

GEORGIA INSTITUTE OF TECHNOLOGY  
OFFICE OF CONTRACT ADMINISTRATION  
SPONSORED PROJECT INITIATION

Date: 6/21/79

Project Title: *Right Ear Advantage and Functions of Recall*

Project No: *G-42-631 Green card*

Project Director: *Dr. John N. Bohannon, III*

Sponsor: *DHEW/PHS - National Institute of Mental Health; Bethesda, MD 20014*

Agreement Period: From 7/1/79 Until 6/30/80 (01 Year)

Type Agreement: *Grant No. 1 R03 MH32886-01*

Amount: *\$7,727 PHS Funds*  
*933 GIT Contribution (G-42-319)*  
*\$8,660 Total*

Reports Required: *Annual Progress Reports with Continuation Applications;*  
*Terminal Progress Report upon Grant Expiration.*

Sponsor Contact Person (s):

Technical Matters

Contractual Matters

(thru OCA)

*Bruce L. Ringler*  
*Chief, Grants and Contracts*  
*Management Branch*  
*National Institute of Mental Health*  
*Bethesda, MD 20014*

Defense Priority Rating: *N/A*

Assigned to: *Psychology* (School/Laboratory)

COPIES TO:

Project Director  
Division Chief (EES)  
School/Laboratory Director  
Dean/Director-EES  
Accounting Office  
Procurement Office  
Security Coordinator (OCA)  
Reports Coordinator (OCA)

Library, Technical Reports Section  
EES Information Office  
EES Reports & Procedures  
Project File (OCA)  
Project Code (GTRI)  
Other \_\_\_\_\_

GEORGIA INSTITUTE OF TECHNOLOGY  
OFFICE OF CONTRACT ADMINISTRATION  
SPONSORED PROJECT TERMINATION

Date: 2/4/81

Project Title: Right Ear Advantage and Functions of Recall

Project No: G-42-631

Project Director: Dr. John N. Bohannon, III

Sponsor: DHEW/PHS - National Institute of Mental Health; Bethesda, MD 20014  
Grant #1 R03 MH32886-01

Effective Termination Date: 6-30-80

Clearance of Accounting Charges: --

Grant/Contract Closeout Actions Remaining:

- Final Invoice and Closing Documents
- Final Fiscal Report
- Final Report of Inventions
- Govt. Property Inventory & Related Certificate
- Classified Material Certificate
- Other \_\_\_\_\_

NOTE: No known continuation.

Assigned to: Psychology (School/~~Laboratory~~)

COPIES TO:

- Project Director
- Division Chief (EES)
- School/Laboratory Director
- Dean/Director-EES
- Accounting Office
- Procurement Office
- Security Coordinator (OCA)
- ~~Reports Coordinator (OCA)~~

- Library, Technical Reports Section
- EES Information Office
- Project File (OCA)
- Project Code (GTRI)
- Other C.E. Smith

GEORGIA INSTITUTE OF TECHNOLOGY  
ATLANTA, GEORGIA 30332

OFFICE OF  
THE  
COMPTROLLER

October 6, 1980

Chief, Grants and Contracts  
Management Branch  
National Institute of Mental  
Health  
DHHS/PHS  
Bethesda, Maryland 20205

Dear Sir or Madam:

Enclosed is the Report of Research Grant Expenditures (Form  
HEW-489) for Grant #1 R03 MH 32886-01 for the period 7/1/79 - 6/30/80.

If you have any questions or require additional information,  
please let us know.

Sincerely,

David V. Welch, Manager  
Grants and Contracts Accounting

DVW/BITS/jb  
Enclosure

cc: Dr. J. N. Bohannon, III  
Dr. E. H. Loveland  
Mr. H. Dean  
Mr. O. H. Rodgers ✓  
File #G-42-631

DEPARTMENT OF HEALTH AND HUMAN SERVICES

(Instructions are on reverse)

Grant No.

G-42-631

1 R03 MH32886-01

DATE OF THIS REPORTING PERIOD

FROM 7/1/79 TO 6/30/80

PROJECT PERIOD

FROM 7/1/79 TO 6/30/80

CHECK IF FINAL REPORT

NAME AND ADDRESS OF GRANTEE INSTITUTION

Georgia Institute of Technology  
Atlanta, Georgia 30332

TRANSACTION NO.

R3MH32886A

INSTITUTIONAL ID NO.

G-42-631

1. Expenditures of DHHS Funds for this Reporting Period

a. Personnel	\$	h. Alterations and renovations	
b. Consultant services		i. Other	
c. Equipment			
d. Supplies		j. Total direct costs	4,985.80
e. Travel, domestic		k. Indirect costs:	
f. Travel, foreign		Rate 76 % <input type="checkbox"/> S&W <input type="checkbox"/> TDC	
g. Patient care costs		Base \$ 3,600.00	2,736.00
		l. TOTAL	\$ 7,721.80
2. Expenditures from Prior Periods (previously reported)			-0-
3. Cumulative Expenditures			7,721.80
4. Total Amount Awarded - Cumulatively			7,727.00
5. Unexpended Balance (Item 4 less Item 3)			5.20
6. Unliquidated Obligations			-0-
7. Unobligated Balance (Item 5 less Item 6)			5.20
8.a. Cost Sharing Information - Grantee Contribution This Period			932.25
b. % of Total Project Costs (Item 8a divided by total of Items 1 and 8a)			% 10.0
9.a. Interest/Income (enclose check)			-0-
b. Other Refundable Income (enclose check)			-0-

10. Remarks

I hereby certify that this report is true and correct to the best of my knowledge, and that all expenditures reported herein have been made in accordance with appropriate grant policies and for the purposes set forth in the application and award documents.

Dr. J. N. Bohannon Assistant Professor

9/3/80  
Date

10/6/80  
DATE

David V. Welch, Manager, Grants & Contracts Acctg.

SIGNATURE OF INSTITUTION OFFICER

Formerly HEW-469 404/894-4624

REPORT OF RESEARCH GRANT EXPENDITURES

G-42-631

DEPARTMENT OF HEALTH AND HUMAN SERVICES  
PUBLIC HEALTH SERVICE  
NATIONAL INSTITUTE OF MENTAL HEALTH

FORM APPROVED  
GSA NO. 101-01351

0	9	8	0
(01)	(02)	(03)	(04)

FINAL REPORT GUIDELINES

INSTRUCTIONS

PHS policy requires that grantees submit a "terminal progress report" (final report) within 90 days after completion of the grant.

Please complete this series of items as *this final report*. The report will be filed with your applications, reports and other grant business in NIMH's central files. It will be read by staff in research program areas, and may be read by other Institute staff concerned with program analysis, communication, evaluation and planning. The report will be used for information about your research, i.e., to describe and summarize the information (*procedural as well as substantive*) resulting from NIMH support, and to relate that information to mental health problems and research. Your report will often be used apart from your application; however, other documents, such as publications and applications, will be available from the project file if needed.

These guidelines have been designed with relatively small response spaces to encourage brevity. However, do not restrict your response if more space is needed: be complete, using additional labeled pages inserted where necessary (*sample page included*). Extensive descriptions and discussions, if desired, should be made *in addition* to your summary response to the item and should be placed as appendices. Discussions of issues not covered by these guidelines are also welcome as appendices. Use clear, concise language, avoiding highly technical language *where practicable (this will vary for different types of research)*; appendices could be more technical than responses to the items.

All publications resulting from this project, and not previously submitted, should be submitted with this report (*or as soon as available*); see the section on Dissemination. Publications should *not* be used in responses to particular items.

Enclosures of this report and all appendices as indicated below.

All Grants  
Send 3 copies \*

TO: GRANTS CLOSEOUT UNIT  
GRANTS MANAGEMENT BRANCH  
OFFICE OF PROGRAM SUPPORT  
NATIONAL INSTITUTE OF MENTAL HEALTH  
5600 FISHERS LANE, ROOM 7C-18  
ROCKVILLE, MARYLAND 20857

FOR NIMH USE ONLY
Branch/Section: _____

Send two copies only of any books included.

ADMINISTRATIVE TAB:  NOTE: If items 1-4 are changed, give the staff information!	1. GRANT NUMBER  R 0 3 M H 3 2 8 8 6 <small>(05) (06) (07) (08) (09) (10) (11) (12) (13) (14)</small>	2. TITLE OF GRANT  Right ear advantage and functions of recall.
	3. NAME OF PRINCIPAL INVESTIGATOR  John Neil Bohannon III	4. SPONSORING INSTITUTION  Georgia Institute of Technology
	SIGNATURE OF PRINCIPAL INVESTIGATOR	5. NAME AND POSITION OF PERSON WRITING THIS REPORT IF OTHER THAN ITEM 3

MM427

CONTINUE ON REVERSE SIDE

Vol. 7/30

6. Describe briefly the *specific aims* of your project, indicating major changes in direction from the original aims:

The aims of this research was to investigate the left hemisphere/right ear asymmetries in processing verbal information. Asymmetrical effects were studied through known memory phenomena (the serial position curve, immediate and delayed recall, and imagery value of the to-be-recalled items) using a monaural presentation of the to-be-recalled items. The development of a monaural presentation procedure was important to avoid the complexities and confoundings inherent in dichotic presentations. For example, when stimuli are presented dichotically, most subjects report first those items presented to the right ear, allowing more time for the items presented to the left ear to decay (output interference at recall). There is evidence that when the ear reported first is properly controlled, the right ear advantage almost disappears from total recall. New data suggested that the right ear advantage appears within the serial learning curve, using monaural presentation of to-be-recalled material. Delineation of this effect was important for understanding the right ear advantage for verbal material.

AIMS OF  
THE PROJECT:

(PROBLEM  
STUDIED)

7. Were the aims pursued as *originally formulated*?

1  Yes

(15)

2  No

8. In general, how would you *characterize* your research?  
(Rank any multiple answers, using "1" as most appropriate)

(16)  Hypothesis development

(19)  Gathering of data; e.g., surveys

(17)  Hypothesis testing

(20)  Other (*Specify*):

(18)  Development or refinement  
of methodology

TYPE OF  
RESEARCH:

9. Describe the *methodology* used in your research, including characteristics of any sample used:

SEE appendix

CONDUCT  
OF  
RESEARCH:

10. Did you have significant *technical methodological* difficulties?  
(Examples: *necessary measurement tools undeveloped; unexpected inadequate data base*)  
If yes, describe, and explain how you dealt with them.

1  Yes  
2  No (21)

11. Did you have significant *practical operational* difficulties?  
(Examples: *trouble with equipment; loss of sample or data; difficulties with cooperating units*)  
If yes, describe, and explain how you dealt with them.

1  Yes  
2  No (22)



12. Describe (a) your *conclusions or results* as they relate to your specific aims (*please include negative results*), and (b) their *significance* in relation to the field. Avoid highly technical language where practicable.

## RESULTS:

The data from Experiment 1 were analyzed by a 2 (ear of input) x 2 (recall times) x 3 (competing stimulus conditions) x 5 (blocks of two serial positions of items at input) within subject factorial analysis of variance. The lone significant effect of ear of input occurred in the three way interaction between ear of input, time of recall and serial position,  $F(4,116) = 3.16, p < .05$ . This interaction is shown in Figure 1.

A fisher's Least Significant Difference (LSD) Test revealed no significant ( $p < .05$ ) REA's in the serial positions of the immediate recall curve. On the other hand, three REA's occurred in the serial positions of the delayed recall curve (see Figure 1). Moreover, the REA's occurred in the initial three blocks of serial positions.

Another finding of note was that the ear effect did not interact with competing stimuli. This is not to say that the competing stimuli had no effect; this factor interacted reliably with serial position,  $F(8,232) = 1.99, p < .05$ . A multiple comparison of the means (LSD) of this interaction revealed that the chatter condition suppressed the primacy part of the serial position curve.

The data from Experiment 2 was analyzed by a 2 (ears) x 2 (types of instructions) x 2 (times of recall) x 5 (blocks of two-serial positions) within subject, factorial analysis of variance.

The differential effects of the backwards instructions on recall (collapsed across ear conditions) can be seen in the significant interaction between instruction type, time of recall and serial position,  $F(4,92) = 8.91, p < .001$ . This interaction is shown in Figure 2. An LSD comparison of the means revealed that the backwards instructions enhanced the recency part and depressed the primacy part of the serial position curve derived from immediate recall. (See Figure 2).

-----  
 Figure 2 about here  
 -----

The deleterious effect of backwards recall instructions on long term memory is most clearly seen in the delayed recall data. Delayed recall in the backwards condition is severely depressed.

A significant interaction between ear of input, time of recall and serial position,  $F(4,92) = 2.47, p < .05$ , was obtained and can be seen in Figure 3. An LSD comparison of the means in this interaction indicates that the REA's occurred in delayed recall regardless of instructions (see Figure 3 for ear comparisons collapsed over instructions), since the effect of instructions did not interact with the effect of ear of stimulus input.



RESULTS  
(Continued)

13. Did you have *other findings* not directly related to the specific aims ("*serendipitous findings*")?  
If yes, describe:
- 1  Yes (23)  
2  No

14. How do the *overall results* of your project fit into these descriptions?  
(If you had multiple expectations or hypotheses, base your response on the predominant trend of the results).
- Confirming your hypotheses or expectations (24)  
 Disproving your hypotheses or expectations (25)  
 Inconclusive (26)

15. Did your research result in significant *methodological developments*?  
If yes, describe:
- 1  Yes (27)  
2  No

The right ear advantage can be demonstrated using a monaural listening procedure, if a delayed recall task is also used. Moreover, no competing stimulus is required in the left ear to obtain an REA.

IMPLICATIONS:

16. How would you describe the *impact* of your project?  
*(Rank any multiple answers, using "1" as most appropriate)*

- |  |  |
|--|--|
| (28) <input type="checkbox"/> Opening up a new line of research                          | (30) <input type="checkbox"/> Providing facts ready for application in a field |
| (29) <input checked="" type="checkbox"/> Contributing to the knowledge base of the field | (31) <input type="checkbox"/> Indicative of a "dead-end" line of pursuit       |

17. Do you have immediate plans for *further research* in this area? 1  Yes (32)  
*If yes, describe:* 2  No

18. Beyond your own plans, what is your opinion of the future directions this research area should take?

Researchers in REA should investigate the way memory strategies and age influence the magnitude of the delayed recall REA.

19. Do you have *specific suggestions (experiments, cautions, etc.)* for other research in this area? 1  Yes (33)  
*if yes, describe:* 2  No

IMPLICATIONS  
(Continued)

20. Are you aware of *other researchers* using your techniques, or planning to replicate your study, or of some individual or organization continuing your work? *If yes, describe, and check the type of impact which best characterizes the impact of your research at this time.*
- 1  Yes  
 2  No (34)
- Specific utilization (35)  
 General field impact (35)

DISSEMINATION:

21. As an appendix, list *all publications (and articles accepted for publication)* resulting from this project. Send any publications which have not already been submitted as *appendices*, with grant number indicated on each. *(See instructions, page 1, regarding submission of books)*
22. Do you have any plans for future publications, papers, and/or demonstrations dealing with the results of this project? If so, describe briefly. Send in any future publications based on this project as per instructions on page one.
- 1  Yes  
 2  No (37)

APPENDICES:

See instructions, page 1, paragraph 3.

Bohannon J. Lynn Baker-Ward Right Ear advantage and delayed recall, Memory and Cognition in press.

Item No. 9

The design of Experiment 1 was a 2 (ear of input, left or right) x 3 (type of competing stimulus, language chatter, music, or no competing stimulus) x 2 (time of recall, immediate or delayed) x 10 (serial positions of the stimulus lists) within subject, factorial design.

The subjects for Experiment 1 were 30 undergraduate male volunteers from psychology classes. The subjects were screened on a version of Bryden's (1965) handedness questionnaire. To be included in the study all subjects had to report biases to eat, throw a ball, bat, kick, and write with the right limb. In addition, the subjects had no history of sinistrality in their immediate families.

The stimuli for Experiment 1 were 240 single-syllable AA nouns taken from the Thorndike-Lorge norms. The words were randomly assigned to 24 lists of ten words each. The lists were then randomly assigned to one of four blocks of six ear/competing conditions (see Table 1 for a sample block of lists). Thus each ear competing condition had four examples. Six such groups of lists were constructed such that each list of ten words occurred in each ear/competing conditions equally. In addition, the headphones were reversed for half of the subjects to avoid any possible "equipment" effects. The baroque melodies were recordings from the works of Bach, Scarlatti, and Vivaldi. The language chatter was several human voices overdubbed on audio tape to create a cocktail party chatter effect recognizable as English language but unintelligible to native speakers.

The stimuli were recorded on Ampex tape using a Studer 1500 reel to reel tape deck, with the to-be-remembered items spoken at the rate of one word a second. The tapes were then re-recorded on cassette tape for delivery to the subjects using headphones and a BIC T-3 cassette deck.

The subjects were tested individually and instructed to recall the ten words from each group of items regardless of the stimuli occurring in the other ear. Two practice trials were given using ten word lists similar to the test lists, to familiarize the subjects with the stimuli and procedure. Subjects were not warned of the ear or condition of each list prior to presentation, nor that there was to be a final delayed recall. Following each ten-word presentation, the subjects were asked to recall orally as many words as possible in any order. When all 24 ten-word items had been presented, the subjects were given a piece of paper and asked to write down as many of the words from all the ten-word items that they could remember.

The design of Experiment 2 was a 2 (types of instructions at input, standard and recall backwards) x 2 (ear of input, right and left) x 2 (time of recall, immediate and delayed) x 10 (serial position of the items at input) within subject factorial design.

The subjects for Experiment 2 were 24 undergraduate male volunteers taken from psychology classes. The subjects were screened for handedness and familial history of sinistrality as in Study 1.

The stimuli for Experiment 2 were 200 single syllable AA nouns taken from the Thorndike-Lorge norms. The words were randomly assigned to 20 lists of ten words each. Each list was randomly assigned to two groups of ten lists (two practice lists and eight test lists.) The lists were then recorded on either the right or left track of a stereo tape at the rate of one word per second, using the same equipment as in Experiment 1.

Form No. 9

The final cassettes used for delivery of the stimuli were presented to the subjects such that each ten-word list occurred in each ear/instruction condition equally often. The stimuli were presented to the subjects through headphones, which were reversed for half of the subjects, as in Experiment 1.

The subjects were tested individually. The standard instructions simply required the subject to orally recall as many words as possible immediately following the presentation of each ten word list. After hearing eight test lists, and attempting to recall each list, the subjects were given a piece of paper and asked to write down as many words from all the lists that they could remember. The procedure for the backwards instructions was identical, save that the subjects were required to recall the items orally in reverse order from input, last one first. The order of presentation of the instructions was counterbalanced across subjects.

The design of experiment 3 was a 2(ear) x 2(competing stimulus, chatter or nothing) x 2 (imagery) x 2 (times of recall) x 9 serial positions mixed design. Competing stimuli was a between subject variable and all the others were within subject variables.

The subjects for experiment 3 were 100 Georgia Tech undergraduates, 70 males and 30 females. The subjects were screened for handedness as in the prior experiments.

The stimuli for experiment 3 were 72 high imagery and 72 low imagery, A and AA words selected from the Pavio et. al.(1968) norms. The words were randomly assigned to 16 lists of nine words each, eight high imagery lists and eight low imagery lists. Half of each group of lists had a concurrent recording of language chatter and the other half, no competing stimulus. In addition, half of the lists were presented the subject's right ear and the other half of the lists were presented to the left ear.

The subjects were individually tested in the prior experiments. They were asked to orally recall after each list presentation. After all the lists were presented the subjects were asked for delayed recall.

Item No. 12

The data from experiment 3 were analyzed by a 2 (competing stimulus) x 2 (times of recall) x 2 (ear of input) x 9 (serial positions) split plot analysis of variance. The main effect of ear  $F(1,98) = 13.97$   $p < .001$  indicated an overall right ear advantage (Right Ear  $\bar{x} = 35.3\%$ , Left Ear  $\bar{x} = 33\%$ ). Since the actual advantage is so small it may have been the subject's encoding variability responsible for the overall ear effect. Yet more interesting was the recall by ear by imagery interaction  $F(1,98) = 3.67$   $p < .05$ . This interaction indicated although delayed recall increased the right ear advantage regardless of imagery, the strongest increase occurred in the high imagery condition (20% REAV). See table 1. This was contrary to the prediction that high imagery value would lower the REA.

Table 1

	Percentage Recall from Imagery and Ear of Input			
	<u>High</u> <u>Right Ear</u>	<u>Imagery</u> <u>Left Ear</u>	<u>Low Imagery</u> <u>Right Ear Left Ear</u>	
Immediate Recall	58%	56%	56%	54%
Delayed Recall	19%	15%	8%	7%



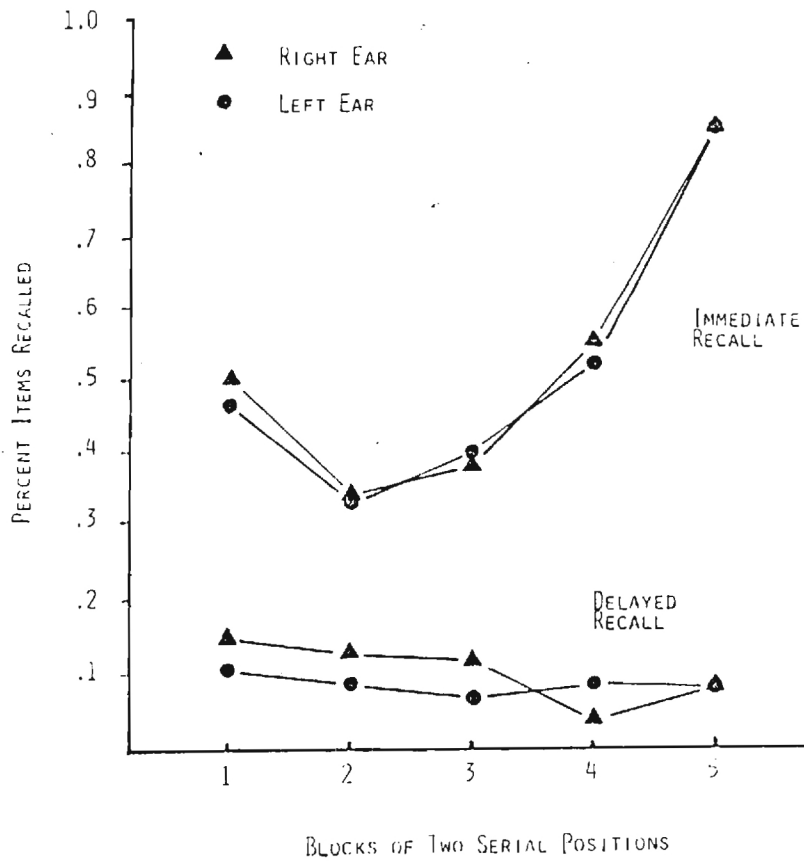


Figure 1. Recall scores from Experiment 1 using two times of recall. The data are collapsed over three types of competing conditions occurring in the opposite ear.

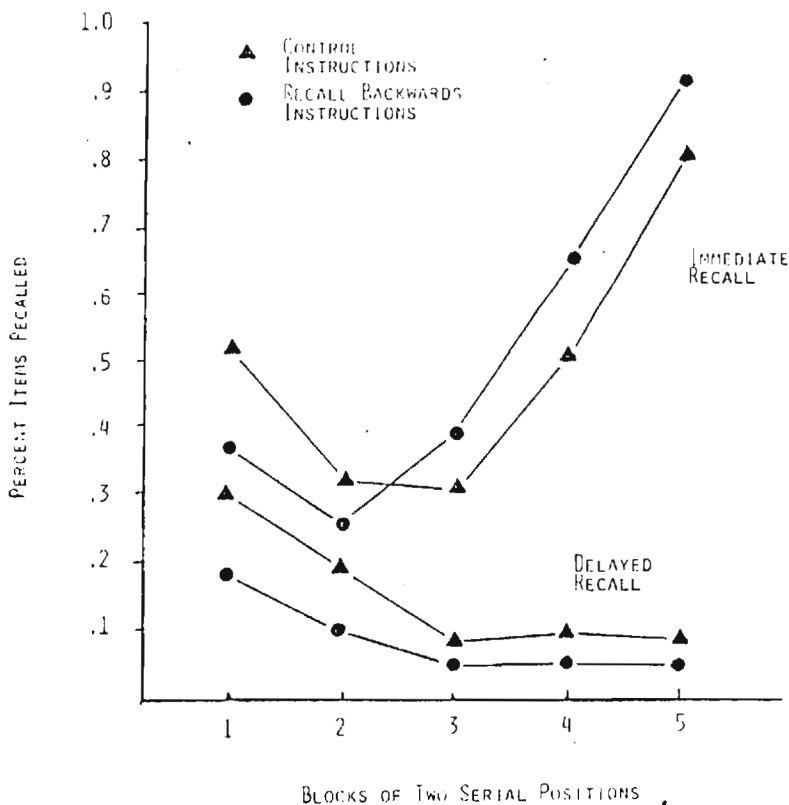


Figure 2. Recall scores from Experiment 2 using two times of recall and two types of instructions at input. The data are collapsed over ear of input.

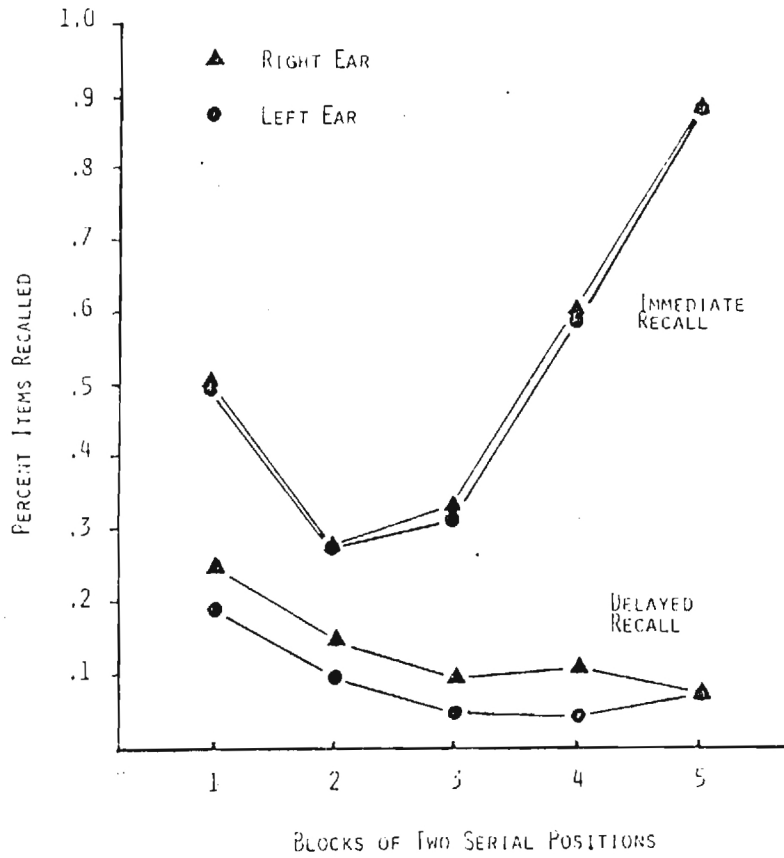


Figure 2. Recall scores from Experiment 2 using two times of recall. The data are collapsed over two types of instruction.