

Experimental Analysis of a Treatment Program  
for Alexia Without Agraphia

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There exists an extensive literature on the interesting though rare disorder called "alexia without agraphia" (Benson and Geschwind, 1969; Damasio and Damasio, 1983; Hecaen and Kremin, 1976). This acquired reading disorder is characterized by inability to read, accompanied by unimpaired writing ability. Reading-related skills accessed through other than visual modalities, such as oral spelling or recognition of letters by touch, remain intact.

Lengthy debate extends from the 1800's to the present regarding the nature of the deficits in pure alexia and the neuroanatomical bases of the disorder. It would seem that such emphasis on an uncommon and isolated syndrome is much ado about nothing. However, valuable information on the differentiation of functions within the cerebral hemisphere has been provided. In addition, treatment studies of such a syndrome would surely help clarify some of our efficacy of treatment questions. For instance, an isolated, modality specific disorder such as alexia might provide an exceptional means for testing concepts such as deblocking and intersystemic reorganization (using an intact functional system to improve an impaired function).

In their chapter in Current Therapy of Communication Disorders, LaPointe and Kraemer (1983) suggest such a technique for remediating alexia without agraphia. Their procedure is based on using the intact writing and auditory-verbal channels. The authors point out that not much exists in the literature to substantiate the effectiveness of such techniques. Furthermore, procedures have not been investigated to determine the generalization of skills acquired through such techniques. Therefore, the present study was designed to examine the effectiveness of using writing and oral spelling to improve reading performance of an individual with alexia without agraphia. Specifically the following questions were investigated:

1. Will training through intact graphic and auditory-verbal modalities result in an increase in reading of trained words in an alexic patient?
2. Will such training result in an increase in reading performance on untrained items?

#### METHOD

Subject. The subject for this study, F.C., was a 72 year old right-handed man with alexia secondary to what appeared to be a left posterior cerebral artery thrombotic CVA. The patient and his wife reported a sudden onset of anomia, right hemianopsia and reading problems. CT scans at one and two months post onset revealed extensive infarction in the left occipital lobe coinciding with the distribution of the left posterior cerebral artery. F.C. had an 8th grade education and described himself as a functional reader, regularly reading materials such as the newspaper, Sports Illustrated and racing forms.

On initial evaluation at one month post onset, F.C. showed mild to moderate anomic aphasia with a disproportionately severe reading deficit. Results of the Porch Index of Communicative Ability (Porch, 1981) at

approximately one month post onset are shown in Table 1. A right homonymous hemianopsia was present. There were no sensory deficits or paralysis.

Table 1. Results of the Porch Index of Communicative Ability at one month post onset for F.C.

	PERCENTILE	MEAN SCORE		PERCENTILE	MEAN SCORE
OVERALL	56%	11.42	VISUAL	14%	14.45
VERBAL	81%	13.87	READING	9%	5.30
AUDITORY	88%	14.46	WRITING	70%	9.12
PANTOMIME	87%	13.00	COPYING	20%	9.45

By two months post onset, at the initiation of this study, the anomia and dysgraphia had resolved based on clinical probes. Screening tasks were completed such as completing pictures, scanning for letters, visual matching, and recognizing numbers and colors, and a primary perceptual deficit was ruled out. Performance on the Reading Comprehension Battery for Aphasia (LaPointe and Horner, 1979) showed no comprehension of printed words, although F.C. recognized words spelled aloud, recognized letters by tracing and wrote spontaneously and to dictation. Copying of printed words was slow but generally accurate (Figure 1). It was felt that the pattern of deficits was consistent with a diagnosis of alexia without agraphia.

<p><b>kitten</b></p> <p>k i t t e n</p>	<p><b>waste</b></p> <p>w a s t e</p>
<p><b>fender</b></p> <p>f e n d e r</p>	<p><b>dark</b></p> <p>d a r k</p>

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Figure 1. Sample of words copied by F.C. and F.C.'s spontaneous written formulation.

Stimuli. The stimuli for this study consisted of four sets of printed 1 or 2 syllable words (14 per set) which were randomly chosen from a list of common words used in the Assessment of Intelligibility of Dysarthric Speech (Yorkston and Beukelman, 1981). Each of the sets included nouns, verbs and adjectives. Words were printed on individual cards in lower case  $\frac{1}{4}$ " letters on white background.

Design. The experimental design was a multiple baseline across behaviors (McReynolds and Kearns, 1983) consisting of a baseline phase and sequential treatment phases. Three baseline sessions conducted prior to treatment required F.C. to read aloud each of 56 printed words presented individually in random order. Feedback was not provided. Responses were scored as correct (reading aloud correctly within 15 seconds) or incorrect (erroneously reading the word, no response within 15 seconds, or rejection).

Treatment sessions were conducted at least three times per week. Training was initiated on Set 1 while baselines were maintained on the untrained sets. The order in which sets were trained was randomized. Treatment required F.C. to copy the target word letter by letter, spell aloud as he copied, then attempt to recognize and verbally produce the word. In other words, his own graphic and verbal output served to aid word recognition through the intact auditory channel. Feedback consisted of verbal reinforcement for all correct responses. Incorrect responses were followed by instructions to try again while the experimenter pointed to specific "problem" letters as a cue. If an incorrect response occurred on this cued trial, training proceeded to the next item. The experimenter never verbally labeled items. At the end of each training session a probe of the patient's reading was conducted as in the baseline phase. That is, all items, trained and untrained, were again presented in random order with no feedback. During the probe F.C. did not use writing and spelling; he was simply required to look at the word and say it aloud. Training continued on the first set of stimuli until 80% correct reading of trained items over at least two sessions was achieved on probes. Once criterion was achieved on the first set, the remaining sets were individually and sequentially trained to criterion. Intrajudge and interjudge reliability was determined during phases, resulting in 96% and 92% point-to-point agreement respectively.

## RESULTS

Results suggested that training reading through graphic and auditory-verbal channels produced improved reading of trained words. Baseline and probe data depicted in Figure 2 show that average reading performance during baseline phases was below 30% correct on all sets, yet rates of responding for training items increased significantly when treatment was introduced. F.C. quickly met the 80% criterion on each set during treatment phases. Improvement appeared to result from the training, since gains were correlated with treatment on each training set while untreated sets remained relatively stable until training was initiated.

It is interesting that no improvement occurred on reading of untrained words. Performance failed to generalize beyond specifically trained items. Set 4, which was never subjected to treatment, remained at a baseline rate of responding below 30% correct. Further examination of the data in Figure 2 shows that after treatment, performance on trained sets was maintained at or above the 80% criterion level until Session 15 (approximately  $1\frac{1}{2}$  months after initiating treatment). In other words, up to this point in time,

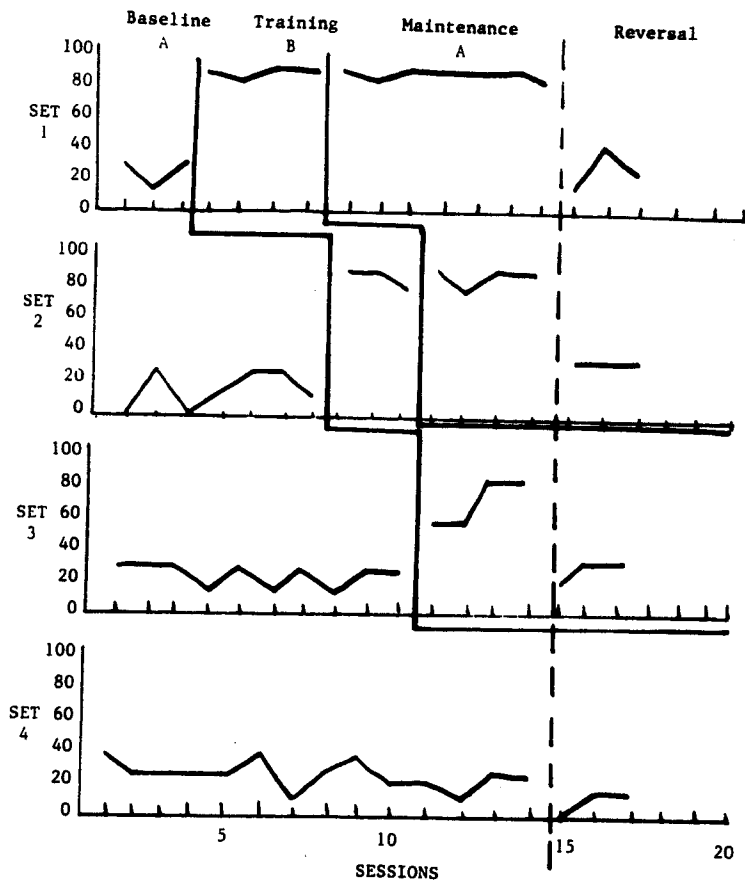


Figure 2. Percent of correct words read on probes across four sets of reading lists during baseline, treatment, and maintenance phases.

treatment of reading through intact channels resulted in improved reading of trained words, but generalization to untrained words did not occur. After Session 15 a marked decrease in correct responses occurred. This was associated with increased neurological deficit. This unexpected "reversal" occurred uniformly across all sets. Unfortunately, an inoperable tumor at the base of the brain was discovered which had escaped earlier diagnosis.

Diagnostically this was a very interesting case so I will diverge slightly to discuss the reversal. The problem which brought F.C. to the hospital originally was, on close examination, felt to be an ischemic infarction; the neurologist and radiologist concluded that the tumor had occluded the left posterior cerebral artery causing a "cerebral vascular" picture. F.D. had remained neurologically stable for over two months. The regression began very subtly and at first was documented only in the decreased performance on treatment tasks. Routine neurologic examinations by two physicians at this time failed to substantiate the neurologic change. Subsequently, F.D.'s performance began to decline rather quickly and the tumor was discovered. Interestingly the collection of carefully controlled data in therapy served as the first and only early clue to neurologic regression.

#### DISCUSSION

This investigation demonstrates that treatment of intact graphic and auditory-verbal modalities resulted in an increase in reading trained words

for an alexic patient. In other words, a disordered function was improved by training through an alternate channel. This result lends support to widely applied but rarely tested approaches such as deblocking and intersystemic reorganization.

This study also demonstrates that, while an altered modality was successfully treated through an intact system, generalization to untrained reading material did not occur. Reviews of generalization literature (Stokes and Baer, 1977; McReynolds and Kearns, 1983; Costello, 1983; LaPointe, 1978) suggest that generalization is not automatic and must be specifically targeted in treatment. The results of this study are in agreement. These results might lead us to question exactly what is meant by effective treatment. For instance, we see here that F.C. learned to read specifically trained words, but did he learn to read? His wife proudly reported that he was beginning to read. F.C. concurred that he was reading headlines and his beloved racing forms. He began to demonstrate limited reading of signs and book covers in the clinic. Yes, he could read some things if he wrote and spelled aloud. He did not read untrained material without this mediating system. What can be concluded?

1. F.C. learned to read a set of trained items on sight.
2. Generalization of the sight reading process to untrained words was not automatic with this amount and type of treatment.
3. F.C. seemed to develop an effective but cumbersome compensated approach to reading using intact graphic and verbal channels.

It is apparent that this was a successful treatment approach for this alexic patient. It is also apparent that the approach did not automatically "reorganize" the reading process to promote generalization of "sight" reading beyond specifically treated items. The results have important implications in our effort to explore treatment efficacy. Wertz (1984) urged us to evaluate our treatment results so that we can become more effective "repairers of language." As he noted "the test of repair is whether the broken gets fixed" (page 65). Perhaps we might extend the analogy to suggest that the test of repair is also recognizing and documenting when we make the system work in the shop but not on the highway, when our repairs produce effective though crude and cumbersome patches, or when the repairs result in an efficient and functional rebuilt system.

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#### DISCUSSION

- Q: You got such a strong visual effect in your results, I wonder if you struggled with the things we struggle with occasionally; that is the application of some of these fancy new inferential statistics packages to single-case research. Did you have any trouble with that, or do any of that?
- A: I didn't do any of that.  
(Note: the reader might refer to Kazdin (1982) and Kitselman, Deal and Wertz (1981) for discussions of statistical analysis in single-case research.)
- Q: I have seen an anomic aphasic patient also, who is alexic without being agraphic. He is also visually agnostic. My aphasic adult also developed the compensatory strategy of reading by writing the word out, spelling it aloud, listening to himself and then decoding the word. With naming he developed the compensatory strategy of reaching out to touch objects to get tactile cues. What is interesting to me is your comment on the cumbersomeness of these compensatory strategies. I found that I could get the patient to use the tactile or kinesthetic imagery by just having him imagine what it would feel like to write it out -- much less conspicuous and a bit less effective -- but I think it heads in an interesting direction.
- A: Yes, I agree. It was unfortunate that this study could not be continued because I think what you describe might be part of what we mean when we talk about reorganization. Perhaps patients start to internalize the strategies so that they don't need the overt activity (writing, feeling, etc.), it becomes some sort of "mental" activity. It is really interesting, though these data can't show this.

- Q: Would you comment on the patient's oral reading skill in relationship to his comprehension skill?
- A: His oral reading was nonexistent though his verbal labeling was excellent. Reading comprehension was tested on matching written words to pictures and the Reading Comprehension Battery for Aphasia (LaPointe and Horner, 1979). These test reading comprehension as opposed to oral reading, so the problem was not that he simply could not orally read; I think it was comprehension. For economy of effort, oral reading was a better task. First of all, I was trying to consistently use the auditory-verbal channel. Also picture-to-word matching would have changed the task demands by limiting the field of choices considerably -- he might have named pictures to himself and used that as the strategy for trying to recognize the written words.
- Q: Do you feel safe in making the inference that the same effect and control that you demonstrated in his oral reading ability also took place in his comprehension?
- A: Of course I can't say that from what was done, but that is what I believe happened.
- Q: Your data would suggest that this patient did not acquire strategies for improvement in reading; he did not generalize to new tasks. But, your anecdote would suggest that he did acquire strategies!
- A: The probes (the data reported on the slides) did not allow him to use the compensatory strategy taught; he was not allowed to write and spell aloud during the probes. Writing and spelling aloud was the training approach (not the goal). I didn't report the treatment data -- on every set trained he went right to 100% correct when using writing and spelling aloud. Obviously I could not score this type performance on untrained items because, in fact, that would have constituted training! The anecdote was a subjective observation of his use of the training approach (writing and spelling aloud) outside of treatment (as a compensatory strategy in reading).
- Q: I'm real curious about the fragility of your treatment effect with this extension of the neurological insult when apparently everything else stayed normal. Would you talk more about that extended neurological insult and your speculations?
- A: Everything else appeared relatively stable with respect to a "neurological examination." I redid the PICA shortly thereafter, and it did show diminished performance across all modalities. But he did not show marked word finding problems or reflex changes. The type and degree of change was not apparent on "gross" examination. His wife thought he was getting "nervous" and more upset about his condition and that is why he wasn't doing as well in treatment. Without sensitive repeated measures his behavior might have been mistaken for depression or variability. Subtle changes were there across all modalities but the only thing that first highlighted the regression was the documented treatment results.