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ABSTRACT

The paper examines the role of morphological (word) cues in reading and considers the implications for deaf students. Theories on the importance of decoding and morphological comparison in competent reading comprehension are reviewed, and studies on how successful deaf readers learn morphological cues are described. Findings show that deaf readers use systems analogous to "sounding out the word" (by mouth movements and translation into finger spelling). The use of the finger spelling strategy is suggested as a way to help deaf students identify more sight vocabulary. Further results are cited to show that deaf Ss can detect morphological regularities between words. The paper concludes with suggestions for helping deaf students improve both their finger spelling decoding and their ability to understand morphological relatedness. (CL)

What deaf individuals bring to the reading task:

A focus on word identification strategies

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Noam Chomsky (1970) suggests that English orthography is optimal. He argues that our writing system strikes a perfect balance between an alphabetic representation that allows readers to "sound-out" the words and a morphological representation that allows readers to detect meaningful relationships between words like telegraph and telegraphy even when they don't sound alike.

Most of the work that has been done on reading and reading acquisition has focused on the alphabetic nature of our writing system. Since the written language is a code for the spoken language, any strategy that enables readers to "crack the code" or to move from print into sound, offers the readers certain advantages. Learning the alphabetic principle--the mapping of letters into sounds--provides just such a strategy. Alphabetic letters correspond rather closely (though not exactly) to sounds in our language. Once the reader has translated or "coded" the print into sound he is aided (1) in word identification -- indentifying words that he knows in sound but not in print; (2) in memory for words -- the ability to retain words used early in a sentence while he is reading the later parts of the sentence; and (3) in whatever advantage is derived from comprehending material in the primary sound-based rather than in the secondary print-based form. That is, there may be some advantage in understanding information in the form in which it was originally learned.

The bulk of the reading acquisition literature, in particular, supports the claim that this translation of print into sound (the so-called decoding and recoding of print) is essential to the young reader's success. It is claimed that decoding of print into sound is one of the major avenues towards proficiency at word identification. Further, proficiency in word identification identifying the meanings of printed vocabulary--is the single best predictor of reading success (Liberman, et al., 1977).

Awareness of the meaningful relationships that exist between words that look alike but arn't pronounced alike, i.e. telegraph and telegraphy or decide & decision, is also a means of promoting word identification. In fact some 50% of an adult reader's written material is comprised of these so-called morphologically complex words. Think about the material that you read for a moment, as you glance at Table 1 on your handout. The morphologically complex words in this passage are circled. You can see that a vast number of the words that we read are complex--composed of simple words with the addition of prefixes or suffixes like er, ness, icity, etc. Translated into real terms, if we as readers know the simple words and a set of rules for appending prefixes and suffixes, we can effectively increase our vocabulary by 100%.

Given these facts, it is surprising that so little has been studied on how the use of morphological (word) knowledge impacts on the reading process. Recent studies by Freyd and Baron (1982), among others, are beginning to shed light on how this second avenue available to readers of the English orthography can interact with reading skill.

In sum, if we buy Chomsky's (1970) analysis, English orthography offers us two means of establishing the word identification skills presumed so essential to competent reading comprehension. The first--decoding, has readers translate print into a sound-based form that is correlated directly with the alphabet and that allows the reader to rely on his natural language. The second, morphological comparison, has readers use their knowledge of specific words and general word-formation rules to discover word meanings through dissection.

The project that we would like to present today focuses on the word identification skills of deaf individuals. We know that deaf individuals experience great difficulty in learning to read English texts (see Moores, 1978; Conrad, 1979, etc.). We also know that part of their problem can be traced to very low vocabulary acquisition or word identification of sight vocabulary within the text (Johnson et al, 1982). Our research project begins to ask--not why these individuals fail, but how those deaf individuals who succeed in reading manage to do so. In particular we ask (1) whether deaf individuals might have an avenue that would enable them to decode print into a language that is both natural and related to the English alphabet and (2) whether deaf individuals are at all sensitive to the morphological consistencies that are presevcd in the writing system. If the answer to either of these questions is yes, then the more successful deaf readers may be approaching vocabulary acquisition in a way that is analogous to that used by hearing readers: in a way that may shed light on new teaching strategies that can help other deaf readers increase their sight vocabularies and their subsequent reading performance. We separately explore the questions of (1) decoding or translation of print and of (2) morphological sensitivity in the experiments that we present below.

Let's begin with the question of decoding. Do deaf individuals have a system that is analogous to the "sounding-out-the-word" system used by hearing readers? Our research suggests an unequivocal answer to this question--YES. In fact, there are two potential ways in which deaf people might capitalize on the alphabetic subsystem within English orthography. One is through articulatory translation (mouth movements). The other is through translation into fingerspelling. Notice how both of these systems can be easily coded onto or correlated with an alphabetic system and how both could be construed in the context of the reader's more natural language depending on the reader's schooling.

A number of studies have suggested that those deaf individuals who were trained in oral schools and who have minimal hearing loss (60 db loss) can adequately use an articulatory coding strategy. Yet, Conrad (1979) has shown that even those students who do decode print into this form, do not reap the benefits of their "internal speech." That is, relative to normal readers who use the same amount of internal speech, the deaf individuals are not profiting from a translation of print into place of articulation.

Other studies, By Treiman and Hirsh-Pasek (1983) among others, note that for congenitally deaf individuals, whose native language is American Sign Language, articulation is not even a preferred mode of translating the print. While there exists some controversy on this issue (see Hanson, in press), a number of studies now maintain that signers are capable of using another coding system that also bears direct relation to the alphabet: a coding system that maps onto that subset of the ASL dictionary that is represented in fingerspelling (Hirsh-Pasek, 1981; Hanson, in press).

For the native signers, a fingerspelling strategy offers several advantages. First, since many signers have sizable fingerspelled vocabularies, the translation of print into fingerspelling or "fingering-out-the-words" may offer them a decoding system that permits them to identify sight words that are in their "spoken" but not in their printed vocabularies. For example they might not recognize the printed word <u>toy</u>, until they fingerspell it to themselves. Second, a number of studies suggest that signers can use a fingerspelling strategy to retain material in short term memory. Third and finally, the translation of print into fingerspelling allows readers to comprehend words in a more primary form that exists as a subset of their mental dictionary. Thus a fingerspelling strategy--used by native signers--seems to offer readers many of the same advantages afforded the hearing reader who translates print into sound.

The only potential disadvantages to this system are: (1) that while deaf individuals do possess fingerspelled vocabularies, their sign vocabularies are far larger. That is, deaf people may not have enough of a fingerspelled vocabulary to make this system truly productive.

(2) That deaf individuals rarely process the fingerspelled words that they do have at the level of a fingerspelled handshape and it is at the level of handshape that the alphabetic print maps onto the language. That is, deaf people are said to process fingerspelled words in units larger than the individual handshapes (i.e., an H or P) that are key to cracking the alphabetic code (Blasdell & Caccamise, 1976 ; and Caccamise, 1977) and;

(3) That even if deaf individuals did analyze fingerspelling into discrete handshapes that map onto print, there is no guarantee that this analysis and use in print would promote the word identification skills presumed necessary to reading comprehension.

Several studies performed in our laboratory begin to address the above concerns. These studies focus on the viability of using a fingerspelling strategy and on its potential merits in promoting word identification skills. In the first study we will suggest that even though deaf individuals process fingerspelling at a level higher than the handshape, they are capable of doing the handshape by handshape analysis that would enable them to map language onto print. The second study suggests that the use of a handshape-letter mapping strategy (decoding into fingerspelling) does indeed elevate word identification skills.

The subjects for these two experiments were second generation deaf individuals all of whom were native users of ASL and attended residential schools for the deaf. The students were all of average or above average intelligence as measured on performance subtests of tests like the Hisky-Nebraska and Merrill-Palmer for the younger children and the WISC for the older children.

For the purposes of this presentation we will only briefly report the experimental procedures and will constrain our focus to those elementary grade students age 6 to 11 all but one of whom are reading at levels between the pre-primer and 3rd grade as measured on the reading comprehension subtest of the Stanford Achievement Test. One 11 year old in our sample has actually attained a 5th grade reading level.

Experiment 1, the segmentation elimination task, was designed to learn whether deaf students were even capable of segmenting fingerspelled words into the discrete handshapes needed for print decoding. A number of studies in the literature (see Blasdell & Caccamise, 1976 for example) report that deaf people process fingerspelling input as whole words or as meaningful subunits of these words. This finding is not unlike that noted among hearing individuals who do not naturally segment the auditory input boy into its three sound components.

The procedure was one borrowed from Fox and Routh (1978) which we have affectionately called the boy - oy experiment. Subjects hear a spoken word, boy and are asked to say the boy without the b producing oy. In our adapted version, subjects see a fingerspelled word, e.g. CAT on a video monitor and are asked what would be left if we took out the C. The students saw 35 of these words, 21 of which were 4-letter words and 14 of which were 3-letter words. The position of the letter to be eliminated also varied across words. An example of the stimuli are offered in Table 2 of your handout.

While this task is not an easy one, the students did remarkably well. Overall, they correctly reported the "word left behind" in 78% of the cases. There was a significant tendency for word length to affect performance, for the students to do better when the word contained 3 rather than 4 letters .

($t(1) = 2.38$, $p < .025$ one tailed). Position of the eliminated letters across the words did not seem to elicit the student's performance. Thus, the students had demonstrated their ability to focus on that level of their fingerspelled vocabulary that would offer them entree to the alphabet. We now ask whether they can use these handshapes to map them onto printed letters and to assist themselves in word identification. Experiment 2 addresses these questions.

Experiment 2 is a word/picture matching task. To their left, students see a set of printed words that are presumed to be in their fingerspelled though not in their sight vocabularies. Some examples are provided in Table 3. There you see that the chosen words are common loan signs (at least in the Philadelphia dialect) or "household" words. To their right, the students saw product examples or insignias like those represented in your handout. Of course, the insignias were randomly distributed on a separate sheet. So, the students might have the word bandaid on a printed list to their left, and the picture of a bandaid canaster--with the words whited out--on a piece of paper to their right. For the first phase of the experiment their job was simply to match the printed word with the product or product insignia. This phase provided a measure of the student's sight vocabulary for these words.

To learn whether a fingerspelling strategy would be beneficial however, one must demonstrate (a) that there is a discrepancy between the student's sight and fingerspelled vocabulary and (b) that an inducement to use the fingerspelled strategy would enhance word identification skills. Hence we bring you the next three phases of the experiment.

In phase two, the experimenter said, "Now I have another list of words that I would like to fingerspell to you. Listen carefully and point to the picture that goes with the word I deliver." The students <u>do not</u> know that the printed and fingerspelled lists are one and the same. Yet, their vocabulary, as expected, is more advanced in fingerspelling than it was in print. On the average subjects identified 4.2 (SD=2.8) more words in phase 2 than in phase 1.

Phase 3 asked that the subjects try again on the sight word list to ensure that there was no practice effect. Since only one child improved his vocabulary by 1 word, we assume no effect of multiple presentations.

Finally, in phase 4 the students are asked to try the sight words just one more time but with the added incentive to "fingerspell the words to yourself to see if it helps you in getting more words."

The results were most interesting. An overwhelming number of the children, 10 out of 11, improved their vocabulary score. Further, many were stunned, for the first time realizing the connection between something they know, i.e. fingerspelling and the printed word. The increase in vocabulary was modest, an average of 3.29 words, but the result was highly significant ($t(1)=3.96$, $p < .005$).

It appears that deaf students not only <u>can</u> use this strategy, but that the use of this strategy would assist them in identifying more sight vocabulary. Independent converging evidence on the merits of fingerspelling decoding also suggests that translation of print into fingerspelling correlates positively and significantly with reading success (Hanson, in press). In sum, deaf students do have an inroad to the English alphabet from within their natural language.

Thus far we have only discussed word identification through alphabetic representation. But as we suggested earlier, a second avenue of word identification through morphological similarity or word relatedness is also available to the reader. That is, English orthography often retains similar spellings for words that are related in meaning even when these words vary in pronunciation. Some examples are listed in Table 4. One might suspect that this avenue of word identification would be even more profitable for deaf individuals who lack the inherent advantages of spelling to sound correspondance. The analysis of word relations can occur at a more visual level of inspection. Of course, not all words that "look alike" are related in meaning (e.g., pun→punster but, ham↛hamster). Yet a large number of our words are morphologically complex and do bear visual similarities.

Time will not permit us to purview all of the research that is currently going on in our laboratory. We would, however, like to whet your appetite with some of our preliminary results on the deaf reader's sensitivity to and understanding of morphological cues. The subjects for the experiments are 10 second generation, congenitally deaf adults. All of the subjects are native users of ASL and have above average reading levels as assessed on the reading comprehension subtest of the Stanford Achievement Test Level III(mean reading level = 9.7). The 3 experiments in which they participated are outlined in Table 5 on your handout.

Experiment 1 is borrowed from a study by Freyd & Baron (1982). Here subjects are asked to circle word pairs that are related in meaning. Experiment 2 requests that subjects analyze the printed words into their component prefixes, suffixes and root word. Experiment 3 then tests for the subject's productive understanding of morphological rules and meanings. They are asked to choose among morphologically complex nonsense words to determine which of these words would best suit a particular sentence context.

The results from these experiments reveal that in the "best case", the successful deaf readers are attuned to the morphological cues that are preserved in the English orthography. The preliminary results from these experiments are also presented in Table 5 in your handout. You see that these readers are performing at levels well above chance on these tasks.

whether or not they use their knowledge in the course of fluent reading and whether the acquisition of word analysis strategies in younger children would actually benefit reading is currently under investigation.

In sum, then, the results of the experiments presented here today point to the capabilities--not the weaknesses that deaf individuals bring to the reading task. The same two inroads that enable hearing readers to master word identification are theoretically available to deaf readers. They can use a fingerspelling decoding strategy that is (1) related to alphabetic representation and (2) that increases word identification ability. Further, they can detect morphological regularities between words. Both of these processes can be used to predict or secure the meaning of newly encountered printed words.

Having suggested that deaf individuals do have these skills, we would like to close by raising the question most relevant to this conference: How can we translate these theoretical findings into practice? How can we increase our students's written vocabularies and guide them towards reading proficiency? Here our ideas can be only speculative, but we have taken the liberty of listing some applications of this research in Table 6 of your handout.

I. With regard to fingerspelling decoding:

1st: make sure that the children have a store of fingerspelled words. Introduce these in class so that there is a common bank of words that can later be used in reading instruction.

2nd: Train the students in handshape-fingering rules. Show them the relationships between what they read and what they know. Such a process may also instill in them the idea that print is meaningful.

3rd: Have the children create books using the new words that they have learned. One might also let the students swap books so that all get practice in reading and in writing. This way students learn that words do not exist in isolation of connected text.

4th: Finally, continue to build their store of words-relating the words to signs for better comprehension--so that the students are prepared for more advanced standard readers.

II. With regard to morphological relatedness:

Present some of the words above as word pairs--either printed or in fingerspelling. Structure these pairs so as to highlight particular rules like word + er → person who. Then see whether the students can (1) generate new words and guess the meanings, and (2) can abstract the meanings of newly encountered complex words that they see in the text.

Exercises like these that have been sketched above begin to ask how readers--with the capabilities that they bring to the task--can take advantage of the material they they are required to master. Because much of this research is in progress, the results are tentative. Yet, the direction is theoretically sound and is encouraging. In a couple of years we hope to be able to report on how the training studies eminating from this research actually impact on reading scores. Until then we can only alert you to the promising directions that have been exposed by these research techniques.

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Table 1

During the past decade, psycholinguistics has been profoundly affected by the impact of structural linguistics. Psychologists have come to recognize that verbal output and comprehension are guided by "rules," so that unique sentences can be produced and understood by speakers in the same speech community. Currently, performance models are beginning to be developed which can account for speech, imitation, comprehension, and other forms of performance, and studies are being made of the development of these abilities in children and of the interpretation of deviant utterances.

Susan M. Ervin-Tripp
Sociolinguistics
in Language, Culture and Society
Ed. : Ben Blount 1974

Example of morphologically complex words and word relations.

Table 2

The segmentation elimination task
examples of stimuli and results.

A. Examples:

Word	Letter eliminated	Desired response
crow	r	cow
fact	c	fat
bet	t	be
sit	s	it

B. Results:

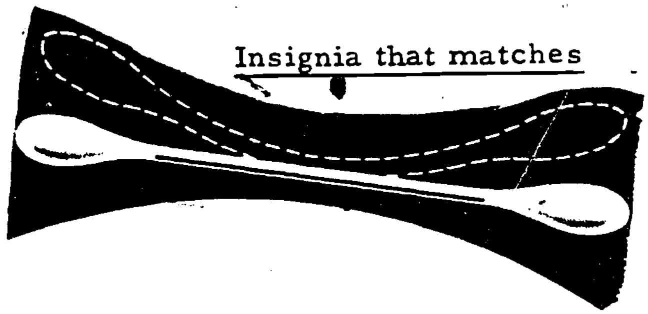
	3-letter words	4-letter words	differences
Mean % correct	82.6	72.6	10
Standard deviation	18.7	28.	

N = 11 $p < .025$ one tailed

Table 3

The word-picture mapping task

A. Examples

Printed word	Insignia that matches
BANDAID Q-TIP COFFEE YOGURT	

B. Results

Sight word vocabulary

	Before Strategy	After Strategy	Difference
Mean words correctly identified	9.27	12.55	3.27
Standard deviation	6.4	6.4	

N = 11 $p < .005$

Table 4

Examples of morphologically related words

vain	vanity	related words with pronunciation change
courage	courageous	
divide	division	
teach	teacher	related words with no pronunciation change
go	going	
kiss	kissed	

Table 5

Morphology Experiments
"word relatedness"

Experiment I : Word relation task

A. Examples:

corn	corner
burn	burner
ham	hamster
pun	punster

B. Results:

Subjects score well above chance

mean % correct	91
standard deviation	6.99

N = 10
$p < .001$

Experiment II: Prefix| Suffix Test

A. Examples:

	prefix	base	suffix	suffix
unfortunately	un	fortune	ate	ly
prepayment	pre	pay	ment	

B. Results:

mean morphemes segmented	80.44
standard deviation	14.81

N = 10
$p < .005$

Experiment III: Word Box Test

A. Example:

kalk kalks, kalkative, kalking, kalked

He is a very ______________ boy.
He ______________ every day.
When he ______________ he is happy.
He ______________ for two hours one day.

B. Results:
Subjects respond well above chance across 3 word box tasks in choosing the appropriate word.

Mean % correct	=	78.3
Standard deviation	=	20.5

N = 10
$p < .01$

Table 6

I. With regard to fingerspelling decoding:

1st: make sure that the children have a store of fingerspelled words. Introduce these in class so that there is a common bank of words that can later be used in reading instruction.

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