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Therapeutic procedures on the aphasic population

Marilyn J. Wilson

M.J. Wilson
Independent Study

Beginning in the early 60's, many studies concerning the "learning characteristics" of "aphasics" began appearing in the literature. Most of these early studies and many present studies are basic research work designed to answer questions of the researcher and not the clinician. Many of these attempted first to find out if "aphasics" could learn, and then explored the variables which might further facilitate the process. Often, the authors acknowledge that the very nature of the studies makes their findings difficult to utilize in developing therapeutic procedures. There have been many studies which are more directly concerned with clinical learning tasks such as those dealing with programmed learning and learning machines. Hopefully, because of their nature, the clinician is already more familiar with these. The more basic research in learning characteristics is often much further removed from clinical goals and procedures. Although the purposes of the researcher and clinician are quite divergent, both can, and should contribute to each other to further our knowledge about the problem of aphasia. Clinicians should not only be aware of the research which is being done, but must learn to glean from it ideas which will make therapeutic procedures more efficient and more beneficial to the aphasic population they serve.

Before the findings of several of these studies are discussed, it is important to become familiar with the many possible limitations to particular experimental designs and to their findings when attempting to apply the results to clinical procedures. All studies are not limited by the same difficulties, but many authors have acknowledged that the readers of their studies should be aware of certain aspects of experimental design. Features of experimental design which particularly should be examined in relation to studies on learning characteristics of aphasia include: population control, (type of aphasia, time since onset of aphasia for the experimental group), subject criteria, control population, and experimental task selection.

Studies vary considerably in the area of ~~population control~~. Clinicians are aware of the possible diversity in characteristics of patients labeled as "aphasics". Simply calling a subject "aphasic" does little to help describe his actual behaviors. When no further breakdown of the population is available, as is the case in many studies, findings are most difficult to utilize because those who do learn and those who do not cannot be separated by any other parameters. In these studies there are simply some aphasics who learn, and some who do not. There is no opportunity to associate the failure to learn with behaviors or characteristics particular to one group of the aphasic population. Brookshire, in a recent article admits, "the label aphasia is not very helpful in predicting how a given patient will perform even on relatively simple learning tasks. It seems clear if we are to accurately predict performance, we must discover additional parameters which will allow us to divide the population of aphasic patients into groups that exhibit greater behavior homogeneity." Brookshire and others have used PICA profiles to define their populations, and although these have not revealed the significant parameters related to learning, they do help to give the clinician a clearer picture of the population being studied. Schuell's five classes have also been utilized to better define a ~~population~~ of aphasic subjects by a few authors. Few other systems have been applied. The expressive-receptive dichotomy has been used by a small group of authors, but this, as the clinician knows when not further defined, also gives little specific information about the behaviors of the aphasic individuals. Nowhere in the literature of this area of research does anyone separate aphasics as fluent or nonfluent (Broca's or Wernicke's aphasia) which might be a very clinically useful description. The major point to be made is that because the populations under study are often ill-defined, and therapists are aware that techniques successful with one group of aphasics are not useful with others, the findings of research dealing with "aphasics" ~~may not be applicable to all~~ cases the clinician may see. ~~It is~~ the ~~trained~~ clinician who ~~will be able to~~ sort out

which techniques will be most useful with which particular types of aphasia.

Another area of population control which creates difficulty in application in the studies is time since onset of aphasic symptoms. Although clinicians are well aware that this will affect the rate and amount of progress of their clinical patients, few studies even discuss this factor. Many do not specify this information and the reader can only hope that the subjects were at least neurologically stable. Some articles include populations with enormous ranges since onset such as Greenberg, who presents cases post onset one to 372 months, and Brookshire with a range of 3 to 45 weeks post onset. A few studies even include, or are based solely on, a neurologically unstable population as the 5-21 day post onset group of Ettlinger and Moffett. The significance of this problem is that the clinician will not always be aware of a possible relationship between learning and time since onset, and generalizations from certain findings must be applied clinically with discretion.

Another clinically unfortunate aspect of population control in many studies is the set of criteria used in selection of subjects. In many instances the only subjects used were those who could perform the tasks, and thus, no data is available on the patients who failed to do the tasks. Often, the more severe aphasic patients are eliminated from the experiment. Some studies do not involve in depth testing of subjects to determine to which group they belong, and some studies may possibly include some mild receptively involved patients in with the "normal" population. Most of the studies are limited to a very small sample; most frequently around 9 to 10 subjects, with none larger than 30. Because of these limitations, the clinician should be aware that the findings are trends, not significantly supported conclusions, and they may apply to a rather limited segment of the aphasic population.

A final comment about population control is concerned with the control population used. This may vary from brain damaged non-aphasics (some which specify right brain damaged or some which do not) to normal non-aphasic hospitalized, to non brain damaged non-aphasic to nondefined non-aphasic. Little agreement seems to exist as to what population "aphasic" performance should be compared. Having no real standardized "normal" population further limits the amount of generalization which can be drawn from the findings, since there must be some basis from which can be judged whether learning is different or deviant or simply ~~a matter of~~ slower ~~processing~~.

The second major difficulty interfering with ease of application with some of the studies has to do with the tasks selected for the experiments. Clinicians must be critical in evaluating whether a specific task actually measures what it purports to (and could be used clinically in that way.) An example of this is a sentence used in the study by Ettlinger and Moffett which, because of it's length and complexity, would immediately be recognized by a clinician as a very difficult task for most aphasic patients, and rarely used in therapy. To measure the ability to learn and later recall a sentence, the sentence they chose was, "Tom Brown's dog ran quickly down the road with a huge bone in his mouth". The study concluded that aphasics have significant impairment in sentence learning. Perhaps use of a less complex sentence or a series of sentences would have indicated more specifically what problems ~~really~~ existed in learning and recalling sentences, and provided more clues to teaching sentence recall to aphasics. Further cautions should include noting whether the task is one which may be difficult due to factors other than aphasia. Many tasks require that non-dominant hemispheric functioning be intact, but reliable proof of this is most difficult to obtain. The clinician must be wary that the aphasia of the patient is what is affecting

performance on the task and not other factors, as for instance, more generalized brain damage, or the findings will not be applicable to therapy except with the few aphasics who may have these other difficulties.

Because of the many difficulties already mentioned, results and conclusions of some of the studies sometimes contradict each other. The contradictory findings could most likely be explained away by different subject populations since "aphasia" includes patients exhibiting very different behavior, and by little control of the many already mentioned factors. There are also very few even related or connected studies in one area. Occasionally an author will follow up an initial study, but there is a general diversity in the problems examined making generalizations more difficult. The clinician will have further difficulty in making applications because of the relative scarcity of published data.

Many studies were not published, but were ASHA presentations or dissertations. Of those that have been published, many have been in journals unfamiliar to many clinicians. There has, however, been a more recent trend to publish some of the more clinically useful studies in JSHR, and clinicians should avail themselves of these. It should be emphasized that there has been considerable improvement in the control of experimental design since this area began to be investigated. Contrasting a 1947 article by Zangwill with one by Brookshire or Greenberg reveals immediately the great improvement in sophistication and greater attention to clinical application.

None of the comments on experimental design should be taken as criticism of researchers. It is important that clinicians are aware of these limitations in applying research to therapy, but they must also keep in mind, that often what appears to be a factor obviously "overlooked" is simply one which was not considered important for the particular purpose of the designer. These factors only become of major importance when attempting to apply the findings to daily therapeutic procedure.

One of the most important findings of the research has been that as a group, aphasics have shown the ability to learn. Learning has been demonstrated for "aphasics" on nonverbal tasks involving discrimination, reaction time, category sorting and matching to sample, on tracking reinforcement tasks and response-reversal reinforcement, and on such verbal tasks as serially listing words, naming pictures, writing names of objects, and supplying a cued final written word. Although learning has been shown to take place for "aphasics" as a group, there also have been many individual failures of "aphasics"to learn. Unfortunately, these failures are rarely accounted for, although a few authors have attempted to discuss reasons for the failures, or to continue the experiments to see if learning could eventually take place. Most studies, because of the nature of the questions they are designed to answer, leave out of their data the subjects unable to complete the tasks. Even though the research may not have been designed for that purpose, it would be more clinically useful for authors in the future to seek answers as to why the failures occurred, and to continue to search for conditions which could eliminate some of these failures. This is a task of extreme difficulty, but a better understanding between clinician and researcher may lead to better knowledge of the aphasic.

A second basic question posed by the learning studies is: "Is learning for "aphasics" the same as for normals?" A general answer to this question is impossible to give since the studies present findings supportive of either "yes" or "no" positions. These apparent contradictions can best be explained in the light of the limitations imposed on these studies as already discussed. Different subject populations may have been examined, although all labeled as "aphasics", the range of disability this may imply must be considered. Each study utilized different tasks of learning. One study may examine verbal learning while another examines non-verbal or reinforcement

tracking. Results of these diverse learning tasks are not readily comparable. It is quite possible that "aphasics" as a group may learn as normal subjects do on some tasks, but not on others. Further, some of the studies may be more limited by the inadequacies of experimental design presented earlier than others, and some may have simply too small an amount of data to allow a definitive interpretation. The significance of this question to the clinician should not be underrated. If research does lead to a definitive answer to the question, then the clinician will be able to know in which tasks traditional teaching-learning techniques will facilitate learning for the "aphasic," and in which tasks a new approach must be designed, possibly providing cues as to appropriate directions for new approaches.

Research has also sought to delineate factors which might be related to learning in aphasics. Regretfully, little has been found to be significantly related to learning ability. Major trends found in most studies simply lend support to fairly widely accepted clinical prognostic categorizations. Brookshire (3) found no significant relations between overall PICA scores or time since onset and ability to perform reinforcement tracking, although trends were present in the clinically expected directions of better learning performance for those with higher PICA scores and greater time since onset. Greenberg's study (12) is perhaps one of the most elaborate in comparisons of various factors but also revealed only non-significant trends, once again in clinically expected directions, in regards to etiology, type of hemiparesis, age, education, and classification by type according to Schuell. Farnsworth (11) found in his study comparing performance of aphasic adults on a task of sorting environmental pictures into pairs, that younger aphasics performed better than older patients. Tikofsky and Berman's (10) findings indicate that differences in learning did not appear related to degree of impairment based on clinical testing. In fact, they found some of the patients with greatest degree of impairment were

among the best learners, and some with only mild or moderate impairments were poor learners. The fact that factors have not been discovered which are correlated significantly with ability to learn emphasizes our lack of in depth understanding of the problem of "aphasia". This area needs a great deal more exploration if clinicians are to provide each patient with maximal therapeutic benefit. Once parameters related to learning are discovered, the clinician will be better able to design the most efficient programs of therapy for each patient.

One questions which is dealt with only minimally in a few isolated studies, which needs continued consideration is:, "Is learning retained?" This question, which is of paramount importance to the clinician who must evaluate the long range as well as short range merits of therapy, has been sadly neglected in most learning studies. The few studies which have examined this, have done so only over a very short interval. Pizzamiglio (14) and Roberts in examining the ability of aphasics to learn a written naming response administered a retest one week after the learning sessions and found learning was retained. Rosenberg and Edwards (15) similarly found retention after one week of a non-verbal matching to sample shape differentiation task. In a study by Tikofsky (16) "aphasics" demonstrated learning over four days on a verbal learning task involving serial anticipation of lists of high and low associate words, and then generalization after two days of no learning to another similar task since a better learning curve was generated when no learning interference was present.

~~These~~ Studies have just begun to answer this question which needs to be explored more extensively. What kinds of learning are retained most easily and for the longest time? What kind of learning is retained that will facilitate further learning? These questions need examination if the clinician is to develop procedures which will not only facilitate learning, but which will facilitate learning which will be maintained. Speech pathologists

must begin to show data which substantiates the long range as well as short term benefits derived from present and future clinical procedures, in aphasia as well as other areas of clinical interest.

In attempting to answer the question about learning in aphasics, most researchers selected non-verbal learning tasks hoping to eliminate the variable of prior knowledge as an influence on their results so that the learning process could be more accurately observed. Thus, few studies have been designed using functional materials in the tasks presented. The speech pathologist is most concerned with verbal behavior and verbal learning. Studies of non-verbal learning may be uncontiminated by previous knowledge, but actual clinical tasks and learning by aphasic subjects is not free of such contamination. Further, investigating non-verbal learning and generalizing the findings to verbal learning tasks is a procedure which cannot be well defended with even our limited present knowledge of hemispheric functioning. Many non-verbal learning tasks may involve right or non-dominant hemispheric function which is relatively unimpaired in some aphasic patients. Generalizing learning on these tasks to those which do require functioning of the hemisphere in which a lesion occurred is a dubious procedure. (23)(24) Thus, those studies which involve verbal learning are those which should have the greatest clinical validity. A few of these which clinicians might find most applicable to their work are:

1) Pizzamiglio and Roberts (14) study which uses a written naming task in which the subjects write object names after being given a cue.
2) And studies by Goehl, (12) Greenberg, (13) and Carson, Carson and Tikofsky (6) involving anticipation learning of series word lists.

Once the clinician is aware of the limitations of application of these findings, he should be aware of the general trends which have been found which are most useful in therapy. All of these, due to the limitations discussed, will not be applicable

to all cases, but the clinician may benefit from the discussions of them and utilize clinical discretion in their application.

One area of immediate concern to therapists not only using more traditional methods is the matter of reinforcement. Some of the most important findings in this area include:

1. Undesired responses should never be reinforced. If the clinician reinforces an incorrect unwanted response, the patient will not seek the right answer nor the most efficient strategy to solve his problem. The clinician must be aware of inadvertently reinforcing a response by non-correction.

2. Findings of Tikofsky and Reynolds would suggest that perseverative errors must be pointed out if they are to be eliminated. They found that a non-corrective technique in which a subject was not allowed to give alternate responses to one set of stimuli before proceeding to another was not effective in reducing perseverative error. In addition to the above, they felt that this might also suggest that patients be trained to differentiate between perseverative and non-perseverative errors, and then to differentially respond to each. No report has been published to date which describes a clinical attempt at implementing this suggestion for patients with many perseverative errors.

3. Brookshire found that his aphasics as a group were affected in their ability to track reinforcement when slight delays were introduced which had no affect on his "normal" population. Although there was individual variation, it would appear that this suggests that in designing therapeutic situations for aphasics, reinforcement should be activated immediately. Immediacy of reinforcement, ~~probably~~ negative as well as positive, is vital to improvement in therapy whether or not an operant model is in use.

If the only reinforcement is that of the social approval or disapproval of the therapist, then this too must be made to immediately follow the patient's response. Brookshire's study emphasizes the fact that reinforcement is effective, especially with aphasic patients only when it is immediate.

4. Another study by Brookshire (4) suggests that we cannot make the assumption that a reinforcer effective with "normal" subjects will be effective with all aphasics. He found that behavior shaping could be used with most aphasics, but that it was always essential to use adequate and appropriate reinforcement for each individual. Thus, if the clinician attempts to utilize behavioral shaping techniques in therapy he must be certain that the reinforcement he will be using is effective for that particular patient.

5. In the same study by Brookshire, (4) the clinican is given the suggestion that to minimize perseverative responses in a patient it is most important to somehow signal changes in reinforcement contingencies. In other words, clinicians must indicate to the patient that what will be approved of is changing, and that the same response is no longer desired. This would further suggest that it would be advisable to punish no longer appropriate responses.

A second area of research findings deals more generally with clinical procedures. A few of the more pertinent findings in this area include:

1. ~~Another~~ One study by Brookshire (5) ~~which~~ revealed that if a patient cannot respond appropriately in early trials of clinical tasks, continued drill on the task without any change is of little value. When no success at all is achieved in early stages, the task must somehow be altered. The clinician must seek to find out why the patient cannot do the task. It is important to not just note that he could not perform the task, but to find out why so that the task may be modified. A few ways in which the clinician might go about altering the task are mentioned by Brookshire

and include: changing the discriminative stimuli, or the response consequence or both. Providing a wide variety of stimuli is important if the task is to have value beyond a specific situation.

2. In the study by Ettlinger & Moffett[10], it was found that repetition of a list of names until they could be repeated correctly two or three times facilitated learning to name objects. Clinicians are immediately aware that this technique would not be useful with some patients, but perhaps simple repetition of the names before association with the object may prove useful with certain cases.

3. Pizzamiglio & Roberts'[14] study showed that written verbal lessons which were massed, that is, were daily rather than on alternate days, were most successful. Clinicians who are able to arrange their schedules to see their patients every day may find this does produce greater increments of verbal learning.

4. Although he did not directly test the hypothesis, Brookshire[4] suggested, based on findings of a project dealing with reinforcement, that when a shaping procedure is used in therapy, perseveration may be reduced if many trials are allowed at each step of the procedure. The clinician must be aware that a patient may require more steps and additional trials at each step to attain a certain level.

5. A comparison of the use of auditory, visual, or combined presentation of materials by Aten, Adams and Helmick[1] indicated that there was no one best technique to teach naming to a patient. This means that ~~it should be left to the discretion of~~ the therapist must determine which condition would be best for each individual patient.

6.

6. When "aphasics" are provided with an external model, or are given feedback with which they can compare their performance, they will, as a group, exhibit good motivation, perseverance, and tolerate frustration. This finding by Carson and Tikofsky (7) in examining aphasic performance on WAIS performance subtests suggests ~~to clinicians~~ that it is most important to provide the aphasic patient with an external check on his performance to maintain the best rapport. They also found that time limits placed on a task disrupt "aphasic" performance, and that "aphasics" will generally sacrifice speed for accuracy. Increased complexity and an increased number of necessary manipulations can also cause breakdowns in performance. Thus, the clinician must slowly increase demands in any of these variables, and do so only at a rate where success can be maintained. In attempting to increase the level of difficulty of a task, these findings would suggest three options: a) the clinician may slowly reduce the amount of external feedback available to the patient having him rely to increasingly greater degrees on self-correction, or b) the clinician may impose shorter and shorter time limits for the performance of a particular task, or c) the task itself may be altered by increasing the number or complexity of its components.

7. Carson, Carson, and Tikofsky (6) have shown not only that aphasics are capable of constructing rules from abstract properties and using these to facilitate performance on a task, but that they learn tasks easier by rule than rote learning methods if the memory load is not too great. Their study was aimed at beginning to uncover facts that would support the idea that in aphasia, linguistic competence, or the underlying rules governing language behavior, is not interfered with, but rather, linguistic performance, or the ability to use the rules in encoding or decoding language ~~or~~ efficiently, ~~and/or~~. Although it was just a

beginning step toward investigating this idea, it suggests the clinical possibilities of designing tasks which would facilitate developing the patients' efficiency in using rules, not in ~~teaching~~ learning them.

8. Carson, Carson, and Tikofsky (6) have also demonstrated that a simple learning task can interfere with a more complex task by distracting the aphasic's attention. Clinicians must take precautions to eliminate diversions from the task at hand, and be certain to separate tasks in a definitive manner to prevent learning in one from interfering with learning in another.

9. Engelmann and Brookshire (9) present evidence that learning will be facilitated for aphasics if the presentation of stimuli, as well as the complexity of the stimuli, is ordered from simple to complex, which is different from the order which facilitated learning for a normal control group. They found that discrimination improved if stimuli were presented in the following manner to aphasics: successive presentations of one stimulus, then simultaneous presentations of two stimuli, and finally, successive presentations of two stimuli. Clinicians should, therefore, strive in therapy to not only control the complexity of material which they present, but also the manner of presenting it to the patient.

A few studies have also dealt more directly with examining the kinds of stimuli which most affect learning performance.

1. Greenberg (13) found that more meaningful words were learned most easily by his aphasic subjects. Meaningfulness in the study was defined as the mean number of associations a group of judges wrote to a stimulus unit in a sixty second response period.

2. Goehl's (12) study suggested that aphasics will respond better to more frequently used words regardless of their length.

3. Studies by Tikofsky and associates, (18) (6) (18) on high versus low associative content word lists indidate that high associative lists can interfere with later learning of low associative word lists, but learning of

low associative lists first facilitates later learning of high associative lists. The implications of these three studies to materials to be used in therapy are obvious.

A final set of findings deal with general characteristics of the "aphasic" population with which the clinician ought to be familiar. A few of these findings include:

1. "Aphasics" as a group are slower at completing tasks than normal subjects. On nonverbal tasks, "aphasics" sacrifice speed to attain accuracy. (7) In general, the response latencies, or time lag before responding, are greater for "aphasics" than for normal subjects. (6)(16) Clinicians must always allow ample time for responses to occur in therapy, and be aware that imposing a time restriction increases the difficulty of the task, and may cause poorer performance.

2. "Aphasics" are not only slower to respond to a task than are normal subjects, but also have more difficulty with non-familiar material. (16)

3. Studies by Greenberg, (13) Tikofsky, and others (6) have shown that aphasic patients can perform tasks which require abstraction, disproving an early misconception about an aphasic "abstraction disability."

4. Finally, Boller and Spinnler (2) found an association between poor memory and visual field defects and DeRenzi and Spinnler (8) found delayed memory affected when visual field defects were present. Clinicians should be aware that both of these are signs of a more generalized factor of severity of cerebral damage.

SUMMARY OF FINDINGS

Bottom of Pg 9 really takes off - before that needs considerable tightening + provision of some headings + help reader follow.

Aphasics

Study	Time Since Onset	Age Range	Type of Origin	Classification	Criterion for Sel.	# of S's & sex	Type of Task
Brookshire (D. 1968) 5	5-44 weeks M-12.75 med. 7 wks	46-75 yrs. M-54 med. 51		aphasics seen in clinic - variety of degree & type	- all pts. in clinic	9 males	Track reinforcem - response reversa non-verb. discrim.
Ettlinger & Moffitt 10	May. 5-21 days after surgery before surgery after vascular acc.	16-60 yrs	Vascular - Surgical - mag. → removals of glioma, angioma, meningioma, or Hematoma.	Dysphasic - judged by author & hospital no res -	Under 60 yrs. no evidence bilateral lesions	31	1. Correct learning of se 2. "Reproduction of rh 3. naming 12 obj. 4. perf. on non-verb it 5. recall sentence lea " rhythm "
Carson, Carson & Tikofsky 6	May → 6 mo - 2 yrs.	30 or below 9 31-45 yrs. 36 46-60 9 61 + yrs		Semantic 29 Syntactic 4 Sem-Syn 12 Global 15 Jargon 2	Rehab. program did not take minimally impaired or emotionally def. #2. Repeat single words	Total 64 1. 18 2. 10	1. Match non-verbal stim Reaction time & accur 2. learning serial l HA - LA 3.
Pizzamiglio & Roberts 14		33-65 yrs. Group 1 M-42.0 Group 2 M 48.9	19 CVA - 15 thrombosis 1 hemorrage 1 trauma	Predominantly expressive (Clinical observation - similar groups.	under treatment in 3 hospitals	10 males 10 females	Supply final word & w sentence provide names of obj. in Retention after 1 we
Tikofsky (1970) 18		broad distrib.		Variety types & levels	Repeat single words in therapy unw. of mich	10 30	
Tikofsky & Reynolds (1963) 21				pts. in aphasia div. Univ. Mich. clinic or dept. neurol. Med. center.	Able to complete task (too difficult for many)		Retention.
Brookshire Mrch (1971) 3	3 wks - 3 yrs. 9 mo.	21-62 yrs. M 44.3	gunshot wound - 2 CVA 6 Blow to head 1	PICA 4.4 - 12.9 overall	Pts. in program	9 males	Tracking reinforcem with delay.
Engmann & Brookshire 9		25-75 yrs. M-53		Schuell - diagnostic ratings in table.	classed as aphasic (Schuell)	10	Non-verbal discr simultan. or success. presen
Brookshire (Dec 1969) 4	[redacted]	25-57 yrs - 39.6		PICA 5.11 - 13.3 overall 20 - 80 % ile		9 males	Track reinforcem
Greenberg 15	1 - 372 mo. Av. 59.4	21-79 M 54.5	CVA trauma epilep. unknown Surgical inter.	Schuell's five	Complete 20 trials (10 S's failed to do this)	30 adults (18 males 12 females)	learning paired associates - diff Study variables M, A, PR
Tik. & Reynolds (1962) 17						15 (11 used in data)	Non-verbal category-sorting
Swinney & Taylor 16		M 48.5 yrs		Schuell - 5 prim. expressive 2 prim. aud. & vis. recept. 1 series up = 11	pass a Visual Numerical Discrimination pre test.	8	Digits - in - o of a list just shown STM (.7s

Controls

Study	Age Range	Classification	# of C's (sex)	Aphasic Group learning ✓	Similar to Norm.?	Task Itself Functional?	Application?
Brookshire (Dec 1968)	45-78 yrs. M-56.4 Med. 52 yrs.	non-aphasic gen. medical patients	8 males	✓	Less eff. strategy	No	✓
E.H. & Moff.	16-60 yrs.	not dysphasic -whenever doubtful.	28				
Car. Car. & Tik.		"Incidental" comparison -no attempt to carefully match "normals"			Yes		
Pizzamiglio Rob.	None	None	None	✓	—	Yes	✓
Tik. (1970)	—	nonaphasics non-brain damaged	10 30	✓	Yes - learning curve similar - not as good.		
Tikofsky & Rey							
Brookshire - March 1971	19-67 yrs M 46.4	nonaphasic pts. Physical Med. no neurologic impairment	9 males	✓	No - delay no effects on normals	No	✓
Eng. & Brook	20-74 yrs. M 47	"controls" staff members & pts VA hosp. - no brain damage hist.	10	✓	Different in difficulty w/ presentation	No	✓
Brookshire (Dec. 1969)	[redacted] 21-74 [redacted] 41.2 yrs.	Nonaphasic	9 males	✓	—	No	✓
Greenberg				✓	Maffects as norm. ✓	Yes	✓
Tik & Reynolds (1962)	19-25 yrs.		20 males	✓	No - relative diff. of category - diff.	No	✓
Swinney & Taylor	47.13 yrs.	nonaphasic adults.	8 (paired for age & ed)	✓	No - diff qualitatively as well as quant.	No	✓

Controls

Study	Age Range	Classification	# of C's (sex)	Aphasic Group learning	Similar to Norm	Task Itself Functional	Application
Tik. & Glazer				✓	Yes - benefit from practice - but reduced rate.	No	
Goehl	?	?	?	✓	more freq. words regardless of length ?	Yes	✓
Aten, Adams, Helmick	?	?	?	✓	Individual pref. - no one training condition best	Yes	✓
Farnsworth		Normal children	70	✓	Like 3rd & 4th gr. in # subtests comp. Unable to select proper cue - go to lower level.	No	✓
Tik. & Berman		not matched	non aphasic non brain dam adults 14	✓	Yes - curves simil. aphasics - fewer correct.	No	✓
Carson & Tik.	~~19-67~~	?	?	Some no-learning. some better than non. ←	Some overlap. Slow - sacrifice Speed for accur. Do better when model provided (feedback) Use variety of strategies appr. to task.	No	?
Rosenberg & Edwards	38-67 M. 57.0	non-brain damaged inpatients geh. med & surgery	5 males	✓	Errors similar to normal, but more & slower.	No	✓

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