Constructive Recall Strategies in Adult Aphasia

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During the past 15 years, there has been an increase in interest in human cognitive processing, particularly in the area of memory. Memory is a central process of thought and involves the active storage of information and its retrieval. One technique which appears to facilitate the storage of information is the organization of material during study time. The retrieval of information appears to be improved when responses are clustered. Both of these strategies involve the structuring of information into meaningful, efficient units. Bousfield (1953) defined clustering as the ability to "sequence associates having an essential relationship between its members."

Organization and clustering strategies have been extensively studied in the area of psychology. Bousfield conducted early studies of clustering in free recall among adults in the early 1950's. In the late 1960's and early 1970's Moely and Neimark and associates have shown that organization and clustering are related to the number of items recalled. Organization during study time and grouping during recall are developmental skills which are positively related to recall for children and adults.

Clustering has recently received some investigation from aphasiologists. Tillman and Gerstman (1977) investigated clustering among 10 left hemiplegics, 25 aphasic subjects and 10 normal subjects in free recall of spoken word lists. Results of their study indicated that aphasic subjects recall fewer words, cluster less and retrieve fewer words over several trials than do left hemiplegics and normal adults. The authors also stated that aphasic subjects do not effectively respond to cues which facilitate recall.

Another study by Scharf and Goldfarb presented at the New York State Speech and Hearing Association Convention in April, 1978, explored the ability of one aphasic subject to cluster responses when spoken word lists were presented at .5 normal speed of speech. Their results indicated that the single subject studied increased his clustering ability upon presentation of the half speed stimuli.

The research to date suggests that the study of memorization among adult aphasic persons is a fruitful area. Further, it demonstrates that such research has the potential to provide a better understanding of the cognitive functioning of aphasic persons.

Therefore, the specific purposes of this study were to answer the following questions:

1. Are there significant differences between aphasic and normal individuals in the number of verbal items recalled?
2. Are there significant differences between aphasic and normal individuals in their organization ability during study periods prior to recall?
3. Are there significant differences between aphasic and normal individuals in their ability to cluster items during recall?

4. What types of errors do aphasic and normal individuals make during recall?
5. Are there significant relationships between number of items recalled, clustering ability and organization ability for aphasic versus normal individuals?
6. Do aphasic and normal individuals improve their memorization strategies on repeated trials?
7. What is the relationship between constructive memory skills and traditional tests of aphasia?

Method

Subjects

Thirty individuals with aphasia and 30 non language impaired adults served as subjects in the study. All aphasic persons had suffered a left cerebral vascular accident, were at least three months past stroke, and achieved an overall score of seven or better on the verbal and gestural sections of the PICA.

All subjects were between 40 and 75 years of age with the average age of normal subjects being 63 years 2 months and aphasic subjects being 62 years. All subjects completed at least the eighth grade but no more than two years past high school. Specifically, mean years of education for normal subjects was 11 years 1 month and 10 years 8 months for aphasic subjects. All subjects spoke English since at least the third grade.

Materials

The materials used in the study included pictures of 24 common objects which could be grouped into four categories of animals, clothing, furniture, and transportation. The items were line drawings on two by two inch cards, each containing a single picture.

Procedures

Prior to administering the memory protocol, all subjects successfully named the items used in the procedures. Each subject was then given a familiarization task. This consisted of the presentation of pictures of five common items. The subjects were given one minute to study them with the instruction "study this for one minute, then I will take them away and I will ask you to tell me what you saw." All subjects successfully completed this task.

The experimental protocol consisted of presenting a random array of 24 pictures before the subjects in four rows. During the practice trial the subjects were given one minute to study the 24 items with the same instructions given in the familiarization task. Each response was recorded in the order given by the subject. Each subject was then given a maximum of three trials to recall the array. Instructions this time were:

> "Now I am going to put all the pictures on the table. When I finish, you will have three minutes to study them. You may move them around, pick them up or do anything you like to help you learn them. After three minutes, I will take them away and you will try to name as many of them as you can. You don't have to learn them in any special order."

The researcher recorded the subjects' behavior during the three minute study period and the sequential order of items recalled at the end of the time period.

Analysis

The study period activity, subjects' responses to the protocol, and clustering during responses were scored. Following the organization scoring developed by Neimark et al. (1971), zero was given if the subject demonstrated no overt manipulation of the picture array, one was given for partial organization, two was given for categorization into four mutually exclusive categories, and three was given for elaborative, exhaustive ordering within and between classes.

The Bousfield technique was used for scoring clustering. This consisted of a ratio $\frac{R}{N-C}$, where R=number of clustered items, N=total number recalled, and C=number of categories represented. Also computed for each subject were the total number recalled, number correctly recalled, number of errors and type of errors for each trial.

Results

The first research questions explored the subjects' ability to recall the pictorial array. Figure 1 shows that normal subjects recalled more items on each trial than did aphasic subjects. The difference between the groups was significant at the .001 level for all trials. The same results hold true when the number of items correctly recalled were analyzed. Interestingly, one aphasic person was able to recall all items during the second experimental trial while eight normal subjects achieved a perfect score on the first experimental trial.

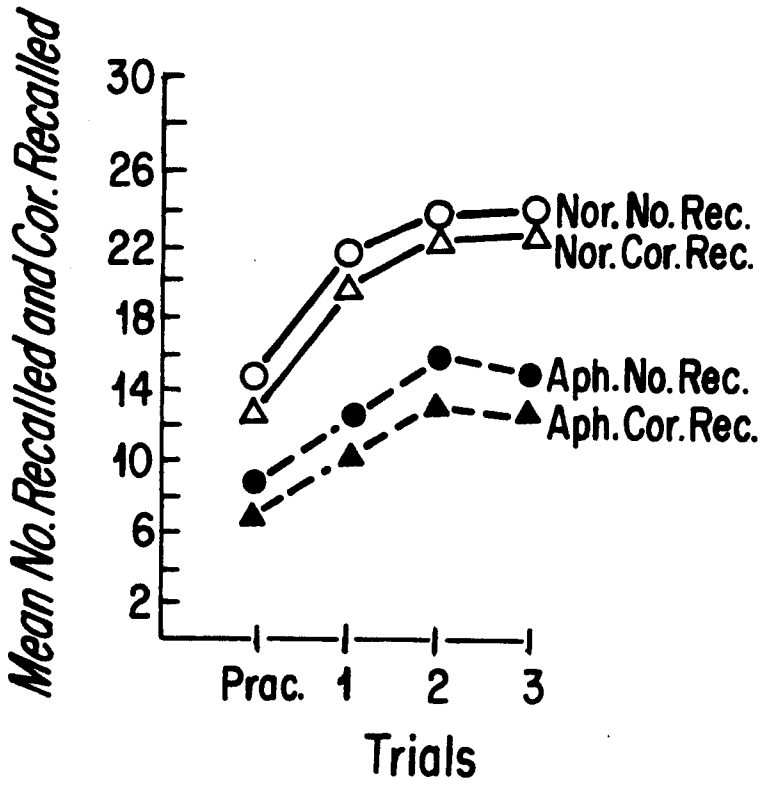

Figure 1. Total number of items recalled and number of items correctly recalled for all trials by aphasic and normal subjects.

The second research question involved a comparison of the subject groups' ability to organize during study periods. Figure 2 shows that the aphasic group was significantly less able than the normals to organize the items efficiently during the study period during all trials ($p < .001$). It appears that both groups focused on a strategy and tended to use it during the study periods. Most aphasic subjects made some attempt at dividing the items into four categories, while most normal subjects consistently categorized the items into four mutually exclusive categories. Normals also engaged in overt rehearsal such as alphabetizing or telling a story. A few aphasic subjects mouthed or orally named items in an attempt to remember the items.

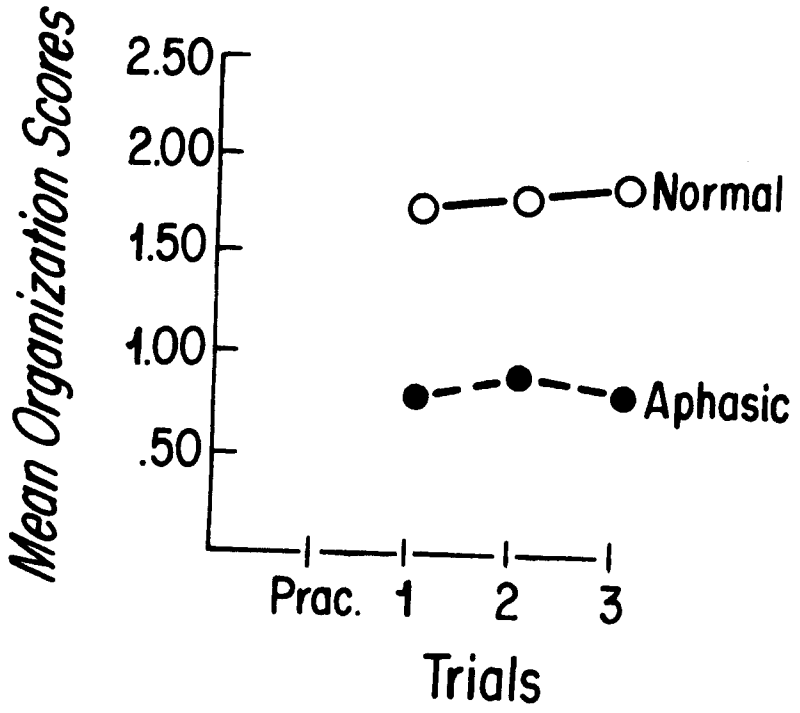

Figure 2. Mean organization scores for aphasic and normal subjects for all trials.

The third research question explored the subjects' ability to cluster responses during recall. Specifically, Figure 3 shows that aphasic subjects are less likely than normals to facilitate recall by clustering their responses. All trials were significantly different for aphasic subjects versus normals at at least the .01 level.

The next research question focused on the type and number of errors made. Three types of errors appeared - categorical intrusions, irrelevant responses and reiterations of items previously given. Interestingly, aphasic and normal subjects did not differ during the practice trial and trial one on the type and number of errors made. During trial two and three the aphasic subjects made more categorical intrusions and repetition errors than did the normals (Table 1).

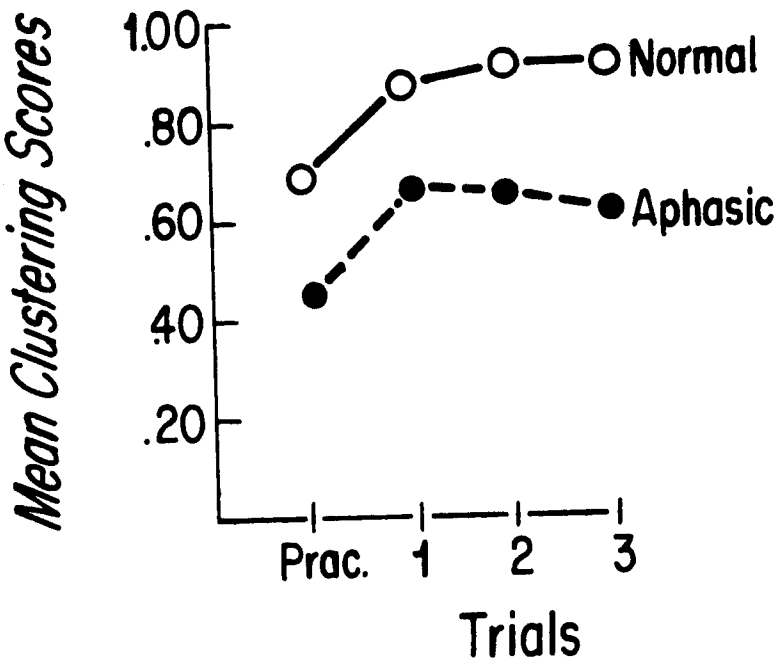

Figure 3. Mean clustering scores for aphasic and normal subjects for all trials.

Table 1. Mean number of errors for aphasic and normal subjects for all trials.

Trial	Aphasic Mean	Normal Mean	T
Practice			
Categorical Intrus.	.50	.43	.29
Irrelevant Resp.	.60	.43	.62
Repetitions	.40	.83	1.31
Trial 1			
Categorical Intrus.	.63	.23	1.54
Irrelevant Resp.	.43	.17	1.17
Repetitions	.80	.97	2.07
Trial 2			
Categorical Intrus.	.43	.06	2.15*
Irrelevant Resp.	.23	.06	1.26
Repetitions	1.67	.57	3.07**
Trial 3			
Categorical Intrus.	.50	.06	3.26**
Irrelevant Resp.	.13	.13	0
Repetitions	1.30	.30	2.52**

* $p < 0.03$
** $p < 0.01$

Table 2 shows the results of the analysis regarding the intercorrelations among the memory variables for the aphasic subjects. For the aphasic subjects the findings indicate that the number recalled on one trial is moderately to highly predictive of the number recalled on other trials. And as expected, the total number recalled on any one trial is highly related to the number correctly recalled. Organization was moderately related to number correctly recalled and with other organization scores. Interestingly, there was little relationship between clustering and the number recalled and only a moderate relationship with organization. The intercorrelations were somewhat similar for the normals, as can be seen in Table 3.

In order to investigate how the subject groups improved over trials, an analysis of variance for repeated measures was used. Results of this analysis indicate that there are significant differences between normal and aphasic subjects on number recalled, number recalled correctly, organization scoring, and clustering. The differences were always in favor of the normals. There are also significant differences across trials for number recalled, number recalled correctly, and clustering. However, this did not hold true for organization. Individual step down comparisons for trial differences indicate that there are significant improvements over trials for all subjects for number recalled, number recalled correctly and clustering, except between trials two and three. Improvement generally occurred between the practice and the first trial and the first trial and the second. Little improvement occurred for the subjects between trials two and three.

Further analysis showed that speech type by trial comparisons were significant for the number recalled and number recalled correctly between the practice trial and trial one and trials one and two. There were no significant interactions for organization or clustering, indicating that organization and clustering were improving in a linear fashion for normal and aphasic subjects. In other words, while normal subjects clustered and organized better during each trial, the improvement between trials was not better than that for aphasic subjects.

The last major question explored in the study was the relationship of aphasic subjects' memory abilities to the PICA. Table 4 shows the correlation analyses between the memory variables and the PICA. In general, there is a moderately strong relationship between aphasia severity as expressed in the overall combined verbal and gestural score and aphasic subjects' ability to recall items, organize their study time effectively and cluster their responses. Clustering has the lowest correlation with overall PICA score and verbal and gestural subtests.

The final analysis involved determining if the PICA measured constructive memory strategies available to aphasic persons (Table 5). Results of factor analysis yielded three meaningful factors after rotation. Factor 1 is a verbal factor, Factor 2 a gestural factor and Factor 3 appears to be a memory factor composed of three of the memory variables. Clustering did not relate strongly to any of the three major factors. The results suggest that the memory variables and the verbal and gestural variables are separate abilities for aphasic persons.

Table 2. Correlations for relationships among memory variables for aphasic subjects for all trials. Abbreviations: NREC, number recalled; NCOR, number recalled correctly; CLUST, clustering score; ORGAN, organization score; PRAC, Practice; T, trial.

	NREC				NCOR				ORGAN			CLUST			
	Prac	T1	T2	T3	Prac	T1	T2	T3	T1	T2	T3	Prac	T1	T2	T3
NREC															
Practice		.72	.49	.34	.93	.64	.46	.32	.39	.28	.35	.21	.04	.04	.31
T1			.77	.56	.70	.93	.70	.57	.44	.37	.46	.17	.19	.07	.30
T2				.68	.51	.76	.95	.67	.56	.49	.57	.24	.26	.07	.46
T3					.39	.61	.70	.96	.65	.63	.64	.40	.29	.25	.64
NCOR															
Practice						.69	.52	.36	.47	.32	.37	.17	.01	.07	.23
T1							.78	.66	.46	.40	.47	.20	.28	.13	.31
T2								.73	.55	.48	.56	.32	.32	.19	.44
T3									.56	.61	.61	.47	.30	.28	.67
ORGAN															
T1										.82	.78	.13	.40	.50	.57
T2											.88	.18	.35	.46	.61
T3												.26	.45	.59	.54

Correlations from .55 to 199 are significant at the .001 level. Correlations from .46 to .54 are significant at the .01 level. Correlations from .36 to .45 are significant at the .05 level.

Table 3. Correlations for relationships among memory variables for normal subjects for all trials. Abbreviations: NREC, number recalled; NREC, number recalled correctly; CLUST, clustering score; ORGAN, organization score; PRAC, Practice; T, trial.

	NREC				NCOR				ORGAN			CLUST			
	Prac	T1	T2	T3	Prac	T1	T2	T3	T1	T2	T3	Prac	T1	T2	T3
NREC															
Practice		.56	.30	.26	.79	.56	.25	.37	.35	.31	.32	.15	.06	.04	.13
T1			.34	.37	.39	.85	.32	.42	.41	.39	.38	.10	.40	.32	.47
T2				.76	.39	.36	.89	.79	.23	.30	.29	.09	.05	.17	.26
T3					.18	.34	.60	.74	.02	.10	.01	.04	.04	.05	.10
NCOR															
Practice						.61	.44	.37	.48	.43	.44	.41	.16	.20	.19
T1							.45	.46	.58	.46	.46	.10	.59	.50	.55
T2								.75	.51	.54	.58	.22	.26	.43	.45
T3									.23	.39	.28	.01	.12	.18	.35
ORGAN															
T1										.87	.94	.37	.63	.63	.63
T2											.93	.28	.45	.46	.47
T3												.34	.49	.55	.55

Correlations from .55 to .99 are significant at the .001 level. Correlations from .46 to .54 are significant at the .01 level. Correlations from .36 to .45 are significant at the .05 level.

Table 5. Factor analysis for memory variables and the PICA: 16 major variables. Principal-factor solution (varimax rotation) (N=30).

	Factor 1 Verbal Behavior	Factor 2 Gestural Behavior	Factor 3 Memory Behavior
Number Recalled	.11	.13	.94
Number Correctly Recalled	.16	.13	.92
Clustering Score	.18	.24	.25
Organization Score	.42	.02	.52
PICA Verbal Tasks			
Subtest 1	.85	.04	.04
Subtest 4	.68	.19	.35
Subtest 9	.79	.18	.29
Subtest 12	.85	.17	.06
PICA Gestural Tasks			
Subtest 2	.18	.30	.08
Subtest 3	.07	.15	.11
Subtest 5	.30	.50	.41
Subtest 6	.10	.15	.21
Subtest 7	.79	.39	.35
Subtest 8	.13	.12	.02
Subtest 10	.21	.86	.01
Subtest 11	.06	.11	.13

Discussion

The results of this study support the fact that aphasic persons have difficulty in the retrieval of verbal material presented as pictorial stimuli. Further, individuals with aphasia do not organize their study periods as effectively and are less likely to cluster their responses to facilitate recall than are normal subjects. These findings support Tillman's research with respect to the reduced clustering ability of aphasic persons. It should be noted, however, that aphasic subjects clustered their responses during recall. Specifically, at least 80 percent of the aphasic subjects clustered some of their responses during one of the trials. This indicates that clustering as a facilitating strategy is available to aphasic persons but is not used as often or as effectively as it is by normals.

This study also shows that some aphasic individuals are able to respond to cues regarding the organization of materials for effective

study. At least half of the aphasic subjects attempted to organize the pictorial stimuli into categories during one of the study times. Further, the ability to organize was related to the number of items recalled correctly. Those aphasic subjects who organized their study time tended to recall more items correctly. This is similar to Neimark's (1971) conclusion that organization is a better determinant of recall than is clustering.

It appears that many of the aphasic subjects understood that to engage in the planful operation of categorization during study time facilitated recall. Further, the aphasic subjects appeared to understand that the array was composed of an exhaustive set of categories. This is evident in the type of errors they made. They made few irrelevant responses, and when in error tended to give either a related item from the appropriate category or repeat a previous correct response. This finding suggests that aphasic individuals were actively processing the input stimuli into appropriate meaningful and stable categories.

The results of this study contrast with those of Tillman and Gerstman (1977) who indicated that aphasic persons do not improve on number of items recalled or clustering ability over repeated trials when given a variety of cues to facilitate recall. It appears that there was no difference in clustering or organization improvement between normal and aphasic subjects. Normals performed better, but did not improve more than aphasic persons for these two variables. Both groups assume an organization strategy which they found useful and seldom deviated from it during subsequent trials.

The results indicate that aphasic persons are capable of improving when the stimuli are presented a second time and for a longer period of time. This is also true for normal subjects and supports the findings of Bousfield and Cohen (1953) that the number of words recalled and degree of clustering increase as a function of number of presentations.

The findings also suggest that memory impairment is a component of aphasia. Those aphasic persons who recalled the most items and had the highest organization scores attained the highest scores on the PICA. Further, it appears that the PICA does not assess the memory variables presented in this study. The memory variables of this study and the verbal and gestural subtests of the PICA appear to require separate abilities.

The emphasis in cognitive psychology that memory involves rule-based cognitive organization has application to the study of aphasia. The study of memory abilities among aphasic individuals is incomplete without an investigation of how aphasic individuals approach a memory task and the aids they use in recall. This study suggests that aphasic persons can organize study time at least rudimentarily and use clustering as a facilitating device. These findings have diagnostic and therapeutic implications. For example, the evaluation of recall abilities might involve the description of the aphasic individual's organization strategies and his ability to respond categorically over a number of trials - at least two or three trials. Further, intervention might be directed toward facilitating a hierarchy of organization skills, from awareness of categories, to simple categorization, to exhaustive categorization within groups.

The results of this study combined with those of Scharf and Goldfarb (1978) suggest that memory abilities of aphasic persons can be improved.

Scharf and Goldfarb's finding that slowed speech improved clustering and the present finding that improvement occurred over several trials and after a three minute study period as compared to a one minute session, suggest that persons with aphasia may need more contact time with the stimuli in order to recall them.

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Discussion

Q: I'm a little stunned that you found 30 aphasics that could name 20 pictures without errors.
A: Yes.

Q: Did you score that on a PICA scale?
A: They actually named it when they were confronted with it; they had to name it accurately; we discounted dysarthric errors or slight apraxic errors but we accepted very very close approximation. There was no difficulty with it. It took a long time to find the subjects.

Q: And how do you rule out the fact that one cluster didn't occur by chance? You said 80 percent of your aphasic subjects gave at least one cluster. Now one cluster, as I recall, could be by chance. And did you have any recognition tests or any recognition recall trials? You asked them afterwards just to tell you how many they recall?
A: No we did not ask how many were recalled. The subjects were asked to name the items they recalled. To give me the name of what they saw. It was a recall test not a recognition test.

Q: You don't have any recognition data on those tests?
A: No we don't, other than that they recognized the object before we started the study.

Q: I think your study has really two important implications. One you alluded to was that repeated trials do help the aphasic subject with his inefficiency in processing information, but there is a ceiling on that. There seems to be a limit as to how repetition will help people use strategies. I think the other one is that there really aren't a lot of qualitative differences between these two populations. Give the aphasic person time to deal with the inefficiency and he'll do a pretty good job of it, and I think your three minute study time is an excellent example of giving an aphasic person enough time to demonstrate that he's got the strategy, that he's capable of doing it.
A: When I started out to do this study I thought clustering was the important variable and as I finish it, I think organization is. What is done during the study time is the most important factor of the study. I think that what we could do with aphasia therapy is to try to develop a hierarchy of strategies to use during the study time. I think that's an important finding of the study.

Q: There's some research in the aging literature that says older people seem to have a little bit more difficulty taking advantage of organization in word lists than younger people. So the aphasic subjects' difficulty may be a subcomponent of age rather than aphasia.
A: I think that's true. I think that's well documented in the literature. However, if you go back to Neimark's study, which she did with children over a number of ages and with young adults, college students, we obtained approximately the same results within two or three-tenths of a point. So my normal older adults didn't do any worse than her young adults.

Q: I just wanted to make a comment about Tillman's study. She makes a point which I think gets back to you. She feels that those subjects sat there during the input stage without bringing any strategy with them. It kind of washed over them. And that may be one of the important variables to look at in terms of prognostication.
A: I sort of expected your question so if you'll bear with me for one second I have a list of differences between Tillman's study and this study. I think that's an important question. I thought my aphasic subjects did better than hers and I think there are a number of reasons. 1) She didn't define the severity of aphasia and I suspected that hers might have been more severe. 2) She used more words. She had a list of 34 and I had a list of 24. 3) Also mine were pictorial—hers were spoken, presented also with a little card. Words were given one by one accompanied by a printed card. 4) There really was no study time in Tillman's study. It was presentation and card down—presentation and card down. I gave them the whole array and they studied it. So it's really looking at study time versus very quick presentation. I don't think that they are the same studies when it comes to clustering. 5) Also, I question the cuing that she gave. The psychological literature suggests that cuing given before the act is more effective than cuing given after and in Tillman's study cuing was given after she gave them the categories.

Q: I just wanted to comment on the practice. I'm glad you mentioned it because I think that's valuable too. But my question is, in your study did you correlate verbal and gestural on the PICA?
A: Yes.

Q: What did you find on the verbal? Generally did they correlate or not?
A: There is a moderate correlation. Where the correlation falls down is on clustering. Clustering seems to be a very separate strategy.

Q: I wanted to ask you a different question. I can understand a verbal correlation but when you talk about a gestural what do you mean?
A: The gestural subtest of the PICA.

Q: Yes I know, but that's so filled with apples and oranges.
A: I agree with you. I just took the verbal and the gestural subtests.

Q: I was trying to read your chart and I couldn't. I thought maybe you pulled out the auditory visual subtests.
A: No I didn't, but I can go back and do that.

Q: It might be interesting.
A: I think it would, and also the graphic. I didn't do the graphic here and I think that may be a component.

Q: I guess I'm trying to get at a way of saying that I think we should be careful of reporting gestural correlations.
A: I can go back and do that. It's a good suggestion.