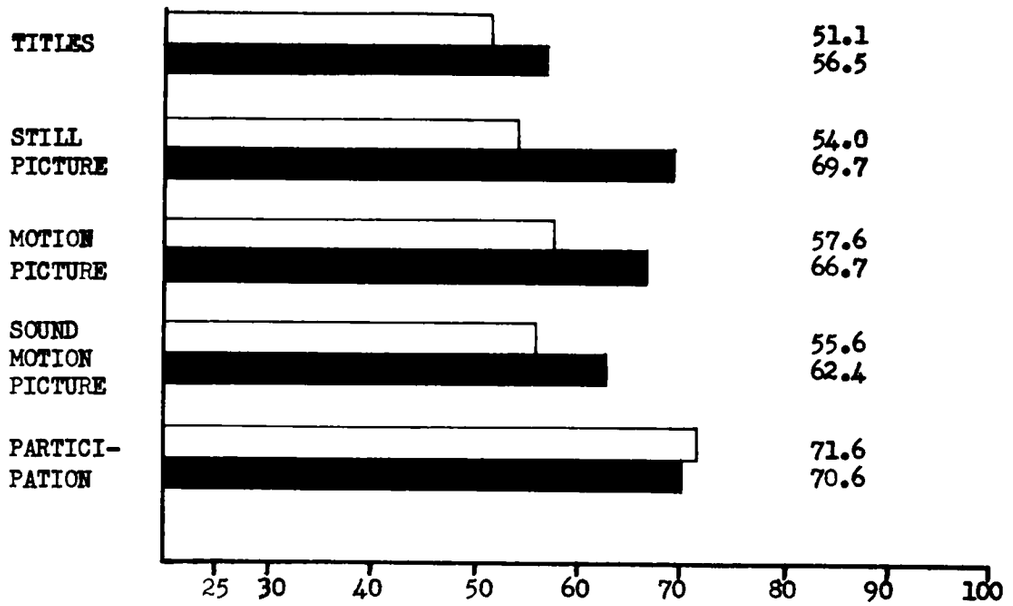

Fig. 1. The mean total scores of female groups learning the nouns list. The vertical axis gives the methods. The horizontal axis gives the score - intervals, ranging from 25 to 100. The open graph gives a group's score on the control version. The solid graph gives its score on the experimental version.

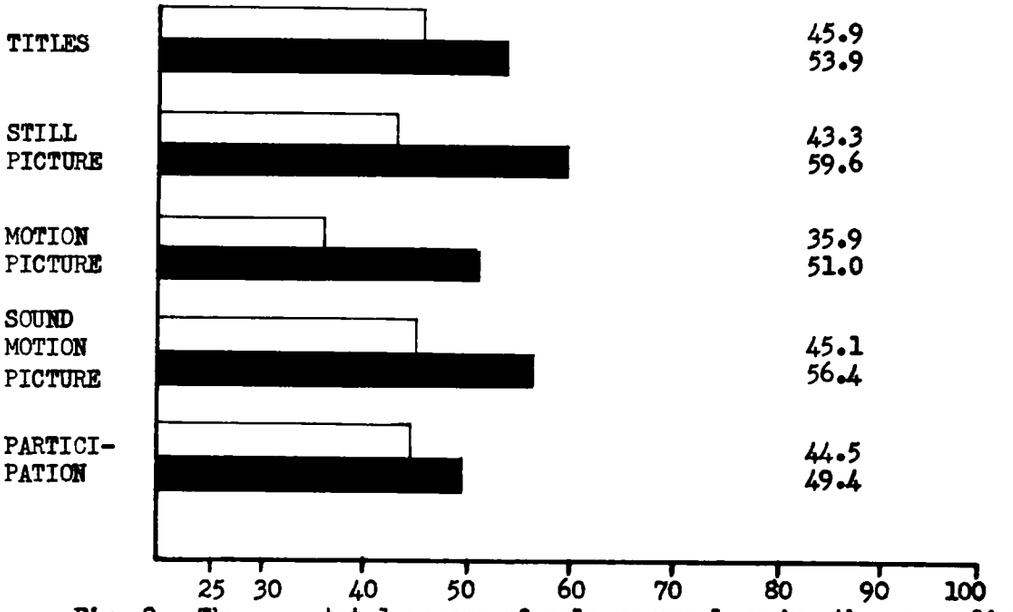

Fig. 2. The mean total scores of male groups learning the nouns list. The vertical axis gives the methods. The horizontal axis gives the score - intervals, ranging from 25 to 100. The open graph gives a group's score on the control version. The solid graph gives its score on the experimental version.

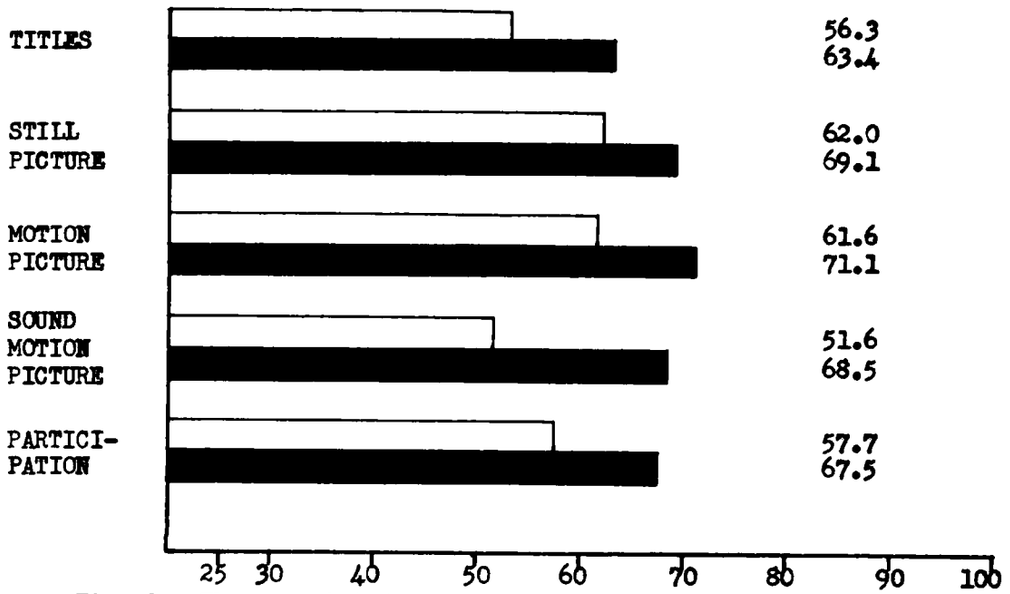

Fig. 3. The mean total scores of female groups learning the verbs list. The vertical axis gives the methods. The horizontal axis gives the score - intervals, ranging from 25 to 100. The open graph gives a group's score on the control version. The solid graph gives its score on the experimental version.

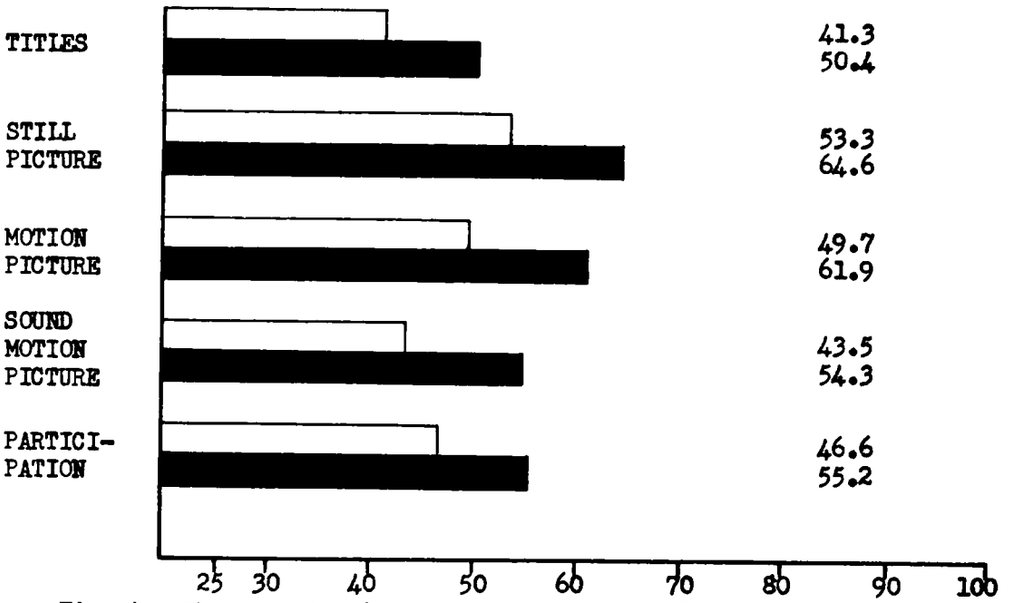

Fig. 4. The mean total score of male groups learning the verbs list. The vertical axis gives the methods. The horizontal axis gives the score - intervals, ranging from 25 to 100. The open graph gives a group's score on the control version. The solid graph gives its score on the experimental version.

TABLE 13

MEAN AND SIGMA VALUES OF FEMALE AND MALE GROUPS' RETENTION SCORES ON THE CONTROL AND THE EXPERIMENTAL VERSIONS*

Film Version	Female Groups				Male Groups			
	Control		Experimental		Control		Experimental	
	M	S.D.	M	S.D.	M	S.D.	M	S.D.
1	2.1685	1.0097	2.2851	1.0003	2.2320	.9318	2.1826	.9414
2	2.2914	.9678	2.4687	1.0748	2.0031	.7721	2.2245	.8125
3	2.5206	.9201	2.7261	1.0494	1.9374	1.1481	2.1905	1.2484
4	2.6280	.8579	2.4650	.9610	2.2460	.9775	2.5429	.8166
5	2.6317	1.1946	2.6874	1.1173	2.0264	1.0296	2.2732	1.0796
6	2.0871	.8383	2.2262	.9318	1.7836	1.0401	1.5701	1.0041
7	2.2613	.9415	2.4725	.7753	1.8960	1.3260	2.4224	1.2184
8	2.3098	1.0233	2.6259	1.0920	1.8328	.8774	2.2893	.8138
9	2.1538	.8042	2.2359	.8169	1.9058	.8559	2.1654	1.1217
10	2.2439	1.0918	2.7411	.7597	1.9985	.6172	2.4527	.5991

*The mean and sigma values were computed from the square-root transformations of the original raw scores.

after square-root transformation.

A question may be raised here: Why do we treat the men and women groups separately for each film version? For, as McGeoch and Irion (58, p. 555) summarized the findings on sex differences in learning,

> sex differences in rate of learning are small and do not consistently favor one sex or the other.

Two exceptions of sex differences have been noted in past research viz. the character of the material learned and the rate of learning as showing significant sex differences. In the present study, the sex differences were apparent in the level of learning reached, which may have been due to the character of the material (language learning) and the importance of rate in learning it. From Table 7, it will be noticed that on Tuesday, November 18, 1952, three groups saw the control version at "silent" speed instead of at "sound" speed. Now the question arises: Is this difference in procedure responsible for any differences that may show up between the groups that came on Tuesday, November 18, 1952 and the groups that came on the other three days in that week? From Table 14, the F-ratio for the eleven (on the scores of the first week's testing) is significant at .05 level. Is this attributable to the difference in procedure between Tuesday and the other days? Or is it due to some factor like sex difference? To find out the answer to this question, another analysis of variance in this data was done, by treating the data for males and females in each group separately. Tables 16, 17, and 18 show that by this method, the F-ratios for the Tuesday and non-Tuesday groups are <u>not</u> significant both for females and males. So it was decided to treat the female and male groups separately throughout the final analysis of this study.

TABLE 14

ANALYSIS OF VARIANCE OF THE LEARNING PRE-TEST SCORES OF 11 GROUPS OF SUBJECTS (FEMALE AND MALE SUBJECTS COMBINED IN EACH GROUP)

Source of Variation	Sum of Squares	df	Mean Squares	F
Between groups	9,867.4954	10	986.7495	$^{x}F_{10,384} = 2.08^{*}$
Between sexes	17,428.3964	1	17,428.3964	$F_{1,384} = 36.66^{**}$
Groups and sexes	2,916.2390	10	291.6239	
Within groups	184,409.2799	384	480.2324	
Error	187,325.5189	394		
Total	214,621.4107	405		

[x]In this and subsequent tables on the analysis of variance, the two subscript figures after the capital letter F indicate the degrees of freedom for the numerator and the denominator in the F-ratio respectively.

*F is significant at .05 level.

**F is significant at .01 level.

TABLE 15

ANALYSIS OF VARIANCE OF GROUPS WHICH CAME ON TUESDAY AND GROUPS WHICH CAME ON OTHER DAYS DURING THE FIRST WEEK'S TESTING

Source of Variation	Sum of Squares	df	Mean Squares	F
Between groups	2,778.7469	1	2,778.7469	$F_{1,404} = 5.30^{*}$
Within groups	211,842.6643	404	524.3630	
Total	214,621.4112	405		

*Significant at .05 level.

TABLE 16

ANALYSIS OF VARIANCE OF THE LEARNING PRE-TEST SCORES FOR 11 FEMALE GROUPS

Source of Variation	Sum of Squares	df	Mean Squares	F
Between groups	6,010.9956	10	601.0996	$F_{10,191} = 1.29$
Within groups	88,677.0237	191	464.2776	
Total	94,688.0193	201		

TABLE 17

ANALYSIS OF VARIANCE OF THE LEARNING PRE-TEST SCORES FOR 11 MALE GROUPS

Source of Variation	Sum of Squares	df	Mean Squares	F
Between groups	6,772.7385	10	677.2738	$F_{10,193} = 1.37$
Within groups	95,732.2562	193	496.0220	
Total	102,504.9947	203		

TABLE 18

ANALYSIS OF VARIANCE OF THE LEARNING PRE-TEST SCORES OF THE GROUPS WHICH CAME ON TUESDAY AND THE GROUPS WHICH CAME ON OTHER DAYS DURING THE FIRST WEEK'S TESTING

Source of Variation	Sum of Squares	df	Mean Squares	F
	Female			
Between groups	743.2755	1	743.2755	$F_{1,200} = 1.58$
Within groups	93,944.7443	200	469.7237	
Total	94,688.0198	201		
	Male			
Between groups	1,666.8847	1	166.6885	
Within groups	100,838.1103	202	499.1985	
Total	102,504.9950	203		

4. Analysis of Covariance for Learning of Female Groups

The analysis was done by using the covariance method, explained in the last chapter. As a first step in the application of the Covariance technique, the data for the control versions for the female groups was analyzed. (The control version gives the initial measure of X.) The summary of this analysis is given in Table 19. The F-ratio between female groups is not significant. Next, exactly the same type of analysis was done for female groups on the ten experimental versions. (The experimental film versions give us the final measure or Y measure.) Table 20 summarizes this analysis. The mean square between groups, when tested by the mean square within groups gives F of 1.0072, which is not significant at 9 and 186 df. Finally, the total of cross products of sums of six film repetitions for each female subject was obtained and analyzed the same way as X and Y were analyzed. The necessary sum for cross-products for "between" and "within" the ten female groups are obtained in order to get the total sum of squares for the errors of estimate for "total" and "within". In this, one degree of freedom is lost, for the sum of squares of estimate within groups is now 195 and not 196. The adjusted sum of squares for between groups is obtained by subtracting the "within" sum of squares of estimate from the total sum of square of estimate. The final analysis of covariance is summarized in Table 21. The adjusted F-ratio for "between" versions (2.3013) is significant at .02 level, with 9 and 185 degrees of freedom.

Kelley (47, pp. 325-331), and Burke (10) discuss the procedures involves in computing the significance level of F-ratio not given in Snedecor's tables. Kelley's method was followed for getting .02 as the significance level of a F-ratio in the above analysis of covariance.

TABLE 19

ANALYSIS OF VARIANCE OF THE LEARNING PRE-TEST SCORES FOR 10 FEMALE GROUPS

Source of Variation	Sum of Squares	df	Mean Squares	F
Between groups	6,028.3211	9	669.8134	$F_{9,186}$ = 1.4612
Within groups	85,265.0659	186	458.4143	
Total	91,293.3870	195		

TABLE 20

ANALYSIS OF VARIANCE OF LEARNING SCORES OF FEMALE GROUPS ON THE EXPERIMENTAL FILM VERSIONS

Source of Variation	Sum of Squares	df	Mean Squares	F
Between versions	3,531.6677	9	392.4075	$F_{9,186}$ = 1.0072
Within versions	72,464.2500	186		
Total	75,995.9177	195		

TABLE 21

ANALYSIS OF COVARIANCE OF ADJUSTED SCORES OF FEMALES ON DIFFERENT FILM VERSIONS

Source of Variation	y^2	$\frac{(\Sigma xy)^2}{x^2}$	$y^2 - 1^x$	df	Mean Square (adjusted)	F
Total	75,995.9177	47,987.1015	28,008.8162	194		
Within Versions	72,464.2500	47,275.4740	25,188.7760	185	136.1555	
Between Versions (adjusted)	3,531.6677		2,820.0402	9	313.3378	$F_{9,185}$ = 2.3013*

*F of 2.3013 is significant at .02 level.

$^x y^2 - 1$ in this and subsequent tables on the analysis of covariance represents the difference between the values of columns 2 and 3.

For details on Kelley's method, see Appendix X-(c).

As the F-ratio between female groups turned out to be significant, "t" tests for the adjusted differences of means for different film versions were next carried out. The method to get the "t"-ratios here employed is different from the one usually employed and is discussed in fuller detail in Appendix X-(a).

Table 22 shows the significance of "t"-ratios for the comparisons of adjusted means for difference between versions, for female groups. It should be noted that in the covariance method A we do not take into account the differences between nouns-list and verbs-list and regard the ten film versions as just ten experimental conditions. The supposition was that the two lists did not differ in difficulty.

It should be mentioned that it is <u>not</u> necessary that the "t"-ratios must be significant in order to confirm the hypotheses of this experiment; e.g., Versions 1 and 6, 2 and 7, 3 and 8, 4 and 9, and 5 and 10 should not differ on the assumption that the nouns-list and verbs-list do not differ in difficulty. Also, if the assumption that nouns-list and verbs-list are equal in difficulty is valid, some "t"-ratios could sometimes be negative instead of positive.

It is worth noting that out of 45 possible "t"-ratios, 11 turned out to be as expected. The chi-square test for obtaining a distribution such as this was significant at the .01 level, with 3 df. As regards the relation between the "t" ratios and the hypotheses proposed for this study, the results show that:

(i) The "sound motion picture" method for nouns is statistically significant when compared with the "still picture" method at .05 level.

TABLE 22

THE "t"-RATIOS FOR THE ADJUSTED DIFFERENCES OF MEAN SCORES OF FEMALE GROUPS ON DIFFERENT FILM VERSIONS

Film Versions	1	2	3	4	5	6	7	8	9	10
1	-----	+2.7212**	+1.3451	+0.5827	-0.2939	+0.7574	+1.1630	+1.9407	+3.0816**	+1.6165
2	-----	--	-1.3377	+1.9965*	-2.9843-**	-1.9582*	-1.7021	-1.2133	+0.1550	-1.2913
3	-----	--	--	-0.6851	-1.6216	-0.5794	-0.2494	+0.3309	+1.6393	+0.1825
4	-----	--	--	--	-0.8560	+0.1344	+0.4803	+1.1317	+2.2667**	+0.8955
5	-----	--	--	--	--	+1.0421	+1.4554	+2.2439*	+3.3441-**	+1.9044
6	-----	--	--	--	--	--	+0.3593	+1.0466	+2.2485*	+0.7978
7	-----	--	--	--	--	--	--	+0.6933	+1.9967*	+0.4593
8	-----	--	--	--	--	--	--	--	+1.5035	-0.1989
9	-----	--	--	--	--	--	--	--	--	+1.5593
10	-----	--	--	--	--	--	--	--	--	--

* "t"-ratio is significant at .05 level in the expected direction
** "t"-ratio is significant at .01 level in the expected direction
-** "t"-ratio is significant at .01 level in the opposite direction

The "sound motion picture" method for verbs proved significantly better than the "titles" method at .05 level and it is also significantly better than the "still picture" method for verbs at .05 level. The sound motion picture method for verbs is also significantly better than the "titles" method for nouns at .01 level.

(ii) However, the effect of the addition of picture, motion picture and sound elements does not seem to contribute to better learning in that order as supposed in the formulation of the hypotheses. For example, version 9 may be better than 6, or version 9 may be better than version 7. But version 7 is not necessarily better than version 6, nor version 8 is better than version 7.

(iii) The still picture method for nouns is better than the "titles" method for nouns at .05 level.

(iv) The introduction of learner participation does not lead to greater learning than the sound motion picture method without participation. This is observed both for the nouns-list and the verbs-list.

(v) The "still picture" method for nouns is better than the "motion picture" method with audience participation.

(vi) One anomaly is that versions 4 and 9 are significantly different.

(vii) All other comparisons are non-significant.

Bartlett's test for homogeneity of variance was carried out on the variance of the control version, of the experimental version, and the adjusted variances. The test for the homogeneity of variance for unequal n's has been discussed by Edwards (22, p. 198) and is essential because homogeneity of variance is a more fundamental assumption in the analysis

of variance than normality (22, p. 166). The chi-square test proposed by Bartlett, gave P of .90 for 9 degrees of freedom on control version, and P of between .30 and .50 for 9 degrees of freedom for the initial and final measures respectively. The chi-square test of homogeneity of adjusted variances was also not significant with a P between .70 and .50 at 9 degrees of freedom.

A test of homogeneity of regression of the difference between deviations from pooled regressions of Y on X, and deviations from "within" regressions of Y on X was also carried out. The F of 1.29 (obtained by testing the difference of 173.1171 by the sum of deviations of regression within each group which was 134.2654) was not significant for 9 and 176 degrees of freedom.

5. Analysis of Covariance for Learning of the Male Groups

This analysis was also done by the method A. The procedure was the same as in Section 4. Table 23 shows that the F for the control version is less than unity. Table 24 shows that the difference between male groups on the experimental versions was also not significant. Table 25 shows that the adjusted variance for different versions is not significant. This shows the mean scores of male groups on different versions to be not very different from chance differences. A theoretical explanation of this discrepancy between the performance of male groups will be attempted later.

Bartlett's test for the homogeneity of variance was carried out on the X variances (control versions), the Y variances (the experimental versions), and the adjusted variances. The chi-square for X and Y was not

TABLE 23

ANALYSIS OF VARIANCE OF THE LEARNING PRE-TEST SCORES FOR MALE GROUPS

Source of Variation	Sum of Squares	df	Mean Square	F
Between groups	3,635.8767	9	403.9862	---
Within groups	91,377.4697	183	499.3304	
Total	95,013.3464	192		

TABLE 24

ANALYSIS OF VARIANCE OF LEARNING SCORES OF MALE GROUPS ON THE EXPERIMENTAL FILM VERSIONS

Source of Variation	Sum of Squares	df	Mean Square	F
Between versions	4,712.6444	9	523.6271	$F_{9,183} = 1.04$
Within versions	92,312.8785	183	504.4419	
Total	97,025.5229	192		

TABLE 25

ANALYSIS OF COVARIANCE OF ADJUSTED SCORES OF MALES ON DIFFERENT FILM VERSIONS

Source of Variation	y^2	$\frac{(\Sigma xy)^2}{x^2}$	$y^2 - 1$	df	Mean Square (adjusted)	F
Total	97,025.5229	65,784.1390	31,241.3839	191		
Within Versions	92,312.8785	63,037.2054	29,275.6731	182	160.8553	
Between Versions (adjusted)	4,712.6444		1,965.7108	9	218.4123	$F_{9,182} = 1.36$

significant - with P between .30 and .50 at 9 df. The chi-square test for homogeneity of adjusted variances turned out to be significant, with a chi-square of 18.3851, which has P between .05 and .02 with 9 degrees of freedom. This indicated that the adjusted variances were not homogeneous. The F-ratio for the homogeneity of regression did not prove to be significant, showing that the regressions were honogeneous.

6. Analysis of Covariance for the Retention of Female Groups

The covariance variance method A was used to compare the different film versions for retention. It will be recalled that the analysis was done by taking the square roots of original scores. Table 26 shows that the F for between groups variance for control version is not significant. In Table 27 the F ratio for between versions variance is also not significant. In Table 28 we have the analysis of covariance of adjusted between versions variance. The F-ratio is not significant. This shows that versions do not differ so far as the retention score for female groups are concerned.

Bartlett's test for the homogeneity of variance did not give a significant chi-square either on X or on Y. (The chi-square on control version = 4.3784; P = between .50 and .70; the chi-square on experimental version = 7.4369; P = between .50 and .30.) The same test for adjusted variances was 29.1564 with P of less than .01 for 9 df. A test of homogeneity of regression showed that F for homogeneity of regression is not significant.

7. Analysis of Covariance for the Retention of Male Groups

The analysis of covariance for the retention of male groups was

TABLE 26

ANALYSIS OF VARIANCE OF RETENTION PRE-TEST SCORES
FOR FEMALE GROUPS

Source of Variation	Sum of Squares	df	Mean Square	F
Between groups	5.7064	9	.6340	---
Within groups	186.5726	185	1.0085	
Total	192.2790	194		

TABLE 27

ANALYSIS OF VARIANCE OF RETENTION SCORES OF FEMALE GROUPS
FOR DIFFERENT FILM VERSIONS

Source of Variation	Sum of Squares	df	Mean Square	F
Between versions	6.7988	9	.7554	---
Within versions	181.7843	185	.9826	
Total	188.5831	194		

TABLE 28

ANALYSIS OF COVARIANCE OF THE ADJUSTED RETENTION SCORES
OF FEMALE GROUPS

Source of Variation	Sum of Squares	df	Mean Square (adjusted)	F
Total	123.6585	193		
Within versions	119.2526	184	.6481	
Between versions (adjusted)	4.4059	9	.4895	

done by the method A. Table 29 shows that the F-ratio for between groups variance for the control version was not significant. Table 30 shows the analysis of variance of male groups for retention on different experimental versions. The F of 1.1994 was not significant. Table 31 shows the analysis of covariance of the adjusted retention scores of male groups. The adjusted sum of errors of estimate between versions is 1.5654. It is considerably increased but somewhat short of the required F level at .05 level, which is 1.94.

Bartlett's test for the control version variances gave a chi-square of 10.3675, with P of .30 at 9 degrees of freedom. The same test for the experimental film version variances gave a chi-square of 11.4651 which has a P between .30 and .20 for 9 degrees of freedom. The same test for adjusted variances for the different versions was 7.3067 with P between .70 and .50 for 9 df. and, therefore, not significant. The F-ratio for the homogeneity of regression is less than unity and not significant.

8. Analysis of Covariance for Learning from Deviations from Regressed Learning Scores

The covariance method B consisted in doing another analysis of variance of the deviations of a subject's score from the same subject's predicted score for a particular film repetition over all the film versions. The prediction of an individual's score necessarily involves the use of the theory of regression and prediction. It is important to emphasize, in the first place, that the predicted score was obtained from a regression equation that applied to a particular film repetition and to every subject in all the ten groups. Thus, the subject's predicted score for the first film repetition would be obtained from the regression equation

TABLE 29

ANALYSIS OF VARIANCE OF THE RETENTION PRE-TEST SCORES FOR MALE GROUPS

Source of Variation	Sum of Squares	df	Mean Square	F
Between groups	4.0294	9	.4477	---
Within groups	174.2203	174	1.0013	
Total	178.2497	183		

TABLE 30

ANALYSIS OF VARIANCE OF THE RETENTION SCORES OF MALE GROUPS FOR DIFFERENT VERSIONS

Source of Variation	Sum of Squares	df	Mean Square	F
Between versions	11.0071	9	1.2230	$F_{9,174} = 1.1994$
Within versions	177.4136	174	1.0196	
Total	188.4207	183		

TABLE 31

ANALYSIS OF COVARIANCE OF THE ADJUSTED RETENTION SCORES FOR MALE GROUPS

Source of Variation	Sum of Squares	df	Mean Square	F
Total	115.6413	182		
Within versions	106.9321	173	.6102	
Between versions (adjusted)	8.7092	9	.9676	$F_{9,173} = 1.5654$

for the first film repetition over all the versions. The subject's predicted score for the second film repetition would be obtained from the regression equation for the second film repetition and so on. As there were six film repetitions, six different regression equations were used for male groups, and six other regression equations were used for female groups.

By the method of computation explained in Appendix X-(b), six regression equations for men and women, one each for six film repetitions, were obtained.

The regression equations for female groups were as follows:

For film repetition 1: $y' = .27x + 1.41$ (i)

For film repetition 2: $y' = .79x + 2.66$ (ii)

For film repetition 3: $y' = .68x + 4.70$ (iii)

For film repetition 4: $y' = .70x + 5.49$ (iv)

For film repetition 5: $y' = .69x + 6.02$ (v)

For film repetition 6: $y' = .68x + 6.15$ (vi)

The regression equations for male groups were as follows:

For film repetition 1: $y' = .57x + .87$ (vii)

For film repetition 2: $y' = .81x + 2.09$ (viii)

For film repetition 3: $y' = .94x + 2.40$ (ix)

For film repetition 4: $y' = .90x + 3.37$ (x)

For film repetition 5: $y' = .91x + 3.19$ (xi)

For film repetition 6: $y' = .86x + 3.60$ (xii)

9. Analysis of Covariance for Learning of Female Groups by the Covariance Method B

Table 32 shows the analysis of covariance of the pre-test learning scores of female groups (reduced population). This analysis shows that

TABLE 32

ANALYSIS OF VARIANCE OF THE LEARNING PRE-TEST SCORES
FOR FEMALE GROUPS
(The variance between repetitions is taken into consideration)

Source of Variation	Sum of Squares	df	Mean Square	F
Between methods	806.2191	9	89.5799	$F_{9,130}$ = 1.23
Between repetitions	22,422.0857	5	44,484.4171	$F_{9,650}$ = 19.59**
Interaction (Methods and repetitions)	199.4381	45	4.4319	$F_{45,650}$ = ____
				$F_{45,130}$ = ____
Error	12,462.7142	780	15.9778	$F_{45,780}$ = ____
Between subjects	9,490.2381	130	73.0018	
Within subjects	2,972.4761	650	4.5730	
Total	35,890.4571	839		

**Significant at .01 level

when film repetitions are taken into account as a source of variance and when the "between-subjects" variance is used as the error term, the ten female groups did not show significant differences on the control version. The error term - the mean square for between subjects - is a rather stringent error term to use; but since we are interested in using the different motion picture methods for group testings, it seems to be an appropriate error term to use. The F-ratio between methods when tested by the mean square for "within-subjects" mean square, is highly significant.

Table 33 shows that the F-ratio for different experimental versions

TABLE 33

ANALYSIS OF VARIANCE OF THE LEARNING SCORES OF FEMALE GROUPS FOR DIFFERENT FILM VERSIONS
(The variance between repetitions is taken into consideration)

Source of Variation	Sum of Squares	df	Mean Square	F
Between methods	340.9593	9	37.8821	$F_{9,130}$ = ____
Between repetitions	24,582.7489	5	4,916.5497	$F_{9,650}$ = 8.92**
Interaction (Methods and repetitions)	233.8107	45	5.1957	$F_{45,650}$ = 1.22
				$F_{45,130}$ = ____
Error	11,129.4999	780	14.2685	$F_{45,780}$ = ____
Between subjects	8,370.2262	130	64.3863	
Within subjects	2,759.2737	650	4.2450	
Total	36,287.0188	839		

**Significant at .01 level

or methods is not significant when tested by using the "between-subjects" variance as the error term. It is significant when tested by using the "within-subjects" variance as the error term. In this analysis film repetitions as a source of variation is taken into consideration.

Table 34 shows that the F-ratio for different experimental film versions is significant at .08 level, when tested by using the "between-subjects" variance as the error term. This analysis is of the deviations from the predicted scores as explained above. The method used is the co-variance method B. It will be noted that since the deviations were taken

TABLE 34

ANALYSIS OF VARIANCE OF THE DEVIATIONS FROM REGRESSED LEARNING SCORES OF FEMALE GROUPS (1)
(The variance between lists is not taken into consideration)

Source of Variation	Sum of Squares	df	Mean Square	F
Between methods	356.1189	9	39.5687	$F_{9,130}$ = 1.79 (Significant at .08 level)
Between subjects	2,878.5820	130	22.1429	$F_{130,700}$ = 6.31**
Within subjects	2,458.0391	700	3.5114	
Composite error	5,336.6211	830	6.4296	
Total	5,692.7400	839		

**Significant at .01 level.

from the mean of each film repetition, the sum of the deviations will be theoretically zero. Hence in this analysis, there was no "between repetitions" source of variation left. And the interaction between versions or methods and repetitions is also equal to zero. A small residual of the magnitude of .05 to .15 due to rounding errors was left but this was added to the composite error. Here, too, the mean square for between subjects was used as an error term.

10. Analysis of Variance of Learning for Female Groups by the Covariance Method C.

This method takes into account the lists as the source of variation.

Otherwise the procedure is exactly the same as in the previous section. Table 35 shows that the F-ratio for learning on different experimental versions for females is significant at .06 level, when the variations between the lists is taken into consideration. The reason why the F-ratio does not approach the significance level of the Method A may lie in the fact that this analysis is on a sample of 14 selected at random from each of the ten groups; and it is likely that this particular sample even though randomly selected may not be representative of the group.

TABLE 35

ANALYSIS OF VARIANCE OF THE DEVIATIONS FROM THE REGRESSED LEARNING SCORES OF FEMALES GROUPS (2)
(The variance between lists is taken into consideration)

Source of Variation	Sum of Squares	df	Mean Square	F
Between methods	141.9207	4	35.4801	$F_{4,130}$ = 1.60 (Significant at .06 level)
Between lists	32.3165	1	32.3165	$F_{1,130}$ = 1.46
Interaction (Methods and lists)	181.8817	4	45.4704	$F_{4,130}$ = 2.04
Between subjects	2,878.5820	130	22.1429	
Within subjects	2,458.0391	700	3.5114	
Composite error	5,336.6211	830	6.4294	
Total	5,692.7400	839		

It is also important to note that the differences between lists were not significant. The F-ratio for "lists" - the mean square for lists tested by the mean square for "between subjects" - was not significant. The two lists, therefore, may be of the same difficulty.

11. Analysis of Covariance for Learning of the Male Groups by Covariance Method B

The procedure of this analysis was the same as that followed for the female groups. Table 36 shows that the ten male groups (reduced population of eight in each group) did not differ on the control version, when the mean square for "between" methods was tested by the mean square for "between" subjects. In this analysis, the film repetitions as a source of variation are taken into consideration. Table 37 shows that the F-ratio for the experimental film versions was also not significant. But when the analysis of variance was done on the deviations from predicted scores (Table 38), the F-ratio was increased considerably, although it is somewhat short of .05 level. Here, as in Table 34, there is no source of variation for repetitions or for interactions of methods and repetitions as the sum of the deviations around the mean of a repetition would be zero and the total of such sums is also equal to zero.

12. Analysis of Covariance for Learning of the Male Groups by Covariance Method C

In Table 39 we have the analysis of the deviations from the regressed learning scores by the Method C. The method takes into account the lists, as a source of variation. It will be noticed that the F-ratio for different versions or methods was significant at .06 level, while the F-ratio for lists was not significant.

TABLE 36

ANALYSIS OF VARIANCE OF THE LEARNING PRE-TEST SCORES
FOR MALE GROUPS
(The variance between repetitions is taken into consideration)

Source of Variation	Sum of Squares	df	Mean Square	F
Between methods	875.7167	9	97.3018	$F_{9,70}$ = 1.25
Between repetitions	8,350.5167	5	1,670.1033	
Interaction (Methods and repetitions)	232.7333	45	5.1718	$F_{4,570}$ = ____
Error	7,304.9999	420	17.3928	
Between subjects	5,450.9166	70	77.8702	$F_{70,350}$ = 14.6999**
Within subjects	1,854.0833	350	5.2973	
Total	16,763.9666	479		

**Significant at the .01 level

TABLE 37

ANALYSIS OF VARIANCE OF THE LEARNING SCORES
OF MALE GROUPS FOR DIFFERENT FILM VERSIONS
(The variance between repetitions is taken into consideration)

Source of Variation	Sum of Squares	df	Mean Square	F
Between methods	325.5938	9	36.1770	$F_{9,70}$ = ____
Between repetitions	10,487.5438	5	2,097.5087	
Interaction (Methods and repetitions)	153.5187	45	3.4115	
Error	8,721.8799	420	20.7663	
Between subjects	6,800.1091	70	97.1443	
Within subjects	1,921.7708	350	5.4907	
Total	19,688.5362	479		

TABLE 38

ANALYSIS OF VARIANCE OF THE DEVIATIONS FROM REGRESSED LEARNING SCORES OF MALE GROUPS (1)
(The variation between lists is not taken into consideration)

Source of Variation	Sum of Squares	df	Mean Square	F
Between methods	374.6035	9	41.6226	$F_{9,70}$ = 1.94 (Significant at .06 level)
Between subjects	1,501.7431	70	21.4534	$F_{70,400}$ = 4.98**
Within subjects	1,722.3082	400	4.3057	
Composite error	3,224.0513	470		
Total	3,598.6548	479		

**Significant at the .01 level.

TABLE 39

ANALYSIS OF VARIANCE OF THE DEVIATIONS FROM REGRESSED LEARNING SCORES OF MALE GROUPS (2)
(The variation between lists is taken into consideration)

Source of Variation	Sum of Squares	df	Mean Square	F
Between methods	198.4688	4	49.6172	$F_{4,70}$ = 2.31 (Significant at .06 level)
Between lists	21.0422	1	21.0422	
Interaction (Methods and lists)	155.0925	4	38.7731	
Between subjects	1,501.7431	70	21.4534	
Within subjects	1,722.3082	400	4.3057	
Total	3,598.6548	479		

13. Analysis of Covariance of the Deviations from Predicted Retention Scores

The general methodology of getting the regression equations is the same for retention as it was for learning. The only difference, here, is that we have only one regression equation for males and only one regression equation for females. This is because, the retention score was not made up of six scores, as in learning, but was a single score. It is also pertinent to point out that this analysis was done on the reduced population of 14 females in each of the ten female groups and 8 males in each of the ten male groups.

The regression equation for women was:

$$y' = .53x + 1.31 \qquad \text{(xiii)}$$

The regression equation for men was:

$$y' = .64x + .89 \qquad \text{(xiv)}$$

14. Analysis of Variance for Retention Scores for Female Groups by Covariance Method C

Table 40 shows that the ten female groups did not differ in their retention scores for the control version. Table 41 shows that the female groups did not differ in their retention scores for the experimental versions either. This analysis did not take into consideration the differences between lists and it was made on the adjusted retention scores for each female group. Table 42 shows that even after the lists variation was taken into consideration, the F-ratio was not significant. The analysis of Table 42 is by the covariance method C. The covariance method B is not used, because we did not have successive film repetitions in the retention test. This leads to the conclusion that the film versions did not differ from each other in their effect on the retention of females, even though

TABLE 40

ANALYSIS OF VARIANCE OF THE RETENTION PRE-TEST SCORES
FOR FEMALE GROUPS
(The variance between lists is taken into consideration)

Source of Variation	Sum of Squares	df	Mean Square		F	
Between methods	2.7929	4	.6982	$F_{4,134}$	=	———
Between lists	1.1426	1	1.1426	$F_{1,134}$	=	1.2183
Composite error	125.6700	134	.9378			
Interaction (Methods and lists)	1.2239	4	.3059			
Error	124.4461	130	.9572			
Total	129.6055	139				

TABLE 41

ANALYSIS OF VARIANCE OF THE RETENTION SCORES
OF FEMALE GROUPS FOR DIFFERENT FILM VERSIONS
(The variance between lists is taken into consideration)

Source of Variation	Sum of Squares	df	Mean Square		F	
Between methods	5.7923	4	1.5699	$F_{4,134}$	=	1.5699
Between lists	.0498	1	.0498	$F_{1,134}$	=	———
Composite error	123.6015	134	.9223			
Interaction (Method and lists)	2.2813	4	.5703			
Error	121.3202	130	.9332			
Total	129.4436	139				

TABLE 42

ANALYSIS OF VARIANCE OF THE DEVIATIONS FROM REGRESSED RETENTION SCORES OF FEMALE GROUPS
(The variance between lists is taken into consideration)

Source of Variation	Sum of Squares	df	Mean Square	F
Between methods	2.8814	4	.7203	$F_{4,134}$ = 1.0951
Between lists	.3621	1	.3621	$F_{1,134}$ = ———
Composite error	88.1328	134	.6577	
Interaction (Between methods and lists)	2.2151	4	.5537	
Error	85.9171	130	.6609	
Total	91.3763	139		

the differences between films for learning were quite apparent from the method A and were somewhat marked from the methods B and C.

15. Analysis of Covariance for Retention of the Male Groups by Covariance Method C

Table 43 shows that the different male groups did not differ so far as the retention on the control version was concerned. Table 44 shows that the F-ratio for the different experimental film versions is not significant when the analysis is done on the unadjusted retention scores for the experimental versions. But when the deviations from regressed retention

TABLE 43

ANALYSIS OF VARIANCE OF THE RETENTION PRE-TEST SCORES FOR MALE GROUPS
(The variance between lists is taken into consideration)

Source of Variation	Sum of Squares	df	Mean Square		F
Between methods	2.3216	4	.5804	$F_{4,74}$	= ———
Between lists	1.4132	1	1.4132	$F_{1,74}$	= 1.4312
Composite error	73.0689	74	.9874		
Interaction (Methods and lists)	2.0789	4	.5197		
Error	70.9900	70	1.0141		
Total	76.8037	79			

TABLE 44

ANALYSIS OF VARIANCE OF THE RETENTION SCORES OF MALE GROUPS FOR DIFFERENT FILM VERSIONS
(The variance of lists is taken into consideration)

Source of Variation	Sum of Squares	df	Mean Square		F
Between methods	5.5880	4	1.3970	$F_{4,74}$	= 1.3079
Between lists	.6122	1	.6122	$F_{1,74}$	= ———
Composite error	79.0427	74	1.0681		
Interaction (Methods and lists)	2.7697	4	.6924		
Error	76.2730	70	1.0896		
Total	85.2429	79			

scores are analyzed, as in Table 45, the differences between versions or methods for retention became significant. The F-ratio (3.2827) is significant at the .02 level. This analysis is by the method C. Here, too, it should be noted that the method B was not employed because of the fact that the retention score was only one score, unlike the six scores available in learning. From both Table 44 and 45, the F-ratios for the lists as tested by the composite error term are not significant.

It should be noted that previously we were using the "between-subjects" error term, as the mean square for the "between-subjects" variance was significant when tested by the mean square for the "within-subjects". variance. But in the analysis of retention of the deviations from the regressed retention scores we have used a composite error term which is made up of the residual error term and interaction between methods and lists which is not significant when tested by the residual error term - written simply as "error". Thus, the pooled sum of squares for the interaction and the error was divided by the pooled degrees of freedom for the interactions and the error, to give a pooled composite error term, with which to obtain the F-ratios.

16. The "t" Tests for the Regressed Deviations of the Male Groups on Retention

Table 46 shows that the comparisons between the "titles-method" on the one hand and all the other four methods on the other are significant. The t-ratio for the pictorial method of presentation and the "titles method" of presentation is significant at .05 level. The motion picture method, the sound motion picture method and the sound motion picture method with learner participation are better than the "titles" method at .01 level.

TABLE 45

ANALYSIS OF VARIANCE OF THE DEVIATIONS FROM REGRESSED RETENTION SCORES OF MALE GROUPS
(The variance between lists is taken into consideration)

Source of Variation	Sum of Squares	df	Mean Square	F
Between methods	8.5221	4	2.1305	$F_{4,74}$ = 3.2827 (Significant at .02 level)
Between lists	.0015	1	.0015	$F_{1,74}$ = ———
Composite error	48.0273	74	.6490	
Interaction (Methods and lists)	.6215	4	.1554	
Error	47.4058	70	.6772	
Total	56.5509	79		

TABLE 46

SIGNIFICANCE OF "t"-RATIOS BETWEEN MEANS OF REGRESSED DEVIATIONS FOR MALE GROUPS ON RETENTION TESTS
(The regressed deviations were obtained by combining the separate regressed deviations of nouns and verbs for each method)

Methods	Method 1	Method 2	Method 3	Method 4	Method 5
1	---	+2.3091*	+3.4394**	+4.3296**	+4.1290**
2	---	---	+1.1302	+2.0204	+1.8198
3	---	---	---	+0.8901	+1.8806
4	---	---	---	---	+1.3197
5	---	---	---	---	---

*The "t"-ratio is significant at .05 level in the expected direction.
**The "t"-ratio is significant at .01 level in the expected direction.

Here, again, as in Table 22, we do not find any evidence that the effects of the different variables - such as still picture, motion picture and sound - are additive. For example, we do not find that the method of motion picture presentation (nouns and verbs combined) was significantly different from methods of still picture presentation. Nor is there any evidence from this table to state that "sound motion picture" method is better than the "motion picture" method. Thus, the postulated additive effects do not hold.

17. Tests of Homogeneity of Variance of the Reduced Populations of Female and Male Groups

As the N in the reduced populations of females (N = 14) was the same for all female groups, and as the N in the reduced population of males (N = 8) was the same for all male groups, a simpler test of homogeneity of variance given by Edwards (22, p. 196) was adopted. For learning scores the chi-square for women (4.6885, df = 9; P = between .90 and .80) and for men (11.8773, df = 9; P = between .30 and .20) were not significant. For retention scores the chi-square for men (4.1511, df = 9; P = between .95 and .90) was not significant. But the chi-square for women was 27.8391 and with P = less than .01, was highly significant.

18. Discussion of the Results

(a) The results of the experiment are clear-cut in certain respects. However, they are not likely to be taken as such, if certain fundamental conditions of analysis of variance are overlooked. The homogeneity of variance is a very basic assumption in the employment of this method. Now, it will be remembered that the female groups were homogeneous with respect to the learning scores and the males were homogeneous with respect to the

retention scores. On the contrary, the female groups were highly heterogeneous with respect to the retention scores, and the male groups were highly heterogeneous with respect to the learning scores. Lindquist (58, p. 133) points out that when we have heterogeneous groups, the danger is that the observed F-ratios will not be given by the standard tables for F or that the F-tests of significance based on these tables will be invalidated. In other words, we assume that whatever factor has resulted in significant differences in group means will not also result in significant differences in group variations. But if, for example, the female group variances, in retention, do differ fundamentally, as has been the case in this study, the standard error of the mean will differ from one female group to another group, even though all groups were of the same size and it would not be valid to compute the standard error of mean from the "within" variance of groups. The same is the case, so far as the position of male groups for learning is concerned. If Bartlett's test on homogeneity of variance is not applicable to the male groups, then it means that the "within" group variation would enter both in the mean square of the "between" and "within" variances and the F-test would not be strictly accurate. The point to emphasize, here, is that any significant or non-significant F-ratios that result from heterogeneous variances do not lend themselves to logical interpretation one way or another. This being so, it is suggested that the results should not be looked upon as ambiguous, because we get different results for men and women both on learning and retention. Even if the sex differences were substantial in this experiment to treat the data of two sexes separately, the two groups should not be expected to give us the same results before the final results are

acceptable. Rather, it is suggested that results could be interpreted, provided they satisfy certain logical requirements of the analysis of variance and covariance and not the requirement that they should be generalizable over the sexes.

Granting this inference, since the F-ratio for the adjusted "between versions" variance for women was 2.3013, and significant at .02 level, it is possible to draw certain valid inferences from the "t" tests: Table 22 shows that

(i) In the first place, the still picture presentation is significantly better than the "titles" presentation, and

(ii) Secondly, the "sound motion picture" method is superior to the "still picture" method.

This is true of both the situations, i.e., for the nouns-list and the verbs-list. On the contrary, the element of action or motion (of the type which was adopted for the film in this study) in a motion picture is not by itself a better method than the still-picture method or the "titles" method, unless it is combined with sound. Thus, it is permissible to say that to match the "titles" method, and the "still-picture" method, or to surpass them in instructional value, we need a sound motion picture method. The superiority of the still picture presentation to the "titles" method is in conformity with the previous studies like that of Herman, Broussard, and Todd (35). In respect to the superiority of the sound motion picture method over the still-picture method and the words-alone method, this study corroborates the findings of previous studies of Nelson and Moll (70), Roshal (79), Vernon (92), and others.

Similarly, from Table 46, it could be stated that the different

methods of presentation - the still picture method, the motion picture method, the sound motion picture method, and the sound motion picture method with participation - are better than the "titles" method for retention. Here, too, the fact that this applies to the male groups and not the female groups, does not, in the opinion of the author, reduce the value of the findings as a whole. This is because the female groups do not retain their homogeneity of variance. Thereby, they reduce the value of making an F-test on them. The findings of this study would have been much more limited in value than they are, if the test of homogeneity of variance had revealed all the groups - male and female - to be equally homogeneous. As a matter of logic, the findings would have seriously come in doubt, under such an eventuality.

(iii) A negative finding that the learner participation did not help in the task of learning vocabulary should also be discussed here. But the question could be raised: Does it, therefore, discount the instructional film as a medium of teaching English-Russian vocabulary? According to the writer, the answer to this question is negative, because in instructional film production we are not yet so sure of the value of introducing the overt participation of audience in a testing situation. The only instructional films that use audience participation as one of the inherent techniques are the experimental film versions. Most of the instructional film producers still prefer that the audience should be invited to take part in the situation after the film showing rather than during it. It must, however, be stated that the findings of this study, so far as audience or learner participation is concerned, do not corroborate with those of Hovland, Lumsdaine, and Sheffield (39), Forster (26), and others, reviewed

in the third chapter.

(iv) The results of this study seem to show that minimum or "molecular" motion is not enough to make the motion picture method better than the still picture method. Thus, the effects of still pictures, motion picture, sound, and participation are not additive in character.

(b) The results by the covariance Method C are more satisfactory than by the covariance Method B or A, although the significance of the F-ratios for women on different experimental versions for learning is lost. The F-ratios for women on deviations from regressed learning scores are significant at .06 level - by the Method C, at .08 level by the Method B and at .02 level by the Method A. The F-ratios for males for deviations from regressed learning scores are significant at .06 level by the Method C, at .06 level by the Method B and at .09 level by the Method A. The chi-square test for homogeneity of variance showed that the reduced population of female and male groups was homogeneous for learning scores; but for the retention scores, only the male group was homogeneous. Although the F-ratios for males by the Methods B and C are close to .05 level, no further analysis such as "t" tests was done on the data. The reason for not doing any further analysis is that traditionally only the F-ratios, which are significant at .05 level or better, are analyzed further. The value of F-ratios significant at .06 or .08 level should <u>not</u>, however, be considered far from satisfactory.

(c) As an experimental study, this study posed the following problems:

<u>Experimental Problem A</u>: Does the addition of still picture, motion, sound, and learner participation to the "titles" method result in significantly greater learning for every such addition? On the basis of the sign-similarity and perceptual reinforcement hypothesis it was hypothesized that

the addition of each factor would increase the rate of learning.

This hypothesis was partly borne out. Two of these additions - still picture method and sound motion picture method - yielded better learning. The supposition that the effects of these methods was additive was not borne out.

Experimental Problem B: Is the motion picture version more appropriate for the verbs-list than for the nouns-list? Or, is the still picture version more appropriate for the nouns-list than for the verbs-list?

The answer to this test proved to be negative.

Experimental Problem C: Are the effects of different versions in learning carried over to the retention test given one week later?

A satisfactory answer to this problem could not be given on the basis of this experiment. The groups did not maintain their homogeneity of variance from the learning test to the retention test, consequently making it difficult to measure this carry-over effect.