



SIGN LANGUAGE AND SUCCESSFUL BILINGUAL DEVELOPMENT OF DEAF CHILDREN

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This paper reviews research on language development of deaf children, comparing those who have early access to natural sign language with those who do not. Early learning of sign language does not create concerns for the child's development of other languages, speech, reading, or other cognitive skills. In fact, it can contribute directly to establishment of more of the high-level skills needed for successful bilingual development. The global benefit of learning a sign language as a first language is that in the resulting bilingual communicative setting, teachers and learners can take advantage of one language to assist in acquiring the other and in the transfer of general knowledge. As part of this discussion, English and ASL are compared as representatives of spoken and signed natural languages to provide explicit examples of their similarities and differences.



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INTRODUCTION

Research on ASL syntactic, prosodic, and pragmatic structure was funded in part by NIH grant R01-DC00935 from the National Institute of Deafness and other Communication Disorders. Prior work on ASL syllables was funded by NSF grant BNS-8317572. Additional support was provided by WIRCO.

This paper provides research support for using natural sign languages in the early education of deaf children with the aim of ultimately developing sophisticated language and literacy skills. A review of the literature indicates that early learning of sign language does not cause deaf students' problems learning English, does not interfere with cognitive development and memory, and does not limit speech skill potential. Furthermore, it does benefit language learning and overall socioeducational performance, and can be used to improve reading and writing by providing a necessary language base. The global benefit of learning a natural sign language as a

first language is that it creates a standard bilingual situation in which teachers and learners can take advantage of one language to assist children in acquiring the second language and in the transfer of general knowledge.

Here the term 'bilingual' is used to refer to a naturally evolved sign language and a naturally evolved spoken language. Most of the available research concentrates on American Sign Language (ASL) and English, hence they will be used in this discussion to represent the larger set of natural languages. It is also important to separate 'language' and 'speech,' as evidenced by talking parrots, which can 'speak' but do not know a language. Further explanation of 'natural language status' will be provided in the second half of this paper; for present purposes, it is sufficient to note that artificially created signing systems, such as signed English (SE), do not qualify as natural languages and are not included in the notion 'standard bilingual situation'. The potential role of such signing systems as educational tools is discussed in the latter part of this paper.

The overall difficulty that deaf children have learning English has been very well documented (Quigley and Kretschmer, 1982; Quigley and Paul, 1984; Wilbur, 1979, 1987). As a general observation, by age 18, deaf students do not have the linguistic competence of 10-year-old hearing children in many syntactic structures of English (Fruchter, Wilbur and Fraser, 1984; Quigley, Montanelli and Wilbur, 1976; Quigley, Wilbur and Montanelli, 1974, 1976; Wilbur, 1980; Wilbur, Goodhart and Fuller, 1989). Studies report that less than 12 percent of deaf students at age 16 can read at a fourth-grade reading level or higher as measured on the Metropolitan Reading Achievement Test (Furth, 1966a; Office of Demographic Studies 1972).

By the time hearing children begin to learn to read, they have already developed conversational fluency in their native language and can be taught to transfer this knowledge to reading and other languages. Deaf children who have lost their hearing at an early age do not have this knowledge; thus, they do not come to the task with the same skills in sentence formation, vocabulary, and world knowledge as hearing children. The powerful role that early learning of sign language plays in linguistic and educational achievement is reflected in the fact that deaf children whose deaf parents use sign language at home with them are exceptional with their accomplishments, because they have a fully-established language base prior to learning to read. These children are more similar to hearing children who must learn to read and write in a second language. The overall outcome is striking: deaf children of deaf parents are four times more likely to go to college than deaf children of hearing parents.

SIGN LANGUAGE DOES NOT CAUSE DEAF STUDENTS' PROBLEMS LEARNING ENGLISH

Consider the steps that would be necessary to prove that sign language interferes with learning a spoken language like English. Research must demonstrate that specific errors in deaf students' English can be attributed to ASL and to no other source; other possible sources must be investigated and eliminated. Then, and only then, could it be determined if sign language interference is responsible for the students' errors. The research must include: (1) analysis of deaf students' errors, (2) determining which errors are typical acquisition errors made even by young hearing children, (3) determining which errors are typical errors made by second language learners, (4) consideration of other linguistic factors that could contribute to learning difficulties, such as theoretical complexity or quirks of English structure, and (5) then examination of the structure of ASL and its possible role with respect to English acquisition.

These research objectives have been pursued systematically. The results are clear and dramatic: ASL is not the source of the language learning problem. ASL contributes to successful language learning by providing a typical bilingual learning environment. In a 1975 review of the research results (see also Charrow, 1975), Veda Charrow and I concluded:

It might be more realistic, and successful, if procedures similar to the ones used in bilingual education programs for minority children were followed in teaching English to deaf children. Ideally, in the earliest years, deaf children should learn ASL. Once ASL is established as a means of communication, teachers can then use it as a medium of instruction for all subjects, including English – which can be taught along with speech, speechreading and reading. Such a program would require that more teachers be fluent in ASL, which would in turn require that biases against ASL be discarded. A first step, then, would be to train more teachers of the deaf to use ASL and understand its structure, and to improve the attitudes of all persons – deaf and hearing, teacher and student – toward ASL (Charrow and Wilbur, 1975: 358).¹

What does cause deaf students' problems learning English?

Research indicates that, in general, problems stem from a) inadequate language skills, compounded by reduced input due to the hearing loss, b) inadequate teaching methods due to concerns over communication modality and lack of appreciation of the complexities of language acquisition, and c) teacher focus on sentence structure over other aspects of language use (inferencing, paragraph structure, conversation and story

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structure as transmission of sequenced information; for summary, see Wilbur, 1977).

Deaf students incorrectly overgeneralize comprehension and production strategies that work for understanding basic sentences, those with a subject, verb, and direct object, e.g., "The truck hit the car." From such sentences, students learn that understanding a sentence involves interpreting the first noun as agent, the verb as action, and the second noun as the recipient of the action, a strategy called "reading surface order" (RSO). Unfortunately, there are many structures where the RSO strategy produces incorrect results, as in the passive sentence "The truck was hit by the car," where it is the car that does the hitting. Schmitt (1968) found that by age 18 almost 40 percent of deaf students had not mastered comprehension of the passive voice. Presented with "the truck was hit by the car", students interpret this according to RSO, for example "The truck hit the car." The strength of this RSO strategy is affected by the type of sentence. For example, if the sentence is 'nonreversible' (the subject and object cannot be readily interchanged because only one is animate and can act as an agent), such as "The books were destroyed by the children", comprehension is better than when the sentence is 'reversible', as in the truck/ car sentence. (It should also be mentioned that only slightly over 40 percent of the oldest students were able to *produce* a correct passive.)

Reading surface order also contributes to errors with relative clauses. Quigley, Smith, and Wilbur (1974) reported that deaf students aged 10 to 18 performed considerably worse when compared with 8 to 10 year old hearing children. Given a sentence such as "The boy who hit the girl went home," deaf students frequently interpreted it to mean "the girl went home." This shows the use of surface reading, connecting the verb 'go' with the closest possible noun 'the girl'.

Common examples of young hearing children's overgeneralizations include morphological rules such as the plural or past tense, yielding forms like "bringed", "shutted", "goed", and even "wented" in their productions. A similar example can be found in the written language of deaf children: "The girl helped her mother to packed the picnic basket." The past tense '-ed' added to the infinitive 'to pack' shows that the student knows the past tense rule and knows that 'pack' is a verb that is eligible (sometimes) to have the past tense suffix added. However, the student does not know why infinitive verb forms do not also receive the past tense suffix.

What differentiates deaf children's use of overgeneralization from hearing children's is its long-term persistence to much older ages and its extension to larger syntactic domains. In the examples discussed above, hearing children overgeneralize morphological word endings to exceptional words

that do not fit the regular rule, whereas deaf children overgeneralize the placement of a morphological ending onto a syntactic construction – the infinitive. For hearing children, these overgeneralizations disappear as the child matures. Why do these overgeneralizations grow and persist in deaf children? At least 3 factors have been identified.

Limited input. Deaf students receive only limited input (all modalities combined). When they learn English syntactic rules, they learn some details incorrectly and do not have enough input and experience using the structures to realize their mistakes.

To see that limited input is a major factor in persistence consider data from conjunction, for example "Kim bounced a basketball and Lee practiced tennis." If the two sentences share similar subjects or objects, unusual omissions occur. Deaf students might rewrite two sentences "John washed the car" and "Mary waxed the car" as "John washed the car and Mary waxed", where the object of the second sentence ('the car') has been deleted because it is identical to the object of the first sentence (object-object deletion). Likewise, "The boy hit the girl" and "The girl hit him back" might be rewritten as "The boy hit the girl and hit him back," where the second subject has been deleted because it is identical to the first object (object-subject deletion). Critically, object-object deletion seems to disappear with age, but object-subject deletion does not, in fact it *increases* (Wilbur, Quigley and Montanelli, 1975).

These are not random deletions; they occur in the second sentence of two conjoined sentences, one of the environments where English normally puts pronouns (but many languages drop the pronouns). Deaf children are aware of the need to reduce redundancy, but instead of pronominalizing, they delete, that is, they *overgeneralize* deletion. However, this observation alone does not explain why use of object-subject deletion increases with age whereas object-object deletion decreases.

There are environments in English in which it is possible to delete the subject of the second sentence in a conjoined structure to form a conjoined verb phrase, e.g., "The elephant crushed the roots and ate them." The general rule for English is that the subject of the second sentence may be deleted if it is identical to the *subject* of the first sentence. The deaf students who use object-subject deletion are deleting the second subject when it is identical to the first *object*. Their generalization may be "delete a *noun phrase* in the second sentence if it *occurs* in the first sentence." With subjects, this generalization sometimes gives correct forms (conjoined verb phrases) as well as the incorrect forms. Increasing mastery and use of conjoined verb phrases *reinforces* deletion of subjects. In contrast, objects are never deleted in English: object deletion is

never correct. Eventually, students arrive at a new generalization: "delete the *subject* in the second sentence if it occurs in the first sentence." This generalization produces correct verb phrases but also allows incorrect object-subject deletion, accounting for the failure of object-subject deletion to disappear over time. Because there is no parallel situation for objects, the loss of object-object deletion is predictable. This situation suggests that deaf students' problems with English syntax reflect their attempts at coping with increasing, but still limited, data. An explanation based solely on overgeneralization fails to address the differential behavior of the two erroneous rules. From this example we can see that limited input is a major factor hindering full development of English skills in deaf children.

Structures are taught in isolation. Another factor contributing to persistence of overgeneralizations is that deaf students are frequently taught in isolated sentences, which does not provide adequate information for them to learn all the situations in which a structure is used and all the constraints on its usage. In a specific test of this hypothesis, Nolen and Wilbur (1985) found that for some difficult structures, such as relative clauses, deaf students' comprehension was much better when the structure was presented in a meaningful context than when it was presented in an isolated sentence.²

Context interacts with syntax in such a way as to allow certain syntactic structures and prohibit others. Consider the two related sentences "The car hit the truck" and "the truck was hit by the car." The difference in meaning or function is not at all obvious without the benefit of context. An appropriate response to "What hit the truck?" may be either "The car hit the truck" or "The truck was hit by the car." However, it is inappropriate to respond to "What did the car hit?" with "The truck was hit by the car" (without special intonation) because of the conflict of contextual focus (what is foregrounded and what is backgrounded). Context reflects shared knowledge between sender and receiver, their expectations based on world knowledge, conversational content, and linguistic structure, and the effects of these on choice of syntactic structure. In the discussion of ASL structure to be presented later in this paper, it will be seen that knowledge of how ASL handles these contextual differences could be useful in rectifying deaf students' lack of knowledge in this area.

Several of the difficult syntactic structures form a group in that they are involved in separating old from new information, which is a function of previous contextual history. Repeated reference to previously presented information may become redundant, hence English uses pronominalization, definite determiners ("the"), deletion in conjoined structures, or relative clauses ("The boy who(m) I told you about").

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Competency in pronoun usage requires mastery of two aspects: which ones to use and what contexts to use them in. Research indicates that deaf students' problems with pronouns are related to when to use them, not which ones to use. For deaf students, deciding which contexts are appropriate for pronouns is easier within a single sentence (ranging from 75 percent correct at age 10 to a high of 93 percent at age 17) than across two sentences in sequence (only 40 percent at age 10 to 80 percent at age 18; Wilbur, Montanelli, and Quigley, 1976). The problem with sentences in sequence is that the first one introduces new information ("This is my friend John") which immediately after presentation is considered *old* information. Thus the second sentence, if it refers back to the first, must use a pronoun ("He goes to school with me"). Pronoun usage is further complicated by the lack of a fixed rule in English. A pronoun should be used to avoid redundancy when someone or something is referred to several times in succession, but ambiguity of reference must be avoided. Thus if more than one male individual has been previously mentioned, the use of "he/him/his" can be problematic. Only practice in extended contextual situations can develop a mature sense of when the pronoun is permitted and when the noun or proper name must be mentioned again. (Pro-drop languages that allow the subject or object pronoun to be omitted may not cause deaf students this specific difficulty.)

The same general tendency to reduce redundancy is apparent in the deletions that produce conjoined structures and likewise, deaf students' confusion is similarly reflected in their errors (Wilbur, Quigley and Montanelli, 1975). Although deaf students seem to know when to use determiners (unlike pronouns), they do not seem to know which ones to use (also unlike pronouns). Deaf students' difficulty with determiners is also an old versus new problem: correctly distinguishing situations for definite/old ('the') and indefinite/new ('a') (Wilbur, 1977). Determiner usage constraints, and other pragmatic constraints, must be applied to each individual conversational task, making the acquisition of such constraints a complicated task. Limited input and interactional experience merely compound the problem. (Again, languages that do not distinguish definite and indefinite determiners may not cause this particular problem, although clearly context will still be relevant to choice of syntactic structure, and deaf students will still have to learn what to do when.)

Only certain structures are taught. Still another factor contributing to difficulties deaf children have learning English is related to teaching. Educational programs must make choices concerning which structures to teach because it is impossible to teach everything all at once. In any given year, a particular

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structure may or may not be covered (this is also true for vocabulary). Given input limitations, deaf students can only be expected to know a structure if it has already been taught. If deaf students' knowledge of English structures is compared with learning predictions made from either the order of acquisition by hearing children or from theoretical syntactic and semantic complexity, theoretical complexity is a better predictor of the order observed in deaf learners, in part because as teachers decide what to teach first, they intuitively feel certain structures are more difficult than others, and their intuitions reflect linguistic complexity (for example, that 'something' is simpler than 'anything'; Wilbur and Goodhart, 1985; Wilbur, Goodhart and Montandon, 1983; for an overview of factors affecting hearing children's acquisition, see Fletcher and Garman, 1986; Slobin, 1985; Bloom, 1993; and for discussion of the contribution of frequency of occurrence, see Pinker, 1993). Deaf students are much more affected by what is presented in class because they lack extensive contextual and interactional experiences outside of class.

We have seen then that deaf learners experience difficulty in the acquisition of English and literacy skills not because of interference from sign language structure, but as a result of several factors. They approach the learning process much like young hearing children, generalizing their linguistic observations to novel structures and contexts. However, unlike young hearing learners, deaf learners' overgeneralizations persist to much older ages, which can be attributed to greatly reduced language input and interactional experiences.

SIGN LANGUAGE DOES NOT INTERFERE WITH COGNITIVE DEVELOPMENT AND MEMORY

It has long been known that hearing people use some form of phonological coding in certain reading and memory tasks. For example, when hearing people are deprived of an opportunity to use semantic information in the recall of word lists, they tend to make mistakes based on the phonological properties of the words they hear or see (Conrad, 1962; Wickelgren, 1965). In parallel fashion, Bellugi and Siple (1974) have demonstrated that phonological/formational properties of signs produce similar errors in deaf memory. Furthermore, Sachs (1967) reported that hearing people discard the specific syntax of a sentence very shortly after it is seen or heard, because once the meaning has been extracted, the syntax is no longer useful for memory. For hearing people, then, one can expect that longer-term memory for sentences will be coded on a semantic basis and not on the form (syntax) of the sentence (Bransford, Barclay and Franks, 1972; Bransford and Franks, 1971; Crowder, 1972; Franks and Bransford, 1972; LaBerge,

1972; Norman, 1972; Paris and Carter, 1973). Moulton and Beasley (1975) report similar results for deaf subjects, showing that they take advantage of the semantics of stimulus items whenever possible, but that they use sign-based coding when semantics cannot be of assistance.

Studies have shown that many deaf people have a choice of coding English either by phonological, visual, or sign-based means, that oral training methods do not guarantee phonological coding strategies, and that non-signing deaf people who do not use phonological coding strategies do not give clear evidence of reliance on any one of the other possible strategies (Conrad, 1970, 1971, 1972, 1973; Locke and Locke, 1971). However, the lack of clear strategies does not indicate that the use of other memory strategies is necessarily impaired. When deaf students are given instructions (for example, to use fingerspelling during rehearsal, or different rehearsal strategies), their performance improves to nearly 100 percent (Belmont, Karchmer and Pilkonis, 1976; Karchmer and Belmont, 1976). Also, when performance is compared on tasks involving English words and nonverbal information such as pictures, it is clear that the problem is specific to the linguistic task (English words) and not to memory in general (Karchmer and Belmont, 1976). It is critical then that we keep in mind that memory strategies must be learned; reports of what deaf subjects do in experimental situations should not be taken as indicators that they cannot be taught more effective approaches.

Furth (1966b) demonstrated that the general cognitive ability of deaf people is not greatly different from hearing people in non-linguistic tasks. Perhaps deaf children do not develop the ability to apply their nonlinguistic cognitive skills to linguistic tasks? This suggestion is clearly not true for those deaf children who learn ASL as a first language, given the fact that the acquisition of ASL is a linguistic task that is easily accomplished by these children (Petitto, 1993; Newport and Meier, 1985; Lillo-Martin, 1994; Wilbur and Jones, 1974). In a study directly addressing this suggestion for deaf children who do not know ASL, Wilbur (1982) investigated linguistic but non-syntactic generalizations made by deaf students. The task required the students to recognize English constraints on allowable words. For example, *blick* could be a word of English whereas *bnick* can not be because of the initial consonant cluster *bn* (compare with Russian which allows clusters *zd* and *gd*). These constraints, unlike spelling rules and grammatical rules, are not taught to either deaf or hearing children in school, hence any knowledge that deaf children have of these constraints must have been extracted by the children entirely on their own using their cognitive processing ability applied to the English language. The deaf students' scores are quantita-

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tively below those of the hearing children at the first, third, and fifth grade levels, but the error patterns are not qualitatively different. That is, violations of word structure constraints that are easy for the hearing children to identify are also easy for the deaf students, and those that are hard for the hearing children are also hard for the deaf children. These data support the conclusion that deaf students' difficulty in learning the proper rules for the more complex syntactic patterns of English is not attributable to a disturbance of general linguistic or cognitive processing, but rather to difficulty in learning the specific rules of English. This conclusion is strengthened by the fact that by seventh grade, the deaf and hearing students performed equally well on this nonsyntactic task despite the huge gap in syntactic performance of hearing and deaf students (Wilbur, 1982).

SIGN LANGUAGE DOES NOT LIMIT SPEECH POTENTIAL

There is no evidence to support the belief that use of sign language interferes with development of speech abilities. In his summary of studies of deaf children with early oral preschool compared to those without, Moores (1971) reported that none of the studies indicated any difference in oral skills (speech and speechreading). Vernon and Koh (1970) compared deaf children of hearing parents with early intensive oral training to deaf children of deaf parents with no preschool (i.e., ASL users). Again, no differences in oral skills were found, but the students with deaf parents were superior in reading and general achievement. Several other studies compared deaf children of deaf parents to deaf children of hearing parents. Four of these studies included results that are relevant here (Meadow, 1966; Quigley and Frisina, 1961; Stevenson, 1964; Stuckless and Birch, 1966; for a description of these, see Bonvillian, Charrow and Nelson, 1973; Moores, 1971, 1974). Deaf children of deaf parents are superior on some or all of the English skills and general measures of ability. Three of these studies reported no difference between the two groups on measures of speech production, but the fourth reported that the deaf children of hearing parents are better. One of the studies also reported that the deaf children of deaf parents are better on measures of speechreading ability, whereas the other three reported no differences between the two groups. A study of children using Swedish Sign (Ahlstrom, 1972) reported that "speech was not adversely affected by knowledge of signs" (Power, 1974). What is striking about these studies is the lack of any direct evidence that the use of signing is detrimental to the development of speech skills. If such an interference relationship existed, one would expect to see it reported in study after study. Its absence is thus noteworthy.

What about phonological coding for reading?

Research on hearing children indicates that children who learn letter-sound associations, and then use these associations in reading (by sounding out the word), experience superior reading achievement (Chall, 1967). Consequently, reading materials intended for hearing children rely heavily on the phonological properties of the words to serve as recognition cues to the beginning reader. Does this mean that phonological coding is necessary for reading?

Chinese provides evidence that reading does not require the reader to be able to pronounce the language. The Chinese writing system is "logographic," meaning that each character represents a separate morpheme (unit of meaning). Each character represents a whole word rather than the individual sounds associated with the word's pronunciation. Because each word has its own symbol, these systems have the disadvantage of being slow to learn; the estimate is that people must learn about 5,000 characters just to read a Chinese newspaper and twice that for a college text. However, the literacy level in China is very high, reflecting the fact that learning this written system is nonetheless routine. The great advantage of logographic systems is that someone does *not* have to know how to pronounce the language in order to be able to read it. This makes it possible for people who speak mutually unintelligible dialects of Chinese (e.g., Mandarin and Cantonese) to read the same newspapers and to communicate with each other by writing even though they cannot carry on a spoken conversation (this is the basis for the language policy of the Chinese government to teach all students Mandarin in school).

One direct investigation of phonological encoding by Chinese readers reports that they do in fact engage in some degree of phonological recoding when presented with Chinese characters (Chu and Loritz, 1976). However, Tzeng and Wang (1983) also report strong visual/logographic coding effects in Chinese readers of Chinese characters, and further that these logographic effects transfer to the treatment of English alphabetic words when English is learned after reading fluency has been achieved in Chinese. Smith (1986) notes that these apparent contradictions can be resolved by not expecting a reader to use the same abilities or strategies for all levels of task difficulty, and provides extensive discussion of strategy change and flexibility with good, medium, and poor hearing and deaf readers (he presents data from Pattison, 1983). Smith (1986: 493) concludes that phonemic awareness is a "crucial concomitant" for reading an alphabetic system but that it is not clear why this is true, as there appears to be no clear link between phonological awareness and information processing. Further, more the phonemic awareness that is helpful to beginning readers can be a hindrance to fluent reading at later ages.

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This brings us to a second issue, whether the phonological coding observed in hearing readers is critical to the reading process, or is the result of the fact that hearing people speak before they read and are taught to read based on the speech they already know. One assumption behind the "phonological coding is necessary to reading" line of reasoning is that children can take advantage of letter-sound relationships, that is, match letters with possible spoken segments (phonemes) of the language. There is clear evidence, however, that hearing children's awareness of segments is a late developing and reading-influenced skill. Language games provide one assessment of children's facility with phonological structure. Bagemihl (1989) and Pierrehumbert and Nair (1995) argue forcefully that subsyllabic [smaller than a syllable] constituents, such as individual segments (phonemes), do not participate in children's language games; indeed Pierrehumbert and Nair extend this to phonological theory in general, claiming that such subsyllabic constituents do not exist. Yip (1982, 1994) further argues that subsyllabic constituents are not referenced by the phonological processes of spoken Chinese and are therefore unnecessary at the phonological level; she concludes that mora (weight units), syllable, and foot (batched sequences of syllables) are the only prosodic units given by Universal Grammar. Bagemihl observes from the wide distribution of language game types that manipulate or reverse syllables as compared to the narrower distribution of language games that explicitly manipulate segments (e.g., Pig Latin requires separation of the first sound from the rest of the syllable): "It seems that the presence of an alphabetic writing system is necessary for the establishment of some metalinguistic awareness of the notion of 'segment'" (1989:485f). That is, the narrower distribution of language games that manipulate segments is restricted to (a subset of) languages that have alphabetic (segmental) writing systems. Thus, he suggests that becoming aware of an alphabet also involves becoming aware of individual segments within syllables. Smith (1986:479) states this relationship even more explicitly:

...children's awareness of units in their speech and their ability to identify and exploit corresponding units in print are two mutually supportive developments: morphophonological awareness aids reading, and reading aids morphophonological awareness.

Herein lies the key to the success of early fingerspelling in the development of literacy as described by Padden and Hanson (2000). Deaf children who know ASL are provided access to fingerspelling before or in conjunction with print and spelling and are able to connect fingerspelling segments

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(handshapes) to printed segments (letters). However, the absence of an alphabetic writing system, and hence the absence of awareness of individual phonemes, is no detriment to literacy, as reflected by the Chinese situation. Recent research on brain development further suggests that the critical features of initial input is that it is consistent, adequate, and interactive, not whether it is auditory or visual (Thelen and Smith, 1994). That is, infants must have adequate amounts of consistent interaction with the environment, including language, to develop properly, but there appears to be no bias towards auditory as opposed to visual input. Again, the parallel course of acquisition for ASL compared to spoken languages (Newport and Meier, 1985; Lillo-Martin, 1994) and the superior achievement in many domains of deaf children who have deaf parents also support the conclusion that higher level cognitive processes and intellectual abilities are not *speech* input dependent but are *information* input dependent. If the input to the child does not carry information in a useable format, there is no information transmission.

There is one further reason to question the importance of phonological coding to deaf readers. In a memory study of orally-trained deaf adults who used ASL as their primary means of daily communication (6 of the 8 subjects had deaf parents as well), Bernstein-Ratner and Wilbur (1984) reported a strong effect of graphemic errors (visually-based on orthography, e. g., confusing "four" with "sour") and no significant differences among errors based on sign, phonological, or miscellaneous foils. In the discussion of their results, they note that Mark, Shankweiler, Liberman, and Fowler (1977) report that hearing beginning readers who use phonological coding strategies are better readers than those who rely on graphemic coding. Bernstein-Ratner and Wilbur suggest that this is true because phonological coding capitalizes on the primary communication mode of speech in hearing children, which of course graphemic coding does not do. "Rather than conclude that phonological coding per se is the most efficient mediator of memory and reading, we would like to suggest that the most efficacious coding strategy will be the one which is congruent with the primary communication mode. The problem in demonstrating that this is so is the apparent absence of a population which has been taught to read using a code other than spoken phonology" (Bernstein-Ratner and Wilbur 1984: 61). That is, in the United States, deaf children are still taught to read using speech and letter sound associations, even when other techniques are also used. It is important then to remember that the results reported on experimental studies of these readers are the outcomes of this tradition and are not in themselves evidence for the way reading *should* necessarily be taught.

SIGN LANGUAGE DOES BENEFIT OVERALL SOCIOEDUCATIONAL PERFORMANCE

Compared to deaf students of hearing parents who presumably do not know ASL, studies overwhelmingly report better overall achievement for deaf students of deaf parents, although there are differences on some measures, and, in some cases, no differences at all. Moores (1974) summarized several such studies. Stevenson (1964) reported higher educational achievement for the deaf students of deaf parents in 90% of the comparisons, with 38% of the students with deaf parents going on to college, compared to only 9% of the students with hearing parents. Stuckless and Birch (1966) reported superior reading, speechreading, and written language for the deaf students of deaf parents, with no differences noted in speech or psychosocial development. Meadow (1966) reported higher self-image and academic achievement (arithmetic, reading, and overall) in deaf children of deaf parents. In addition, teachers' ratings of the students were in favor of the deaf students of deaf parents on maturity, responsibility, independence, sociability, appropriate sex role, popularity, appropriate responses to situations, fingerspelling ability, written language, signing ability, absence of communicative frustration, and willingness to communicate with strangers. No difference was noted in speech or speechreading. Vernon and Koh (1970) likewise reported that deaf students of deaf parents were superior in reading, vocabulary, and written language. No differences were found in speech, speechreading, or psychosocial adjustment. Quigley and Frisina (1961) reported higher vocabulary levels for the deaf students of deaf parents, no differences in speechreading or educational achievement, and better speech for the deaf students of hearing parents. Finally, Vernon and Koh (1970) compared the academic achievement of deaf students of deaf parents with early ASL to deaf students of hearing parents with early intensive oral training. They reported that the students of deaf parents were ahead in all areas and had superior reading skills. No differences were found in speech or speechreading.

The above studies have established to the satisfaction of more than a generation of researchers that knowledge of ASL is invaluable in the education of deaf children. A quick look at the successful deaf individuals in my professional field reveals that they either have deaf parents (indeed, in some cases large deaf families) or they have hearing parents who began signing with them, however awkwardly, when they were diagnosed as deaf as children. Poor parental signing skills are easily overcome by providing deaf children with interactional opportunities with ASL-fluent members of the Deaf community (deaf clubs, deaf schools, deaf athletics, etc.). The best general discussion of these conclusions is contained in John-

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son, Liddell and Erting (1989; readily available from Gallaudet University), in which they outline a model program for the education of deaf children with ASL as a central focus and family support provided by Deaf community interaction (among other sources). Crucially, they set a clear goal for deaf education: access to age-appropriate curriculum. Are e. g., third grade deaf children able to demonstrate competency in the standard third grade curriculum in math, history, science, and whatever else is typical for third grade? Anything less is unacceptable.

SIGN LANGUAGE CAN BE USED AS A BASIS FOR BILINGUALISM AND LITERACY

Consider then the benefits that all deaf children would receive from early exposure to ASL. One would be the fully developed language base that deaf children of deaf parents are already getting. A fully developed language base provides normal cognitive development within the critical language acquisition period (Newport and Meier, 1985; Petitto, 1993; Lillo-Martin, 1994; review of older work in Wilbur, 1987). Teacher-child and parent-child communication is vastly improved and the limited input problem discussed above with respect to reading and writing English is eliminated. Instead, ASL-signing deaf children are another bilingual minority learning English (Charrow and Wilbur, 1975). It is already known that deaf children approach learning English as though it were a foreign language. Charrow and Fletcher (1974) gave the Test of English as a Foreign Language (TOEFL) to deaf high-school students of college-entrance age. Although the deaf subjects did not perform as well as foreign college entrants, in general their results more closely resembled those of foreign students than those of native speakers of English. From the perspective of treating deaf children like other second language learners, it is reasonable to expect on-grade-level performance, and that some of that performance may be demonstrated in the first, rather than the second, language. Hakuta (1986) has demonstrated that there is no problem with transfer of curricula material learned in one language to eventual use in the other language.

ADVANTAGES OF HAVING A FULLY DEVELOPED FIRST LANGUAGE

From a linguistic perspective, knowledge of ASL as a first language is beneficial because it taps normal capacities at the appropriate stage of development. As Lillo-Martin (1993, 1994) discusses, when children have a first language (ASL or other language), their linguistic competence is constrained by Universal Grammar, that is, the normal language acquisition process has taken place within the confines of what all natur-

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al languages have in common (related discussion in Petitto, 1993; Newport and Meier, 1985; Pinker, 1993, inter alia). As a result of this first language acquisition process, there is reduced need for emphasis on teaching particular syntactic structures in the second language (see also discussion of knowledge transfer in Hakuta 1986). Given a first language, learners of a second language have some idea of what to expect, making the acquisition of the second language a task with reduced complexity.

In several publications, VanPatten (1995, 1996) has argued that for successful language acquisition, learners need access to input which is communicatively and/or meaningfully oriented and comprehensible in nature. He notes that there are three corollaries to this observation: 1) the learner must interact with the input to maximize language acquisition, 2) the input must not only be comprehensible, it must be comprehended with *ease*, and 3) the degree and quality of language acquisition is partially determined by degree and quality of input received. Deaf children of deaf parents are clearly provided with the necessities for successful acquisition of English, and this is reflected in their academic and professional accomplishments.

Learning to read requires an already developed language base. As deaf children are traditionally taught, they are asked to learn English language structure, speech, and reading all at the same time. The problem with this is that students cannot understand what they are being told until they have mastered English well enough to understand the teacher's instructions. This vicious cycle is broken when the children come to school with a fully established ASL language base – then a normal situation is encountered for teaching English as a second language (ESL). Properly trained teachers of the deaf should have substantial expertise in ESL methods, and speech-language pathologists and audiologists working to develop speech and listening skills should have conversational fluency in ASL in order to be able to work with the children.

Consider what hearing children are expected to be able to do with the language base before learning to read (reading readiness). They are supposed to have a reasonably well-developed vocabulary, otherwise they will not recognize a written word even if they sound it out. They are supposed to be able to handle sentences of some complexity; even though the construction of beginning readers limits the number of words per sentence, actual syntactic structure is not properly regulated (Quigley, Wilbur, Power, Montanelli and Steinkamp, 1976; Wilbur and Nolen, 1986b). Finally, they are supposed to be able to draw on their conversational skills and their knowl-

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edge of story structure to draw inferences and conclusions so that they can "read between the lines". With ASL as a fully developed language base, deaf children could be expected to meet reading readiness milestones as well. While they might not be able to recognize words that they sound out, they might be able to do the equivalent with fingerspelling (again, see Padden and Hanson, 2000). Certainly, they should be able to understand those words when signed, and this is precisely where knowledge of ASL makes a difference. Stuckless (1981) noted that deaf children exposed only to a graphic form of English are working with a clear and complete code, but still need to have an established language base in order to derive meaning from it. Similarly, Hirsh-Pasek and Treiman (1982) note that deaf children rarely possess a strong language base that is compatible with the alphabetic writing system and that recoding in the absence of extensive articulatory or fingerspelled vocabularies is unprofitable. They suggest that teachers working with signing deaf children can increase the child's fingerspelled lexicon, but that explicit instruction in using fingerspelling as a coding strategy related to print may be necessary because children may not discover it without assistance. In this manner, the process of learning to deal with printed material is separate from the task of learning a language in the first place. As long as the two goals are collapsed, progress towards both will continue to be hindered.

When teachers and students are able to turn their attention to the development of reading skills, other reading issues and options also become relevant. For example, Clarke, Rogers, and Booth (1982: 59) point out that "[t]here is no compelling evidence that any one reasonable method of teaching reading will yield results that are significantly better than any other reasonable method". Hirsh-Pasek and Treiman (1983) caution that the studies involving memory tasks with lists of single words may not be generalizable to the reading of sentences and larger units, and that studies using fairly realistic reading tasks have failed to find articulatory recoding among congenitally hearing-impaired subjects. Ewoldt (1982:85) further warns, "the reading of isolated sentences is also foreign to real reading. It is more difficult than reading a whole story, in which semantic build-up helps the reader not only to identify words but also to handle difficult or unusual syntax." Finally, Chall (1967) warns that teaching methods are difficult to define in practice.

The 12 Essential Components for a research-based reading program for beginning readers provided by The Texas Reading Initiative report (www.just4kids.org/html/bri.html) may be very useful here. The only adaptation that should be made

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for deaf readers is to replace "oral/spoken" with "conversational", which covers both speech and signing, and to include "fingerspelling" with "sounds":

1. Opportunities to expand use and appreciation of oral language
2. Opportunities to expand use and appreciation of printed language
3. Opportunities to hear good stories and informational books read aloud daily
4. Opportunities to understand and manipulate the building blocks of spoken language
5. Opportunities to learn about and manipulate the building blocks of written language
6. Opportunities to learn the relationship between sounds and letters
7. Opportunities to learn decoding strategies
8. Opportunities to write and relate writing to spelling and reading
9. Opportunities to practice accurate and fluent reading in decodable stories
10. Opportunities to read and comprehend wide assortment of books and other texts
11. Opportunities to develop new vocabulary through wide reading and vocabulary instruction
12. Opportunities to learn and apply comprehension strategies as they reflect upon and think critically about what they read.

Note the use of the key word "opportunities" – one of the most significant advantages of working with deaf children who already have a well-developed first language base is that many opportunities for learning can be found outside of the traditional classroom situation. For example, a trip to the zoo becomes more than just an opportunity to learn the names of animals; with extensive communication provided through ASL, teacher and students can have a discussion about which animals are more interesting to write stories about and why. Children can make up short stories and tell them in ASL, enjoying the experience without the frustration of English structure, spelling, and writing. When the children do finally write the stories, the task is different, but typical for bilingual children: translating into another language. For children who do not know ASL, writing the story is not a translation task and requires attention to factors other than just the structure of English (for example, the notion of a 'story grammar' has to be developed, whereas children who can use ASL will have already learned many things about normal story structure, such as creating the setting, introducing participants, etc.).

ASL AS A NATURAL LANGUAGE

ASL is a naturally evolved complex language that varies significantly from English. Like many other languages (e. g., Russian, Spanish), it has a somewhat flexible word order, preferring that sentence elements reflect discourse roles (topic, focus) rather than the grammatical relations (subject, object) that English prefers (Wilbur, 1997). Another difference between ASL and English is that ASL has what is called fixed phrasal stress, that is, it does not allow stress to shift to different words in a sentence in order to focus on different items (Wilbur, 1997). Instead, ASL takes advantage of its more flexible word order to ensure that the desired focus will receive stress only in sentence-final position. Languages that allow phrasal stress shift, like English and Russian, are referred to as [+plastic], whereas languages like ASL and Catalan are [-plastic], where [-plastic] is a typological feature that reflects how a language brings stress prominence and information focus together (Vallduví, 1991).

An illustration of the differences between the two types of languages may be helpful here. English allows the following sentences, each one with a different stressed item but all with the same word order:

- 1a. Selena saw Marita put the book
on the TABLE (not the SHELF)
- 1b. Selena saw Marita put the BOOK
on the table. (not the MANUSCRIPT)
- 1c. Selena saw MARITA put the book
on the table. (not ADONI)
- 1d. SELENA saw Marita put the book
on the table. (it was not KIM)

Such stress movement cannot be done in languages like ASL with fixed phrasal stress. Instead, the word order must be changed so that the item to be stressed is situated in the place that is reserved for focused items; in ASL and many other languages, this position is at the end of a sentence (Wilbur, 1994b, 1995b, 1996). ASL has a very common structure that translates into English in two ways, either as in (1a-d) or as the *wh*-cleft as in (2); signs are glossed in small capitals and the required non-manual markers have been omitted for simplicity:

- 2a. SELENA SEE MARITA PUT BOOK WHERE, TABLE
"The place where Selena saw Marita put the book was the table."
- 2b. SELENA SEE MARITA PUT-ON-TABLE WHAT, BOOK
"What Selena saw Marita put on the table was the book."
- 2c. SELENA SEE BOOK PUT-ON-TABLE WHO, MARITA
"The person who Selena saw put the book on the table was Marita."
- 2d. SEE MARITA BOOK PUT-ON-TABLE WHO, SELENA
"It was Selena who saw Marita put the book on the table."

The ASL structure can be generalized easily to create further structures that are considered exceptionally complex in English:

- 2e. SELENA SEE MARITA DO++, BOOK PUT-ON-TABLE
"What Selena saw Marita do was put the book on the table."
- 2f. SELENA DO++, SEE MARITA BOOK PUT-ON-TABLE
"What Selena did was see Marita put the book on the table."
- 2g. SELENA SEE MARITA DO++ WITH BOOK,
PUT-ON-TABLE
"What Selena saw Marita do with the book was put it on the table."

The basic form of this construction in ASL is "old information + wh-word, new information", with the old information clause marked by a brow raise (Wilbur, 1996). Brow raises and other non-manual markers are integral components of the ASL intonation system, performing many of the same functions in the signed modality that pitch performs in the spoken modality (Baker and Padden, 1978; Battison, 1974; Frishberg, 1978; Siple, 1978; Wilbur, 1991, 1994b, 1994c, 1995a, 1999b; Wilbur and Patschke, 1999). These differences in prosodic structure and intonational marking are primary contributors to significant differences in syntactic structure between ASL and English (Wilbur, 1999a, 2000). The prosodic, intonational, and syntactic structures evolved together to provide natural language capability in the signed modality (Allen, Wilbur and Schick, 1991; Wilbur and Allen, 1991; Wilbur, 1997, 1999c).

The non-manual markers comprise a number of independent channels: head; body position; eyebrow and forehead; eyeblink and eye gaze; nose; and mouth, tongue, and cheek (Wilbur, 1994a). Non-manual cues provide morphemic information on lexical items, or indicate the ends of phrases (boundary markers) or their extent (domain markers). The non-manual signals made on the face can be roughly divided into two groups, lower and upper. The lower portion of the face is used to provide adverbial and adjectival information. The mouth, tongue, and cheeks provide meaningful markers that associate with specific lexical items or phrases (Liddell, 1978, 1980; Wilbur, 2000) and the nose can be used for discourse marking purposes (Wood, 1996). Readers are referred to introductory textbooks on ASL, such as Baker and Cokely (1980) and Valli and Lucas (1992), for overviews.

The non-manuals supplied by the upper part of the face and the head (eyebrows, head nods, tilts, shakes, eyegaze; Wilbur, 1991) occur with higher syntactic constituents (clauses, sentences), even if such constituents contain only a single sign (e.g., a topicalized noun). Liddell (1978, 1980) noted the larg-

WHY I REALLY MEAN ASL, NOT SIGNED ENGLISH (SE)

There are many situations in the daily lives of deaf children, especially those who have hearing parents, where communication in a form of signed English between adult and child is acceptable and adequate for information transfer. Those situations arise when, and only when, the child has acquired a sufficient knowledge of English for the signed English to be meaningfully interpreted. It is clear from the research and the success of deaf children of deaf parents who use ASL that one can reasonably expect to reach this point sooner and more efficiently with ASL as the first, early established language. There is one study, Brasel and Quigley (1977), that suggests a slight advantage to performance on tests of English syntax for those children whose parents used signed English with them instead of ASL; however there were no other advantages in favor of the signed English group. Let us conclude from this that when English syntax is the focus of educational attention, signed English usage may have an appropriate place as an effective educational tool. (For a review of the history of the debate surrounding signed English as an educational tool back to 1834, see Lane, 1992.) This does not mean that signed English should be used with very young deaf children, as it is quite clear that there are many stages of language acquisition that precede specific concern with syntactic structures (lexical development, lexical categorization such as transitive vs. intransitive verbs, concepts of aspect and time, morphological marking, among many others; see Radford, 1990; Atkinson, 1992; Lust, Suñer and Whitman, 1994; Lust, Hermon and Kornfilt, 1994), and there are many cognitive and socioemotional things that children must develop during the early years in addition to language (see relevant discussions in Bloom, 1993; Fletcher and Garman, 1986; Slobin, 1985).

With respect to the disadvantages of early use of signed English, it is clear that natural languages have certain linguistic characteristics in common, including those features that linguists refer to as Universal Grammar. I have argued that "layering" is one such characteristic (Wilbur, 2000). Could someone argue that signed English is just a coding for English, and certainly English is a natural language, so why should signed English be problematic? Good question.

Two criterial features for defining a natural language are that 1) it has a community of users and 2) it can be learned by babies from birth. It must be a perfect fit with the perception and production characteristics of the human user, and over time, natural languages evolve to fit the modality in which they are produced and perceived. Obviously, spoken languages are designed to be communicative with *ease* by people who

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speak and hear. Similarly, signed languages are evolved to provide communication with *ease* by people who sign and see. It is only when spoken languages and signed languages are compared for what they have in common, despite their modality differences, that these linguistic design features become obvious.

What SE lacks is adaptation to its modality, which would allow it to take advantage of simultaneity rather than sequentiality. It has not developed an intonational and rhythmic system of its own that is designed to be seen by the eyes and produced by the hands and face. Let me explain first why this evolution has not taken place and then describe briefly what that leaves with respect to the structure of signed English. The sociolinguistic reasoning for the absence of prosodic and linguistic evolution of signed English to natural language status is as follows:

The various forms of SE are artificially created systems for communication in pedagogical situations. They are designed as a code to mimic the lexicon, morphology and syntax of English. SE is in essence re-created as it is learned by each learner and it is learned with the over-riding constraint that it should follow English word order. Thus, syntactic structure is not available for adaptation for modality purposes; that is, flexible word order could not develop under the circumstances that now surround signed English usage. However this fact by itself is not a problem as there is no principled reason why a natural signed language could not have the word order of English if by "syntax" we mean merely the basic word order.

More critically, SE is supposed to follow English morphology, which makes the morphological domain also off-limits for modification for modality purposes. The lexical vocabulary of ASL and SE overlap approximately 90% (Wilbur, 1987). These signs do not provide an exact match with English because certain information is carried in ASL not by separate signs, but by derivational and inflectional morphological modifications (e. g., aspect, verb agreement, classifier constructions) that are marked on basic signs by making spatial or temporal adjustments to the sign movement (Klima and Bellugi, 1979). English morphology involves affixes which are added to the stems (plural, past tense, progressive, comparative, superlative, possessive) and freestanding grammatical words (future, prepositions, infinitival "to", and determiners). Because ASL uses other grammatical methods such as spatial arrangement in place of several types of prepositional phrases, signs for many function words and morphemes (e.g., at, to, the, -ing) that are not needed in ASL were invented for SE. These are translated into SE as separate signs, each requiring independent ar-

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tication in sequence; the result is that SE sentences have substantially more signs per sentence than ASL. Therefore, SE takes at least 50% longer to produce the same set of propositions than the two natural languages, spoken English and ASL, which are roughly comparable (Bellugi and Fischer, 1972).

The constraint that SE should follow English morphology encourages sequentiality and prevents layering mechanisms from arising. Given the requirement that SE should match English, any child inventions for SE (such as those reported by Supalla, 1991; Gee and Mounty, 1991) involving the types of manual or non-manual mechanisms that we have discussed for ASL will be under pressure to normalize to the proper English sequence of signs. For example, Supalla (1991) reports that despite pure signed English input and modeling containing no spatially modified verbs or pronouns (and no known contamination by ASL signers), 10 year-old deaf students produced signing in which 80% of the verbs and 86% of the pronouns were spatially modified. The total absence of these devices in the teacher's signing suggests that these innovative spatial modifications will be increasingly treated as unacceptable errors until they are completely eliminated from the students' signing and are replaced by the proper signed English forms (sequentially suffixed in the case of the verbs, simultaneously initialized handshapes in the case of the pronouns). Under these circumstances, grammaticization of non-manuals or manual sign modifications for functions like verb agreement cannot evolve. Furthermore, when adults (usually hearing) learn to sign English, they are already fluent in English and find it convenient to follow English principles, making innovations by this older population less likely. In essence, then, the dominance of English sequentiality of words and morphemes in this communication situation suppresses layering adaptations of signed English.

Wilbur and Petersen (1998) studied two groups of fluent SE users, one which also knows ASL (adult children of deaf parents) and one which does not (teachers, parents, audiologists, speech-language pathologists). In this study, the signers who know ASL were relatively diligent in using ASL non-manual markers to convey information while producing SE (with or without speech), that is, they extended layering from ASL to SE. The signers who do not know ASL used minimal and occasionally incorrect non-manual marking while signing SE. For example, some of their SE productions of yes/no questions had correct ASL brow raise on them whereas other productions were inappropriately marked with brow lowering. Fully 81% of the yes/no questions produced by these signers were not correctly marked by ASL standards. Other non-ma-

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nuals (blinks, negative headshakes) clearly differed between the two groups even though both groups were supposed to be producing the same SE content. The signers who knew ASL were able to transfer non-manuals to SE because SE has no specified non-manuals of its own. As a group, the signers who did not know ASL but who are nonetheless fluent users of SE were not homogeneous in their use of non-manuals because no such system has developed for SE. If this is true for the general population of SE signers who do not know ASL, then it is clear that children are not presented with a consistent adult model of SE in the settings in which it is used.

Finally, the observation that there are systematic cues for intonation in signed languages provides insight into the universal structure of natural languages (Wilbur, 1991, 1997, 2000). One may infer that intonational information is a necessary component of the human linguistic and cognitive systems, and that at the prosodic level, the central processing mechanisms of the brain is indifferent to the modality in which such information is received by the peripheral mechanisms (ear or eye), so long as the information is present and appropriate to the linguistic content and communicative situation. There are clear differences between naturally evolved languages prosodically suited to their modality by appropriate layering (ASL and English) and artificial systems like signed English which take structure from one modality (spoken English) and attempt to convey it in another modality (signed English) without regard to modifications that might be appropriate for the production modality.

THE PROBLEM WITH SPEAKING AND SIGNING AT THE SAME TIME

The position that I am arguing for here is one where ASL is used as the initial language of communication and instruction for deaf children and where English is treated as a second language. That second language has a signed form (SE), a spoken form, and a written form. I have identified problems with signed English and indicated why I do not think it should be the first method of communication and language instruction. However, I want to make it clear that I think there is a role for signed English and that it is separate from signing and speaking at the same time. Signed English can be used to assist deaf children as they struggle to understand the differences between ASL and English. It can be used to concentrate on English syntax and morphology and on its written form (reading and writing).

Speaking and signing at the same time is another matter altogether. First, it should be clear from the above description of ASL that it is impossible to sign ASL and speak English at the same time. There are cognitive, linguistic, and motoric rea-

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sons for the presence of English-based signing and the absence of ASL-based signing when speaking English. For example, in English, analytical causatives "causer cause causee event" can occur with animate or inanimate causers, as in "Susan forced Paul to rewrite the report" and "The earthquake made the buildings shake", respectively. In ASL, animate causers take the same word order as English, but inanimate causers require a different structure, as in BUILDINGS SHAKE WHY, EARTHQUAKE (the same wh-cleft structure illustrated in (2) above) (Wilbur, 1994c). Furthermore, the wh-clause BUILDINGS SHAKE WHY is accompanied by a required brow raise, followed by a pause and possibly a blink, and EARTHQUAKE is typically marked with a head nod (Wilbur, 1994a, 1994b, 1995b). To produce spoken English with ASL, one would have to say "The earthquake" while signing BUILDINGS SHAKE WHY, and say "made the buildings shake" while signing EARTHQUAKE. Aside from such linguistic and motoric mismatches, the information flow that must be tracked cognitively for effective discourse structure is also mismatched, with the causer preceding the resulting event in English and the resulting event preceding the causer in ASL.

Second, simultaneous communication (SC) was designed as an instructional communication method for deaf students. The rationale was that continued exposure to speech while signing would decrease the need for separate speech training. Questions have arisen about the quality of speech that serves as input to deaf children in SC situations. The Wilbur and Petersen (1998) study reported that in the production of simultaneous communication, speech duration increased as compared to producing speech alone. The rates of speech observed in both conditions confirm those reported by Hyde and Power (1991) for Australasian Signed English. Similarly, Whitehead et al. (1995) and Schiavetti et al. (1996) report increased duration measures for various characteristics of speech accompanied by signing, most notably vowel duration and voice onset time (VOT). Taken together, these data indicate that signers have slower speaking rates when accompanied by signing than with speech alone. The speech is not only slower, it is distorted. As part of the original design of the Wilbur and Petersen study, the speech with and without accompanying signs was also recorded on audiotapes so that the speech could be presented to 'blind' duration-measurers who would not know if the speakers were signing or not. It proved impossible to carry out this portion of the experimental design, as even native listeners were instantly able to identify from the speech when the subjects were also signing. It is important to understand that this does not mean that the speech was unintelligible. As Whitehead et al. (1995) and Schiavetti et al. (1996)

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document, speech produced in simultaneous communication does not violate the English phonological rules that provide necessary cues for morpheme intelligibility, namely the marking of voicing (VOT and vowel duration). Voicing distinctions are critical to separating English consonants and hence English words. For example, the difference between the two words 'bill' and 'pill' is the voicing of the initial consonant (carried by VOT); the difference between 'bid' and 'bit' is a matter of the voicing of the final consonant, the first cue for which is the duration of the vowel that precedes it (longer before voiced consonants). Instead, what slower speaking rate in simultaneous communication creates is a perception of decreased naturalness. A recent study by Schiavetti et al. (1998) includes ratings of perceived naturalness in addition to their acoustic measures. They report "significant differences in temporal measures and naturalness ratings between the speech and simultaneous communication conditions." Furthermore, their regression analysis indicated a significant correlation between the measures of temporal duration (which included word, sentence, and interword interval durations) and the ratings of perceived naturalness. Slower, elongated speech such as that produced in simultaneous communication sounds less natural than speech produced alone, with intelligibility in need of further investigation.

The source of these speech production modifications was not signer fluency (see similar findings in Whitehead et al., 1995; Schiavetti et al., 1996). Rather, the observed modality interaction is likely the result of the prosodic structural mismatches between spoken and signed English. Theoretically, simultaneous speaking and signing contains the same number of words in each modality as they are both coding English. However, the number of syllables in the two modalities, and the concomitant metrical pattern, are extremely unlikely to match (Wilbur, 1990c, 1990d, 1993; Wilbur and Petersen, 1997; Wilbur and Schick, 1987). There are numerous mismatches in the number of forms produced because SE frequently requires a separate sign for spoken English suffixes (e.g., -s); hence a single syllable word in spoken English (e.g. "cats") may be two separate signs in SE (e.g., CAT + Plural). Every sign is given full metrical timing (e.g., comparable sign duration) regardless of whether its corresponding English translation is a lexical item or suffixal morpheme (Wilbur and Nolen, 1986a). Hence, the single spoken syllable for "cats" is matched by two full sign productions. Furthermore, spoken English has many words that have two or more syllables, but SE, which gets its basic vocabulary from ASL, contains mostly monosyllabic signs (Coulter, 1982; Wilbur, 1990). For example, the English word meaning "eliminate" has 4 spoken syllables but only 1 signed

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syllable (cf. discussion of signed syllables in Wilbur, 1990b). Thus, in simultaneous signing and speaking, the number of syllables being produced is usually different in the two modalities.

One implication of the Wilbur and Petersen (1998) study is that there may be a learning sequence toward the development of optimal signer fluency for SC productions: ASL first, SE alone second, and SE combined with speech last. The acquisition of ASL first would provide several benefits. Signers would develop fluency in signing as a motor skill, with an established production prosody against which progress could be measured. There would be fewer problems of interference from the translation of English into ASL, as most modern ASL courses avoid instructional strategies that involve such translation wherever possible. Signers would learn the use of nonmanual marking and develop a grammatical sense of licensed omissions with contextual support. When signers progress to SE alone, they must acquire word-to-sign translation skills and fluency in this new motoric format. Practicing these new skills without the interference of speech effects is likely to be more efficient. Finally, when SE and speech are combined, signers must acquire additional motor fluency to synchronize the two channels. It is at this point that knowledge of ASL will allow signers to make appropriate decisions concerning permissible sign omissions and enable them to provide compensating nonmanual marking and other devices to ensure effective message transmission. Clearly, the linguistic, cognitive and motoric complexity of simultaneous production of speech and signing is continually underestimated. Having said this, it is not at all clear what educational functions can be optimally served by SC as opposed to separating signing (ASL or SE) from speech. Until such functions are identified, a straightforward bilingual approach would use ASL for establishing communication and fostering general education, SE as part of the program to teach English contrastively with ASL, and speech separately as a skill to be acquired for future use with hearing people and voice-operated software.

SUMMARY OF THE BENEFITS OF EARLY SIGN LANGUAGE ACQUISITION

The research that has been reviewed here provides strong support for the use of ASL as a medium of communication before the child enters school and continuing into the classroom to develop cognition, socialization, and an age-appropriate knowledge base, as well as providing a basis for learning English and English literacy. Consider the various ways in which knowledge of ASL can be helpful in improving acquisition of English and literacy proficiency with deaf children.

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Conversational use of ASL models important features of ASL discourse, and discourse in general (Wilbur, 1990a, Wilbur and Petitto, 1983). As we have seen, ASL requires more obvious attention to what is the focus of the sentence in order to construct sentences in accordance with the requirement that the focus should be at the end of the sentence. This structural requirement in turn requires the signer to separate old and new information, placing the discourse old information prior to the new. Deaf students' difficulty with determiner usage ("a/the"), pronoun usage, and the stiltedness of their paragraphs, is precisely that they do not understand when and how to push old information to the background and how to bring new information to the foreground. The mechanisms for accomplishing these tasks in ASL are clear and consistent, so that children who know ASL come to the task of learning the English counterpart constructions with a strong base of understanding of the differences in meaning that need to be encoded in English syntax. That is, they would already know how to separate old from new information and have a sense of how conversational flow affects individual sentence structure. The task then becomes one of presenting these children with a situation in the form of "if this is what you mean in ASL, here's how you express it in English." When phrased this way, the task is not confounded by the necessity to also teach the notions of old and new; in short, we now have a typical bilingual learning environment.

Prosodic structure (intonation, stress placement) provides cues to the listener as to where sentences end and new ones begin, as well as providing cues as to whether the speaker intends to continue, plans to yield the floor, expects a response from the addressee, and other conversational controlling functions. These functions are only partially represented in the written form of English, through the use of punctuation and novelty uses of capitals, italics, bold, and graphic symbols (!@\$%#). In ASL, sentence boundaries, signer intentions, and conversational controllers are all provided by cues other than the signs themselves. Various non-manual cues provide overt information about phrasing and syntactic constituency. The difference between a string of words and a real sentence is the "sentence glue" that binds the words into phrases and the phrases into sentences. In ASL, eyeblinks, head nods, and when the brows are raised or lowered all signal the ends of clauses and sentences. The height of the hands signals whether the signer intends to continue, yield, or interrupt someone else (Wilbur and Petitto, 1983). Focus, contrast, emphasis, and other more subtle functions, such as uncertainty, specificity, and inclusion/exclusion, are carried by the face, head,

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and body (Wilbur and Patschke, 1998). Deaf children who learn ASL first are prepared with full conversational fluency before they begin the task of learning to use English fluently. Full conversational fluency includes the signer's responsibility to ensure that the addressee can follow the topic, who is doing what to whom, and how much certainty the signer places in the truth of the assertions. These are all things that are coded in normal English usage, but are not part of the standard English lessons that are provided for deaf students. Again, the task of acquiring English is already simplified when learners have a first language that has prepared them with notions of conversational structure.

Along the same lines, ASL provides clear cues to which noun phrase is the subject/agent and which is the object/undergoer. For many verbs, formation is adjusted so that the verb production starts at a location representing the subject and moves to a location representing the object (see Meir, 1998 for a complete linguistic discussion). In addition, eye gaze and head tilt are also used as subject and object markers (Bahan, 1996). Information about subject and object in English is carried strictly by word order, subject before the verb and object after. Students with knowledge of ASL will find this aspect of English syntax fairly easy to acquire. More importantly, they will then be prepared to deal with exceptional constructions, such as the passive where the agent is not the subject, because it can be explained to them how the two structures (active and passive) differ with respect to the placement of the agent. The use of non-manuals and spatial modifications of sign formations is one of the reasons why ASL does not need separate signs for many of the concepts that (spoken/signed) English has separate words for. In this respect, the fact that ASL is a naturally evolved language in the visual/manual modality can be fully appreciated – more information is conveyed simultaneously than in comparable English renditions.

As we have seen in the section on the development of speech skills in deaf learners, early acquisition of ASL does not affect the development of speech production or speech-reading skills. Deaf children who have deaf parents who use ASL as the primary means of communication perform at a level comparable to orally trained deaf children from hearing households with respect to speech skills. Deaf children of deaf parents, like other deaf children, routinely receive speech skill training in school. ASL does not compete or interfere with this training; clearly it produces speech results at least as effective as oral-only training. In addition, deaf children who know ASL have the further advantages of superior performance on measures of cognitive, linguistic, and social skills.

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Finally, there is the fact that sign languages have no written form. This is also not a major concern, as more languages do not have written forms than do; many languages are written with the International Phonetic Alphabet (IPA) for use only by linguists and missionaries. Consider the functions that writing serves: long-distance (not face-to-face) communication and preservation of documents for future use. For signed languages, these functions are easily served by videotape. The history, stories, biographies, theatrical performances, poetry, and other linguistic expressions of American Deaf culture in ASL are preserved in videorecordings (and earlier, on film) dating back to the beginning of the twentieth century. Early knowledge of sign language allows deaf students access to their history and culture, which in turn engenders pride in who they are. Through a bilingual, bicultural approach, we should see elimination of what Johnson, Liddell, and Erting (1989) call "the cycle of low expectations" – which they suggest is the primary cause of the failure of deaf education.

If the adults in the deaf child's environment do not know the local natural sign language, how can the child develop full sign language fluency? Parents trigger the language acquisition process, but they do not control its ultimate outcome. Instead, children acquire the language of their peers. The earlier the child is placed in contact with the natural sign language, the better the child will learn it. Strategies for accomplishing this contact include opportunities for the child to play with other signing children (deaf or hearing), signing babysitters, regular visits to the local Deaf clubs or schools, and other interactions with members of the Deaf community. Johnson, Liddell, and Erting (1989) provide a number of additional suggestions, many modeled after the successful programs for the Deaf in Sweden. The critical factor is that the child must be placed in an appropriate language learning environment. If the parents never become fluent in the natural sign language and can only just manage in say, signed English, so be it. The focus should not be on what the parents can or cannot do. Rather the focus should be on the child's education, which requires communication in a natural language, on which all advanced learning is built. Early knowledge of sign language is a critical part of the solution, not part of the problem.

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¹ We emphasized the concept of deaf children as a linguistic minority, whose linguistic and cultural rights should be respected, rather than the older view of deaf children as flawed and somehow incomplete children, who must be made to look and act like hearing children. Prelingually deaf children, after all, are not aware of a "handicap," since they do not know what "normal hearing" is. Only when

they are required to look, perform, behave and achieve like hearing children do they begin to see themselves as "not normal" – as opposed to merely deaf (see extensive discussion of this topic in Padden and Humphries, 1988). It is my hope in reiterating those results here that a responsible approach to deaf education will finally come to pass.

² But not all structures were similarly enhanced by context, see Wilbur and Nolen (1986b) for details.

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Znakovni jezik i uspješan dvojezični razvoj gluhe djece

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Rad prikazuje istraživanja o jezičnom razvoju gluhe djece, uspoređujući onu koja se rano počinju sporazumijevati znakovima i onu koja to ne čine. Rano učenje znakovnog jezika ne stvara djetetu teškoće u svladavanju drugih jezika, govoru, čitanju ili drugim kognitivnim vještinama. Naprotiv, ono može izravno pridonijeti stvaranju većega broja razvijenih vještina potrebnih za uspješan dvojezični razvoj. Opća korist učenja znakovnog jezika kao prvog jezika je ta da u proizlazećem dvojezičnom komunikacijskom okružju učitelji i učenici mogu iskoristiti jedan jezik koji će pomoći pri usvajanju drugoga te potaknuti prijenos općega znanja. U okviru ove rasprave, autorica uspoređuje engleski jezik i ASL (američki znakovni jezik) kao predstavnike govornoga i znakovnoga prirodnog jezika, kako bi dala jasne primjere njihovih sličnosti i razlika.

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Zeichensprache und erfolgreiche bilinguale Entwicklung bei gehörgeschädigten Kindern

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Dieser Artikel präsentiert eine Untersuchung über die Entwicklung gehörgeschädigter Kinder. Es geht konkret um einen Vergleich zwischen Kindern, die sich früh mit dem Gebrauch der Zeichensprache vertraut machen, und solchen, die sich auf andere Weise verständigen. Der frühe Erwerb der Zeichensprache bereitet dem Kind keinerlei Schwierigkeiten beim Erwerb anderer Sprachen, beim Sprechen, Lesen oder bei anderen kognitiven Fähigkeiten. Im Gegenteil: Die Beherrschung der Zeichensprache kann unmittelbar zur Entwicklung einer größeren Zahl von Fähigkeiten beitragen, die die Voraussetzung für eine erfolgreiche bilinguale Entwicklung des Kindes sind. Der allgemeine Nutzen vom Erwerb der Zeichensprache als der ersten Sprache besteht darin, dass in dem sich ergebenden zweisprachigen Kommunikationsumfeld Lehrer und Schüler die erste Sprache als Lernstütze beim Erwerb der zweiten Sprache verwenden und so außerdem die Vermittlung von allgemeinen Kenntnissen anregen können. Der Verfasser des Artikels stellt einen Vergleich zwischen dem Englischen und der Amerikanischen Zeichensprache (ASL) an, welche zum einen die gesprochene und zum anderen eine natürliche Zeichensprache darstellen, und führt klare Beispiele zum Beleg ihrer Ähnlichkeiten und Unterschiede an.