An Overview on the ASL-phabet

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Abstract

The ASL-phabet is described in detail as a writing system representing American Sign Language (ASL). The graphemes used to write signs are based on ASL's phonological parameters: handshape, location, and movement. The ASL-phabet is designed to help establish the alphabetic principle in deaf children starting to read and facilitate their transition to written English at the same time. As part of understanding the system's efficiency, we discuss conditions that shape alphabets for the ease of learning and use. Also subject to discussion is how the ASL-phabet shares a number of features found in spoken language alphabets. Examples are provided throughout, including illustrating decoding attempts with a deaf child in a tutorial setting in support of the potential for readability of written signs.

Introduction

The ASL-phabet is a system designed for writing American Sign Language (ASL), and teaching the alphabetic principle to young deaf students. It is one component of a comprehensive literacy program put together in an Arizona charter school founded by the first author. The school had a formal affiliation with the University of Arizona written into its charter; and this strengthened the collaborative effort that was instrumental to the development of the ASL-phabet (Supalla, Wix, & McKee, 2001). As the name indicates, the ASL-phabet is designed to function as an alphabet for ASL. This provides deaf learners with the opportunity to grasp the concept that signs are made up of phonological parameters that represent different handshapes, movements, and locations that can all be represented on paper. Once the learners begin to understand the correlation of written graphemes to signed parameters, they are on the way to reading words in ASL. The ultimate goal is to complete a series of steps and eventually transition from ASL to written English.

What was undertaken at the Arizona charter school is innovative, especially when considering how alphabets have widely been viewed as limited to spoken languages. Even though there have been several ASL writing systems developed over the years, they were not explored in terms of achieving an alphabetic status, for example. Rather the individual ASL writing systems have been treated as simply a 'writing system' or 'notation system' (e.g., Hopkins, 2008; Miller, 2001; van der Hulst & Channon, 2010).

Taking a closer look at the ASL-phabet is timely and critical. Effective reading instruction practices in schools have become a priority in the United States. The fact that deaf students experience reading difficulties with English (e.g., Padden & Ramsey, 1998; Paul, 2003) has a lot to do with its status as a spoken language. Those who are born profoundly deaf or became deaf before the age of two do not enjoy access to English and later in reading. The situation with ASL is different. ASL, a signed language, underlines the concept of linguistic accessibility where deaf individuals can become language proficient through normal learning and interaction with signers (Supalla & Cripps, 2008). It has been shown that deaf students who know ASL perform better with English literacy than those who are not highly proficient in ASL (e.g., Fish, Hoffmeister, McVey, & Clinton, 2006; Hoffmeister, 2000; Padden & Ramsey, 2000; Strong & Prinz, 2000). This indicates that reading must start with ASL, and deaf students can transition to written English as a second language. Padden and Ramsey (1998) made it clear that knowing ASL is not enough since reading must be taught to deaf students just as with hearing students. The ASL-phabet allows us to introduce and reinforce ASL linguistic concepts in young learners to further improve their reading potential.

Supalla and Cripps (2011) explained that the reading program set-up for deaf students at the Arizona charter school was unique in many ways, but designed to meet the students' need in becoming literate in English. It is important to note that the ASL-phabet was not used for writing sentences or even in the production of books. The ASL-phabet was used for writing individual words only. There were other components of the reading program that took readers to the next literacy level, but since the scope of this paper is to focus on the ASL-phabet, those components will not be discussed in depth here.

An obvious question here is how does the ASL-phabet operate in the context of the ASL to written English process? In other words, what does "reading signs" mean, and how does this help a deaf child transition to written English? What does decoding in ASL look like? How does the ASL-phabet compare to spoken language alphabets and various ASL writing systems developed over the years? A review on what constitutes an ideal alphabet serves as the starting point. Data provided on two spoken language alphabets helps with understanding why they are ideal and what features are involved. The information serves as a basis for examining the ASL-phabet and two other ASL writing systems. Efficiency is part of understanding how the ASL-phabet may be more appropriate for use in schools. Finally, it is the review of a study on how a deaf child learns to read words written in the ASL-phabet that provides insights on decoding and the universality of reading.

Conditions for an Ideal Alphabetic System

Alphabetic systems are associated with many spoken languages around the world, including English. Adams (1990, p. 19) made an important comment on the nature of alphabets as compared to other writing system types as follows:

> The advantages of an alphabetic system are clear. Like the syllabaries and advanced logographies, it is capable of representing any speakable expression. Unlike either of those systems, it can do so by means of remarkably few symbols…the number of symbols in an alphabetic system tends to range between 20 and 35 – few enough to be memorized by almost anyone and, once memorized,

adequate – at least in a perfectly alphabetic system – for purposes of reading and writing any word in the language…

While this quote focuses on spoken languages, an alphabetic type for a writing system to be adopted for ASL must include a consideration for the number of symbols or graphemes. The range of 20-35 graphemes appears to be something ideal for alphabets. It is easy to imagine the difficulty in reading words when there are more graphemes to learn and use. Havelock (1976) made a similar remark on the number of graphemes for an alphabet. This includes a discussion on how a large number of graphemes would tax readers' memory.[1]

In addition, it is important to consider the correspondence between individual graphemes and phonemes and how variation occurs across language-alphabet pairs in the spoken language modality. The fact that ASL has a set of phonemes will be subject to elaboration later on. The distinction between shallow and deep orthographies is helpful in understanding how different alphabets operate. With a shallow system, there is close to a one-to-one correspondence between graphemes and phonemes. Such a correspondence is unambiguous. But in a deep system, the correspondence between grapheme and phoneme may be many-to-many, and the relations are ambiguous. The one-to-one correspondence between graphemes and phonemes is noted for its simplicity (e.g., Havelock, 1976), however such feature may not be an option for a language with many phonemes. In that situation, pursuing ambiguity can help keep the total number of graphemes low and the alphabetic system staying within the ideal range.

Insights from English and Spanish

Beginning with vowels in English, (1a) shows how a single grapheme corresponds to several phonemes; (1b) shows how a single phoneme corresponds to several graphemes. Turning to English consonants, (2a) shows two phonemes corresponding to the grapheme C; (2b) shows a similar ambiguity, but with the digraph CH; (2c) shows a single phoneme corresponding to several graphemes.

(1) a. the letter A → three sounds

- [a] as in *f<u>a</u>ther*
- [ə] as in *<u>a</u>bout*
- [æ] as in *<u>a</u>pple*

b. the sound [i] → several letters

[1] Readers need to note there is considerable variation in the size of alphabets developed for spoken languages, for example, 11 letters in Rotokas and 74 in Khmer (Crystal, 1997). The fact that the latter language has so many graphemes suggest a high number of graphemes is not impossible for an alphabet. Children learning to read in Khmer must deal with the pressure of memorizing a large number of graphemes.

- E as in *meter*
- EE as in *meet*
- EA as in *meat*
- AY as in *quay*
- EY as in *key*
- EI as in *ceiling*

(2) a. the letter C → two sounds

- [k] as in *cat, color,* and *curtain*
- [s] as in *cinema* and *certain*

b. the digraph CH → three sounds

- [k] as in *chemistry*
- [ĉ] as in *church*
- [ŝ] as in *champagne*

c. the sound [k] → several letters and combinations of letters

- K as in *soak*
- Q as in *queue*
- K as in *sock*

In contrast, the five vowels of Spanish are unambiguous. The letter A is always pronounced [a]; see (3a). And the phoneme [i] is always represented by the letter I; see (3b). Spanish consonants are more regular than English consonants, but a few do represent multiple phonemes. As (4) shows, the letter C corresponds to both [k] and [s]. Comparison of (2a) and (4) illustrates one of the ways that both alphabets are more regular than they first appear to be: A phonological context determines how the letter C is pronounced. In both language, it corresponds to a [k] when followed by the vowels [a, o, u] and to an [s] when followed by the vowels [i, e].

(3) a. the letter A → always [a] as in *padre* and *casa*

b. the sound [i] → always I as in *libro* and *Maria*

(4) the letter C → two sounds

- [k] as in *cantar, color* and *culebra*

- [s] as in *c̲inta* and *c̲enar*

English and Spanish share many of the Roman alphabet's symbols, but the two languages have different numbers of phonemes. English represents its roughly 40 phonemes with 26 letters, and Spanish represents its roughly 24 phonemes with roughly 28 graphemes (the specifics of the latter depend on whether one counts digraphs like CH and LL separately). (Please note that the total number of graphemes for English and Spanish fall within the ideal range (i.e., 20-35).) The fact that people can become proficient readers of English proves that its deep orthography is functional, even if it is more challenging than some other language-alphabet pairs (e.g., Ziegler & Goswami, 2006).

As a byproduct of deep orthography, English has a number of homographs. For example, the form wind sounds different when it refers to winding a clock or blowing air. Homographs are interesting in their own right. As in written English, homographs can be distinguished through context. The reading process with the wind example shows that one of the two word possibilities would be chosen over the other. For example, a child who can hear and read aloud the text about the coming of a storm and how hard the wind blows is most likely to pronounce the word as [wɪnd], not [waynd].

Precedents to the ASL-phabet

Two ASL writing systems, Stokoe and SignFont were introduced to the public in the 1960s and the 1980s, respectively.[2] The developers of these systems aspired to alphabetic writing. With Stokoe, it was used to alphabetize hundreds of signs in the Dictionary of American Sign Language on Linguistic Principles (DASL hereafter; Stokoe, Casterline, & Croneberg, 1965). When DASL was first published, it was widely thought that languages only used the vocal-auditory channel. DASL itself improved our understanding of linguistic principles in the ASL lexicon. But Stokoe developers came up with 55 graphemes to represent the signs in DASL. The number is higher than what is desirable for alphabets in general. The graphemes were broken down into three phonological parameters: 19 for handshape, 12 for location, and 24 for movement. The developers attempted to downplay the high number of graphemes as follows:

> [F]ifty-five symbols ... may seem more burdensome to learn than the English alphabet's 26 symbols. But the writing of signs is both simpler and more consistent than English spelling. Our conventions of spelling in English allow o-u-g-h to have five different pronunciations, for instance, and one vowel sound may be spelled with *e, ee, ei, ie, ea, ae, ay, i, y, oe*, and otherwise. The 55 symbols used to write American [S]ign [L]anguage stand for just 55 things visibly unlike all the rest (Stokoe et al., 1965, ix).

[2] Two other ASL writing systems not included in this paper are SignWriting (created by Valie Sutton in 1974) and si5s (by Robert Augustus in 2003). These systems rely on highly stylized drawings of signs rather than strings of symbols as adopted for the Stokoe, SignFont, and ASL-phabet systems. SignWriting and si5s deserve attention for their use of a different approach in writing signs, but the space of the paper does not allow for their inclusion. The French Sign Language version of Mimeography introduced back in the early nineteenth century (see Rée, 1990) also requires a thorough examination in the near future.

While Stokoe and his colleagues made important observations about the complexity of the English alphabet, their own system is not as simple as they thought. The last part of the quote emphasizing that the Stokoe system adopts a one-to-one grapheme and phoneme correspondence ("55 symbols…stand[ing] for just for 55 things…") requires a correction. The developers' description of the first grapheme (of the 55 grapheme inventory), for example, suggests that it represents three handshapes rather than one: "compact hand, fist; may be like 'a,' 's,' or 't' of manual alphabet" (Stokoe et al., 1965, xi). The ASL sign PRIVATE includes the A handshape, and the ASL signs WORK and BATHROOM use the S and T handshapes, respectively. But written in Stokoe, all three signs use the same handshape grapheme (with the remaining graphemes being different). A similar outcome occurs with the location parameter. One grapheme is described as referring to "cheek, temple, ear, side-face" (p. x). The sign CANDY is produced on the cheek and the sign IDEA on the temple. But written in Stokoe, both signs use the same location grapheme.

Stokoe's simplicity is clearer in the movement graphemes. These are more specific and less ambiguous. Unsurprisingly then, the number of movement graphemes is the highest (i.e., 24) in comparison to those for the handshape and location parameters. The developers were aware that many of the movements in ASL could be grouped together (into, e.g., Vertical Action, Sideways Action, Horizontal Action, Rotary Action, and Interaction). And yet they assigned distinct graphemes to all the different movements. The reason for the high number of movement graphemes lies in the developers' goal of avoiding homographs, as the following quote clarifies:

> [T]here are four subgroups of three [graphemes] each, showing a similar relationship within the subgroup. Vertical motion, for instance, might be considered one [movement] and given one [grapheme]; but some signs are identical in every respect except that the [movement] of one is upward motion, of another downward motion, and a third up-and-down motion (p. x).

This remark suggests that homographs were undesirable. It appears that the developers realized that a homograph would have occurred had a grapheme represented both upward and downward movements. This direction would result in a smaller number of graphemes, but the developers opted for more graphemes so that every written word in DASL differed orthographically. Their priority was showing that signs are componential and phonologically distinctive. Not only do we agree with Brentari (1995) that the Stokoe system is phonemic, but we also come to the conclusion that ASL has a large number of phonemes (based on how Stokoe and his colleagues came up with the number of 55 for their system).

With the SignFont developers, keeping the number of graphemes low was not a priority. Instead, the system's emphasis was on precision in how signs were written. This led to the increase of the grapheme count to 85 (see SignFont Handbook for the complete set of graphemes, p. 44). This increase reflected two decisions: no grouping of any parameters, and the addition of a fourth parameter. Another set of graphemes was developed to represent the contacting regions of the hand called the Action Area. This depicts whether the hand makes contact with its finger/thumb tip(s), palm, or edges (of the hand) depending on the sign involved.

We note SignFont's similarity to the International Phonetic Alphabet (IPA), which is best described as phonetic. (More work is needed to confirm this point.) It is easy to see how linguists would appreciate SignFont as it allows precise transcription of signs (see Miller, 2001, on the need for a functional and standardized phonetic transcription system for the signed language modality). It would be interesting to see if an IPA system could be developed based on SignFont. The new system would need to account for ASL and other signed languages around the world.[3] Like the IPA designed for representing spoken languages, SignFont is not an ideal tool for conventional reading or writing. For educational purposes, it is thus unlikely that the SignFont system would be appropriate to use in schools.

In comparing the Stokoe and SignFont systems, one difference requires mention. The availability of technology when these systems were developed probably affected the way they were written. The graphemes for the Stokoe system were made with a conventional typewriter. Some English letters (e.g., A, B, C, but not D, etc.) were used along with other keys such as [], 3 and >. Modern computer technology allowed the SignFont developers to create graphemes independent of the Roman alphabet (and other symbols on the keyboard).

The ASL-phabet as a System

The ASL-phabet has 32 graphemes, (which falls within the range of what is ideal for spoken language alphabets). There are 22 graphemes for handshape, five for location, and five for movement. This reflects a more aggressive grouping of phonemes than was done in Stokoe. The ASL-phabet's symbols are based on SignFont graphemes, which signaled independence from English and the spoken language modality.

An example of how the ASL-phabet works can be seen in the written sign for CAT, with its signed illustration shown in Figure 1. The sign is broken down into its handshape, location, and movement parameters (which is similar to what is reported earlier for the Stokoe system, not SignFont with its additional parameter involving the contacting regions of the hand). The written sign is read from right to left consisting of four graphemes with the first being handshape (i.e.,), the second location (i.e.,), and the third and fourth movement (i.e., and). The order of these parameters is Handshape (H), Location (L), and Movement (M) or HLM serves as the basis for many words in ASL.

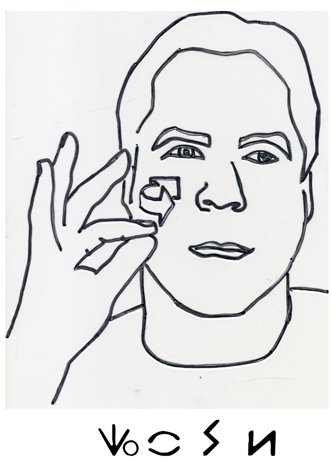

Figure 1: Sign Form of CAT with Its ASL-phabet Writing

[3] In Europe, a system called HamNoSys has "the goal of allowing for a phonetic transcription of any potentially significant characteristic of any sign in any sign language" (van der Hulst & Channon, 2010, p. 155). That system will need to be further examined with a comparison to SignFont and spoken language IPA in a future study.

The ASL-phabet has a degree of ambiguity, which is evidenced with the word's first grapheme , corresponds to two phonemes that are formationally related (i.e., both involving a thumb and index finger configuration, but one has a round formation and the other flattened). Because of this, the two phonemes are grouped under one grapheme. The second grapheme represents one of five phonemes. As the sign CAT is produced on the cheek, the location is part of a larger area on the lower face and neck. ASL signs may be produced on the cheek (as with CAT), or the area right under nose, on the mouth, the chin, or the neck. The five possible locations (or phonemes) are grouped under one grapheme (leaving other locations on the forehead, chest, and others to different graphemes). The grapheme involves four movements, left, right, up, and down. Because they share the same feature: vertical movement, they are grouped under one grapheme. Finally, the last grapheme is unambiguous and indicates repetitive movement (as found for CAT).

Some Considerations for the Orthographic Types

Here we demonstrate how the ASL-phabet falls between the English and Spanish orthographic types. Recall how the shallow orthography of Spanish tends to represent one phoneme with one grapheme. This feature is also characteristic of the ASL-phabet. There is no ASL phoneme being represented by two graphemes, for example (while English has many). Figure 2 shows how reliable the graphemes are for all three parameters of written signs. In the first column, all five signs incorporate the two-finger/thumb handshape. There is no case of the information being represented by a grapheme other than . The signs in the second column are produced in the lower face and neck region of the signer's body, and they are all written using the grapheme . The third column lists five signs that move away from or towards the signer's body, and the grapheme is used in each of those signs.

Figure 2: Reliable Correspondence of Graphemes and Their Phonemes According to the Parameters

However, one grapheme can correspond to several phonemes in the ASL-phabet (as discussed in the CAT example earlier). This recalls the deeper orthography of English. More examples are provided starting with LOUSY in the first listing above uses once, whereas FUNNY incorporates the other phoneme (see Figure 3(a)). In the second listing, the grapheme is used for DRINK and CANDY even though the former is produced on the mouth (serving as one phoneme of the grapheme) and the latter on the cheek (serving as the other phoneme of the same grapheme; see Figure 3(b)). In the third listing, the movement for ACCEPT is towards the signer's body, whereas TELL moves from the signer's mouth to the signing space. Both phonemes of the movements towards and leaving the signer's body are represented by the grapheme (see Figure 3(c)).

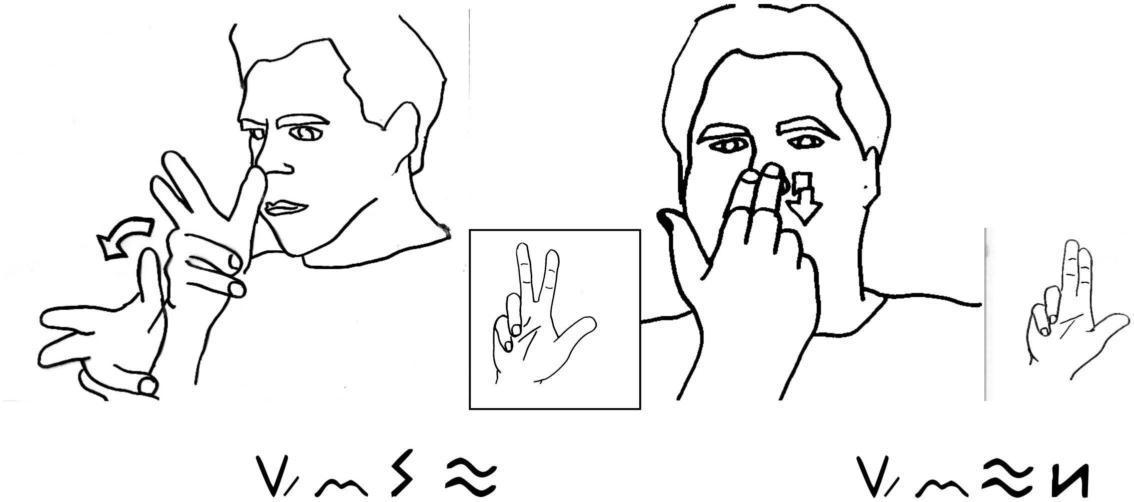

Figure 3a: Two Phonemes in Use for the Same Handshape Grapheme (LOUSY and FUNNY)

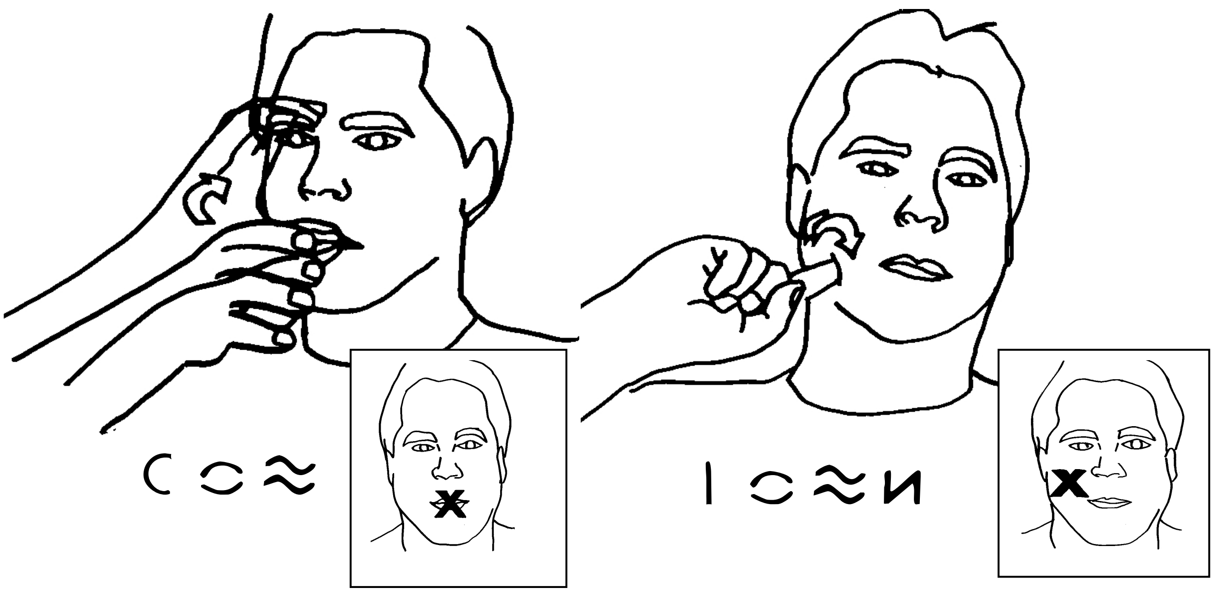

Figure 3b: Two Phonemes in Use for the Same Location Grapheme (DRINK and CANDY)

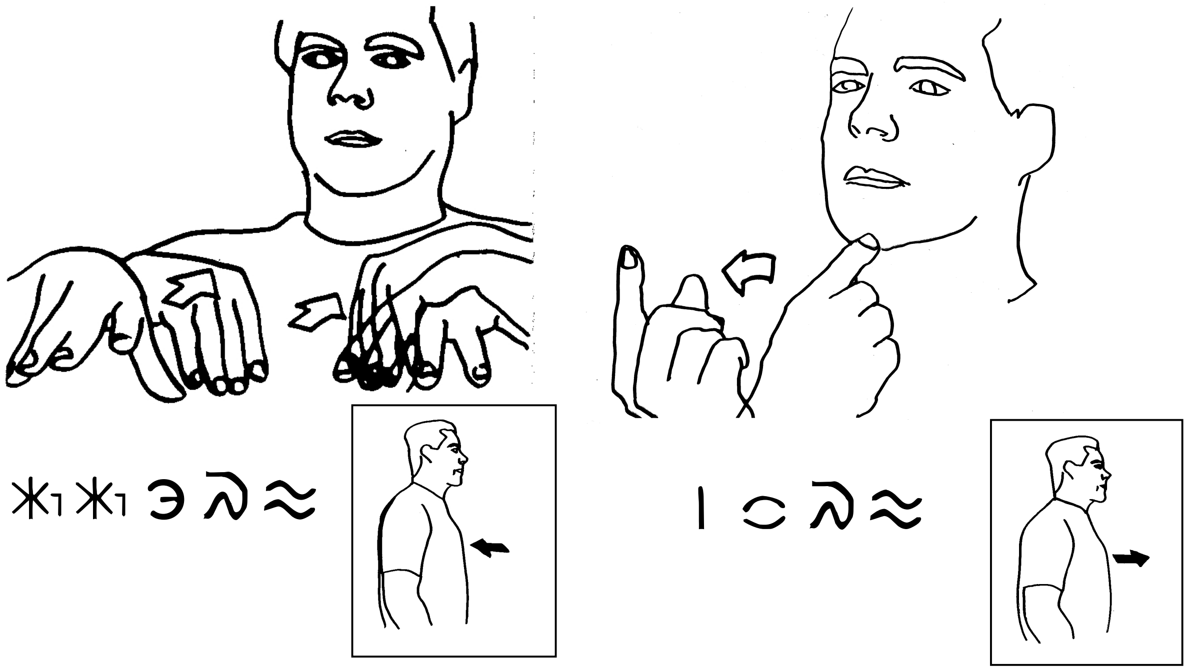

Figure 3c: Two Phonemes in Use for the Same Movement Grapheme ᘐ (ACCEPT and TELL)

Prevalence of Homographs

Here we address homographs in the ASL-phabet. The system’s homographs follow from the fact that one grapheme can represent multiple phonemes. Serving as our first homograph example, WATER and SPEAK are written identically; yet the handshapes in these signs differ. Although the handshape grapheme for both signs is ⩛ , the handshape for WATER is a three extended finger formation (or one of the two phonemes for ⩛); it is the four extended finger formation (or the other phoneme of ⩛) for SPEAK. See Figure 4 for the illustration of both signs and their common written word.

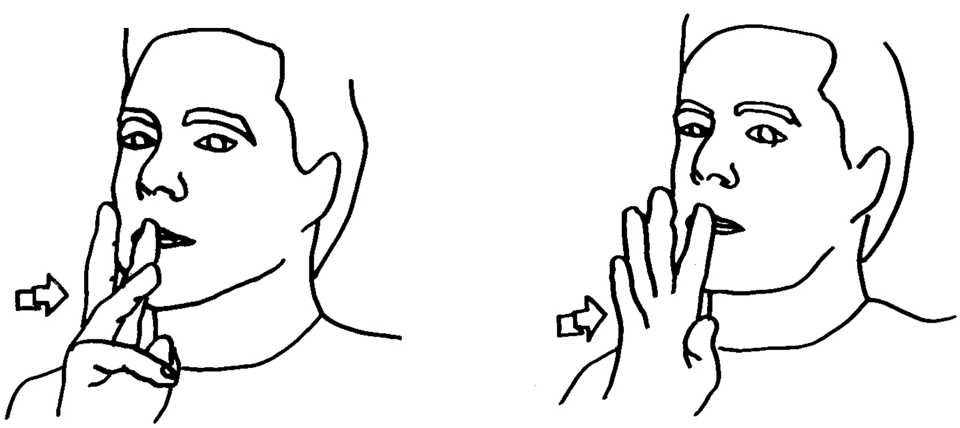

Figure 4: Homograph Example for ⩛ ᴐ ᘐ И (WATER and SPEAK)

ON and STOP provide a homograph example with the location parameter. The first sign has the active handshape produced on the top of the passive handshape. The same active handshape is produced on the palm of the passive hand for the second sign. This difference in locations (i.e., on the back of the hand or on its palm) does not change the ASL-phabet graphemes. The location grapheme for ON and STOP is ᒍ (which refers to the signer's active handshape using any location of the passive handshape or the different arm; see Figure 5 for the illustration of ON and STOP and their homograph).

Figure 5: Homograph Example for ᑎ⁄ ᑎ⁄ ᒍ ϟ (ON and STOP)

Finally, the homograph of CLEAN and PAPER indicates that the movement grapheme ϟ does not account for the contrast of one direction and the opposite direction. This grapheme refers to any movement in the vertical plane (or left, right, up, and down in relations to the signer's body). CLEAN and PAPER are produced with movements in opposite directions (i.e., leftward or rightward moving), yet they are written the same according to the ASL-phabet (see Figure 6 for the illustration of both signs and their homograph).

Figure 6: Homograph Example for ᑎ⁄ ᑎ⁄ ᒍ ϟ ᴎ (CLEAN and PAPER)

A Deaf Student's Reading Performance with the ASL-phabet

Here we cover a tutorial setting involving one female deaf child who was 9 years old from a family with deaf parents who used ASL. Her signed language skills were formally assessed with the American Sign Language Proficiency Assessment (Maller, Singleton, Supalla, & Wix, 1999), on which she was ranked as highly fluent. The data is from the student's participation in a two-week tutorial that was subject to thorough examination in Cripps (2008). It was from that source that we demonstrate a brief session with the child reading a small set of words written in the ASL-phabet.

A Close Look at the Flashcard Activity

For this lesson, the tutor had a set of flashcards with signs written on them and showed them to the child. All of the words were new to her. The child was instructed to look at the word and sign it correctly. The tutor gave her immediate feedback on whether the sign was correct or not. Any time that the child failed to come up with the correct sign, the tutor had the option of intervening and guiding her in reading the word. The four ASL words used in the lesson are shown in Figure 7.[4]

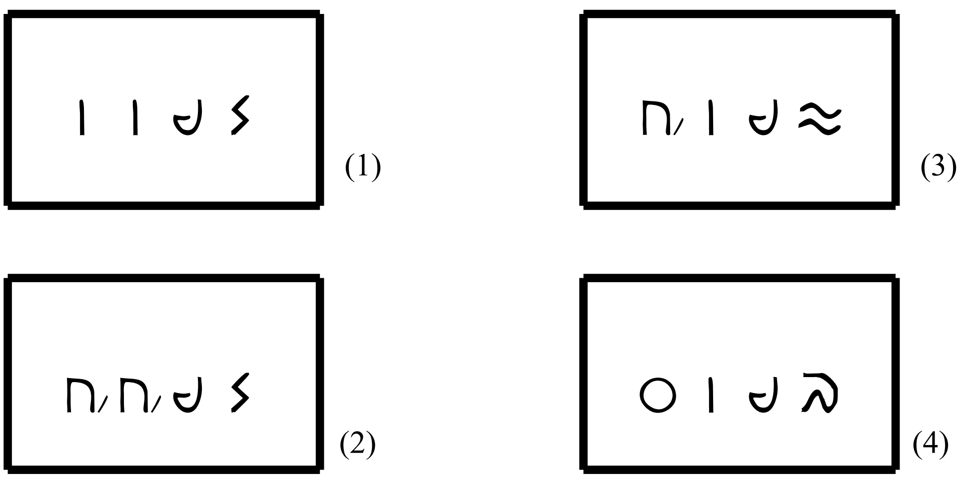

Figure 7: Flashcards Used in the Tutorial

The English equivalent for the first flashcard word is correct. The sign for ǀ ǀ is produced with two handshapes, both in the form of an extended index finger (as represented through the two graphemes ǀ and ǀ). One hand sits passively in the signing space (as represented through grapheme). The active hand moves downward (as represented through grapheme) and stops on the top of the hand of the different arm. The child was not a fluent

[4] The signs written on the flashcards are slightly different from the present set-up of the ASL-phabet. The tutorial took place in 2004 and a few changes have since been made to the ASL-phabet writing conventions. The written sign examples shown earlier also belong to the older writing version, and these minor differences do not affect our discussions in this paper.

reader, but she kept trying to decode the word and was successful in her eighth attempt. Her erroneous attempts included signs that were *close* to how the target word is pronounced in ASL.

To help understand exactly how the child read the word ǀ ǀ ᑯ ϟ , Figure 8 includes all of her signed responses written in the ASL-phabet. The underlining of the graphemes in her signed response represents correct phonological information in the target word. The target sign written in the ASL-phabet (on the top) is for comparison purposes. The English equivalents sitting next to the ASL words are for the reader to know what the written signs are. We turned those into glosses for better use in the analysis to follow.

Target sign:	ǀ ǀ ᑯ ϟ	(CORRECT)
Attempt 1:	O ǀ ᑯ ᘕ	(LONG)
Attempt 2:	O ǀ ᑯ ϟ ᴎ	(TIME)
Attempt 3:	ǀ ǀ Э ϟ ≈	(HAPPEN)
Attempt 4:	ǀ ǀ ᑯ ϟ ᴎ	(INTERSECTION)
Attempt 5:	ǀ ǀ ᑯ ϟ ᴎ	(?)
Attempt 6:	ǀ ǀ ᑯ ϟ ≈ ᴎ	(KNIFE)
Attempt 7:	ǀ ǀ ᑯ ϟ	(CANNOT)
Attempt 8:	ǀ ǀ ᑯ ϟ	(CORRECT)

Figure 8: Decoding Attempts with ǀ ǀ ᑯ ϟ

In most attempts to read the word, the child incorporated two correct pieces of information: ǀ and ᑯ in her signed responses. Her strength lies in reading the handshape and location graphemes (with movement graphemes being more difficult).[5] However, the child improves with each attempt. As successive attempts were made, the correct number of graphemes increased from two to three and finally four graphemes. The child's first attempt at decoding the word ǀ ǀ ᑯ ϟ was the production of the sign LONG. While this sign shares the handshape and location information as CORRECT (i.e., the second grapheme of ǀ and the third graheme of ᑯ), it has other handshape and movement information not included in print (i.e., O and ᘕ). The child failed to read the first grapheme (ǀ) and the last grapheme (ϟ) in CORRECT.

The second attempt was TIME, and has the additional correct movement ϟ (that the sign now moves downward), but a full reading of the word still did not occur. The child continued missing the first grapheme (ǀ). She also added the movement information or ᴎ , which was not part of the print form. The movement is made repeatedly with downward movement, instead of once as required for CORRECT. The combination of adding information and not reading the handshape grapheme (i.e., ǀ) caused the child to come up with TIME instead of CORRECT.

With the child's third attempt, she regressed by producing a location in the signing space (Э referring to the location in the signing space to produce HAPPEN instead of ᑯ) in lieu of

[5] The child's reading pattern associated with the handshape/location combination and movement deserves comment. Brentari (2002) compared the handshape/location combinations in ASL to consonants and movement to vowels. This would explain the child reportedly having an easier time with consonants (handshape/location) than with vowels (movement) and also parallels how hearing students cope with consonants and vowels in written English (e.g., Vacca, Vacca, & Gove, 1987).

what she used in her first two attempts (i.e., the sign is no longer associated with the signer's arm). The child also added movement information of the hands (i.e., ≈ referring to the hands twisting at the wrist) that was not in the print form. Yet, the child did produce the two handshapes (in the form of |), which was a successful reading of the first two graphemes in CORRECT.

In her fourth attempt, the child retained the arm location information (i.e., ᒍ), and this time included all of the information for CORRECT (i.e., | | ᒍ ʃ). However, she added the repeated movement information (i.e., ᴎ) once again. This caused her to produce INTERSECTION or | | ᒍ ʃ ᴎ .

It is the child's fifth attempt that she resorted to a nonsense sign written | | ᒍ ʃ ᴎ . See Figure 9 for the illustration of the non-sense sign. While the child was creative in her response, it is not necessarily the best strategy for this reading situation. We compare the reading behavior here to a hearing child who might produce an English gibberish word in a desperate act of reading.

Figure 9: Nonsense Sign Created by the Student

In her sixth attempt, the child returned to the use of conventional signs. She continued to preserve the information for | | ᒍ ʃ and responded with KNIFE, which includes the repeated information (or ᴎ). The child added yet the twisting movement information (i.e., ≈) that resulted in her decoding error. The combination of twisting and repeated movement information distinguishes KNIFE from CORRECT. This is when the tutor decided to intervene.

In the videotaped discourse, the tutor was helping the child by directing her attention to the fact that the word on the flashcard does not have any repeated movement information (i.e., ᴎ) written into it. This intervention was enough for the child to do a complete turn around in her responses. The child produced CANNOT in her seventh attempt. As written in the ASL-phabet, CANNOT is a homograph, and it is written identical to CORRECT, even though the signs are produced differently. The tutor was aware of the homographs for ASL, and he asked the child to try another word. It was then that the child produced CORRECT. Here the child had no difficulty in thinking about how a word can refer to two signs that are produced differently in a slight way (like the 'wind' example in English with hearing readers).

Up to this point, only one word has been discussed for the flashcard activity. There was some improvement and independent reading in the child's attempt with reading successive signs. The child read the second sign (i.e., ∩⁄∩⁄ᑯ ʃ or ON), and produced it correctly the first time. The target sign involves the use of two handshapes sharing the same form: straightened palm. One hand sits passively in the signing space and the other hand moves to it. The child was now careful reading the word by paying attention to the first and last letters of the word and without adding information.

With the third word ∩⁄ ı ᑯ ≈, the target sign is DAY with two handshapes in use. The passive hand involves straightened palm (and arm) laying flat in the signing space. The active hand making up the extended index finger and arm is attached to the other hand by the elbow. The active hand moves over the passive hand and arm in a pivotal fashion. Upon reading the word, the child produced an error by signing CORRECT, which resembles the word for DAY in some letters and spelling (i.e., ı ᑯ) as shown in Figure 10. Recall that with the first flashcard, the child kept reading ı ᑯ successfully for the word CORRECT with many failed attempts made at the same time. It is sensible that the child was distracted by the fact that DAY in the third flashcard incorporates ı ᑯ in the written form. Once again, this reading behavior is something that hearing children experience when learning to read words. That is, many English words are written similarly so these students are liable to think of the other words that share some of the letters and spelling. With ASL word reading, the error that the child made with CORRECT for DAY is not something off the mark.

Target:	∩⁄ ı ᑯ ≈	(DAY)
Attempt 1:	∩⁄ ı ᑯ ᘐ ≈	(LONG)
Attempt 2:	ı ı ᑯ ʃ	(CORRECT)
Attempt 3:	∩⁄ ı ᑯ ≈	(DAY; with tutor's guidance)

Figure 11: Decoding Attempts with ∩⁄ ı ᑯ ≈

In any case, the tutor realized that the child was confused. He intervened and pointed to the letters in the word on the flashcard that indicate the target sign DAY is spelled differently from the previously read word CORRECT. The tutor brought up the first flashcard to show the child the differences in spelling. The child read both words again and realized that she made the error. The child had proven her competency in reading by signing DAY the second time.

The fourth word was read successfully on the first try (i.e., ○ ı ᑯ ᘐ ≈ or LONG). The target sign is produced with two handshapes. The passive hand is in the fist form, sitting flat with the arm in the signing space. The active hand (comprising the extended index finger) makes contact with the passive hand and moves across the arm toward the signer's body. Upon reading the word, the child came up with LONG with no difficulty.

The flashcard activity included one more step, which was reviewing the four words with the child. When the tutor mixed the order of the four words and showed them to the child again, she responded correctly to all words. Regardless of the fact that the child had most trouble with CORRECT, she read it perfectly during the review of the four words. The same is true for the initial confusion between CORRECT and DAY. The child was able to distinguish these two words in print.

Discussion and Conclusion

The results of the flashcard activity (with the ASL-phabet) deserve a few comments. First, the tutor acted as a teacher with students who have emerging reading skills (by guiding, which is an important teaching technique). The alphabetic principle was emerging as well through a variety of reading behaviors and patterns observed for the deaf child. Although there were some struggles, she decoded all four words in ASL. The ASL-phabet's degree of ambiguity (i.e., graphemes representing more than one phoneme) did not disrupt the reading process with the child, even though a written word could represent two signs (e.g., the homograph example). Finally, the graphemes appeared to be functioning well as letters and allowed the child to read the individual words and corresponding signs. The fact that the child mediated in an accessible language (i.e., ASL) is critical for a successful reading outcome.[6]

Future areas of investigation to help determine overall effectiveness of the ASL-phabet should include a larger number of words, as well as a study including students with different learning styles and backgrounds. As predicted, a younger student will need more time in learning the ASL-phabet as compared to an older student who is introduced to the system at a later age. The differing levels of cognitive maturation should distinguish the performance of these students. Likewise, students who have not gained a high level of proficiency in ASL should demonstrate problems in reading signed words as opposed to those who are native or native-like signers. These different studies will help further validate the ASL-phabet and the concept of signed language reading.

Within the context of deaf/special education, there are issues to consider. While signing and signed language may be part of a long history in schools in the United States, the fact that they are confined to use 'through the air' is problematic. A group of deaf education experts recently published an article on the topic of language and literacy development among deaf students (i.e., Lederberg, Schick, & Spencer, 2013) and mentioned ASL more than once, but nothing on its writing systems or about the concept of signed language reading. The article's tone and outlook for deaf students' prospects for becoming fluent readers are best described as challenging. Spoken language reading is discussed as if it is the only way that any child can become literate.

The coverage on the ASL-phabet is our attempt at broadening educators' view on what constitutes reading. The overview format of this paper was designed to provide readers with a sense of confidence in the ASL-phabet. This system can help with the development of phonemic awareness, the development of an understanding of the alphabetic principle, and the translation of these skills to the application of phonics in reading. These are non-negotiable beginning reading skills that all students must master. When used in conjunction with additional components of a systematic and predictable reading program, the ASL-phabet can provide deaf students with an equivalent support to hearing students. With comparisons to the Stokoe and SignFont systems, it appears that the ASL-phabet hits the mark in terms of an ideal alphabet. The descriptions associated with deep and shallow orthographic types for the ASL-phabet are also

[6] As a related topic, readers should check into the work by Di Perri (2004) on the question of phonemic awareness in ASL. A group of young deaf students were asked to perform phonemic awareness tasks in the signed language. The findings include how these students were capable of thinking about signs having their own parts or phonemes. The students were not exposed to the ASL-phabet or any ASL writing system, but they are expected to decode and read words in the signed language when there is an opportunity.

insightful. The ASL-phabet cannot be written off as something peculiar, but rather on par with the alphabets in use around the world. Thus the ASL-phabet is emerging as an important instructional tool that can be used to ameliorate reading deficits for deaf students.

With these considerations, we hope that a new direction is set for deaf students, including the provision of reading skills to help transfer to stronger foundational skills for all school-based learning. By setting higher expectations and providing better aligned tools for deaf learners, perhaps the bar can be raised in terms of academic achievement. We also need to explore other components of the literacy program mentioned at the Arizona charter school and see how they are combined with the ASL-phabet to teach additional reading and translation skills (via an intermediary writing system between ASL and English). With the current set-up in deaf/special education, it is clear that without a strong foundation for learning how to read, chances for academic and occupational success are limited. ASL needs to serve as the starting point for learning to read as it meets the requirement for linguistic accessibility. The time has come to stop overlooking an obvious first step, (the place in which all hearing learners begin), and begin focusing on an alphabetic principle that makes sense to the deaf learner.

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