

Lessons to Be Learned from the Young Deaf Orthographer

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In the study reported here, the nonstandard spellings produced in free-writing samples by young deaf children ages 4 to 10 years were analyzed. The forms of spellings revealed a different analysis of the English orthographic system. Instead of the pervasive sound-symbol analysis of most hearing children, the deaf children produced qualitatively different attempts. Their attempts cannot be entirely accounted for as "visual"; instead, many can be characterized as featural, involving letters as units, and features of letters spanning over more than one letter, such as position and quantity.

In 1975, Read published an article, "Lessons to Be Learned from the Preschool Orthographer," (1975b) in which he showed that the misspellings of young preschoolers were a rich resource for understanding the nature of orthographic systems and how humans learn to use them. His collection of novel spellings of young 4- and 5-year-olds showed that their choices of spellings were not random but systematic in interesting ways. Contrary to standard adult spelling, the children had invented a sophisticated and complex relationship between the alphabet and their analysis of the sound system of spoken English. Their spellings reflected astute generalizations about, for example, how vowels are articulated and the saliency of nasals in certain environments. Among the lessons from Read's (1975a) children are how orthographic systems can reflect associations between sound and symbol, between categories of speech sounds and alphabetic representations.

Since then, there has been no lessening of interest in early spelling. Many have seen the study of early spelling as one of the best sources for tracking children's acquisition of writing (e.g., Bissex, 1980; Clay, 1975; Wilde, 1987). They see creative spelling as a later development along a long trajectory of symbolic transitions between scribbles and marks to, finally, the system of orthography itself. The arrival of the child to creative spelling marks a transition from early theories of representation to sophisticated types of symbol making requiring an understanding of the special properties of orthographic systems.

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The study reported here shows that the path to writing for some deaf children differs in at least one significant way: They do not display the strong sound-spelling correspondences that Read (1975a) reported in his study of children's spelling. Instead, the deaf children in the study devise theoretical correspondences of another kind. These correspondences can superficially be called visual, but on closer examination, are actually theories about the graphemic and positional regularities of the English orthographic system. Where Read's (1975a) children were interested in making connections between sound and written representation, these deaf children experiment with correspondences between position, quantity, and identity of letters and the creation of words in English orthography.

Indeed, if the two groups of children, those in Read's (1975a) study and those here are compared, they offer a view of two sides of the English orthographic system. Hearing children reveal how orthographic systems lend themselves to phonemic analyses and deaf children reveal how the same system is also amenable to other types of generalizations, particularly positional and graphemic. In their two alternative routes to acquisition of spelling, the two groups of children reveal the flexibility and the redundancies inherent in the English orthographic system.

BACKGROUND

The picture of early spelling in young children must be described in the context of the different language repertoires of young deaf children. The deaf children in this study live and are educated in a community where both English and a signed language, American Sign Language (ASL) are used in daily life.

All the children in this study have very good to native competence in ASL; 19 children (48%) have deaf parents, and are native users of ASL. The remainder have hearing parents and acquired ASL in one of the following ways: Some entered the school as young as 6 months as part of the school's extensive infant and preschool program; others were enrolled in the school by kindergarten or first grade. For those children who came to the school through the preschool program, their hearing parents were encouraged to learn sign language, and to use it with their deaf infants and toddlers. Some parents learned the language well enough to use it at home, but for the most part, the hearing parents have minimal competence in ASL. For these children, competence in ASL is acquired primarily at the school, among peers and teachers who are more competent in ASL.

Describing deaf children's competence in English is more difficult. Although they are surrounded by speakers of English and exemplars of English appear around them in written form, their command of, indeed, their interactions with English are not like those of hearing children their age (Ramsey, 1993). A standard way of evaluating the students' competence in written English at the

schools included in this study is the Stanford Achievement Test (SAT), administered to all children 7 years and older. However, because of minimum age requirements, and whether the children were in school at the time the tests were given, reading scores are not available for nearly half the children in this study. But as a rough measure of the distribution of reading skills in one of the two schools, an analysis of the SAT reading scores of 55 deaf 7- to 10-year-old students in 1991 showed that 13 (24%) scored at or above grade level, and 42 (76%) scored below grade level.

Interpretation of these results is complicated by the fact that in the pool of children who took the test, the school administration reports that some have learning disabilities or other cognitive difficulties contributing to the delay in reading skills. Accordingly, the results should be seen as reflecting a, perhaps, typical mix of reading skills among deaf children in one elementary school, but *not* the range of individual reading skills that deaf children are capable of. In other words, although the pattern of reading research on deaf children shows that, as a group, deaf children score lower than hearing children on tests of reading competence (Conrad, 1979; Karchmer, Milone, & Wolk, 1979), it should be noted that there are children at this school, although in small numbers, who read very well.

From observations at the two schools included in this study, it is clear that the children begin training in English text from an early age. Beginning in first grade, the children are taught to read individual English words, and practice reciting and writing them for their teachers. The manner of reciting individual English text is in a form of manual representation called *fingerspelling*, in which individual letters of English words are represented by handshape configurations strung together to make up a fingerspelled word. The children, even the younger ones, use and watch other children and their teachers fingerspell English vocabulary interspersed with signing.

It would seem that fingerspelling is actually instruction in English orthography, but younger preschool children are typically not aware that the handshapes have a one-to-one correspondence to print words. Instead, their command of fingerspelling is by way of a stock of fingerspelled words they produce in whole, unanalyzed form. By the time they enter kindergarten, most children finally realize that the internal structure of fingerspelling entails representation of alphabetic letters (Maxwell, 1984; Padden, 1992; Padden & LeMaster, 1985).

Instruction in writing out letters of the alphabet and writing short words for deaf children begins at about the same age as for hearing children. In preschool and kindergarten classrooms, deaf children see numerous examples of the alphabet and print words. They have cubbyholes with their names on them, and are encouraged to identify their belongings by the names written on them. Their teachers may encourage them to practice matching fingerspelled handshapes to written alphabetic characters. By first grade, their teachers begin instruction in writing in earnest.

By the end of their first-grade year, they have accomplished much of the mechanics of penmanship. They can write upper- and lowercase letters, and write within lines on marked sheets of paper. They usually can write common words: their own names, names of some friends and classmates, names of siblings, colors, and some animals. But, although hearing children are beginning to discover the relationship between the sound stream of the English language and its expression in written form, deaf children wonder what else they can write besides lists of English words.

The leap from a small written vocabulary to self-expression in writing is a great one for young deaf children. The problem is a complex one, involving the task of acquiring language knowledge of different types. They not only need to learn more about English, but also how it distinguishes itself from other languages the child knows, particularly ASL (Erting, 1985, 1988; Ramsey, 1993). The details of the relationship between English and ASL in young children's language practices are beyond the scope of this article; however, I will remark on this relationship as it bears on spelling.

For purposes of this article, I will confine myself to one aspect of the larger discussion of young deaf children's early language knowledge: I will describe how they begin to create spelled text, and what their text tells us about some of the strategies they use. Whereas there have been experimental studies of spelling in older deaf children and adults (Gibson, Shurcliff, & Yonas, 1986; Hanson, 1986; Hoemann, Andrews, Florian, Hoemann, & Jensema, 1976), there has been little analysis of early spelling attempts of deaf children. The goal here is to examine spontaneously created written productions of young deaf children and develop from them a description of what ideas they have about the nature of English orthography.

METHOD

The Children

This study involves children who can write letters of the alphabet and are actively constructing words in print. These are children ranging in age from 4 through 9 years. I have included older children because the acquisition of English in many deaf children extends over a long period of time. The 9-year-olds are still expanding their repertoire of English vocabulary and sentences. Their command of ASL is usually quite sophisticated, as evidenced by the level of their storytelling and conversational competence in the language, but they may be still struggling to construct extended prose in English.

Writing samples were collected from 40 deaf children who were enrolled in one of two schools, a residential school for deaf children in the western United States ($n = 19$), and another similar school on the East coast ($n = 21$). Nearly all children were labeled by school audiologists as "severely or profoundly deaf," defined as having a hearing loss of 85 dB or higher in their better ear. None of the

children would be described by their audiologists as having great facility with spoken communication, or being able to hear well enough to engage in extended communication using only speech.

The Data

Most writing samples were obtained during interviews with children at school. The children were invited to write their names on a piece of paper, and then to write words they knew. There was no required set of words across all children. The children were encouraged to write words along a familiar theme such as "all the colors I know," or "all the animals I can think of." One older child wanted to write words from different sports activities. If they could not think of more than a few words, the interviewer showed pictures of objects and asked them to try to write the words for the objects.

In some cases, more than one writing sample was collected, as in the case of 5 children whose writing in classroom journals was analyzed. One child's mother saved notes her daughter wrote to herself and other family members and contributed the slips of paper for analysis. In the case of children younger than 5 years, the writing samples were collected from interviews at home. The goal was to collect spontaneously generated written material, with some prompting to generate additional examples.

During the interviews, most of the children contributed lists of English words. The children were asked to write short stories, or even sentences, but many were reluctant, preferring instead to play a game of writing down English words. Younger children were invited to draw and to write text to accompany their drawing, but most chose only to write words, not sentences. The children seemed to find writing extended prose a test of their sentence skills in English. Most of the extended prose was found in journals assigned to older children as classroom exercises.

Many writing samples were collected during videotaped interactions with the interviewer. A videotaped record of the interaction allowed us to verify the target word; the child would either announce what word he or she was writing or write a word at the suggestion of the interviewer. For those samples collected outside of interactions with the interviewer, there were opportunities for checking what the child intended to write. In the case of the journals, the teacher and the student took turns writing short notes to each other. The teacher would sometimes correct misspelled vocabulary produced by the student. For materials collected at home, parents were asked to name the target of a word, and if parents were confident about the intended target, the spelling was included in the corpus.

Of the 99 writing samples collected, there were 2,262 intelligible and identifiable words. Illegible words or words that could not be independently identified were discarded from the pool of words studied. (This number was quite small, comprising about 30 words of the entire data.) Of this pool, 185 deviated from the standard spelling. This corpus of nonstandard spelling comprised 122 differ-

TABLE 1
Distribution of Writing Samples
and Nonstandard Spellings by Age Range

Age ^a	<i>n</i>	No. of Writing Samples	No. of Nonstandard Spellings
4;0-5;11	10	14	17
6;0-6;11	9	13	22
7;0-7;11	9	37	70
8;0-8;11	8	30	57
9;0-9;11	4	5	19

^aAge = years;months.

ent words. Some words like *cat* and the colors appeared repeatedly across several children, evidently because they are commonly practiced at home and at school (see Table 1).

The primary focus of this study is spelling produced by deaf children who are creating words and other types of extended text. As can be seen in the following, the bulk of the writing samples were collected from children in the 7- to 9-year-old range, with fewer at ages younger than 6. From children ages 7 to 9 years, there were more attempts at writing words per writing sample, thus more examples of nonstandard spellings. I have included spellings from children younger than 6 and older than 9 despite their smaller numbers in order to provide a comparative insight into possible directions of change over a range of age 4 to 9 years.

Frames of Analysis

At first glance, few of the spelling attempts of young deaf children resemble those of hearing children. Of the 185 nonstandard spellings, 38 (20%) could be judged to be similar to the kinds made by hearing children. For example, 1 child spelled CAMARA (camera) in which the choice of the medial vowel could be judged as sound-based. Although there are grounds for not totally ruling out phonetic or sound bases for spelling in deaf children,¹ only a small number of spellings can be indisputably accounted for in this way, that is, do not have graphemic explanations as well. CAMARA could likewise be explained as perseveration, or copying of the initial vowel grapheme in subsequent vowel slots.

The bulk of the nonstandard spelling attempts were of the following type: They did not retain the syllabic structure of the target word, either deleting a syllable, GIFFE (giraffe), or adding a syllable, BOTA (boat). Transpositions, or switching of letter positions and substitutions of letters may render the word visually dissimilar to the target, for example, HOSUE (house) and CHEALE (chair).

	Attempt	Target
Transpositions	HOSUE	house
	BOTA	boat
Deletions	UMBER	umbrella
	GIFFE	giraffe
Substitutions	MOKLEY	monkey
	CHEALE	chair

Read's (1975a) categories of spelling attempts in hearing children—analyses of phonological form, voiced and voiceless consonants, vowel height, and pre-consonantal nasals—do not seem to be relevant here. None of these spellings conform to a predominantly phonological analysis. Clearly, some other frame of analysis is needed to describe the pattern of these, and the range of attempts that young deaf children make.

Alternative Analyses of the English Orthographic System

The English orthographic system is nearly always described as primarily reflective of the sound system of the spoken language it represents (Venezky, 1970). Examples of strong phonemic-graphemic correspondences are given in support of this claim of the primacy of this relationship, for example, *ph* as [f] in *photograph*, *kn* as [n] in *knight*, and the alternation between short and long vowels when preceding a final consonant or a final -e, for example, *shin* versus *shine* and *ban* versus *bane*.

But what is often overlooked in these phonemic correspondences are how the same correspondences have positional-graphemic correspondences as well. In each of the previous examples, there are graphemic regularities as well, such as position and environment. The pronunciation of *ph* as [f] is position-dependent. If the sequence appears straddling two syllables, it is not interpreted as a digraph representing one phoneme, but as two separate consonants, for example, in *haphazard*. And the examples of short and long vowel alternation depending on the presence of -e in final position shows that the environment and position count a great deal in determining sound-spelling correspondences. Yet, these visually based rules are seen as incidental to the larger sound-symbol correspondences.

Furthermore, it is well known that the orthographic system preserves morphological alternations that are only partially represented in the spoken forms. In pairs like *sign* and *signature*, the morphological alternation of the root and its derived form is preserved in spelling although the stress pattern, vowels, and consonants vary. There is the initial [ai] in *sign* but [-i-] for *signature* and the [g] in *signature* is absent in *sign*. Acquiring spelling involves knowledge of morphological regularities in the language despite their varying phonemic form.

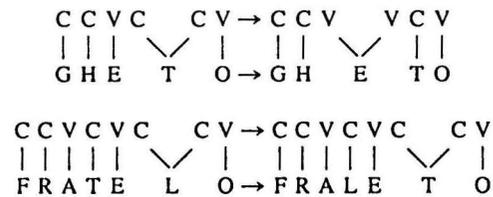
Despite the intertwining of "visual" graphemic information and phonemic forms, many have argued that the orthography is primarily "parasitic" on the

sound structure. Indeed, some have posited that the correct course of acquisition of English orthography is first to analyze the orthography in terms of sound-symbol correspondences, and then to acquire the special nonphonemic conventions of the system (Barron, 1980; Read, 1975a).

Recently, analyses of spelling behavior in other populations have discovered evidence of spelling strategies that are not phonemic, but based on the positional-graphemic elements of English orthography. Badecker (1988), in his analysis of adult patients with acquired agraphia, or a form of brain damage in which patients are impaired in their ability to write, argued that patients' difficulties cannot be accounted for by a phonemic analysis. Instead, he analyzed their errors as strongly graphemic, resulting in another view of English orthography as essentially autonomous from the spoken string. He proposed that, at least with respect to his patients, orthographic rules may, in fact, be more independent of their relationship to the spoken form.

Among the spellings, which Badecker (1988) argued cannot be accounted for by a simple sound-symbol correspondence, is an agraphic patient's misspelling of *ghetto* as *gheeto*. The vowel quality is altered in the misspelled form but Badecker argued that the relevant change should not be described in terms of vowel quality, but, instead, in terms of a featural, that is, the feature of "doubling" shift: shifting the doubling of *t* to an adjacent letter, *e*. In the error, the feature of doubling is preserved in the misspelling, but shifted to a different position. To account for the two distinctive elements of the misspelled form, Badecker proposed a "multitiered" analysis of English orthography, in which the dimensions of *identity*, or the choice of letters, is put on a different tier from *quantity*, or the feature of doubling, which is a feature of more than one letter.

Two different types of doubling errors were found among Badecker's (1988) patients, and each can be analyzed using the multitiered approach. The first type of error, displayed in the following, involves a shift of the doubling (represented by converging marks) to a different position as in GHEETO (*ghetto*). In this type of error, the order of letters remains the same, but the feature of doubling, represented on the upper tier, shifts position. The second type of error leaves the position of the doubling intact, but there is an alteration of the order of letters, marked on the lower tier, as in an Italian agraphic patient who misspelled FRA-TELLO (brother) as FRALETTO.



Badecker's approach of distinguishing between errors having to do with individual letters from errors of position and clustering (such as doubling) into different tiers offers a way to evaluate the patterning of errors in young deaf children. The approach yields interesting insights into the categories of errors made by deaf children.

RESULTS

Deaf Children's Spelling

In general terms, the patterning of spelling errors in this study can be described as follows: The earliest attempts treat the entire word as a single unit, and later attempts treat smaller units within the word. At first, the target words are simple 3- to 4-letter words. The types of errors at this age show knowledge of positional regularities at initial, final, and medial positions of a word. At later ages, as the target words become longer and the attempts become likewise longer, the errors turn to a finer analysis of regularities internal to words, in medial position. By the time the deaf children in this study reach 9 to 10 years of age, they are beginning to experiment with units smaller than position, for example, units as small as, but not always corresponding to, the syllable. Because the bulk of the spelling data is centered around 7- to 9-year-olds who are still attempting shorter words, the description here will be mostly about deaf children's analysis of regularities of initial letters, final letters, and all other letters between.

From looking at the range of spelling attempts, one could say that young deaf children's basic spelling strategy is based on visible properties of written words, in which they try to replicate the visual "shape" of written words. This is partly true. Some attempts at substituting letters in medial position seem to be experiments in replicating visually "tall" letters (e.g., t, d, b) and letters with "tails" (e.g., p, q, g), but more significantly, the errors show sensitivity to orthographic regularities and conventions in the system, which are not entirely by visual analog, but more appropriately "featural"; that is, a property shared by sets of letters, but not of *individual* letters themselves. One example of this is systematicities in their errors with respect to where doubled letters can occur in the English orthographic system.

Very early spelling attempts by children as young as 4;0 to 5;11 years old, shows that they are selective about which words they will try to spell. At ages 4;0 to 5;11 years, spelling attempts average 3.95 letters per word. This is roughly 1 letter per position: initial, medial, and final. After this age, the length increases steadily, to an average of 6.1 letters at age 9 to 10 years (see Table 2, p. 80).

At the same time that they increase the length of their attempts, they more consistently replicate initial letters. At no other position are letters so consistently replicated, suggesting that the intuitive impression of initial letters as especially salient is correct. By the time the children reach age 8, 100% of the first letters of

TABLE 2
Mean Length of Nonstandard Spellings
by Age Group

Age ^a	Mean Length of Nonstandard Spellings
4;0-5;11	3.95
6;0-6;11	4.41
7;0-7;11	5.32
8;0-8;11	5.63
9;0-9;11	6.10

^aAge = years;months.

TABLE 3
Percentages of Standard First Letter
in Corpus of Attempts

Age ^a	% Standard First Letter
4;0-5;11	.86
6;0-6;11	.95
7;0-7;11	.89
8;0-8;11	1.00
9;0-9;11	1.00

^aAge = years;months.

TABLE 4
Percentages of Standard Last Letter
in Corpus of Attempts

Age ^a	% Standard Last Letter
4;0-5;11	.64
6;0-6;11	.55
7;0-7;11	.89
8;0-8;11	.74
9;0-9;11	.79

^aAge = years;months.

their spellings mirror the target initial letter (see Table 3). In contrast, final letters are replicated less consistently, but the attempts are nonetheless more likely to be similar to target letters (see Table 4). From this data, we can see that, from an early age, position of letters is very salient to young deaf orthographers. In fact, as the pattern of their nonstandard attempts becomes clearer, letter position emerges as a consistent guide to their strategies.

Positional Regularities

By the time the children reach age 8 years, the initial letter is consistently similar to standard spelling. In this sense, the initial position becomes inviolable; as will be discussed later, they are astutely aware of possible letter sequences in initial position, and nearly all their attempts are orthographically consistent with standard spelling. But prior to this age, when conformity to the initial letter is more fluid, the children allow transpositions across positions and substitutions at all positions, for example:

	Attempt	Target
Transpositions	GIP	pig
	BLLA	ball
	CTA	cat
	WSA	was
Substitutions	LOG	love
	RAR	car
	ROD	red

By ages 7 to 9, transpositions and substitutions no longer occur involving initial letters, but almost entirely between medial and final positions and within medial position. In the following examples, note how different children spell the same target, carrying out transpositions or substitutions of several types:

	Attempt	Target
Transpositions	BOTA	boat
	BAOT	boat
	BERA	bear
	BRID	bird
	CHARI	chair
	HOSEU	house
	HOSUE	house
	NAEM	name
Substitutions	BIAD	bird
	BLIA	blue
	BALLOW	balloon

Transpositions and substitutions remain the most consistent types of actions by young deaf orthographers through age 10 years. Deletions in medial and final position, on the other hand, are common through the younger ages, until about age 9, when they start to involve units larger than single letters. Examples of deletions at different ages are:

	Attempt	Target
4;0-5;11	LOG	love

	HOSE	house
6;0-6;11	BAR	bear
	BAB	baby
	NOING	nothing
7;0-7;11	SITER	sister
	DIN'T	didn't
	CLOR	color
	CHEERLING	cheerleading
8;0-8;11	URMLEM	umbrella

This pattern shows that the length of their spelling attempts closely mirrors the length of the target words. They continue to switch letter positions and change the identity of letters, but deletions are comparatively less frequent. In this way, the "sanctity" of the word is preserved: The overall appearance of the word is maintained, but the identity of individual letters may be changed. The fact that they selectively transpose or substitute in medial and final positions but not in initial position, shows that they have an awareness of position within the word.

If it is the case that patterning of attempts follows letter position, there is a second question: What do they know about regularities in English orthography pertaining to these positions? There are two pieces of evidence that show they are sensitive to regularities that apply to each of the three positions. The first concerns the rules for doubled letters in English orthography. In English orthography there are two main rules for doubled letters concerning identity and position. First, only certain letters can be doubled, for example, -gg- or -nn- but not -jj- or -hh-. The second is that there cannot be doubled consonants in initial position: A word like *bbode* is impossible in English orthography, although there can be doubled vowels, for example, *ooze*.

None of the attempts collected from young deaf children contained impossible doubled sequences. The children doubled either consonants and vowels, but never impossible sequences of consonants. Some of their attempts involved reduction or insertion: deleting or adding doubling, for example, *BIGER* (bigger) or *VERRY* (very). Crucially, none of the attempts contained doubled consonants in initial position. All nonstandard attempts with doubling involved either switching the position of the doubling or switching the identity of the letter being doubled.

Transpositions	Attempt	Target
Position	ALPPE	apple
	UMBLLLEA	umbrella
Identity	GANNE	green
	FRZZE	freeze
	TERRE	three
	GENNY	green
	GERRN	green

As can be seen from these examples, doubling is not merely a feature of individual letters, but also of where the doubling is located in the word. Transpositions of identity preserved the position of doubling, even as the children switched letters within words. The sample of nonstandard words with doubling is too small to determine whether they are more likely to preserve position or letter identity, but this is certainly something to be pursued in later investigations.

It should be noted here that, were doubling a feature of individual letters, then there would only be transpositions of position. However, because there are examples of doubling retained in medial position, this provides support for Badecker's (1988) multitiered approach to orthographic rules: Some rules apply to individual letters and others to units larger than the letter, at the level of the word such as position.

A second piece of evidence of the children's awareness of positional regularities can be seen in their use of initial consonant clusters. Of 185 attempts across all ages, only 7 contained impossible initial clusters:

Age	Attempt	Target
4;0-5;11	CTA	cat
	BLLA	ball
6;0-6;11	GREEN	green
	SMLIE	smile
8;0-8;11	FRZZE	freeze
	NRESE	nurse
	BCOW	boat

Of these 7 attempts, several can be accounted for by other, more salient principles. For the 4;0- to 5;11-year-olds, the impossible initial clusters came about as a result of transposing medial and final units. Experimenting with letter position seems to be an overriding principle; note that the doubled final sequence in *BLLA* is preserved as its letter position is switched. The sequence *QR-* in *GREEN* is most likely the result of visual identity: *G* and *Q* are highly graphemically similar letters. The doubled *-ZZ-* sequence in *FRZZE* preserves doubling in the medial position, but the child used a different letter for representing the doubled sequence. It may be the case that the real initial cluster is *FR-*, entirely permissible, followed by a medial doubled sequence. *BCOW* seems to be guided by a similarity motivation: *C* and *O* are highly similar, and perhaps the child wished to create medial sequences that were similar to *-OA-* in the standard spelling of *boat*.

In sum, the attempts taken as a whole show a remarkable degree of selectivity in attempts. Initial position is most conforming of all positions; the child is more likely to conform to standard rules for English orthography in initial position than any other position. But the child is also more likely, if not perfectly, to use standard conventions in other positions as well. In other positions, there are more insertions, substitutions, transpositions, and deletions, creating nonstandard spellings that are, nonetheless, not entirely random, but even motivated.

Letter Identity

A second central principle guides the children's nonstandard spelling: letter selection based on visual-graphemic elements. A number of attempts involve a simple substitution of like-appearing letters. (In the following list of attempts, the child's use of lower- and uppercase letters is recorded.)

	Attempt	Target
Letter substitution	momkey	monkey
	Qreen	green
	Lub caps	hub caps
	enyoy	enjoy
	enjoj	enjoy
	dest	desk
	gramdpa	grandpa

The letters M and N both have "humped" features. Q and G are round letters with "details." H and L are upright, as are *t* and *k*; *y* and *j* both have "tails."

Our substitutions are larger than individual letters, and seem to be attempts to re-create either the word, or smaller units within the word, usually by approximating shape of medial letters, if not their standard positions.

	Attempt	Target
Whole word shape	ONLYS	always
	CAREFLY	carefully
	UMBLLA	umbrella
	ELEPTANT	elephant
	ALPHALBET	alphabet
	FREDICK	Frederick
	ALEBATATH	alphabet

The operative strategy with these words seems to be an overall attempt to re-create words that contain one or more salient elements: a tall letter or a letter with a tail, or a set of essential letters: *h* and *t* in medial position for *elephant*, or *b* and *h* for *alphabet*. As discussed earlier, in medial position, the position of letters is more likely to vary from the target, composed mostly of the set of salient letters in the word, arranged in some shape approximating the target, for example, similarly tall letters or tailed letters. Note, however, that in most of the preceding attempts, the final letter is usually standard.

CONCLUSIONS

Among the lessons that young deaf orthographers in this study teach, are the ways in which the English orthographic system lends itself to numerous positional and graphemic redundancies. From an early age, the children in this study

recognized and experimented with systematicities at the level of the position of the letter in the word. They very quickly establish rules for letters in initial and final positions. In medial position, they test different letter permutations, most of which are orthographically possible. Despite the fact that there are many permutations of letters that are impossible sequences in the English orthographic system, the deaf children, in general, do not attempt to create them. This can be seen in spelling attempts involving doubled consonants and initial consonant clusters: Although the possibility for impossible sequences is no more difficult than rearranging letters, they do not create words with impossible doubled sequences, and with a few exceptions, do not create impossible initial consonant clusters.

It may be that the larger lessons that these young children teach us are that the orthographic system is amenable to analysis of at least two different types: primarily phonemic or primarily positional-graphemic. Many descriptions of the acquisition of spelling in young hearing children report a transition from basically phonemic to more visual-graphemic strategies in spelling by the time they reach third grade (Baron, Treiman, Wilf, & Kellman 1980; Barron, 1980). This study charts, in preliminary form, transitions made by a group of deaf children over the same period of time, but their transitions are clearly different. More samples from younger and slightly older deaf children would be needed for a clearer account of transitions in young children, particularly young deaf children.

Endnote

1. Almost all deaf children receive training in speech skills at school. It would not be accurate to say that none of them have interest in, or knowledge of, speech and speaking. Furthermore, Hanson and Fowler (1987) found evidence of phonological coding in skilled deaf readers. It would be reasonable to expect that some of their spellings reflect an analysis, on their part, of speech representation. However, as the numbers of potentially phonetic spellings by deaf children in this study are so small, I will not discuss this category of errors here.

REFERENCES

- Badecker, W. (1988). *Representational properties common to phonological and orthographic output systems*. Unpublished manuscript, Johns Hopkins University, Baltimore, MD.
- Baron, J., Treiman, R., Wilf, J., & Kellman, P. (1980). Spelling and reading by rules. In U. Frith (Ed.), *Cognitive processes in spelling* (pp. 159-194). London: Academic.
- Barron, R. (1980). Visual and phonological strategies in reading and spelling. In U. Frith (Ed.), *Cognitive processes in spelling* (pp. 195-213). London: Academic.
- Bissex, G. (1980). *Gnys at work: A child learns to read and write*. Cambridge, MA: Harvard University Press.
- Clay, M. (1975). *What did I write?* London: Heinemann.
- Conrad, R. (1979). *The deaf schoolchild*. London: Harper & Row.

- Erting, C. (1985). Linguistic variation in a school for deaf children. In W. Stokoe & V. Volterra (Eds.), *Proceedings of the Third International Symposium on Sign Language Research*. Rome, Italy: Consiglio Nazionale delle Ricerche.
- Erting, C. (1988). Acquiring linguistic and social identity: Interaction of deaf children with a hearing teacher and a deaf adult. In M. Strong (Ed.), *Language learning and deafness* (pp. 192-219). New York: Cambridge University Press.
- Gibson, E., Schurcliff, A., & Yonas, A. (1986). Utilization of spelling patterns by deaf and hearing subjects. In H. Levin & J. Williams (Eds.), *Basic studies in reading* (pp. 51-73). New York: Basic Books.
- Hanson, V. (1986). Access to spoken language and the acquisition of orthographic structure: Evidence from deaf readers. *The Quarterly Journal of Experimental Psychology*, 38A, 193-212.
- Hoemann, H., Andrews, C., Florian, V., Hoemann, S., & Jensema, C. (1976). The spelling proficiency of deaf children. *American Annals of the Deaf*, 489-493.
- Karchmer, M.A., Milone, M.N., Jr., & Wolk, S. (1979). Educational significance of hearing loss at three levels of severity. *American Annals of the Deaf*, 124, 97-109.
- Maxwell, M. (1984). A deaf child's natural development of literacy. *Sign Language Studies*, 44, 191-224.
- Padden, C. (1991). The acquisition of fingerspelling by deaf children. In P. Siple & S. Fischer (Eds.), *Theoretical issues in sign language research* (Vol. 2, pp. 191-210). Chicago, IL: University of Chicago Press.
- Padden, C., & LeMaster, B. (1985). An alphabet on hand: The acquisition of fingerspelling in deaf children. *Sign Language Studies*, 47, 161-172.
- Ramsey, C. (1993). *A description of classroom language and literacy learning among deaf children in a mainstreaming program*. Unpublished doctoral dissertation, University of California, Berkeley.
- Read, C. (1975a). *Children's categorizations of speech sounds in English*. Urbana, IL: National Council of Teachers of English.
- Read, C. (1975b). Lessons to be learned from the preschool orthographer. In E. Lenneberg & E. Lenneberg (Eds.), *Foundations of language development*. New York: Academic.
- Venezky, R. (1970). *The structure of English orthography*. The Hague: Mouton.
- Wilde, S. (1987). *Spelling and punctuation development in selected third- and fourth-grade children* (Research Rep. No. 17). Charlotte: University of North Carolina.