The metalinguistics of fingerspelling: An alternate way to increase reading vocabulary in congenitally deaf readers

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THE ABILITY to analyze speech helps children deduce the phonological level of language that is represented in English orthography. This metalinguistic ability to focus on the phonological level is a prerequisite to reading acquisition, for it paves the way for the decoding and recoding of texts, and thus for word identification and short-term memory storage. However, most congenitally deaf readers probably don't analyze speech to access a phonological representation. This research explores one way in which native users of American Sign Language (ASL) can nonetheless decode or recode print, through translation of print into English phonemes via the manual alphabet called fingerspelling. Fingerspelled words appear within the ASL lexicon and are perceptually analyzed by users as whole lexical units. In three experiments, the author explored the metalinguistic competence of 26 deaf students to segment and manipulate their fingerspelled lexicons. The students demonstrated their metalinguistic sophistication. This ability correlated significantly and selectively with reading success. In a fourth experiment, a training task, the author showed that students identify more sight words when they are encouraged to decode into fingerspelling. These results are discussed relative to (a) more general access codes to the phonological substrate than are currently proposed, (b) a more general understanding of the relationship between metalinguistic competence and reading, and (c) implications for deaf readers, in particular, and for poor readers, generally.

La métalinguistique de l'orthographe digitale: Un moyen alternatif d'augmenter le vocabulaire chez les lecteurs sourds

LA CAPACITÉ d'analyser la parole permet aux enfants de déduire le niveau phonologique de la langue anglaise qui est représenté dans son orthographe. Cette habileté métalinguistique de concentration sur le niveau phonologique constitue une condition préalable à l'acquisition de la lecture, puisqu'elle prépare la voie au décodage et à l'encodage des textes, ainsi qu'à l'identification des mots et à l'émagasinage à court terme dans la mémoire. Toutefois, les lecteurs sourds n'analysent probablement pas la parole pour parvenir à une représentation phonologique. Cette recherche examine un moyen par lequel les utilisateurs natifs du Langage par Signes Américain (American Sign Language, ASL) parviennent quand même à décoder ou encoder l'écriture, par la transposition des lettres en phonèmes anglais via l'alphabet manuel dit l'orthographe digitale (fingerspelling). Les mots orthographiés avec les doigts font partie du lexique de l'ASL et les utilisateurs les perçoivent et les analysent comme des unités lexicales entières. A l'aide de trois expériences, l'auteur a étudié la compétence métalinguistique de 26 étudiants sourds à segmenter et manipuler leurs lexiques de l'orthographe digitale. Les élèves ont démontré un raffinement métalinguistique, et cette capacité présentait une corrélation considérable et sélective avec la réussite en lecture. Dans une quatrième expérience, d'enseignement celle-là, l'auteur démontre que les étudiants déchiffrent plus de mots quand on les encourage à décoder en orthographiant avec les doigts. Les résultats sont analysés en fonction (a) d'une meilleure diffusion des codes d'accès au substrat phonologique, (b) d'une compréhension plus étendue de la relation existant entre la compétence métalinguistique et la lecture et (c) des répercussions, en particulier pour les lecteurs sourds et, en général pour les lecteurs faibles.
Los elementos metalingüísticos del deletreo digital: Una manera alternativa de incrementar el vocabulario de lectura en lectores sordos congénitos

LA HABILIDAD para analizar discurso ayuda a los niños a deducir el nivel fonológico del lenguaje que está representado en la ortografía inglesa. Esta habilidad metalingüística para enfocar los niveles fonológicos es un prerrequisito para la adquisición de la lectura, ya que esta habilidad allana el camino para la decodificación del texto de lectura, y por lo tanto para la identificación de palabras y para su almacenamiento en memoria a corto plazo. Aún así, los lectores sordos congénitos probablemente no analizan el habla para tener acceso a las representaciones fonológicas. Esta investigación explora una manera en la cual la gente que ha usado el Lenguaje de Señas Americano (American Sign Language, ASL) como lengua nativa puede sin embargo decodificar o recodificar material impreso, por medio de la traducción del material impreso a fonemas ingleses por vía del alfabeto manual llamado deletreo digital (fingerspelling). Las palabras deletreadas digitalmente que aparecen en el lexicón del ASL son analizadas perceptualmente como unidades léxicas completas. En tres experimentos el autor exploró la competencia metalingüística de 26 estudiantes sordos congénitos para segmentar y manipular sus lexicones de deletreo digital. Los estudiantes demostraron sofisticación metalingüística, y esta habilidad correlacionó significativa y selectivamente con el éxito en la lectura. En un cuarto experimento que consistió en una tarea de entrenamiento, el autor demostró que los estudiantes identificaron más palabras leídas cuando se les había animado a decodificarlas en deletreo digital. Estos resultados se discuten en relación a (a) la existencia de más codigos de acceso general al substrato fonológico que aquellos que se sugieren en la actualidad, (b) un entendimiento más general de la relación entre la competencia metalingüística y la lectura, y (c) implicaciones para los lectores sordos en particular, y para los lectores ineptos en general.

Die Meta-Linguistik des Finger-Buchstabierens: Eine Alternative, das Lese-Vokabular in von Geburt an tauben Lesern zu vergrößern

The child who can sound-out a nonsense word, such as *pramedom* (Firth, 1972), tell you that *mom* and *man* start with the same sound (Calfee, Chapman, & Venezky, 1972), and tap out the number of sounds in a word like *box* (Liberman, Shankweiler, Liberman, Fowler, & Fischer, 1977) will predictably be a more successful reader. Results of studies that have used these tasks, and of others like them, are testimony to the claim that the ability to analyze units in speech can provide an important insight for the child who is trying to master alphabetic reading. The ability to manipulate or segment speech sounds provides young readers with access to the abstract phonological system of our language. This phonological system then maps (albeit indirectly) onto the alphabetic representation in our writing system. Thus the child who can attend to phonemes can learn the grapheme-to-phoneme rules that help readers translate print into a more primary language form (Huey, 1968). Consequently, this translation into the phonemic representation promotes reading skill (a) by fostering word identification, and (b) by coding the print into a more durable form that enables readers to retain early portions of the text while later portions are being processed (see Crowder, 1982, for a review).

To date, the evidence in favor of the importance of phonemic awareness in reading acquisition is extensive. Research by Liberman and her colleagues (Liberman, 1983; Liberman, Cooper, Shankweiler, & Studdert-Kennedy, 1976; Liberman, Liberman, Mattingly, & Shankweiler, 1978; Liberman & Shankweiler, 1979, 1985; Liberman, Shankweiler, Fisher, & Carter, 1974; Liberman, Shankweiler, et al., 1977), among others, links phonemic awareness through the analysis of speech with early decoding skills, and early decoding skills with reading proficiency. Research on reading methods has corroborated these findings by suggesting that those phonic methods that encourage the segmentation and blending of phonological units tend to promote early grapheme-to-phoneme mapping and tend to produce more advanced readers (Anderson & Freebody, 1985; Chall, 1983; Johnson & Baumann, 1984). Finally, results of training studies by Bradley and Bryant (1983) suggest that explicit training in metalinguistic skill for speech segmentation and phonological access can lead directly to increased reading performance.

The thread that links all of the above studies is the notion that access to the phonological level of representation is achieved through an analysis of the speech stream. That is, even though the phoneme is not directly available in the acoustic cues, attention to units of speech (e.g., particular syllables) helps young children converge on the phonemic units that are so important in reading. Attention to speech can thus be thought of as a primary route to the eventual mastery of grapheme-to-phoneme rules, and therefore as a primary route to early reading success.

Although the analysis of acoustic cues in the speech stream provides a primary route to phonological awareness, it does not necessarily provide the only route to this representation. Profoundly deaf readers are often unable to hear any sounds that occur within the speech range. Yet some deaf individuals do attain reading proficiency without the ability to analyze acoustic cues in speech. There are even a number of tasks in which profoundly deaf individuals, of varying backgrounds, have demonstrated difficulty with serial recall or word judgment on lists of rhyming letters or words and on lists of homophones (e.g., Conrad, 1979; Gibson, Shurcliff, & Yonis, 1970; Hanson, 1984; Hanson & Fowler, in press; Locke & Locke, 1971). Why would deaf individuals show confusion on word lists that contained rhymes? Undoubtedly their confusions do not arise from analyses of the acoustic signal (though this is somewhat unclear with Conrad's and Locke & Locke's subjects, who may have had higher levels of residual hearing). Instead, subjects in these tasks must have used other internal codes to represent the word and letter lists. Prime candidates for these codes include internal word representation through articulatory cues and through lipread cues. For example, words like *pan* and *fan* not only sound similar, but are also pronounced similarly. Further, if they are pronounced similarly, then the articulatory gestures used in forming these words will be
visually similar to the onlooker who is lipreading. Both types of codes have been suggested as ones that deaf persons might use in the memory and judgment tasks mentioned above (see Conrad, 1979, and Hanson & Fowler, in press, for evidence of articulation; and see Dodd, 1980, and Dodd & Hermelin, 1979, for evidence of lipreading). Both types of codes could also theoretically be used to help these individuals tap into the level of phonemic representation used in reading.

Thus, although the analysis of acoustic cues in speech provides most beginning readers with access to the phonological level of their language, it is not the only means of access to this level. What is important for beginning reading success is that one tap this abstract level of the language system somehow. After all, it is at the phonological level that the English orthographic system roughly maps onto the language system. The ability to find the connection between the language system and the written system enables readers to bring their already existing knowledge of the language to bear on their burgeoning knowledge of reading. It provides them with a way of identifying words that they know in their spoken form, but which are new in written form. It allows them to predict the grammar used in the text. What is clear from the research, then, is that a number of codes—be they speech-based, articulatory, or lipread—will provide access to the phonological code, which is required for grapheme-to-phoneme correspondence and for word identification through decoding. What is also clear is that the mapping between phonemes and graphemes is liable to be less accurate. The resultant early reading skills are also likely to be impaired.

Thus, the research presented here is an attempt to find another way for deaf individuals to access some phonological representation in the service of reading acquisition. Following leads by Locke and Locke (1971) and Hanson, Liberman, and Shankweiler (1984), in this research I explore the possibility that the manual spelling system called fingerspelling can also provide deaf people with access to phonological representation.

Unlike American Sign Language (ASL), in which each sign tends to represent an entire word, fingerspelling is a representation of the English alphabet, in which each alphabetic letter is manually represented by a single, discrete handshape. This may imply that fingerspelled words are processed as a sequence of individual handshapes. Yet experimental evidence indicates otherwise. From research on the speed of fingerspelling recognition and the results of memory tasks that require individual letter reporting, one may conclude that fingerspelled words are processed as whole units or as meaningful subunits within words (Blasdell & Caccamise, 1976; Hanson, 1982; Zakia & Haber, 1971). Thus—to strike a parallel with spoken languages—deaf people are no more likely to process fingerspelled words as a sequence of individual handshapes than are hearing people to process spoken words as a sequence of discrete phonemes.

Though fingerspelled words originate in English, they have filtered into the ASL lexicon and emerge in a number of contexts. Finger spelling is used in four ways: (a) to represent proper names, (b) to represent technical concepts for which there is no signed equivalent (e.g., ION), (c) as an acronymic device that sig-
nals the first letter of two formationally similar signs (e.g., the C handshape is used in the sign CLASS, whereas the F handshape with the same sign signals the word FAMILY), and (d) in loan signs, where frequently used fingerspelled words undergo morphological changes that render them sign-like in appearance (see Battison, 1978). Figure 1 depicts these various uses of fingerspelling within the language. Although signs are more frequently used than are fingerspelled words, these words do coexist in the signers' lexicon. Young children learning sign language, for example, receive vocabulary that is both signed and fingerspelled.

Fingerspelling offers deaf readers one way to access the internal lexical coding system that can be used to foster word identification and subsequent reading skills. It is part of the signers' natural lexicon, and it bears a direct relationship to English alphabetic print. Indeed, fingerspelling is a manual representation system that was modeled on the alphabet. Whether this decoding system will help deaf readers, however, depends on the answer to several subsidiary questions based on research with hearing people:

1. Do deaf individuals have the metalinguistic competence to attend to individual hand-
shapes within whole fingerspelled words, and does this ability correlate with beginning reading achievement?

2. Will such a segmentation ability afford deaf readers advantages of access to a phonological representation (i.e., memory durability and prompts for word identification)?

3. Can we establish some causal relationship between the ability to decode into fingerspelling and proficiency at word identification by training deaf individuals to note the rules that relate spelling to handshape?

Some of these questions have been addressed. Locke and Locke (1971), for example, found that deaf individuals without intelligible oral language use dactylic or fingerspelling coding when asked to remember a series of printed letters. Hanson, Liberman and Shankweiler (1984) confirmed and extended these findings with 6- to 11-year-old subjects who participated in a serial recall experiment. As in Locke and Locke's (1971) task, the subjects of the Hanson et al. study were presented with letter strings that were either visually, dactylically, or phonetically similar to control strings. The results provide evidence that fingerspelling can be used by deaf people as a durable coding system. Beyond demonstrating existence of such a coding system, however, Hanson et al. examined the merits of using this system in facilitating reading, and concluded that “although the language system is accessed via different modalities in the speech-based and manually-based codes used by good readers, both provide the reader with a means of representing the internal string of words and . . . provide a linguistic basis for holding information in short-term memory” (pp. 391-392). Hanson et al. found that the deaf students classified as good readers used dactylic coding more than deaf students classified as poor readers.

The Hanson et al. (1984) data provide the best evidence to date that fingerspelling can serve as an important mediator between alphabetic print and reading comprehension. Yet this demonstration is incomplete in several respects. First, Hanson et al. presented subjects with unconnected printed letters for recall. Such a task may overestimate the deaf child's ability to use fingerspelling because attention is drawn to single letters and to the code most adapted to the translation of single letters: fingerspelling. Second, and relatedly, we know that the perceptual unit of processing in fingerspelled words (and potentially in printed words translated into fingerspelling) is larger than the single handshape (Blasdell & Caccamise, 1976). Consequently, it is unclear whether deaf readers even have the metalinguistic competence to divide fingerspelled words into the individual handshapes that are represented in print. That is, students who can use a fingerspelling decoding system when presented with isolated letters may not be able to use the system in the natural context of word presentation. They may not even know that these words are composed of individual handshapes. Third, Hanson et al. provide only correlational evidence for a relationship between coding into fingerspelling and reading. Fourth, and finally, Hanson et al. never specify the language background of their subjects. They all attended schools that instruct children in both ASL and oral English. But instruction in a language does not guarantee mastery of that language. Hence, the division between poor readers and good readers in that study may reflect a deeper division between those who have mastered a first language (either ASL or oral English) versus those who have not mastered any first language. This potential confounding of reading with general communication ability is serious. It means that the good readers may have differed from poor readers not only on reading, but also on a number of other variables that could have affected the results.

The research presented in this study provides a more direct test of the hypothesis that the abilities to focus on fingerspelling handshapes and todecode print into these handshapes are related to early reading achievement, at least to that achievement marked by the transition from illiteracy to word identification. I hope to demonstrate that metalinguistic competence, broadly defined as the ability to manipulate the level of language represented in print, is related to reading achievement; that at least a partial phonological level can be accessed through fingerspelling; and that the direct mapping provided in the resultant grapheme-to-
phoneme relationship can assist in word identification.

Although I hope to demonstrate the viability of a fingerspelling coding system, one must bear in mind that this alternate coding system, like the articulatory or lipreading systems discussed earlier, provides the reader with only a partial phonological representation. This phonological system does not fit neatly with the signer's language system in the broadest sense. That is, for hearing readers, access to the phonological system serves as an inroad to a large set of words that are arranged in the text according to the grammatical rules of the reader's native (oral) language. But most orally trained deaf people do not have fully developed language systems or grammars that they can access through articulation or lipreading (Conrad, 1979). If they did, access to the phoneme through these systems would be equally profitable. Similarly, for signers using fingerspelling, there is access to a phonological system that corresponds to only a small set of words in their native language—the fingerspelled or loan words in ASL. Moreover, once they have learned to decode English words, these words will not be arranged in the text according to the rules of grammar of their native language, ASL. The promise of this coding system, like the others, thus rests in its ability to foster word identification and to increase memory for words encountered in text. Once the words are identified, signers would still need to learn other strategies to determine how independent strings of words become organized in the grammar used in the text.

Nonetheless, it is important to assess this promise of increased word identification skills. To do so, I conducted a series of four experiments with native users of American Sign Language: three investigative studies and one training study. The first three experiments were designed to test whether deaf students are capable of recognizing the individual handshapes in fingerspelled words, and whether this metalinguistic ability correlates more with reading ability than with other indices of intelligence, such as mathematical ability. These experiments parallel reading research with hearing people that demonstrates a relationship between phonemic awareness and beginning reading achievement. The fourth experiment was designed to test whether training in decoding into fingerspelling would directly bolster word identification.

The subjects for all studies were 26 second-generation (all had deaf parents who were themselves native signers) congenitally and profoundly deaf students who use ASL as their native language. All attended either the Pennsylvania School for the Deaf in Philadelphia or the Millburn School for the Deaf in Millburn, New Jersey. All were of average or above-average intelligence.

It was important to the studies that only deaf signers whose parents were also native users of ASL be accepted as subjects. This control helped to alleviate two potential confounds. First, it ensured that all subjects would have an adequate first language with all of the conceptual advantages afforded by a conventional first language. Second, it served to ensure that these subjects were not emotionally traumatized by being the only deaf person in a family. A deaf child is treated “normally” in a deaf household. Thus, by adopting stringent subject criteria, I alleviated some of the problems encountered in past studies. Using such strong criteria, however, results in certain limitations. Because the number of second-generation, congenitally deaf subjects is such a small portion of the deaf population (7% of the deaf population, which is itself 1% of the total population), it was necessary to accept subjects who varied widely in age (5-16 years) and who ranged in reading level from preprimer through seventh-grade, as measured on the reading comprehension subtest of the Stanford Achievement Test, Levels I and II. As is characteristic of much of the deaf population, however, most of these students (18 of 26) had reading levels between first- and third-grade, with an overall mean grade reading level of 2.75. To help constrain the focus in the reported experiments, results will be presented separately for the elementary school children, age 5-11 (n = 13; mean reading grade level, 1.59) and for the secondary students, age 13-16 (n = 13; mean reading grade level, 3.98).
EXPERIMENT 1: Segmentation Sorting Task

Perceptually distinct signed and fingerspelled words coexist in the signer's manual vocabulary. The relationship between handshapes and print (handshape-to-letter rules) may assist deaf readers when applied to the subset of the lexicon that is fingerspelled, but not to those words that are signed. Even though signed words are constructed from handshapes, the handshape positions within signed words bear no consistent relationship to printed letters. The signed words for PLAY and STILL, for example, are each formed using a single Y handshape, followed by a particular motion that differentiates these words. The handshape used in signed word formation, as is evident, does not reflect English language roots, whereas the handshapes chosen to represent fingerspelled words directly map the English language and thus might prove a better route to the phonological substrate that is represented in the English writing system.

If fingerspelling mediation is to prove a productive decoding system, then deaf individuals must demonstrate, at minimum, the ability to differentiate those instances in which handshapes will (fingerspelled and loan-sign words) and will not (signed words) assist word identification. That is, if they cannot tell the difference between signed words and fingerspelled words, then they will not be able to use effectively a decoding system that maps fingerspelled rather than signed handshapes onto graphemes.

Method

Subjects

Subjects were 22 second-generation congenitally deaf students. Four students of the 26 mentioned above could not participate due to equipment failure. Nine of the students fell within the age range of 5-11 years (M = 8.11), 13 within the range of 13-16 years (M = 14.85).

Procedures

The students engaged in a sorting task. They viewed 20 unfamiliar signed and fingerspelled words that were presented to them on a video monitor. All of the stimuli were delivered by a native user of ASL. Unfamiliar fingerspelled words were compiled from among infrequently used technical terms like ION and QUARTZ. Unfamiliar signed words—nonsense signs—were Israeli signs that are formationally legal, but are not used, in ASL. To promote classification on linguistic grounds, single-handed signs were used that were matched as closely as possible to the fingerspelled words for duration on the video screen. The stimulus set also included seven loan or borrowed signs—words (like HAHA, DOG, and JOB) that are derived from fingerspelling but have undergone morphological changes that make them sign-like in appearance (see Battison, 1978). If perceptual characteristics are the sole determinants of the classification, these words should be classified as signs, whereas on linguistic grounds, they should be classified as fingerspelling.

The experiment consisted of three phases: instruction, training with feedback, and test. In the instructional phase, the research assistant, a native user of ASL, paired the child's namesign with a red chip and his or her fingerspelled name with a black chip. Three more live demonstrations followed in which the experimenter announced, “This goes with the red chip, and this with the black chip.” In the training phase, subjects viewed a 1-minute videotape of assorted fingerspelled and signed words. They were instructed to choose the color chip that “went with” the presented word. Feedback was provided for each incorrect response. Finally, in the test phase, each student viewed the 27 items without feedback. The child was requested to place an appropriately colored chip in the box for each word as it appeared on the video monitor. Afterwards, the children were asked to explain why they had sorted certain words as black and others as red. The experimenter recorded all of the subjects' responses. Thus, linguistic classification (signed vs. fingerspelled
or loan sign) was the independent variable, and accuracy in sorting and explanation for the sort served as the dependent variables.

Results and Discussion

The results are presented in Table 1. Subjects could reliably distinguish the two distinct sets of lexical items in their vocabulary. Overall, they correctly classified signs in 90% of the cases, and fingerspelling in 98% of the cases, both at levels above chance: signs, \( t(21) = 11.33, p < .0005 \) (one-tailed); fingerspelling, \( t(21) = 34.00, p < .0005 \) (one-tailed).

Even the younger group scored well on this task. Moreover, all but one child (a six-year-old) could verbalize the rationale for the sort using some sort of linguistic classification, such as “The signed ones go here and the fingerspelled ones go here.” Most importantly, the subjects were not sorting on visual/perceptual grounds alone. If they had been responding only to visual/perceptual cues, they might have classified the loan signs as signs, not as fingerspelling. Instead, subjects on average correctly classified 91% of the loan signs as fingerspelling—a result that was both unexpected and above chance, \( t(21) = 9.26, p < .0005 \) (one-tailed). Deaf students thus were found to satisfy the minimum requirement for use of a fingerspelling decoding system: They can identify and presumably access that subset of their lexicon that can be directly represented in print.

Table 1

<table>
<thead>
<tr>
<th>Condition</th>
<th>Age</th>
<th>n</th>
<th>fingerspelling</th>
<th>sign</th>
<th>loan sign</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary</td>
<td>9</td>
<td></td>
<td>100.00</td>
<td>93.33</td>
<td>96.88</td>
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<tr>
<td></td>
<td></td>
<td>SD</td>
<td>0.00</td>
<td>5.00</td>
<td>6.17</td>
</tr>
<tr>
<td>Secondary</td>
<td>13</td>
<td></td>
<td>96.92</td>
<td>88.50</td>
<td>86.92</td>
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<tr>
<td></td>
<td></td>
<td>SD</td>
<td>8.50</td>
<td>21.50</td>
<td>35.20</td>
</tr>
</tbody>
</table>

\( ^{a} \)Correct classification was as fingerspelling.
\( ^{b} \)Correct classification was as sign.

EXPERIMENT 2: Handshape Monitoring Task

This experiment is analogous to those in the literature that explore whether children can detect that the spoken words \( \text{mom} \) and \( \text{man} \) start with the same sound (e.g., Calfee, Chapman, & Venezky, 1972). It uses a procedure adapted from the phoneme monitoring task introduced by Foss (1969, 1970; Foss & Fay, 1975), in which subjects respond to target phonemes that are embedded in various linguistic contexts. In this experiment, subjects were asked whether they recognized particular handshapes within words or sentences that were presented in real time on a video display.

Method

Subjects

A total of 21 subjects completed this experiment: 8 from the elementary school age group (\( M = 8.20 \)), and 13 from the secondary school age group (\( M = 14.85 \)). Four of the original 26 subjects could not participate due to equipment failure at the second school. In addition, the five-year-old could not complete the task.

Procedure

Children were seated individually in front of a video monitor and were told that they were detectives, responsible for detecting particular handshapes. Subjects were given a small mechanical box which had a protruding lever. They were instructed to press this lever whenever the designated handshape appeared on the screen. Pressing the lever set off simultaneously a small red light at the top center of the video monitor and a buzzer recorded on the test tape to permit the subsequent measurement of reaction time. First, subjects viewed a trial tape on which the instructions were delivered in ASL,
by a native speaker of the language. Subjects saw a signed sequence, *LOOK FOR THE B HANDSHAPE*, and then saw the fingerspelled word *B-L-U-E* (where the B handshape appears in the first position) or the signed sentence *BROWN DOGS ARE BEAUTIFUL* (where the B handshape appears in the first position as one of the features of the word *BROWN*). In a similar matched example, subjects saw the instruction *LOOK FOR THE V*, followed by the signed sentence *I WANT TWO ORANGES* (where V designates the word *TWO*) or the fingerspelled word *HAVE* (where V appears in the 3rd position). It is important to note that the sentences were not necessarily delivered in ASL syntax. That is, in some cases English word order was used to maintain consistency with the fingerspelled stimuli. Figure 2 depicts some of the stimuli used in the task. This trial tape with feedback lasted for approximately 2 minutes, or until the subject could follow the instructions accurately.

During the test phase, subjects viewed 20 matched pairs like those above. The signed sentence occurred first in half of the pairs, and the fingerspelled word occurred first in the other half. Target letters were varied across four positions within the word or sentence. The handshapes were equally visible in all conditions, and the exposure time of the handshapes was carefully controlled by presenting handshapes or signs at a speed regulated by the tick of a metronome. There was no gross difference in delivery speed across the two conditions. The signers chose a delivery speed that was considered “sluggish,” but within the bounds of normal conversation. They were instructed to have the fingerspelled letter or signed word in full view at the tick of the metronome.

The independent variables were position of handshape, context of probe (sign vs. fingerspelling), and age of subjects (elementary vs. secondary). The dependent measures were (a)

*Figure 2*

Matched fingerspelling/sign pairs from Experiment 2

![Figure 2](image-url)
reaction time, recorded from the moment that the handshape was fully visible on the screen until the buzzer sounded, and (b) error, recorded as either a false positive (pressing the lever when a handshape did not occur) or a false negative (failing to press the lever when a handshape did occur). Time measurements accurate to .01 of a second were made by superimposing a clock counter on the bottom left hand corner of the entire set of video sequences. Two judges assessed the time at which the target handshape was in full view for a given trial. Reaction time was then calculated, for each subject individually, as the time recorded at the sounding of the buzzer minus the time at which the handshape was judged to appear in full view.

Results and Discussion

The results of this experiment were analyzed in a $2 \times 4 \times 2$ analysis of variance (ANOVA) with repeated measures, on the two age levels (elementary vs. secondary), four handshape positions (1, 2, 3, 4/5), and two contexts (sign vs. fingerspelling). A significant main effect was found for grade level: The younger children committed more errors, $F(1, 19) = 9.30, p < .01$, and took more time to respond, $F(1, 19) = 9.25, p < .01$, than older students. Despite this expected difference, the elementary children did surprisingly well on this task, responding correctly 68% of the time (see Table 2). There were no false positive responses from either group.

More interestingly, the position of the probe also affected recognition (see Tables 2 and 3). The students took significantly longer to respond to handshapes in the first position than in the later positions, $F(3, 57) = 27.83, p < .001$. Similarly, significantly more subjects missed letters occurring in the first position, $F(3, 57) = 12.56, p < .001$, and signs in the first position, $F(3, 57) = 4.26, p < .05$. This result probably reflects the fact that after the first letter or word is presented, subsequent letters or words are contextually constrained. This result suggests that these students have acquired

<table>
<thead>
<tr>
<th>Table 2</th>
<th>Mean percentage correct for handshape recognition task (Experiment 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Position of probe</td>
</tr>
<tr>
<td>Age n</td>
<td>1</td>
</tr>
<tr>
<td>Elementary</td>
<td>8</td>
</tr>
<tr>
<td>M</td>
<td>79.13</td>
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<tr>
<td>SD</td>
<td>21.66</td>
</tr>
<tr>
<td>Secondary</td>
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</tr>
<tr>
<td>M</td>
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</tr>
<tr>
<td>SD</td>
<td>18.15</td>
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<table>
<thead>
<tr>
<th>Position of probe</th>
</tr>
</thead>
</table>

<table>
<thead>
<tr>
<th>Table 3</th>
<th>Mean reaction time (in seconds) for handshape recognition task (Experiment 2)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Position of probe</td>
</tr>
<tr>
<td>Age n</td>
<td>1</td>
</tr>
<tr>
<td>Elementary</td>
<td>8</td>
</tr>
<tr>
<td>M</td>
<td>0.91</td>
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<tr>
<td>SD</td>
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<tr>
<td>Secondary</td>
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<tr>
<td>SD</td>
<td>0.15</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Position of probe</th>
</tr>
</thead>
</table>

| Note. Data were collapsed for positions 4 and 5. |
at least minimal knowledge of English orthographic constraints. They may realize, for example, that after the letter (handshape) T is presented, they are unlikely to see a V or a Z because such combinations are illegal in English orthography. (See Hanson, 1982, for a discussion of sensitivity of the deaf to orthographic context effects, and McClelland & Rumelhart, 1981, for a discussion of evidence for and against the role of orthographic contextual constraints).

Finally, subjects were significantly more likely to target handshapes in fingerspelled words than they were in signed words: an effect that appeared in both the percentage of handshapes correctly identified, \( F(1, 19) = 39.76, p < .001 \), and in the speed of response, \( F(1, 19) = 48.00, p < .001 \). On average, subjects identified 95% of the letters in the fingerspelled context, and 85% of the words in the signed condition. They took an average of .48 seconds to identify the fingerspelled handshapes, and an average of .61 seconds to respond to those same handshapes when they represented words in a signed context. In part, these results may be explained by the fact that there was higher expectation for which letters would appear in the fingerspelled condition than for which words could occur in the signed condition. Also, a small portion of the sentences were not legal in ASL, which may have affected the response. However, these results are also consistent with those reported in the hearing literature by McNeil and Stone (1965). In that study, children were better able to hear separate spoken sounds in nonsense words than in familiar words. McNeil and Stone concluded that the more meaningful the material, the less likely one was to attend to surface details. This result is also consistent with the finding in memory studies that attention to more global meaning tends to obscure recognition of surface details (see Sachs, 1967; Mandler & Richey, 1977). Given that the subjects did see the target handshapes in both conditions, they may simply have been more salient in the less meaningful condition.

The important result here is that deaf students can direct their attention to fingerspelled words, and can isolate handshapes within these words. Furthermore, these handshapes are more salient in fingerspelled words than they are at the higher level, in signed sentences.

**EXPERIMENT 3: Handshape Manipulation Task**

The final metalinguistic task is adapted from those in the hearing literature that ask children to “take the b sound out of boy” (Rosner & Simon, 1971). Those hearing children who are most sensitive to phoneme characteristics, and who subsequently become the best readers, are those who accurately respond with the syllable oy. That is, the better readers are those who can not only recognize that the word boy starts with the same phoneme as the word box, but can also isolate and manipulate the b phoneme within the word boy. It is this latter task that convincingly demonstrates the child’s ability to isolate just those phonemic units that map onto alphabetic letters. Following the same logic, I designed this experiment to determine whether deaf students can go beyond handshape recognition to handshape manipulation. In addition, I was interested in whether the ability to perform a phonological segmentation task relates to initial reading skill for deaf people in the same way as it does for hearing readers. That is, I wanted to know whether metalinguistic competence, as reflected through the fingerspelling segmentation tasks, correlated specifically with reading competence, but not with other indices of intelligence, such as mathematical ability.

**Method**

**Subjects**

Twenty-five subjects participated in this experiment: 12 in the 5-11 age range \( (M = 8.43) \), and 13 in the 13-16 age range \( (M = 14.85) \). One of the original 26 subjects chose not to complete the task.
Scores were obtained for these subjects on reading comprehension (from the reading comprehension subtest of the Stanford Achievement Test, Level 1), mathematical computation (from the mathematical computation subtest of the Stanford Achievement Test, Level 1), and reading level (assessed by the classroom teachers as the grade level of the reading material that the students were using in their standard classroom textbooks). Unfortunately, full scores on these three scales were available for only 12 of the subjects.

Stimuli

The stimuli were 14 three-letter words and 21 four-letter words that were randomly presented on a videotape. The words were selected with two constraints in mind: (a) so that target handshapes could be eliminated at varying positions within the word (i.e., at outer as well as medial positions), and (b) so that a complete and common English word would remain once each of the target letters had been removed. For example, if we remove the S from the stimulus word *SEAT*, we eliminate a letter in an outer position, and leave the word *EAT*. Likewise, if we take the E out of *FEAT*, we remove a letter in a medial position, and leave the word *FAT*.

Procedure

The testing procedure was adapted directly from the phoneme deletion tasks of Rosner and Simon (1971). Students were individually seated in front of a video monitor on which they saw the fingerspelled stimulus words presented in random order. Their task was to report the letters that would be left behind after a target letter was removed. For example, if the interpreter appeared on the screen signing *HE'S GOING TO TAKE THE R. HE'S GOING TO TAKE THE R.* Subjects then saw the fingerspelled word *ARM* twice in succession, and were asked, *WHAT'S LEFT?* In this case the subjects would respond by fingerspelling the word *AM*.

Each child saw two demonstrations before participating in the test. The first was a live demonstration, in which one experimenter fingerspelled a word while the other pretended to grab and to remove the handshape from the ongoing word display. The second demonstration was a five-trial, taped practice session that resembled the testing condition except that feedback was provided by the experimenter for each incorrect response. Finally, subjects participated in the test trials. Responses were hand-recorded after each trial. Grade level, length of word, and position of probe served as the independent variables. The number of words correctly fingerspelled was the dependent variable. The native signer recorded all responses on a score sheet as the task was being implemented.

Results and Discussion

Again the deaf students demonstrated a clear ability to attend to individual handshapes, even in this more taxing experiment. On average the group answered correctly 88% of the time, with even the youngest students responding with 78% accuracy. The general results of this experiment were analyzed in a three-way ANOVA with repeated measures, with two grade levels (elementary vs. secondary), two word lengths (3-letter words and 4-letter words), and two letter positions (outer and medial). As expected, the secondary school students significantly outscored the elementary students across both word length and position eliminated $F(1, 23) = 11.53, p < .005$.

More interesting, however, are the results for main effects of word length and position of letter eliminated. Word length did not affect performance, $F(1, 23) = .23, p > .10$. Position eliminated did affect performance: Students were better able to manipulate outer letters ($M = 91\%$) than medial letters ($M = 84\%$), $F(1, 23) = 9.38, p < .01$. There are a number of possible explanations for the students' greater difficulty with processing medial letters. First, it may have been an artifact of the testing procedure. Perhaps subjects have greater difficulty combining two sets of letters into a word than they do reporting a word that remains from an uninterrupted sequence of letters. However, this finding is also consistent with results reported by Caccamise (1977) on the visual
processing of fingerspelling. Medial letters (handshapes) are the first to be deleted when one increases the speed of fingerspelling (Blasdell, 1977) and are the first to be dropped from a word as it evolves from fingerspelling into an ASL loan sign (Battison, 1978). These results also build on those found in Experiment 2 for effects of orthographic constraints. Medial letters do not carry as much information as the initial and final letters, which serve to constrain a word for those who know orthographic rules. Thus, given limited processing time, one attends to those letters that flank a word.

Taken together, the three metalinguistic experiments provide convincing evidence that deaf students—even at elementary school ages—are capable of segmenting “whole” fingerspelled words into the discrete handshapes that map onto print. That is, there is reason to believe that students can attend to the individual handshapes in fingerspelling in much the same way that readers attend to the phonemes that map onto printed words (see Gough, 1985; McClelland & Rumelhart, 1981). This finding is upheld even with the youngest members of the sample. It is also a result of importance because attention to individual handshapes gives the deaf student a direct, alphabetically relevant phonological representation that is accessible through some of the words in the child’s lexicon.

Relation to Reading Ability

The next question was whether the subjects’ performance on phonological segmentation correlated with their reading ability. A composite segmentation score was calculated for each student by averaging his or her separate scores from Experiments 1, 2, and 3. Using a partial (Pearson) correlation controlling for age and IQ of subject, we found a positive and significant correlation between this global segmentation score and the subject’s grade reading level \( r = .61, p < .05 \), and a trend between this segmentation score and the reading comprehension score from the SAT \( r = .55, p < .10 \). No relationship was found between segmentation score and mathematical computation score on the SAT \( r = .28, p > .10 \). It appears that metalinguistic ability in fingerspelling does relate selectively to measures of initial reading achievement, but not to indices of general intelligence such as mathematical ability. This result parallels those found in the hearing literature.

Because the sample size was so small and because the tests used to measure deaf reading ability are often less accurate than those used with hearing children (see Conrad, 1979, for a review), these parallel findings must be interpreted with caution. Furthermore, this subject population is representative only of deaf reading skill advancement from first to third grade. More challenging fingerspelling tasks might have permitted us to view the relationship between metalinguistics and reading skill beyond the beginner reading levels. Despite these reservations, the shift from reading at Grade 1.5 to reading at Grade 3.5 is itself significant because it represents a development from “word-poking,” or painstaking decoding, to an emphasis on comprehension (Chall, 1983). Thus, even though the range of reading grade levels represented by these deaf students was narrow, one can at minimum argue that metalinguistic skill in fingerspelling may prove an important tool for those beginning readers who are moving from decoding into the early stages of reading comprehension (see Chall, 1983).

EXPERIMENT 4: Training Study

The correlations found in the previous study are promising in that they suggest some relation between the signers’ language and English orthography. They do not, however, demonstrate a causal relationship between fingerspelling use and reading competence. This point is clearly articulated in the literature on normal reading acquisition. Many of the early experiments asked whether children had the metalinguistic ability to segment words and went on to demonstrate a relationship between this ability and reading (e.g., Fox & Routh, 1975; Liberman et al., 1977). The precise relationship between these tasks was not made apparent, however, until some demonstrated that (a) these skills are used in the appli-
cation of grapheme-to-phoneme rules (Treiman & Baron, 1981), and that (b) the use of the grapheme-to-phoneme rules themselves are important in promoting skill in word identification (Firth, 1972; Treiman & Baron, 1981).

In this experiment, deaf individuals were trained in the use of a fingerspelling decoding system to see whether such training would improve their proficiency at word identification.

Method

Subjects

All 26 students participated in this task: 13 from the younger age group ($M = 8.15$), and 13 from the older age group ($M = 14.85$).

Stimuli

The 24 words used in this experiment were taken from names of products and stores, such as ACME, CHEVROLET, and BANDAID. These words were chosen because they occur as loan signs in the Philadelphia dialect of American Sign Language, and because they were judged to be within most students' fingerspelling (loan sign) vocabulary, but not necessarily in their sight-word vocabulary.

Students saw (a) a vertical, hand-printed list of the 24 words, and (b) a white sheet of paper on which were mounted 28 product logos, 24 of which corresponded to the 24 printed words. All print within the logos was erased to prevent matching on word characteristics alone. Logos rather than objects were pictured because many of the loan signs, such as that for the ACME supermarket, could not be readily depicted in any other way. Finally, 28 logos were used so that there would be more pictures to choose from than there were words to identify.

Procedure

The task was simply to match the word with the picture. The experimenter randomly pointed to a printed word and requested that the student respond by pointing to the logo or “picture” associated with that word. Because there were so few subjects in the younger and older populations, complete counterbalancing was impossible. Thus, these procedures were repeated in invariant order, with a control for practice effect built into the design during the third of four trial conditions. The four conditions were as follows:

1. The experimenter randomly pointed to each of the printed words and requested that the child point to the appropriate picture—yielding a measure of the student's sight-word vocabulary.

2. The experimenter told the subject that she would fingerspell a set of words, and requested that the child again point to the corresponding picture—yielding a measure of the child's competence with the fingerspelled vocabulary. The child was not told that the set of words being fingerspelled was the same as that used in the previous trial.

3. The experimenter again selected words from the printed word list in random order and requested that the child point to the appropriate pictures, with the incentive to “try harder”—yielding a measure of any practice effect and, of course, a second measure of the child's sight-word vocabulary.

4. The experimenter randomly pointed to the words from the word list and asked the child to “try just once more by attempting to fingerspell each word before pointing to the corresponding picture”—yielding a measure of the hypothesized improvement with decoding into fingerspelling.

The independent variables were age of subject (younger vs. older) and trial condition (1–4). The dependent variable was the percentage correct across conditions.

Results

The results for this experiment for elementary and secondary students across conditions are presented in Table 4. A two-way ANOVA with repeated measures, on two ages (elementary vs. secondary) by four trial conditions, revealed main effects of age, $F(1, 24) = 31.87$, $p$
< .001, and condition, \(F(3, 72) = 38.79, p < .001\). Further, the significant effect of the interaction of age and condition, \(F(3, 72) = 7.60, p < .001\), can probably be traced to the responses by the younger age group—that group not responding at ceiling on the task—on Conditions 1 and 4.

A more detailed picture of these results emerges when one does pairwise comparisons on the different task conditions. First, there is no evidence that these students regularly decode sight words into fingerspelling—either overtly or covertly. This can be deduced from the finding that subjects, as predicted, responded significantly better in Condition 2 than they did in Condition 1, \(t(25) = 4.81, p < .001\). On the average, they comprehended 2.5 more words in the fingerspelling condition (Condition 2) than they did with sight words alone. This discrepancy would not have emerged were subjects spontaneously using a fingerspelling strategy. Second, there appeared to be no practice effect across conditions; that is, no difference was found between Conditions 1 and 3, \(t(25) = -.133, p > .10\). Third, and most impressive, the students significantly increased their word identification score when they decoded into fingerspelling: Condition 3 versus Condition 4, \(t(25) = 4.42, p < .001\). This finding was especially pronounced for the children at elementary age, who identified approximately 3 more words using the strategy than they did without the strategy, \(t(12) = 3.95, p < .01\).

**Discussion**

The results of Experiment 4 provide the most compelling evidence that the use of fingerspelling decoding (or recoding) can facilitate word identification. Yet these results leave open the question of whether such decoding is done through word-specific association or through the phonological level via the implementation of spelling-to-handshape rules. As Baron (1979) demonstrated with hearing people, subjects may be able to decode a given word phonetically (a) because they have memorized a particular whole-word pronunciation for the word, as is common for irregular words like pint, or (b) because they are using grapheme-to-phoneme rules that generate a regular pronunciation, as in mint. Experiment 4 does not distinguish between these two hypotheses: That is, subjects could be associating each word with the entire sequence of handshapes that make it up. Coupled with the results of Experiments 1–3, however, one can conclude that subjects can use the grapheme-to-handshape rules, and that it would seem to benefit them if they did use these rules. As is the case with hearing children, these rules are not spontaneously used, but must be taught.

**GENERAL DISCUSSION**

The results of these studies offer partial answers to questions of the relationship between metalinguistic competence and reading. Metalinguistic competence in fingerspelling does selectively correlate with beginning reading achievement, and not with other indices of intelligence, such as mathematical skill. Further, training in fingerspelling does promote word identification for those words in the signer's fingerspelling lexicon. Because word identifica-

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**Table 4** Mean percentage of words identified by trial condition (Experiment 4)

<table>
<thead>
<tr>
<th>Condition</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Elementary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>36.31</td>
<td>51.76</td>
<td>36.31</td>
<td>48.62</td>
</tr>
<tr>
<td>SD</td>
<td>25.84</td>
<td>22.73</td>
<td>26.24</td>
<td>26.63</td>
</tr>
<tr>
<td>Secondary</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>M</td>
<td>82.15</td>
<td>87.62</td>
<td>81.85</td>
<td>87.31</td>
</tr>
<tr>
<td>SD</td>
<td>11.93</td>
<td>6.60</td>
<td>11.59</td>
<td>6.21</td>
</tr>
</tbody>
</table>

*Note.* The values represent percentage identified out of 24 words.

*Conditions:*  
1 = sight-word identification  
2 = fingerspelling alone  
3 = practice with sight-word identification  
4 = sight-word identification with fingerspelling strategy
tion skill is the single best predictor of reading success (Anderson & Freebody, 1985; Becker, 1977; Liberman et al., 1977), one might leap to the conclusion that decoding into fingerspelling will, at minimum, help beginning readers move from earlier stages of decoding print to more advanced stages of reading comprehension by offering deaf readers partial access to an abstract phonological level in their language that relates to alphabetic text. Ongoing research in our laboratory is directly testing this hypothesis.

Even as it stands, however, this research offers both theoretical and practical insights. Theoretically, it is now well documented that access to the phonological level of language can play an important role in the decoding and recoding of print (see, e.g., reviews by Anderson & Freebody, 1985; Chall, 1983; Crowder, 1982; Johnson & Baumann, 1984; and Sticht & James, 1984). Phonemic awareness is particularly important for young readers whose language vocabularies far exceed their written vocabularies. The ability to identify new words in print is often contingent upon the reader's ability to use the grapheme-to-phoneme correspondences that translate the less familiar written code into the more familiar—and, in terms of processing, the more durable—native language. Because for most beginning readers the native language is spoken, it is no wonder that speech analysis has been extensively studied as the major inroad to phonemic analysis and hence as the primary route towards mastery of the phoneme-to-grapheme rule system.

Analysis of the speech stream, however, is not a profitable avenue for all readers. Profoundly deaf readers often fail to hear any sounds that occur within the speech range. For them, full analysis of speech is often impossible. Further, if Vellutino (1979) and others are correct, a number of dyslexic students have problems in perceiving the speech sounds that are mapped by the phoneme-to-grapheme rule system. Given that some among these deaf and dyslexic individuals do learn to read, it becomes important to explore alternate access routes to the abstract phonological level and to determine how these routes serve the readers who must depend on them.

The study of an inner speech through articulatory decoding marked one attempt to document a non-sound-based route of access to the phoneme. Studies by Conrad (1979), Hanson et al. (1984), Locke and Locke (1971), and Treiman and Hirsh-Pasek (1983) all demonstrated that deaf individuals could gain some knowledge of English phonological structure through articulation. Conrad's (1979) seminal work demonstrated that the use of this inner speech correlated with reading achievement. The articulatory-based inner speech, however, did not provide deaf readers with the same benefits that the speech-based code affords hearing readers. Conrad reported that when deaf and hearing readers were matched for level of inner speech, the hearing readers outperformed their deaf counterparts. It is possible that the level of use of inner speech is not as important as the accuracy of that inner speech. That is, deaf people rarely master the range of articulatory gestures used in the target language, and such mastery is highly dependent on hearing level. Because inner speech is positively and significantly correlated with level of hearing, there is also reason to doubt that this system can be widely used for reading (Conrad, 1979), because many deaf people are precluded from using it. Further, those who do use it often do not have a complete enough language (here, English language) system to permit them to go beyond the decoding of individual words to comprehension of the language/grammatical system in printed text.

Unlike the use of articulatory cues, mediation through fingerspelling provides even profoundly deaf readers with an internal system that directly relates to the alphabet. Such a system provides them not only with some insight into the English phonological system represented in print, but also with a way to relate one portion of their own language (ASL) with printed text. Results like those reported here suggest that attention to fingerspelling can assist readers in word identification and may be related to more general reading achievement. Because decoding into fingerspelling represents a way of relating one part of the signers' language (and, of course, the English language on
which it was based) with print, it may also provide them with a way of increasing their written vocabularies. The weaknesses of such a system are that fingerspelled words represent a rather small proportion of the signers’ overall vocabulary, and that the fingerspelling-based phonological code can, in principle, only help them in word identification, and not in the carry-over to syntax. That is, for hearing readers, access to the phoneme through speech analysis can potentially provide them with the means to bring their oral language skills—which include knowledge of the grammar and syntax of English—to bear on the interpretation of printed text. For deaf readers, in contrast, the fingerspelling strategy is less far-reaching. It would enable connections between some individual words in their vocabulary and some printed text, but it stops short of providing a means for decoding all vocabulary or a means of moving beyond words to an understanding of the grammar represented in the text. Indeed, as readers attempt to move beyond word identification in this system, they will be confronted with the problems faced when reading a foreign language. They will have to learn strategies for reading in a grammar that has little resemblance to their own.

Given that fingerspelling decoding may provide deaf readers with a way to connect at least one part of their language with print, and given that the number of fingerspelled words that regularly occur in the signed vocabulary is small, one might ask how the fingerspelling system could be made profitable for readers. Here we turn to the instructional strategy of bilexicalism. Bilexicalism refers to the idea of teaching children a number of fingerspelled glosses for words already in their signed vocabulary. Bilexicality would allow teachers to supplement a child’s vocabulary to facilitate reading without replacing the child’s vocabulary with an artificial language. It is important to recognize that bilexicality does not imply learning a fingerspelled term at the expense of a sign term; nor does it imply creating a “language” of fingerspelling (whatever that would be). For example, the bilexical child would know not only the signs for words like TABLE and CHAIR, but also a fingerspelled “spelling-out” of these words. Once the child knew enough fingerspelled words and once the child was explicitly taught to decode into fingerspelling, beginning reading could take place. At minimum, such a strategy would teach the deaf child that the process of reading was meant to be meaningful—a lesson that many deaf students fail to learn (Stage I in Chall’s stages of reading, 1983). The deaf students might even be able to decode enough words in the sentence and to recognize enough word patterns that they could learn something about the syntax of English as they begin to comprehend text (Stage III in Chall, 1983).

In sum, then, decoding through fingerspelling offers one possible way for those who have trouble with the analysis of speech to gain access to a partial phonological system that maps language onto print. Suggesting this partial route to the lexicon in no way implies that decoding skills and word identification are sufficient for reading progress (see Spiro & Myers, 1984). Yet vocabulary development remains the best predictor of reading success (Anderson & Freebody, 1985; Becker, 1977), and the lack of word identification skill remains one of the major problems for deaf readers (Johnson, Toms-Bronowski, & Pittelman, 1982). Given these facts, instruction in fingerspelling and in grapheme-handshape correspondences may offer a welcome step toward success in beginning reading for deaf students and perhaps for others who have trouble in discovering the phoneme through the avenue of speech.

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Metalinguistics of fingerspelling

HIRSH-PASEK


Footnote

I would like to thank April Nelson (my informant), Anna Steckle (my interpreter), and Susan Leviton (my consultant and artist) for the many hours they spent introducing me to ASL and the deaf community. The teachers, students, and staff at the Pennsylvania School for the Deaf and the Millburn School for the Deaf were most generous with their time. Finally, a number of my colleagues offered constructive criticism throughout the work and commented upon earlier drafts. Among them are Drs. Lila Gleitman, Elizabeth Shipley, Henry Gleitman, Roberta Golinkoff, R. Conrad, Leslie Rescorla, Rebecca Treiman, Frank Caccamise, and the reviewers. This work was completed in partial fulfillment of the Ph.D. requirement at The University of Pennsylvania.