Abstract. Deaf adults' knowledge of English word structure was tested in a task requiring letter report for finger-spelled words, pseudowords, and nonwords. Deaf subjects, like hearing subjects, were sensitive to orthographic structure as indicated by accuracy of letter report: Letters of words were reported most accurately, while letters of pseudowords were reported more accurately than letters of nonwords. Analysis of the incorrect letter reports for correctly recognized words revealed that deaf subjects tended to produce orthographically regular responses. However, in contrast to the reports of hearing subjects, the responses of deaf subjects did not tend to be phonetically consistent with the presented word. These results provide clear evidence that deaf adults are able to abstract principles of English orthography, although the phonetically inconsistent letter reports suggest that the spelling process for deaf persons may be fundamentally different from that for hearing persons.

The present research examines the use of orthographic structure by prelingually and profoundly deaf adults. The orthography of English reflects the phonological structure of the spoken language. As a result, segments of

#An earlier version of this paper was presented at the meeting of the American Psychological Association, Los Angeles, August, 1981.

Acknowledgment. I am grateful to many people for their help on this project. First, I would like to thank Carol Padden for making the stimulus tape. I would also like to thank the people who made arrangements for facilities and subjects for the reported experiment and for pilot work: Nancy Fishbein, Nancy Frishberg, Peg Hlibok, Gary Scharff, Dennis Schemenauer, and Marie Taccogna. The cooperation of the following organizations and institutions is gratefully acknowledged: National Center on Deafness at California State University, Northridge; New York University; New York Society for the Deaf; Connecticut Commission for the Deaf and Hearing Impaired; and the Linguistics Research Laboratory at Gallaudet College. John Richards graciously helped with portions of the data analysis. The handshapes in Figure 1 were drawn by John Conti. Portions of this research were conducted while the author was a postdoctoral fellow at The Salk Institute for Biological Studies. The work was supported by the National Institute of Education Grant #NIE-G-80-0178 and by NINCDS Research Service Award #NS06109 and NICHD Grant HD-01994.

the written language map onto segments of the spoken language. The question here is whether deaf adults, in the absence of normal speech input, are able to abstract the regularities of English orthographic structure.

Ability to use the regularities of the orthography is an important component both in word recognition and in spelling. Research on word recognition with normally-hearing adults has found that there is an advantage in letter recognition for orthographically regular nonsense words (pseudowords) over orthographically irregular nonwords (Aderman & Smith, 1971; Baron & Thurston, 1973; Carr, Davidson, & Hawkins, 1978) and an advantage in letter recall for these regular over irregular nonsense words (Gibson, Pick, Osser, & Hammond, 1962).

In spelling, the ability to access and exploit the orthographic regularities of English is a factor determining spelling success. While accurate spelling of words can result from rote memorization or from visual recognition of the correct spelling from a collection of possible spellings (Simon & Simon, 1973; Tenney, 1980), these strategies ignore the systematic aspects of English orthography (Chomsky, 1970; Klima, 1972; Venezky, 1970). Recent work by Fischer (1980) has shown that good spellers have greater ability to exploit these regularities of the orthography than do poor spellers.

To date, little work has been concerned with the question of use of orthographic structure by deaf individuals. One study that has been directed at this issue is that of Gibson, Shurcliff, and Yonas (1970). Testing for recall of tachistoscopically presented pseudowords and nonwords, they found that deaf adults, like hearing adults, correctly recalled more of the orthographically regular than of the orthographically irregular letter strings. Similar findings were obtained by Doehring & Rosenstein (1960) in an experiment with deaf children (ages 9-16 years). They found better recall of CVC trigrams (pseudowords) than of CCC trigrams (nonwords). These findings led Gibson et al. (1970) to conclude that "The redundancy contributed by invariant mapping of speech sounds may well make it easier for the hearing child to pick up the common spelling patterns and regularities as he learns to read, but clearly it can be done without this" (p. 71).

The present research examined their conclusion. The ability of deaf adults to use orthographic structure in word recognition and in reporting the letters of words was tested. Deaf subjects in this research were all congenitally and profoundly deaf adults. These persons are unable to acquire knowledge of speech by normal means. Since the orthography of English reflects the structure of the spoken language, these deaf adults may be expected to be less able than hearing adults to acquire knowledge of this structure and to use it. If, however, as suggested by Gibson et al. (1970), ability to acquire knowledge of orthographic structure does not depend on availability of normal speech input, then deaf adults may still be able to acquire this knowledge. To investigate whether these deaf adults differ from hearing adults in the use of orthographic structure, the performance of a group of normally-hearing subjects was compared with that of deaf subjects.

The use of orthographic structure was investigated testing recognition and recall of fingerspelled letter strings. Fingerspelling is a manual communication system based on English in which words are spelled out by the
sequential production of letters of the manual alphabet. As shown in Figure 1, the American manual alphabet has a handshape for each letter of the English alphabet. Fingerspelling is used both in American Sign Language (ASL or Ameslan) and in manual communication systems based on English.

In fingerspelling, words are presented as a temporally sequential display of individually produced letters with an average presentation rate of 20 msec per letter (Bornstein, 1965). Letters are displayed with the hand held in one spatial location. For printed letters, display characteristics such as this make word recognition difficult. With sequential presentation of printed letters displayed in one spatial location, normally-hearing readers can accurately name words only when the duration of each letter is at least 375 msec (Kohlers & Katzman, 1966). Even when the printed letters are spatially distinct, ability to read words is dramatically reduced for sequentially displayed individual letters compared with multi-letter displays (Newman, 1966). Fingerspelling provides an interesting case in word recognition in that fingerspelled words can be recognized at rates that are difficult for the recognition of sequentially presented printed letters. For this reason, a secondary goal of the present research was to examine skilled reading of fingerspelling.

A sequential presentation of letters might suggest sequential recognition of individual letters. However, it may be that, similar to the recognition of printed words, orthographic structure is used in the recognition of fingerspelled words. Since it has been demonstrated that there are "co-articulatory" effects in skilled fingerspelling, with letter context influencing letter production (Reich, 1974), this could allow for the use of orthographic structure in word recognition.

In the present experiment, fingerspelled words, pseudowords, and nonwords were presented to deaf and hearing adults skilled in the use of fingerspelling. If orthographic structure is used in processing the fingerspelled stimuli, then letters of orthographically regular nonsense words should be recalled more accurately than letters of orthographically irregular nonsense words. Errors in letter report for words were analyzed to examine orthographic regularities in production for both deaf and hearing subjects.

METHOD

Stimuli

Sixty stimulus items were used. Thirty were real words chosen from samples of words found misspelled in writing by deaf adults. These words ranged in length from five to thirteen letters, mean length being 8.3 letters per word. The words ranged in frequency of occurrence from 1 - 190 (median of 10.5) according to Kucera and Francis (1967). These thirty words were matched in mean length with 20 orthographically regular pseudowords (e.g., BRANDIGAN, MUNGRATS, VISTARMS) and 10 orthographically irregular nonwords (e.g., FTERNAPS, PKANT, VETMFTERN). The selection criteria for the orthographically regular and irregular words were in accord with the criteria outlined in Appendix A of Massaro, Venezky, and Taylor (1979). According to these criteria, the regular strings (pseudowords) were pronounceable and had ortho-
Figure 1. Handshapes of the American Manual Alphabet.
graphically legal spelling patterns. The irregular strings (nonwords) contained unpronounceable consonant clusters. A complete listing of the stimuli is given here in the Appendix.

Stimuli were recorded on videotape by a deaf native signer of ASL (i.e., a person who had deaf parents and had learned ASL as a first language). The signer made no mouth movements nor facial expressions that would indicate the lexical status of items. Measurement of the length of each recorded item revealed a mean presentation rate of 354 letters per minute. This rate is consistent with the rate found by Bornstein (1965) to be a natural ASL rate. The production rate for the thirty words did not differ from the production rate for the other thirty items, \( t(58)=1.87, p>.05 \). Words, pseudowords, and nonwords were mixed throughout the list. Following each item, a blank interval of approximately 10 seconds was recorded for use as a response period.

Procedure

Subjects were instructed that they would see many fingerspelled items and that for each they were to make two responses: First, write the letters of the item they had just seen; second, make a lexical decision. They were to circle YES or NO on their answer sheet to indicate whether they thought the presented letter string was or was not an actual word. The instructions, signed in ASL, were recorded on videotape.

Subjects were run in groups of one to six persons. The entire experiment lasted approximately 30 minutes.

Subjects

A group of deaf subjects and a group of hearing subjects were tested. Subjects in both groups had deaf parents and had learned fingerspelling from their parents.

Deaf subjects were 14 congenitally deaf adults recruited through New York University and California State University, Northridge. All were profoundly deaf. There were six women and eight men, ranging in age from 17 – 53 years, median age 28.5 years.

Hearing subjects were recruited through interpreter services in Connecticut and New York. There were five women and three men ranging in age from 22 – 49 years, median age 29 years.

RESULTS AND DISCUSSION

To examine possible processing differences for the two groups, the eight hearing subjects were matched in overall accuracy with eight deaf subjects. Overall accuracy was determined for each subject as the percentage of correct responses across conditions. Only items for which there was both a correct lexical decision and a correct report of all letters were considered to be correct responses. Overall, hearing subjects had an accuracy rate of 43.7% (range 21.7% – 65.0%). Eight deaf subjects, whose accuracy was in the middle
of the performance range for the 14 who participated, performed at a comparable level. Overall they were 40.8\% accurate (range 20.0\% - 70.0\%), which was not significantly different from the accuracy of the hearing subjects, t(14)=.34, p>.05. Further analyses are based on these two matched groups of eight subjects each.

**Lexical Identification**

Mean overall accuracy for the lexical decision task was 85.5\%. Analysis of group (deaf, hearing) by stimulus type (words, pseudowords, nonwords) found that there was no significant difference in accuracy across stimulus type, $F(2,28)=.88, MSe=70.06, p>.05$, nor was there an interaction between group and stimulus type, $F(2,28)=.74, MSe=70.06, p>.05$. There was a tendency for deaf subjects to perform this task more accurately than hearing subjects, although the difference only approached significance, $F(1,14)=3.00, MSe=339.35, p<.20$. The performance of both groups of subjects in this task is shown in Table 1.

<table>
<thead>
<tr>
<th></th>
<th>Deaf</th>
<th>Hearing</th>
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</thead>
<tbody>
<tr>
<td><strong>Lexical Decisions</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Words</td>
<td>91.7%</td>
<td>80.4%</td>
</tr>
<tr>
<td>Pseudowords</td>
<td>89.4%</td>
<td>84.4%</td>
</tr>
<tr>
<td>Nonwords</td>
<td>88.8%</td>
<td>77.5%</td>
</tr>
<tr>
<td><strong>Word Identification</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>correct lexical decision</td>
<td>93.0%</td>
<td>92.6%</td>
</tr>
</tbody>
</table>

To ensure that this high accuracy could not have been due to some non-linguistic cue to wordness of the stimulus items (e.g., facial cues or "awkward" production of pseudowords and nonwords), eight hearing adults, naive with respect to fingerspelling, were asked to make lexical decisions regarding the stimuli. They viewed the videotape and were told that for every fingerspelled item they were to circle YES or NO on their answer sheet to indicate whether or not they thought the item was an actual word. This group of naive adults was only 49.2\% accurate in the task, a rate that does not differ from chance performance, $x^2(1)=.05, p>.05$. Therefore, the high accuracy of the two groups of deaf and hearing subjects in this task can be attributed to their knowledge of fingerspelling.
The whole report technique of the present experiment allowed for a
determination as to whether or not there was correct identification of words.
Three types of response errors were considered to be failures to identify the
word. First were those responses on which more than 50% of the letters were
omitted. These omissions were rare; only three such errors were made (by deaf
subjects). The second source of error consisted of responding with a
morphologically incorrect form of the word (e.g., baptized for BAPTIZE) and
accounted for three errors of the deaf subjects and five errors of the hearing
subjects. The third source of error consisted of responding with the wrong
word (e.g., complicate for COMMUNICATE), accounting for five errors of the
deaf subjects and nine errors of the hearing subjects. Table 1 presents
subjects' accuracy of word identification given a correct lexical decision.
Deaf and hearing subjects did not differ in their accuracy on word identifica-
tion, \( t(14) = .09, p > .05 \).

These latter two sources of error in lexical identification appear to
result from guessing the word on the basis of a few letters. It should be
pointed out that this strategy of identifying a word on the basis of a few
perceived letters is not a bad one in normal conversations. In these
conversations, letters of fingerspelled words are often omitted or sloppily
produced (Caccamise, Hatfield, & Brewer, 1978), but within the syntactic and
semantic context provided by the conversation, word identification from
partial information is possible. In the present task, however, recognition of
only a few letters led to the errors in lexical identification. These errors
resulted both in incorrectly identifying actual words and in incorrectly
responding that pseudowords and nonwords were words (e.g., raps for RAPAS and
veteran for VETMFTERN).

**Letter Report Accuracy**

Given a correct response on the lexical decision task and a correct
lexical identification of the words, how accurate were subjects at reporting
all the letters of an item? A summary of this performance by the two groups
on each word type is shown in Table 2. An analysis of the percentage correct
was performed on group (deaf or hearing) by word type (word, pseudoword,
nonword) for trials on which there was a correct lexical decision and
identification. The analysis revealed a strong effect of word type,
\( F(2,28) = 170.03, \text{MSE}=129.32, p < .001 \). This difference was significant between
all word types (Newman-Keuls, \( p < .01 \)), thus indicating effects of word famili-
arity (letters of words better recalled than letters of pseudowords) and
orthographic structure (letters of pseudowords better recalled than letters of
nonwords). There was no main effect of group for accuracy of letter report,
\( F(1,14) = 1.65, \text{MSE}=368.33, p > .05 \), but there was an interaction of group by word
type, \( F(2,28) = 6.70, \text{MSE}=129.32, p < .005 \). Analysis of the simple effects
revealed that the two subject groups differed in letter report accuracy for
words, \( F(1,28) = 13.93, p < .001 \), but did not differ significantly in letter report accuracy for pseudowords, \( F(1,28) = .00, p > .05 \), or nonwords, \( F(1,28) = .29, p > .05 \). Thus, the interaction of group by word type was due to greater
accuracy by hearing than deaf subjects on letter report for words.
Table 2

Mean percentage correct report of all letters given a correct identification of words and a correct lexical decision for the pseudowords and nonwords.

<table>
<thead>
<tr>
<th></th>
<th>Deaf</th>
<th>Hearing</th>
</tr>
</thead>
<tbody>
<tr>
<td>Words</td>
<td>70.2%</td>
<td>92.3%</td>
</tr>
<tr>
<td>Pseudowords</td>
<td>30.7%</td>
<td>31.4%</td>
</tr>
<tr>
<td>Nonwords</td>
<td>9.3%</td>
<td>6.0%</td>
</tr>
</tbody>
</table>

If subjects were using orthographic structure in the processing of words and pseudowords, there should be nonindependence of letter report for these stimuli. That is, the probability of letter report of a given letter should be a function of the probability of the recall of the other letters in the word. This interdependence of letter report would not be expected to be involved in letter report for nonwords, however, since principles of English orthography are violated in these nonwords. Tests for independence of letter report were performed separately on words, pseudowords, and nonwords. Independence is indicated if the following equation holds:

\[ p(\text{all letters of an item}) = p(\text{individual letter})^n \]  

(1)

where \( n=\) number of letters in the word.

Analyzing for group (deaf or hearing) by word length by probability (all letters vs. individual letters), it was found that for words and pseudowords the probability of correctly reporting all the letters of the item was greater than the probability of reporting the letters independently: for words, \( F(1,14)=71.71, \text{MSE}=263.40, p<.001 \); for pseudowords, \( F(1,14)=26.95, \text{MSE}=285.02, p<.001 \). The effect did not interact with subject population for either the analysis of words, \( F(1,14)=.22, \text{MSE}=263.40, p>.05 \), or pseudowords, \( F(1,14)=.81, \text{MSE}=285.02, p>.05 \). Thus, the letters of words and pseudowords were not processed independently. However, for the fingerspelled items that violated orthographic structure (the nonwords), the probability of correctly reporting all the letters of the item was not greater than the probability of independently reporting each letter, \( F(1,14)=1.98, \text{MSE}=103.43, p>.05 \). For nonwords, therefore, the letters were processed independently. As before, there was no interaction with subject group, \( F(1,14)=1.35, \text{MSE}=103.43, p>.05 \).

These results give evidence for the ability of deaf adults to use orthographic structure. Similar to the orthographic structure effects previously reported for deaf adults by Gibson et al., (1970), the present study found greater accuracy in letter report for pseudowords than nonwords. In accord with these findings, the nonindependence of letter processing for words and pseudowords indicates interdependence of letter processing. That is, processing of a given letter was influenced by other letters of the word or
pseudoword. There were also other indications that deaf and hearing subjects in the present experiment were aware of violations of English orthography: When the fingerspelled nonwords were presented, subjects often laughed. Generally a look of surprise would appear on their faces at these violations of orthographic structure.

Together, the above results also clearly indicate that orthographic structure is used in processing fingerspelling. They indicate that even though letter presentation is temporally sequential, letter processing is influenced by surrounding letters. Since there are coarticulatory effects in skilled fingerspelling, it is reasonable to assume that a fingerspelled letter contains information about adjacent letters. A skilled fingerspeller would, therefore, be expected to make use of this context information in word recognition (see Wickelgren [1969, 1976] for a discussion of context-sensitive coding in speech). This context-sensitivity may explain how the fingerspelled letters can be processed so much more rapidly than sequentially presented printed letters.

In addition to the effects of orthographic structure, word familiarity effects were found here. These word familiarity effects, involving better recall of letters of words than letters of pseudowords, are consistent with the greater accuracy of letter report for letters of printed words than for letters of printed pseudowords (Manelis, 1974; Spoehr & Smith, 1975). A word superiority effect of fingerspelled words over fingerspelled nonwords, consistent with the present findings, has been reported earlier by Zakia and Haber (1971).

Some theorists attribute the word familiarity effect to the fact that words allow for holistic recognition of visual configurations. However, it is unlikely that this interpretation can account for the present results for the following reason: The majority of stimulus words would rarely, if ever, have been seen as fingerspelled words by the subjects prior to this experiment because the words would tend to be signed rather than fingerspelled in signed conversations. The familiarity that the subjects have with these words, therefore, would be with the printed form of the word. This situation is analogous, perhaps, to that of the recognition of mixed-case printed words in that the orthographic integrity of the words is preserved, but the visual configuration is disrupted. Studies have found the while there is a perceptual advantage for same-case over mixed-case words, word familiarity effects are obtained with mixed-cases, indicating that the word familiarity effect need not be totally attributable to holistic word recognition (Coltheart & Freeman, 1974; McClelland, 1976). What, then, contributes to superior letter report for words in the present experiment?

Two factors appear to be involved. The first is that the associations between letter sequences of words should be stronger than the associations for the sequences of permissible although novel items. These stronger associations would allow more perceptual facilitation of letters for words than pseudowords (Adams, 1979). Thus, the letters would be more accurately recognized for words than for pseudowords. The second factor contributing to the word familiarity effect is one of memorability. Pseudowords and nonwords
Figure 2. Mean percentage occurrence of each error type for deaf and hearing subjects.
represent novel letter sequences. The subjects must recall the letters based on a single presentation. But for words, once the word is recognized, the subjects are able to bring their productive spelling abilities to bear on the task of letter report. Incorrect letter reports for these words, in this respect, represent spelling errors.

**Incorrect Letter Reports for Words**

Each incorrect letter report for a correctly identified word was scored in three ways: (1) each was classified as to whether or not the reported letter string produced a sequence that preserved the phonetic structure of the presented word, (2) each was classified as to whether the reported sequence was orthographically regular or irregular, and (3) each was classified as to the type of error.

For hearing adults and children, the predominant form of spelling error is a phonetically consistent but orthographically incorrect rendering of the intended word (Fischer, 1980; Frith, 1980; Masters, 1927). In these misspellings, each phonetic segment of the word is graphemically represented in the order of occurrence. The phonetic structure is therefore maintained in the misspelling. Did the incorrect responses for words in the present experiment preserve the phonetic structure of the words presented? Analysis revealed that the hearing subjects made more incorrect letter reports phonetically equivalent to the target word than did the deaf subjects, $X^2(1) = 10.01, p < .005$. For hearing subjects, the mean percentage of such responses was 63.6%; for deaf subjects, the corresponding percentage was only 18.6%.

But while the letter reports for deaf subjects were not consistent with the phonetic structure of the target word, by and large, the responses were orthographically regular. Orthographically regular words, in accord with Massaro et al. (1979), were both pronounceable and contained only legal consonant and vowel clusters. For deaf subjects, 93.8% of the incorrect responses were regular English letter sequences. For hearing subjects, 95.8% were regular. There was no difference in the frequency of deaf and hearing subjects making such responses, $X^2(1) = .62, p > .05$. This indicates that, like hearing adults, deaf adults have a definite knowledge of English orthographic constraints.

The incorrect letter reports were further classified using the following categories of error type: letter deletions, substitutions, insertions, and transpositions. As shown in Figure 2, a major difference in error type for deaf and hearing subjects was the tendency for deaf, but not hearing, subjects to order the letters of words incorrectly, resulting in a transposition of phonetic segments. Some examples are adveristement for ADVERTISEMENT, funreal for FUNERAL, hemsiphere for HEMISPHERE, viedo for VIDEO, and vechile for VEHICLE. While deaf subjects made 17 errors of this type (representing 23.9% of their total errors), only 1 such error was made by hearing subjects (7.7% of the total). For hearing persons, the incidence of letter transpositions is generally so low that it may be possible to account for all the errors in spelling experiments without even including a category for letter transpositions (Fischer, 1980). It is interesting to note that none of these transpositions preserved the phonetic structure of the words. In all cases the transposed letters incorrectly ordered phonetic segments.
Little work has been undertaken to understand the spelling process for deaf persons. The present finding of the low percentage of letter reports phonetically equivalent to the target is of great interest as it suggests that the cognitive processes underlying spelling for deaf adults may be fundamentally different from those underlying productive spelling for hearing adults. Models of the spelling process for hearing persons commonly hypothesize that productive spelling involves generating a phonetic representation of the target word and then generating possible orthographic realizations of this representation (Frith, 1980; Simon & Simon, 1973). These models therefore account for the tendency of hearing persons to make misspellings that preserve the phonetic structure of the intended word.

The low incidence of phonetically consistent letter reports by the deaf adults in this experiment suggests that the spelling process of deaf persons is not well described by these models. The few studies that have been concerned with the spelling process for deaf persons have been conducted with deaf children. Dodd (1980) examined the spelling of words by orally-trained deaf children in England. The task in Dodd's experiment was to lipread words pronounced by the experimenter and then spell the words. The children (mean age 14.5 years) made only about 11% misspellings that were classified as reflecting the phonetic structure of the pronounced words. It should be noted, however, that 64.8% of the children's errors were classified as "refusals" to spell the pronounced word. If only the actual misspellings of the children are considered in Dodd's data, the incidence of phonetically consistent misspellings is 31.5%.

In another experiment designed to determine the underlying spelling processes of deaf children, Hoemann, Andrews, Florian, Hoemann, and Jansema (1976) found that few of the misspellings of the deaf and hearing-impaired children they tested could be considered phonetically equivalent to the target word. Children in their experiment were ages 6 - 19 years and were being educated with the Rochester Method (combined speech and fingerspelling). The children were presented with pictures of objects and were asked to spell the name of each of the objects. Earlier work had found that the majority of misspellings made by hearing children on this task were phonetically consistent with the target word (Mendenhall, 1930). No more than 19% of the misspellings of the children tested by Hoemann et al. could be considered phonetically equivalent to the target.

Cromer (1980) analyzed samples of free writing from six orally-educated deaf children in England (median age 10.5 years). By Cromer's analysis, 52.25% of the misspellings of the deaf children were "phono-graphic errors," defined as resembling "in some respect the sound of the target word when pronounced" (p. 412). By this definition, errors such as basking for "basket" and amanals for "animals" were scored as phono-graphic errors. Thus, not all these phono-graphic errors would be phonetically consistent with the target. Examining Cromer's corpus of errors according to the present concern of phonetic misspellings, it is apparent that only few of the misspellings can be considered to be consistent with the phonetic structure of the intended word.

One final point is worth mentioning. The deaf children studied by Cromer (1980) made transpositions similar to those made by the adults in the present study. Cromer classified these transpositions and ordering errors under the
category "Visual Errors." While this type of error accounted for 15.75% of the errors made by the deaf children in his study, no such errors were made by the normally-hearing control children. As with the present findings, these ordering errors did not preserve the phonetic structure of the target word.

Together, these studies with children and the present one with adults are consistent, a consistency that is especially striking given the differences in methodology of these studies and the differences in the age and language background of the subjects. These studies converge on the finding that deaf persons do not make phonetically consistent spelling errors to the degree that hearing persons do. The suggestion from these findings is that the spelling process for deaf persons may be fundamentally different from the spelling process for hearing persons. In comparison with hearing persons, it appears that deaf persons may make less use of a stored phonetic representation of words when spelling. The types of errors they make appear to be consistent with what Ellis (in press) terms as errors based on "partial lexical knowledge" in which the speller knows "some but not all of the letters, or all of the letters but not the correct order." While the errors of deaf adults in the present experiment were often consistent with this definition, it should be borne in mind that deaf signers may have additional strategies available to them.

One strategy of deaf signers in the present experiment deserves mention: Very often the deaf subjects fingerspelled items on their hands before writing their responses. This fingerspelling often allowed them to try different spellings in an effort to decide the correct letter sequence. This "trying out" spellings should not be thought of as equivalent to the strategy of writing down various spellings of a word to determine which "looks" correct. The deaf subjects occasionally employed this strategy also. Rather, the manual strategy seems more to determine which spelling "feels" correct. Often subjects did not even look at their hands while trying out the letter sequences. Often the hand they were not using for writing their answers was held under the table as they fingerspelled the different sequences. This suggests, therefore, that whereas a component of the spelling process for hearing persons is phonetic, a component of the spelling process for deaf signers may be kinesthetic.

CONCLUSIONS

The present experiment clearly indicates that deaf adults are able to make use of orthographic structure. This was shown both in the recall advantage for orthographically regular over orthographically irregular letter strings, similar to the findings of Gibson et al. (1970), and in the analysis of errors in letter reports for words. These results support the conclusion of Gibson et al. that while the mapping of speech sounds to graphemes may facilitate the acquisition of orthographic structure for hearing persons, congenitally and profoundly deaf persons are, nevertheless, able to acquire this knowledge.

The analysis of letter report errors for words indicates that the deaf adults were sensitive to the orthographic regularities of English in their productions. But in contrast to the hearing adults, the responses of deaf
adults were not consistent with the phonetic structure of words. These results suggest that deaf adults may use orthographic but not phonetic structure when spelling.

A secondary goal of the present research was to examine recognition of fingerspelled words. The work suggests that signers, both deaf and hearing, make use of orthographic structure in the processing of fingerspelling.

REFERENCES


## Appendix

<table>
<thead>
<tr>
<th>Words</th>
<th>Pseudowords</th>
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<tr>
<td>ADVERTISEMENT</td>
<td>BRANDIGAN</td>
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<td>CADERMELTON</td>
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<tr>
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<td>CHIGGETH</td>
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<td>PINCKMORE</td>
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<tr>
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