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Use of orthographic structure by deaf adults: Recognition of fingerspelled words

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ABSTRACT
Deaf adults' access to English word structure was tested in a task requiring letter report for fingerspelled words, orthographically regular nonsense words (pseudowords), and orthographically irregular nonsense words (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 errors on letter reports revealed that deaf subjects tended to produce orthographically regular responses. These results provide clear evidence that deaf adults are able to make use of orthographic structure.

For hearing persons, knowledge of written and spoken words are interrelated: Reading involves relating written words to spoken words (Baddeley, 1979; Hanson, 1981; Liberman, Liberman, Mattingly, & Shankweiler, 1980), and there is evidence that phoneme analysis of spoken words is influenced by access to the written representation of the words (Ehri & Wilce, 1980; Morais, Cary, Alegria, & Bertelson, 1979; Seidenberg & Tanenhaus, 1979). The underlying regularities governing orthographic structure are thought to be abstracted through this experience in relating the written and spoken systems (Ehri, 1980; Gibson, Shurcliff, & Yonas, 1970; Liberman et al., 1980). Ability to use orthographic structure is an important component in word recognition, as demonstrated by an advantage for orthographically regular nonsense words over orthographically irregular nonsense words in both letter recognition (Baron & Thurstone, 1973; Carr, Davidson, & Hawkins, 1978; McClelland, 1976) and letter report (Gibson, Pick, Osser, & Hammond, 1962; McClelland, 1976). If ability to take advantage of orthographic structure requires appreciation of the phonological link between written and spoken English, then deaf persons, unable to acquire speech by normal means, may be less able than hearing persons to make use of this structure. The present research investigates the ability of congenitally and profoundly deaf adults to make use of orthographic structure in word recognition.

To date, little work has investigated the use of orthographic structure by deaf

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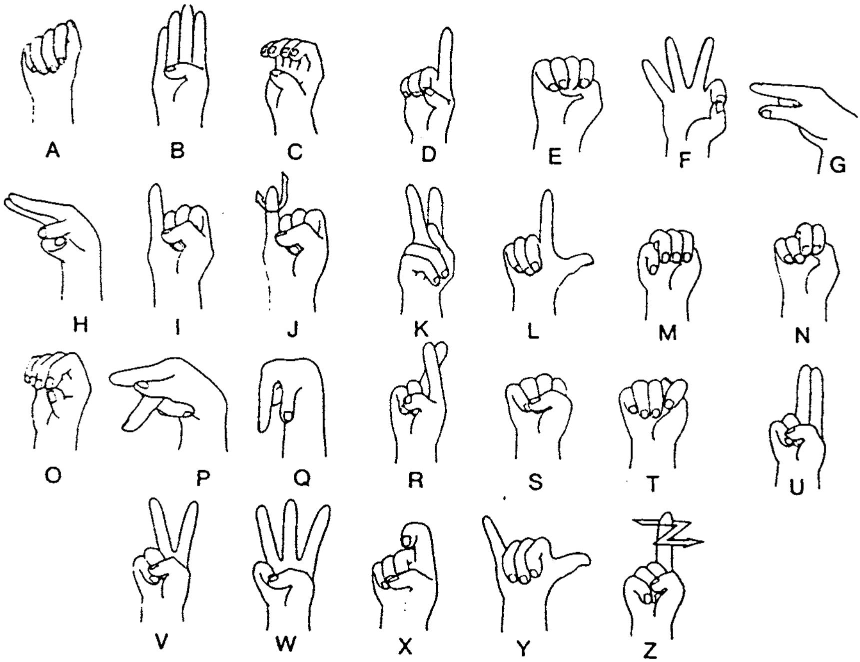

Figure 1. Handshapes of the American Manual Alphabet.

individuals. One study that has been directed to this issue is that of Gibson et al. (1970). Testing for recall of tachistiscopically presented pronounceable (orthographically regular) and unpronounceable (orthographically irregular) letter strings, they found that deaf adults, like hearing adults (Gibson et al., 1962), correctly reported more of the pronounceable than of the unpronounceable strings. Similar findings were obtained by Doehring & Rosenstein (1960) in an experiment with deaf children (ages 9–16 years). They found better recall of pronounceable CVC trigrams than of unpronounceable CCC trigrams. These findings led Gibson et al. (1970) to conclude that the mapping between the written and spoken language may make it *easier* for hearing than deaf children to pick up regularities of the orthography, but that the availability of this mapping is not necessary.

Orthographic structure, as used here, is defined in accordance with linguistically derived descriptions (Venezky, 1970). As such, regularity of orthographic structure refers to letter sequences that are legal given English phonological constraints and graphemic conventions. If, as suggested by Gibson et al. (1970), sensitivity to these linguistic principles does not depend on availability of normal speech input, then deaf adults may have access to orthographic structure. To investigate whether deaf adults differ from hearing adults in this measure of linguistic sensitivity, the performance of a group of hearing subjects was compared with that of a group of congenitally and profoundly deaf subjects.

The use of orthographic structure was investigated by testing recognition of fingerspelled words and nonsense words. 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. It is used both in American Sign Language (ASL or Ameslan) and in manual communication systems based on English. As shown in Figure 1, the American manual alphabet has a handshape for each letter of the English alphabet.

In fingerspelling, words are presented as a temporally sequential display of individually produced letters with an average presentation rate of .20 sec 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 temporally sequential presentation of printed letters displayed in one spatial location, hearing readers are accurate in naming six-letter words only when the duration of each letter approximates at least .375 sec (Kolers & Katzman, 1966). Even when the printed letters are spatially distinct, ability to read words is dramatically reduced for temporally sequential individual letters compared with multiletter displays (Newman, 1966).

Fingerspelling thus provides an interesting case in word recognition in that fingerspelled words can be recognized under conditions for which recognition of printed words is difficult. The sequential presentation of letters might suggest sequential recognition of individual letters. However, a prevalent position among persons involved in fingerspelling instruction and research is that fingerspelled words are recognized as "wholes" (see, for example, Bornstein, 1965; Zakia & Haber, 1971). The present research investigates whether individual letters of fingerspelled words are independently processed, and further explores the possibility that recognition of word "wholes" in fingerspelling might have as its basis the use of orthographic structure.

To examine the ability of deaf adults to take advantage of the regularities underlying orthographic structure, deaf adults were compared with hearing adults on recognition of orthographically regular and irregular letter strings. If orthographic structure is used in processing fingerspelled stimuli, then letters of orthographically irregular strings should be reported more accurately than letters of orthographically irregular strings. The subjects were deaf and hearing adults skilled in the use of fingerspelling.

METHOD

Stimuli

To avoid biasing to words or nonsense words, the number of words and nonsense words was equated: There were 30 words and 30 nonsense words. The words ranged in length from 5 to 13 letters (mean length 8.3 letters per word) and ranged in frequency of occurrence from 1 to 190 (median of 10.5) according to Kučera & Francis (1967). These words were matched in length with the nonsense words. Within the nonsense words, 20 were orthographically regular pseudowords (e.g., BRANDIGAN, MUNGRATS, VISTARMS) and 10 were orthographically irregular nonwords (e.g., FTERNAPS, RICGH, 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 legal vowel spellings and orthographically legal consonants or consonant clusters in initial and final positions. The irregular strings (nonwords) contained illegal and unpronounceable consonant clusters. While certain segments of the nonwords were legal and pronounceable, each nonword, when considered as a whole, was an illegal word in English. A complete listing of the stimuli is given 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 the following mean presentation rates for each stimulus type: .17 sec. per letter for words, .18 sec. per letter for pseudowords, and .19 sec. per letter for nonwords. An analysis of each stimulus type found a difference in production rate, $F(2,57) = 5.35$, $p < .01$, $MS_e = .001$, with post hoc analyses indicating that words were produced more rapidly than nonwords (Newman-Keuls, $p < .05$), although pseudowords did not differ significantly in production rate from either words or nonwords (Newman-Keuls, $p > .05$). 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 words and that for each they were to make two responses: First, write the word they had just seen; second, decide whether or not the word was an actual English word. For this 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 participated in the study in groups of one to six persons. The entire experiment lasted approximately 30 minutes.

Subjects

A group of deaf adults and a group of hearing adults were tested. To obtain subject groups homogeneous in fingerspelling experience, subjects in both groups had deaf parents and had learned fingerspelling from their parents.

Deaf subjects were eight congenitally deaf adults recruited through New York University and California State University, Northridge. There were three women and five men, mean age 28.2 years (SD = 6.2). All reported that results of audiometric tests indicated a hearing loss of 85 dB or greater (better ear average). One person was a senior in high school, two of the subjects were currently enrolled in college, and five were college graduates. Two of the college graduates were presently enrolled in graduate school. The intelligibility of the speech

Table 1. *Mean percentage correct lexical decisions and letter reports, and mean percentage orthographically regular responses for deaf and hearing subjects. Standard deviations are given in parentheses.*

	Lexical decision		Letter report		Orthographic regularity	
	Deaf	Hearing	Deaf	Hearing	Deaf	Hearing
Words	94.2% (6.1)	80.0% (15.2)	67.9% (22.7)	70.4% (22.1)	98.8% (3.5)	96.9% (8.8)
Pseudowords	90.6% (9.4)	84.4% (15.4)	37.5% (30.2)	21.9% (21.0)	88.5% (10.9)	93.0% (7.7)
Nonwords	91.3% (8.3)	77.5% (14.9)	18.8% (19.6)	5.0% (5.3)	62.1% (13.7)	92.4% (8.8)

productions of these subjects was not formally assessed. However, in a study of the speech production of deaf children, Smith (1975) reports relatively poor speech intelligibility for children with backgrounds similar to those of the present subjects.

Hearing subjects were eight adults recruited through interpreter services in Connecticut and New York. There were five women and three men, mean age 31.4 years (SD = 9.5). The highest grade completed for one subject was ninth grade. The other hearing subjects had some college experience. Two were presently enrolled in graduate school.

RESULTS AND DISCUSSION

Lexical decision

Overall percentage correct in the lexical decision task for deaf subjects was 92.5% (SD = 6.0) and for hearing subjects was 81.0% (SD = 12.8). This level of accuracy was significantly better than chance performance for both groups [for deaf subjects, $t(7) = 20.18$, $p < .001$; for hearing subjects, $t(7) = 6.85$, $p < .001$]. The *t*-tests were two-tailed. Following application of an arcsine transformation, percentage correct in this task was subjected to an analysis of variance on group (deaf, hearing) by stimulus type (words, pseudowords, nonwords). It was found that there was no significant difference in accuracy across stimulus type, $F(2,28) = .27$, $p > .20$, $MS_e = .08$, nor was there a significant interaction between group and word type, $F(2,28) = .77$, $p > .20$, $MS_e = .08$. Deaf subjects tended to perform this task more accurately than did hearing subjects, $F(1,14) = 6.15$, $p < .05$, $MS_e = .27$. The accuracy of both groups of subjects is shown in Table 1. As the equating of stimuli for number of words and nonsense words had necessitated a confounding of list length by stimulus type, the data were additionally analyzed for only the first ten occurrences of the words and pseudowords. The analysis of stimulus type yielded the same results as with the complete stimulus set: There was no difference in accuracy across the three stimulus types, $F(2,28) = .84$, $p > .20$, $MS_e = .12$, an effect that did not interact with group, $F(2,28) = 1.66$, $p > .20$, $MS_e = .12$. However, on this subset of the stimuli the accuracy of deaf subjects (90.0%, SD = 8.1) and hearing subjects (85.0%, SD = 10.5) did not differ significantly, $F(1,14) = 1.46$, $p > .10$, $MS_e = .27$.

To ensure that the high accuracy of subjects on this task could not have been due to some nonlinguistic cue to wordness of the stimulus items (e.g., facial cues, differences in production rates for stimuli, or "awkward" production of pseudowords and nonwords), eight hearing adults, naive with respect to fingerspelling, were asked to make lexical decisions regarding the stimuli. These subjects were graduate students and faculty members at Yale University and the University of Connecticut. They viewed the videotape and were told that for each fingerspelled word 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 subjects was only 49.2% (SD = 5.4) accurate in the task, a rate that does not differ from chance performance, $t(7) = -.42$, $p > .20$, two-tailed. Therefore, the high accuracy of the experimental groups of deaf and hearing subjects in this task can be attributed to their knowledge of fingerspelling.

Letter report

The use of orthographic structure can be tested by examining letter report accuracy for the different word types. An analysis of the percent correct was performed on group by stimulus type for trials on which there was a correct lexical decision. The analysis of the arcsine transformed data revealed an effect of word type, $F(2,28) = 91.60$, $p < .001$, $MS_e = .10$. This difference was significant between all stimulus types (Newman-Keuls, $p < .01$), thus indicating effects of orthographic structure (letters of pseudowords recalled more accurately than letters of nonwords) and word familiarity (letters of words recalled more accurately than letters of pseudowords). There was no significant main effect of group for accuracy of letter report, $F(1,14) = 1.34$, $p > .20$, $MS_e = .79$, nor significant interaction of group by word type, $F(2,28) = 3.08$, $p > .05$, $MS_e = .10$. Results are shown in Table 1. These results are not due to the differential number of stimuli for each stimulus type. In an analysis that utilized only the first ten instances of the words and pseudowords, there was a significant effect of stimulus type, $F(2,28) = 89.00$, $p < .001$, $MS_e = .154$, and no significant main effect of group, $F(1,14) = .58$, $p > .20$, $MS_e = .73$. In this analysis, there was a significant interaction of the two variables, $F(2,28) = 3.74$, $p < .05$, $MS_e = .15$, although analysis of the simple effects indicated significant effects of stimulus type for both deaf subjects, $F(2,28) = 29.45$, $p < .001$, and hearing subjects, $F(2,28) = 63.03$, $p < .001$. For each group, the difference was significant between each stimulus type (Newman-Keuls, $p < .01$). The interaction was due to the fact that (consistent with the results of the entire stimulus set as shown in Table 1) hearing subjects were somewhat more accurate than deaf subjects on words, and deaf subjects were somewhat more accurate than hearing subjects on pseudowords and nonwords.

Table 2. *Examples of incorrect letter reports*

Stimulus	Incorrect response	
	Deaf	Hearing
Words		
ADVERTISEMENT	adveristement+	advertizement+*[a]
BANKRUPTCY	bankruptucy+	
BAPTIZE	bapitize+	
CADILLAC	cadialic+	cadilac+*
ELABORATE	elebrate+	
HEMISPHERE	hemipshere+	
INTERRUPT	interupt+*	interupt+*
PHILADELPHIA	Philaphelia+	Philadephia+
VIDEO	viedo+	
VINEGAR	vinigar+*	
Pseudowords		
BRANDIGAN	brandigner+	brandegon+
CADERMELTON	camderlton+	catermelon+
MUNGRATS	mungrates+	mungrants+
PILTERN	pilertine+	altern+
SNERGLIN	snerglish+	surglin+
VALETOR	valtor+	valder+
Nonwords		
FTERNAPS	ferntaps+	ferturbs+
HSPERACH	husperach+	hosprach+
PGANTERLH	ghanterlh	perghph
PKANT	pkants	phint+
RANGKPES	rangkles	rankers+
VETMFTERN	vetmfern	vefteran+

Note: The symbol (+) indicates that the response was orthographically regular. The symbol (*) by errors on words indicates that the response was consistent with the phonetic structure of the target word.
[a]In the current experiment, the word as presented was *advertisement*. While *advertizement* is an acceptable spelling of the word, in the present case the spelling with the letter *z* represents an incorrect letter report.

These results give evidence for the ability of deaf adults to use orthographic structure. Similar to the orthographic structure effects with printed words previously reported for deaf adults by Gibson et al. (1970), the present study found greater accuracy in letter report for pseudowords than nonwords. 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.

There is yet another indication of deaf subjects' ability to use orthographic structure, which is that incorrect letter reports tended to be orthographically regular. Each of these incorrect letter reports for which there was a correct lexical identification was classified as to whether the reported sequence was orthographically regular or irregular. Occasionally subjects left blanks in their letter reports (e.g., p—— or cozme——ker). These responses were not analyzed. Orthographic regularity was determined in accord with the criteria used in stimulus selection. Responses were scored independently by two judges. These judges agreed on their classifications on 92.4% of the responses. For those responses on which there was a disagreement, a third judge scored the response and the decision of the third judge was used as the classification. Examples of incorrect letter reports and their classifications are given in Table 2.

The mean percentage of orthographically regular responses for each word type is shown in Table 1. An arcsine transformation was applied on the percentage regular responses. There were significant main effects of both group, $F(1,14) = 8.02$, $p < .025$, $MS_e = .16$, and word type, $F(2,28) = 19.59$, $p < .001$, $MS_e = .10$, that were qualified by an interaction of the two variables, $F(2,28) = 9.43$, $p < .001$, $MS_e = .10$. As shown by an analysis of the simple effects, this interaction reflected the fact that the percent of orthographically regular responses did not differ significantly for the two groups for words, $F(1,28) = .10$, $p > .20$, or pseudowords, $F(1,28) = .70$, $p > .20$, but did differ for nonwords, $F(1,28) = 29.96$, $p < .001$. By definition, however, the nonwords in the experiment were orthographically irregular. As shown in the examples in Table 1, the difference for the two groups on the nonwords resulted from the deaf subjects reporting the illegal consonant strings of the nonwords more closely than the hearing subjects.

The results of the letter report task can also be examined to determine whether or not letters of fingerspelled words are processed independently. If there is independence of letter processing, then 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. Independence is indicated if the following equation holds:

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

where n = number of letters in the word.

An arcsine transformation was applied to the data and an analysis was performed on group by stimulus type by probability (all letters [regardless of order] vs. individual letters). It was found that there was a significant effect of probability, $F(1,14) = 96.14$, $p < .001$, $MS_e = .05$, indicating nonindependence of letter processing. There was also an interaction of stimulus type by probability, $F(2,28) = 8.81$, $p < .005$, $MS_e = .05$, reflecting the fact that the magnitude of this effect differed across stimulus types. Post hoc analyses of the simple effects demonstrated, however, that the finding of nonindependence was significant for each stimulus type [for words, $F(1,28) = 68.83$, $p < .001$; for pseudowords, $F(1,28) = 46.91$, $p < .001$; for nonwords, $F(1,28) = 6.65$, $p < .025$]. This effect of nonindependence was similarly revealed in the analysis that used only the first ten instances of words and pseudowords. In this analysis there was a significant main effect of probability, $F(1,14) = 36.73$, $p < .001$, $MS_e = .06$, and no significant interaction of this effect with stimulus type, $F(2,28) = 1.54$, $p > .20$, $MS_e = .05$. These findings of nonindependence suggest that even though letter presentation in fingerspelling is temporally sequential, letter processing is influenced by surrounding letters.

Since there are "coarticulatory" effects in skilled fingerspelling production (Reich, 1974), with letter context influencing handshape formation, it is reasonable to assume that a fingerspelled letter contains information about adjacent letters. A skilled fingerspeller may 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 orthographic structure is able to be used in identifying fingerspelled letters despite the temporally sequential display of letters, and may explain how these sequential letters can be processed so much more rapidly than sequentially presented printed letters.

Errors on words

Errors in the lexical decision task provide one source of indication for failure to recognize a word. The whole report technique of the present experiment provides a second basis for a determination as to whether or not there was correct recognition of words. For words on which there was a correct lexical decision, two types of incorrect responses were considered to be failures to recognize the word. The first type of error consisted of responding with a morphologically incorrect form of the word (e.g., *baptized* for BAPTIZE). This accounted for three errors of the deaf subjects and three errors of the hearing subjects. The second type of error consisted of responding with the wrong word (e.g., *complicate* for COMMUNICATE), accounting for two errors of the deaf subjects and nine errors of the hearing subjects. In all, deaf subjects made errors in word recognition on only 2.2% of the trials on which they made a correct lexical decision, and hearing subjects made errors in word recognition on only 6.2% of the trials on which they made correct lexical decisions. There were no cases in which a subject made a correct letter report (for words, pseudowords, or nonwords) and then made an incorrect lexical decision.

Having recognized a word, the task of letter report becomes a type of spelling task. Hearing subjects were quite accurate in their letter reports for words. Excluding those trials on which there was an error in word recognition, they made only 6.6% misspellings (12 errors). For deaf subjects the corresponding rate was 26.1% (58 errors).

For hearing adults, the predominant form of spelling error is a phonetically consistent but orthographically incorrect rendering of the target word (Fischer, 1980). In these misspellings, each phonetic segment of the word is graphemically represented in the order of occurrence. Examples from the present experiment are *rhythum* for RHYTHM and *interupt* for INTERRUPT. The phonetic structure is therefore maintained in the misspelling.

To examine whether the responses for subjects were phonetically consistent with the target, incorrect letter reports for words were classified as to whether or not the reported letter string produced a sequence that preserved the phonetic structure of the stimulus word. Responses that had indicated an error in word recognition were excluded from this analysis. These classifications were made independently by two judges who agreed on the classification for 91.7% of the responses. A third judge classified the two responses for which there was a disagreement. Table 2 gives examples of phonetically consistent and inconsistent letter reports for words.

As the present task involves reporting letters for words just seen fingerspelled, it might be suspected that this would influence the spelling strategies of the subjects. However, responses of the present subjects were found to be quite consistent with results of spelling research with deaf children in finding that deaf subjects make relatively few phonetic misspellings (Dodd, 1980; Hoemann, Andrews, Florian, Hoemann, & Jansema, 1976). The responses of the deaf subjects in the present experiment were classified as phonetically consistent with the target on only 21.0% of the trials. As there were only 12 incorrect responses for the hearing subjects, the analysis of their data based on so few trials must be viewed with caution. For completeness, however, it should be noted that seven of these responses (58.3%) were phonetically consistent with the target.

The phonetically inconsistent responses resulted from four sources: segment omissions (e.g., *umbella* for UMBRELLA), segment substitutions (e.g., *fuderal* for FUNERAL), segment insertions (e.g., *bapitize* for BAPTIZE), and sequencing errors (e.g., *vechile* for VEHICLE). These latter errors, those of sequencing, are especially intriguing in that they are so rare for hearing persons. Only one such error was made by the hearing subjects (7.7% of their incorrect responses). Of the incorrect responses by deaf subjects, 18 responses (31.0%) contained a sequencing error. These sequencing errors occurred either as the sole error in a word or in conjunction with another error. For example, the response *philaphelia* for PHILADELPHIA was both an error of sequencing and of consonant omission. Additional examples of sequencing errors are shown in Table 2.

The analysis of letter report errors for words thus has indicated that the deaf subjects were sensitive to the orthographic regularities of English in their responses, but, in contrast to the hearing adults, the responses of the deaf adults were *not* generally consistent with the phonetic structure of words. This finding that deaf persons do not make phonetically consistent spelling errors to the degree that hearing persons do suggests that deaf persons may not use accurate word pronunciations as a basis for spelling and, in this regard, their spelling strategies may differ from the spelling strategies used by hearing persons.

CONCLUSIONS

The present research provides evidence indicating that profoundly deaf adults are able to make use of orthographic structure in the recognition of fingerspelled words. This was shown in the letter report advantage for orthographically regular over orthographically irregular letter strings and in the analysis of errors in letter reports. Further, the finding of nonindependence of letter processing provides evidence that fingerspelled letters are not recognized individually, but rather are recognized in the context of their adjacent letters. Moreover, this work provides data relevant to understanding the spelling of deaf persons – the low percentage of phonetically accurate letter reports of deaf subjects suggests that deaf adults may rely less than hearing adults on the phonetic structure of words when spelling.

These results support the conclusion of Gibson et al. (1970) that the mapping of sounds to letters may facilitate the acquisition of orthographic structure for hearing persons but that such acquisition does not *require* hearing the spoken language. While profoundly deaf persons may not be able to take advantage of the acoustic or auditory aspects of speech, this does not preclude the possibility that they may be able to acquire a knowledge of phonological principles. Several sources of information could be used to acquire this knowledge of linguistic aspects of English: lipreading (Dodd & Hermelin, 1977), speech production, fingerspelling, and reading. Therefore, ability of deaf adults to use orthographic structure may have a basis in phonological principles.

In addition to this phonological information, deaf persons, like hearing persons, may have access to information about letter positional frequencies to facilitate word recognition (Mason, 1975). Such knowledge could be acquired both through experience with fingerspelling and reading.

Two characteristics of the present deaf subjects deserve discussion: They tended to be well educated, and all had deaf parents. While ability to use orthographic structure may be expected to be related to educational achievement, such ability would not necessarily be expected to be related to hearing status of parents, as indicated by the consistency of the present work with the findings of Gibson et al. (1970), who did not use only subjects with deaf parents.

This finding that deaf persons have access to information about orthographic structure is relevant not only in understanding how fingerspelled words are recognized, but may have implications for the recognition of printed words by deaf adults. Reading may be thought of as involving both word recognition and text comprehension. To date, studies concerned with the reading process for deaf persons have focused primarily on the use of speech-based and sign-based short-term memory codes that would mediate comprehension (Conrad, 1979; Hanson, 1982; Locke, 1978; Shand, 1982). The present study provides information about word recognition, suggesting that deaf adults, like hearing adults, may make use of orthographic structure in this task.

APPENDIX

Stimulus items

Words

ADVERTISEMENT
AWKWARDLY
BANKRUPTCY
BAPTIZE
CADILLAC
CAREFUL
CHIMNEY
COMMUNICATE
ELABORATE
FUNERAL
GRADUATE
HELICOPTER
HEMISPHERE
INTERRUPT
MOUNTAIN
PANTOMIME
PHILADELPHIA
PHYSICS
PREGNANT
PSYCHOLOGICAL

PUMPKIN
RHYTHM
SUBMARINE
SURGERY
THIRD
TOMATO
UMBRELLA
VEHICLE
VIDEO
VINEGAR

PHALTERNOPE
PILTERN
PINCKMORE
PRECKUM
RAPAS
SNERGLIN
STILCHUNING
SWITZEL
VALETOR
VISTARMS

Pseudowords
BRANDIGAN
CADERMELTON
CHIGGETH
COSMERTRAN
EAGLUMATE
FREZNIK
FRUMHENSER
HANNERBAD
INVENCHIP
MUNGRATS

Nonwords
CONKZMER
ENGKSTERN
FTERNAPS
HSPERACH
PGANTERLH
PIGTLANING
PKANT
RANGKPES
RICGH
VETMFTERN

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