Deafness, Story Understanding, and Theory of Mind

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The results of a number of studies indicate that prelingually deaf children raised in a spoken language environnent appear to have difficulty in understanding and retelling stories. Various explanations have been offered: story understanding may be impaired by lack of background knowledge and vocabulary; the lack of access to the phonology of spoken language may reduce the capacity of short-term or working memory, preventing the child from retaining story events and organizing them into a meaningful interpretation; it has also been suggested that deaf children may lack story schemata and so cannot organize the incoming material. Other work, however, indicates that deaf children's story production can be excellent when elicited and evaluated by sensitive methods that place minimal emphasis upon English language. In this ar- ticle, we argue that, in order to understand such apparent discrepancies, story understanding must be viewed within a broader perspective, including considerations of theory of mind and early socialization.

> Handling fictional stories can contribute to the emergence of an imaginative, creative attitude, to the development of empathy, fantasy and self-involvement, as well as to the testing of models of the world and the self (Ulich & Ulich, 1994, p. 821).

The story is an important aspect of a hearing child's life. Hearing children love stories; and, if they are lucky, they will hear many during their early years. Telling a story is not just a way of giving a child a treat, nor is it merely, from the parent's point of view, a convenient soporific: The story is an important medium through which the parent can communicate many of the essential foundations of successful education. Indeed, long after the bedtime stories of infancy, the story will continue to play an important role as an integral part of the school curriculum. The experience of hearing and seeing a parent read a story imparts, in an enjoyable, informal context, many important features of language and metalanguage, enriches vocabulary and general knowledge, and inculcates the moral qualities that the parent wishes the child to acquire. And as the child grows older, the complexity and subtlety of the stories can be increased, promoting an increasingly sophisticated *Weltanschauung*.

Story Comprehension: A Complex Process

The childhood story is such a familiar aspect of the everyday life of the hearing child that it is easy to overlook the complexity of the processes by which the listener becomes involved in the action, builds up a growing appreciation of what is going on, and (afterwards) attempts to recall or to retell the story. In fact, story understanding has many aspects, drawing upon a broad

spectrum of psychological functions, the importance of some of which is only just beginning to be appreciated.

Story comprehension in deaf children. From our own research experience, classroom observation, and conversations with teachers of the deaf over a period of several years, we suggest that prelingually deaf children who have been raised in a spoken language environment apparently have difficulty in understanding stories. The findings of several published studies with such children converge upon the rather bleak conclusion that orally-schooled deaf children of hearing parents (particularly when they are young) appear to have difficulty in understanding the main import of the stories their parents and teachers try to communicate to them (Banks, Gray, & Fyfe, 1990; Gray, Banks, Fyfe, & Morris, 1992; Donin, Doehring, & Browns, 1991). The purpose of this article is to present a more comprehensive analysis of the story comprehension problem than is already available, with a view to reconciling the foregoing results with some of the more encouraging findings reported by other authors, such as Marschark (1993), Marschark and Clark (1993), and Marschark, Mouradian, and Halas (1994).

Some aspects of story understanding extend far beyond the exercise of basic cognitive functions such as short-term or working memory, or even of language and phonology. The full appreciation of many stories requires the receiver to view the developing action from the different points of view of the story characters and to empathize with their varying (and often conflicting) motives. This, in turn, presupposes that the listener has developed other abilities. Some of these are cognitive, but others are acquired as aspects of social, emotional, and empathic development.

Much of the published research on the psychology of deafness has concentrated upon the academic and cognitive abilities of deaf children, but, until very recently, other important aspects of their development have been somewhat neglected. In this article, deaf children's difficulties with stories will be considered in the light of some recent advances in developmental psychology, with a view to exploring the way in which deaf children's social development affects their response to discourse.

The Language Problem

Orally-trained, prelingually deaf children of hearing parents usually fail to attain proficiency in the language of the hearing people around them, in either its spoken or its written form. Although the lack of spoken language might seem, on first consideration, irrelevant to the needs of those who cannot hear human speech, deaf children's difficulties with written language obviously present a major obstacle to communication and to the investigation of their mental processes.

Deaf children's problems with literacy. The main purpose of the first few years of schooling is to effect a shift in the balance from spoken to written language, to capitalize on the fact that print "makes possible a realm of abstraction that could hardly be provided by any other means" (Carroll, 1974; p. 172). In the phrase "a realm of abstraction" is expressed the power of literacy to free the child from confinement to what can be immediately seen and touched and to permit consideration not only of a real world beyond the child's immediate environs but also of the hypothetical and (ultimately) the symbolic.

These considerations should apply, a fortiori, to deaf children, whose world is, ab initio, narrowed by the blocking of a major information highway. For the deaf child, learning to read should be even more liberating than it is for hearing children. On every reading test yet devised for use with hearing children, however, prelingually deaf children perform at a level well below that of their hearing contemporaries. Moreover, the differential increases as the deaf child grows up; on hearing-standardized tests, their developmental trajectory of performance typically levels off at a plateau reading age of 8½ years (Conrad, 1979; Trybus & Karchmer, 1977; Waters & Doehring, 1990).

Decoding. Reading is a complex process, with decoding, syntactic, and semantic aspects (cf. Waters & Doehring, 1990). Expert private reading is both swift and silent. Yet there is an overwhelming body of evidence to show that an important aspect of written word identification is something akin to a physically inaudible "sounding out" of the letters (or combinations of letters) making up a written word. By means of a

transcoding of these visual fragments into phonological fragments, followed by a rather mysterious "blending" process, the spoken word is assembled (Cossu, Rossini, & Marshall, 1993; Morton & Frith, 1993). Such segmentation and phonological reassembly has the great advantage of enabling readers to pronounce words they have never seen before (Ellis, 1984). Written language, then, exploits the phonology of the spoken language, so that "there is good reason to suppose that in hearing people, written English comes to speak with an 'inner voice', which acts as a sole, an alternative or a synergistic route to meaning, depending upon the stage of development of the child and the familiarity of the text" (Gray, 1995, p. 6).

Written language and basic cognitive processes. Although the "inner voice" and the "inner ear" are metaphors, they receive strong empirical support from cognitive psychology (Campbell, 1992). The theory of working memory (Baddeley, 1979; Baddeley & Hitch, 1974), and especially the role of the "articulatory loop," would seem to have wide-reaching implications for reading at the coding, the syntactic, and (perhaps) even the semantic levels. It is a reasonable surmise that, just as we can hold a telephone number in our heads longer if we repeat it over and over, the articulatory loop should make phonological transcoding an efficient way of retaining sequences of visual items in memory, provided the latter have pronounceable names. And this may be true whether those sequences consist of graphemes, the words of a sentence, or even, speculatively, a developing model of the meaning of a written passage. (It is, on the other hand, quite possible that signs also have some kind of articulatory loop that facilitates retention in an analogous way.)

Spoken language as the basis of written language. Over the past three decades, the landscape of reading theory has undergone considerable change. In the sixties, the phonological emphasis in the theory and teaching of reading (the phonics approach) began to come under fire, some specialists arguing enthusiastically for the independence of the processing of written language from speech processing (Baron, 1973; Barron & Baron, 1977; Goodman, 1967; Smith, 1971). Proponents of the "written language" approach stressed the role played

by inference in reading in its decoding, syntactic, and semantic aspects. This has become known as the "top-down" approach to reading.

With this theoretical holism came new developments and shifts of emphasis in teaching practice. Few orthodoxies succeed in totally eliminating heterodox opinions, and perhaps there never was a time when every teacher of reading subscribed wholeheartedly to the orthodoxy of phonics. Whole word, or look-and-say, methods, in which children are required to respond verbally to entire written words (presented on flash cards), rather than isolated letters, have a long, if peripheral, history before the sixties. In that decade, however, phonics seemed in danger of losing its dominant position because of an upsurge of support and advocacy for look-and-say.

Associated with look-and-say was a tendency to present, at any early stage, words in the context of phrases or sentences, rather than in isolation. Top-down theorists also recommended an early introduction to integrated passages, stories, and texts, in order to encourage children to read for gist.

Despite the persuasiveness of the arguments of the top-down reading theorists and the strong evidence now available for the importance of inference in reading comprehension in its syntactic and semantic aspects, empirical work does not confirm the supposed role of inference in written word-identification by skilled readers; on the contrary, apparently the use of inference in word identification is characteristic of poor, rather than good, readers (see Oakhill & Garnham, 1988, for a detailed review of the research on this question). By the early eighties, therefore, the focus of research on reading comprehension in its decoding aspects had begun to move away from purely top-down accounts, and greater credence was being given to the interactive-compensatory models propounded by those such as Stanovich (1980) and Rumelhart (1980). Now, a decade later, the pendulum of reading theory has swung strongly back to phonology and phonics (Patterson, 1992).

Deaf children's problems with English syntax. One of the most salient features of the deaf child's reading performance profile is a marked difficulty with the syntactic rules of English (Kyle, 1980; King & Quigley, 1985;

Waters & Doehring, 1990). Although restriction of vocabulary (particularly abstract vocabulary) is understandable (and usual) in deaf children, many achieve a good level of automaticity at the word-decoding level. A good indicator of automaticity is the occurrence of Stroop interference (Stroop, 1935), which has been demonstrated in deaf children by Allen (1971) and by Leybaert and Alegria (1993). But even the combination of a good vocabulary with automaticity is insufficient to ensure adequate syntactic processing. It is quite possible to match deaf and hearing children on "reading age" as measured by screening instruments such as the Young test (Young, 1982), yet still have a marked mismatch on syntax (Gaines, Mandler, & Bryant, 1981; Banks, Gray & Fyfe, 1990).

It has been suggested that, in deaf readers, nonaccess to phonological coding prevents strings of words from being retained in working memory in their original order, with the result that syntactic skills cannot develop. On the other hand, the empirical basis for this is distinctly shaky; a number of studies have shown that the usual working memory measures correlate poorly with reading skills (e.g., Hunt, Lunneborg, & Lewis, 1975; Perfetti & Goldman, 1976); moreover, in studies of story recall in two samples of deaf children at different levels of literacy, neither Gaines, Mandler, and Bryant (1981) nor Banks, Gray, and Fyfe (1990) found any evidence of a memory problem in the written recall of printed stories by deaf children.

There is, however, another consideration. Well before they come to their first formal reading lessons, hearing children have acquired most of the syntactic structures of English (King & Quigley, 1985). They develop these naturally, in their spoken interactions with their parents and others on whom they must depend to satisfy their needs. Arguably, therefore, hearing children whose coding skills are sufficiently developed need only map the syntax of written language onto a knowledge base already well established in their spoken language. There is no reason to suppose that any of this is true of prelingually deaf children of hearing parents. Their first linguistic experiences likely come at the stage of nursery school, when a skilled teacher probably instructs them in some form of signed, or sign-assisted, English (though there are still strict oralist establishments that have resisted the introduction of signs of any kind). Clearly, since they do not acquire spoken language before they begin their schooling, prelingually deaf children cannot be expected to acquire written language syntax in the "natural" manner of hearing children.

In view of the foregoing considerations, reliance may have to be placed upon artificial routines and explicit demonstrations of principles that would otherwise be acquired, without conscious effort, in the course of natural, preschool English language use. The demonstrated efficacy of visual displays in the context of the reception and retelling of stories (Banks, Gray, Fyfe, & Morris, 1991; Gray, Banks, Fyfe & Morris, 1992) would suggest that such methods might profitably be adapted for use at other levels of reading: words within sentences and letters within words, as well as representations of the conceptual structures of written discourse.

Perhaps the teaching of English syntactic rules (such as those governing the production of interrogative forms) can be aided by the use of display kits. In a study by Fyfe, Mitchell, Gray, Ritchie, Grant, and Banks (1993), the various sentence parts (words or word sequences) were carried on cards, which could be manipulated according to certain rules to effect the transformation from the declarative form of a sentence to the simple yes/no interrogative form.

The semantic aspect: extracting the meaning from a written passage. Although the techniques of Computer-Assisted Learning (CAL) are very promising, they cannot, by themselves, empower the deaf child to extract the meaning from a printed story; merely making a passage easier to read by simplifying the English does not ensure that the gist of the passage will be extracted (Banks, Gray, & Fyfe, 1990).

Metalanguage and metacognition. The early experiences of hearing children enable them also to acquire, to some degree, what is known as metalanguage. This term is not used with equal clarity by all authors. According to Olson and Torrance (1983), who offer perhaps the clearest explanation, children, having unselfconsciously used language merely as a medium for com-

municating their needs, begin to see language as a thing of interest in itself; language becomes, as it were, opaque, another object (or set of objects) in the child's world, distinguishable from the things to which the language refers (the set of meanings that the language communicates). Metalanguage is a set of concepts and terms that permit the speaker to talk about language itself, rather than its content. For example, the unit of spoken discourse is the "word." Words are grouped into "sentences," and words themselves are often made up of "parts" known as "syllables." In the hearing child's development, some metalinguistic knowledge is acquired very early indeed: "All speakers have some such metalanguage even if it merely discriminates talk from song, or prayers from curses" (Olson & Torrance, 1983, p. 147). It is only through the attainment of *written* language (or literacy), however, that metalanguage is fully acquired. For Olson and Torrance, this is the major developmental change that takes place in the primary school years.

An important aspect of successful learning is a growing knowledge of the way we learn things, as opposed to what we are learning. This awareness is known as metacognition. Metacognition is evinced by frequent reflective activity; efficient learners monitor their own progress by testing themselves in various ways. The good reader also shows this tendency to monitor progress: "Good comprehenders seem to have a better awareness of what comprehension is and when it has occurred" (Oakhill & Garnham, 1988, p. 139). Oakhill and Garnham (1988) were concerned with reading comprehension; metacognitive skills, however, are likely to be relevant in almost any learning situation, including story comprehension. Facility with written language, however, is likely to be a great boost to the development of metacognitive awareness.

Sign language. It is well known that deaf communities have their own languages (Klima & Bellugi, 1979; Kyle & Woll, 1985; Stokoe, 1960; Stokoe, Casterline, & Croneberg, 1965), examples of which are British Sign Language (BSL), American Sign Language (ASL), and Australian Sign Language (Auslan). Most prelingually deaf children, however, have hearing parents who cannot sign. Their first experience with natural sign language comes with their informal contacts with other children at school, where the official language is often some form of signed English (Wood, Wood, Griffiths, & Howarth, 1986).

The seventies saw the first thawing of the permafrost of prejudice against sign, though even today that thaw is still far from complete. There were several reasons for this antipathy. Strict oralists held that if children were allowed to use their hands to communicate, they would turn aside from the more difficult task of learning English: "[The deaf child] must not learn to rely on silent gesture to get what he wants" (Ewing & Ewing, 1961, p. 75). To such authorities, in fact, to speak of a sign *language* was a contradiction in terms: "Gestures have a place in normal communication, but signs have not" (Ewing & Ewing, 1961, p. 75). Only comparatively recently has the status of sign as a true natural language gained wider acceptance (Klima & Bellugi, 1979; Kyle & Woll, 1985).

Early experience with sign is likely to confer many advantages upon the prelingually deaf child. For example, the child can acquire early experience of conversation, which, arguably, is crucial for later development (Peterson & Siegal, 1995). The promotion of sign may also bring more subtle benefits. Probably very few hearing people cannot tell a speech from a song or a prayer from a curse. In a prelingually deaf child with nonsigning parents, however, it is difficult to see how this or any other aspect of metalinguistic awareness could easily be acquired. Very young hearing children soon become aware that somehow the story they are enjoying emanates from the print on the page of the book that the teller is holding, a discovery that may be hastened by the solicitous reader occasionally running a finger along each word as it is read. The hearing child probably acquires much metalinguistic knowledge in this manner. None of this is likely to be true for prelingually deaf children raised in a spoken language environment, who may see no reason to be motivated by mere marks on a page. And since no sound emanates from the lips of their parents, lip movements may also be of little interest, making it difficult, at a later stage, for the teacher to impart the phonemic significance of the graphemes. Perhaps the acquisition of natural sign language can promote the metalinguistic awareness necessary to bootstrap the acquisition of English.

Studying Story Recall

The importance of stories has been recognized for many years, and, since they reflect to some degree the attitudes and values that obtain in the societies in which they are told (Levi-Strauss, 1955), they have been of great interest to anthropologists and linguists (Greimas, 1971; Prince, 1973). (For a review, see Stein, 1979). Until comparatively recently, however, there had been few attempts to measure story recall, even with hearing children.

What is a story? The advent of "story grammars." There has been disagreement about precisely what constitutes a "story" (Brewer & Lichtenstein, 1982; Stein & Policrasto, 1984). It is easy to give an ostensive definition by pointing to examples of stories, and no one feels in any doubt that they know what a story is, but it is quite another matter to give a formal definition. Apart from the work of Bartlett (1932), stories were little used in psychological research for many years. It is easy to see why; if we cannot specify a story's structure, we have no yardstick with which to evaluate a subject's recall. Similarly, should one wish to assert that two stories are of equal "complexity," or of "comparable structure," it would be difficult to sustain such a claim in the absence of precise measurements of those qualities.

In response to the need for more precision, Rumelhart (1975), using the work of Bartlett (1932) on story recall and the literature on the structures of myths, legends, and folk tales (Propp, 1958), constructed a so-called "story grammar" describing the general structure of a story and developed a classification system. Other story grammars were developed by Mandler and Johnson (1977), Stein and Glenn (1979), and Thorndyke (1977). Of the various systems, that of Stein and her co-workers has been used most by researchers.

A story grammar defines the elements of the internal structure of a schematic, generic story: a setting (in which the background and characters are introduced); a problem (that the main character must solve); an outcome (or resolution); and an ending, in which any loose ends are duly tied up (Stein & Glenn, 1979). Within this general framework, a variety of episodic structures can be specified, some linear, others hierarchical, and so on. Although the status of such story templates as true "grammars" has been seriously questioned (cf. Oakhill & Garnham, 1988), they have proved to be useful yardsticks for measuring (in recall or retelling) the extent to which the main developments in a story have been understood (Weaver, 1978; Feagans & Short, 1984).

The concept of schema. So far, the term "schematic" has been used somewhat descriptively to indicate that story recall has a discernible structure, conforming (at least to some extent) to the characteristics described by Stein (1979) and her collaborators. Although the idea of a schema goes back to Binet (and Immanuel Kant), the term was introduced into psychology by Bartlett (1932), where it has had an enormous influence. Bartlett (1932) defined a schema as an active organization of past reactions and experiences always operating in any well-developed organism. Bartlett showed that when subjects tried to recall stories, they did not produce imperfect imitations of the originals; on the contrary, they seemed to impose their own structures on the story, to the point of adding entirely new material, as well as omitting aspects of the original story. Thus, story memory is very much a product of input from the listener, as well as of incoming information.

Bartlett provided ample evidence for the structured nature of story recall, yet he offered no precise description of a schema. The story grammar of Rumelhart (1975) was devised with the intention of describing not only observable story features but also the underlying psychological structures used to encode, represent, and retrieve story information. On that assumption, the processes involved in story comprehension could, in principle, be studied as reflected in the "grammaticality" of story recall. In the seventies, there was intensive investigation, by those of top-down persuasion, of the use by hearing readers of their knowledge of "story schemata," supposed sets of expectations about the internal structures of stories derived from accumulated experience. These investigators claimed that story schemata enable the reader (or listener) to organize and predict incoming story information (Mandler, 1978).

Even though the story grammars have proved valuable in research when used descriptively, they also carry assumptions that tend to obscure, rather than to illuminate, the underlying mental processes of story

recall. In some interpretations, for example, it is suggested (often implicitly) that story schemata are rather like rigid templates, with "gaps" that are "filled in" with new, specific information (e.g., Stein, 1979). There is here, however, a risk of the "homuncular fallacy," that is, the attachment of whole-human-being predicates to parts that cannot have such capabilities (Kenny, 1991). Often (as in Minsky, 1975, and Rumelhart, 1975), the schema seems to assume two aspects, the organizer and the organized; much as the Cartesian soul (Descartes, 1649) contemplated the representations of the two retinal images in the pineal gland before reconstructing the viewed object, the organizing schema scans the templates and selects the "right" one for the story. But how is the selection made? How does the listener handle a new type of story? How do the template schemata develop? Some would replace the notion of story schemata with the view that the listener (or reader, or viewer) constructs a fresh model for every new story, rather than searching in the drawer for an old one resembling the present input. The processes by which such a model is synthesized, however, remain unclear (Brewer, 1987; Eysenck & Keane, 1995).

How well do hearing children understand and recall stories? The import of studies of story recall in hearing children is that even at the preschool stage, they have well-formed expectations about stories (Allen, Kertoy, Sherblom, & Petit, 1994; Mandler, 1978; Stein & Glenn, 1979; Thorndyke, 1977; Trabasso, Stein, Rodkin, Munger, & Baughn, 1992). Provided the sequence of events in a story corresponds to the expected sequence, six-year-old children recall the temporal sequence of story events quite accurately (Mandler & Johnson, 1977). Stein (1979) reported a similar result with four- to five-year-old children.

The story grammar work thus failed to confirm the claim of Piaget (1960) that six- to eight-year-old children do not produce coherent story recall; although Brown (1975) found preschool children less impressive. Stein (1979) suggested that this was because "the sequences did not correspond identically to the structure of an expected sequence. Certain categories might also have been missing, and 4-to 5-year-olds may not have been able to make the appropriate inferences to fill

in the 'gaps'" (Stein, 1979, p. 269). Stein (1979) reviews a number of studies, the import of which is that as children get older, their story recall approximates more and more closely to "well-formed" stories, that is, stories that conform to story-grammatical structures.

Story Understanding and Recall in Deaf Children

Because of numerous methodological difficulties, story comprehension in deaf children has been little studied. Hearing children can be told a story and asked to recall it. Older children can also be asked to express their recall of the story in writing, thus providing a permanent record that the researcher can study at leisure. But as we have seen, deaf children's written language, even in their later school years, is often insufficiently developed to serve as a sensitive measure of understanding.

Another way of trying to ascertain whether a story has been understood is to ask the child to sign it back to the teller and videorecord the child's version. In our experience with deaf children raised in a spoken language environment, however, it is very difficult to obtain agreement, even among experienced teachers of the deaf, about exactly how much of the story a child has understood; the feasibility of using this method in the study of story *production*, however, has been well demonstrated by Marschark, Mouradian, and Halas (1994).

Studies of the written recall of stories by deaf children. In the few published studies of the written recall of story texts by deaf children, the main purpose was to ascertain the extent to which prelingually deaf readers (who are usually raised in a spoken language environment) can draw inferences from text fragments and background knowledge to overcome their difficulties with word identification and English syntax and extract the meaning of the text as a whole.

Gaines, Mandler, and Bryant (1981) asked linguistically advanced teenaged deaf readers to read and then to write down, from memory, three stories, all of similar complexity. In other respects, however, the stories differed: One was written in ordinary English, another contained words that had been misspelled nonphonetically (e.g., "throgh") as opposed to phonetically

("thru"), and a third contained ambiguous anaphoric noun and pronoun references (e.g., "He rode on his back all the way to London").

Despite no significant difference between mean scores of the two groups of participants on recall of the unmodified story, the deaf children outperformed the hearing children in their recall of *both* the modified stories. The authors suggested that, in comparison with hearing readers, deaf children read "with a broader reconstructive strategy"—that is, they guess more and reconstruct the meaning from partial cues in the text (Gaines, Mandler, & Bryant, 1981, p. 467). By placing greater reliance upon picking up the gist of the stories (even of those whose English has been modified), deaf readers can avoid being confused by altered textual detail.

In a study of deaf children (with hearing parents) whose English language was less proficient than that of the participants in Gaines, Mandler, and Bryant (1981), Banks, Gray, and Fyfe (1990) carried out an experiment in which the word order of the sentences within one story was modified to mimic the topic-comment sign order characteristic of natural sign language. The sign-order condition improved the deaf children's cloze recall, indicating that, for them, the text had been made easier to read; there was no such effect with the hearing controls. On the other hand, the manipulation did not enable the deaf children to achieve better comprehension at passage level. It would seem, therefore, that unless they are unusually good readers, deaf children do not generally follow a "broad reconstructive strategy" when reading stories.

Griffith and Ripich (1988) asked children with varying degrees of hearing impairment to retell stories. The children's stories did have the correct story-grammatical form, although many events were omitted in the retellings. In a later study (Griffith, Ripich, & Dastoli, 1990), the same investigators used a more fine-grained analysis of story structure, as described by propositional analysis (Kintsch, 1977) and cohesion analysis (Halliday & Hasan, 1976). They found that, as the stories became longer, the number of incomplete propositions increased. Also, the pattern of recall suggested that the children were failing to keep track of the main story line.

Other approaches to the study of deaf children's story comprehension. It has been found that if prelingually deaf signing children are asked to sign their interpretations of written stories, they are better able to overcome their difficulties with English syntax and extract a coherent story line (Ewoldt, 1981; Yurkowski & Ewoldt, 1986). Referring the written text to their first language (ASL) appears to have helped them to read more selectively and purposefully. This would seem to be an instance of a positive effect, in a situation of coordinate bilingualism, of the learner's first language upon semantic processing in her second. It also attests to the importance of early experience of conversation for the development of story understanding (cf. Peterson & Siegal, 1995).

The danger of performance errors being interpreted as competence limitations is ubiquitous in psychology, and never does it loom larger than when one is trying to study cognitive processes in deaf people, as viewed through the dark glass of their difficulties with written language (Kyle, 1989; Marschark, 1993). Fortunately, there are other media to be considered. It can be argued that if deaf children are asked to reproduce written stories by arranging a set of pictures in a sequence, this should place minimal demand upon the child's expressive language; moreover, since deaf children receive many of their stories in pictorial form, they should be particularly at ease in that medium (Gray, Fyfe, & Banks, 1991). Picture arrangement has been used successfully to study story knowledge in very young hearing children (Brown & Hurtig, 1983; Poulsen, Kintsch, Kintsch, & Premack, 1979). The picture arrangement sequences of deaf children educated in a spoken language environment were found to conform to the main Stein and Glenn (1979) story-grammatical categories (Banks, Gray, Fyfe, & Morris, 1991), which is consistent with the findings of Griffith and Ripich (1988).

In a later study, however, the same picture arrangement test was used to investigate the use of story knowledge by deaf children when reproducing the meaning of written passages (Gray, Banks, Fyfe & Morris, 1992). The results showed that, while the children evinced knowledge of some general aspects of story structure, they were insensitive to certain story features which, when present in stories given to hear-

ing children, are known to add strength and salience to the story line.

The theme of villainy, for example, is ubiquitous in children's stories (Botvin & Sutton-Smith, 1977). Villainy usually implies the inclusion in a story of a protagonist-antagonist conflict, with a shifting viewpoint and an interesting emphasis upon character motive lacking in most other stories. Sensitivity to such elements represents a degree of sophistication one would not expect in the youngest children (Bisantz, 1982). A comparison between picture-arrangement reconstructions of stories by deaf and hearing children showed that the theme of villainy enhanced the performance of the hearing children but not that of the deaf group, confirming that the latter's sensitivity to some story features is delayed (cf. Banks, Gray, Fyfe, & Morris, 1991; Griffith & Ripich, 1988).

The import of the studies reviewed so far is that, even in circumstances wherein the linguistic demands of reception and recall are minimized, deaf children with hearing parents appear to be unable to pick up some features of stories that are known to be attractive to hearing children.

So far, all the studies considered required the participants to recall, or to retell, a story they had just received. The next section concerns the production of stories by deaf and hearing children.

Studies of story production by deaf children. Some comparative studies of the production of written stories by deaf and hearing children have led researchers to conclude that deaf children raised in a spoken language environment find it relatively difficult to produce coherent stories (Webster, 1986; Yoshinaga-Itano & Snyder, 1985). Here, as with written recall of stories, it is difficult to ascertain whether the children's attempts reflect their linguistic difficulties, or their cognition. Marschark, Mouradian, and Halas (1994) used a scheme devised by Trabasso and his associates (Trabasso & Nickels, 1992; Trabasso, van den Broek, & Suh, 1989) to compare the semantic structures of stories produced by deaf and hearing children in sign, orally, and in writing. They found that signed and oral productions had similar discourse structures as indi-

cated by the patterns of causal goal-action-outcome episodes.

The finding by Marschark, Mouradian, and Halas (1994) that the semantic structures of the stories produced by deaf children and hearing children are quite similar contrasts with the results of several other studies, such as that of Gray et al. (1992), which suggested that deaf children might be less sensitive to features of stories that required the receiver to view the action from the varying points of view of the story characters. This may be the crucial difference between the reception and production paradigms; deaf children from a spoken language environment may find it easier to produce stories than to receive them because production does not require the shifts of perspective required by reception.

The need for a broader view. From the point of view of one attempting to understand the comprehension of stories by deaf children, both the schematic and model-building positions tend to upstage many other processes that might be involved in story comprehension. A somewhat inchoate structure in story recall may also reflect a delay in a receiver's emotional development, or difficulty in empathizing with the story characters. These possibilities will be explored in the next section.

Theory of Mind

During the past decade, there has been a rapid growth in research examining children's understanding of "theory of mind." According to Premack and Woodruff (1978), who coined the phrase, one is said to have a theory of mind when one imputes mental states to oneself and to others. Moreover, "a system of inferences of this kind is properly viewed as a theory, first because such states are not directly observable, and second, because the system can be used to make predictions, specifically about the behaviour of other organisms" (Premack & Woodruff, 1978, p. 515). By theory of mind, then, is meant the awareness that a situation may not look the same to another person, together with the ability to view the scene from someone s else's standpoint; in this sense, theory of mind could be described as "mind reading" (Happé & Frith, 1995).

Speech Act Theorists, such as Grice (1975), Austin (1962), and Searle (1969) argued that all communication requires both participants to take into account the background knowledge and presuppositions of the other person in the dialogue, as well as their intentions in communicating; otherwise, a dialogue could not meet the conversational rules of pragmatics, as described by Sperber and Wilson (1986). The concept of theory of mind can be viewed as an extension of some of the ideas of Speech Act Theory to more general considerations of social, emotional, and cognitive development (Baron-Cohen, 1988). Clearly, theory of mind is an essential prerequisite for the understanding of many stories, for much of the tension that gives a story its appeal derives from the differing viewpoints of the characters and the receiver's awareness of them.

How can theory of mind be demonstrated? One of the most convincing tests for theory of mind in hearing children is the false-belief paradigm developed by Wimmer and Perner (1983), in which a puppet character holds a belief about the location of an object that is both wrong and at variance with that of the child subject (S). In the original version (Wimmer & Perner, 1983: experiment 1), the puppet, called Maxi, returns home from a shopping trip with his mother and puts some chocolate they have bought into a cupboard. When Maxi is out playing, his mother takes the chocolate down and returns it to a different cupboard. S is asked, "Where will Maxi look for the chocolate?" Children pass the test if they can take into account the fact that Maxi will still think that the chocolate is in the original cupboard, and, although this is a false belief, it will nevertheless determine Maxi's behavior. This test and numerous variations on the theme have demonstrated an important developmental watershed reached at approximately the four-year age level (Leslie & Frith, 1988; Moore, Pure, & Furrow, 1990; Moses & Flavell, 1990; Perner, Frith, Leslie, & Leekam, 1989).

In all the tasks referred to so far, the child is required to show awareness of the false belief of a story character. More difficult tasks have been devised, in which S is asked not directly about the belief of one protagonist but about the belief of one protagonist about that of another. The former are known as "first-

order tasks," the latter as "second-order tasks" (Perner & Wimmer, 1985).

An adaptation of Wimmer and Perner's first-order theory of mind test, intended to minimize the demands on S's expressive language abilities, is described by Baron-Cohen, Leslie, and Frith (1985). In Baron-Cohen's test, the experimenter (E), sitting across a table from S, shows S two dolls: Sally, with a basket in front of her, and Anne, with a box. Sally places a marble in her basket and then gets up and leaves the room, whereupon Anne reaches over and transfers the marble from Sally's basket to her own box. Sally comes back. E asks S, "Where will Sally look for her marble?" S need only point to either the basket or the box. The theory of mind choice is the basket; the "wrong" choice is the box.

There is, however, a major problem of interpretation here: a young child, ignorant of the adult rules of pragmatics as described by Speech Act Theorists, might think that E has simply asked for the true location of the marble. To exclude that possibility, the practice has been to ask S certain "control questions," to establish that S really has understood what is being asked for (Baron-Cohen, 1992). The two control questions asked by Baron-Cohen were (1) "Where is the marble really?" and (2) "Where was the marble in the beginning?" (Baron-Cohen, Leslie, & Frith, 1985). The first question supposedly establishes that S knows where the marble is at the moment; the second shows that S can accurately recall the original hiding place.

Development of theory of mind. Theory of mind develops early in normal childhood. By four years of age, most hearing children can successfully perform first-order belief tasks, and by the age of nine years they can handle second-order tasks (Perner & Wimmer, 1985).

The one exception to this general pattern in hearing children is the developmental profile of autistic children, who rarely succeed on false-belief tasks (Baron-Cohen, 1992; Leslie & Frith, 1988). In fact, on such tasks, autistic children perform below the level of normal or preschool children with similar or lower verbal intelligence, children with Down's syndrome (Baron-Cohen, Leslie, & Frith, 1985), and children with specific language impairments (Leslie & Frith,

1988; Perner et al., 1989). Apparently, therefore, for autistic children, the difficulty lies neither in general mental retardation nor in language impairment.

Frith (1989) has speculated that the autistic child's persistent failure on theory of mind tasks may have a biological basis and may arise from a prenatal neurological fault. Baron-Cohen (1992) suggests that scanning techniques that allow imaging of the brain during cognitive tasks may show us where a brain dysfunction might exist. Fletcher, Happé, Frith, Baker, Dolan, Frackowiak, and Frith (1995) report a neuroimaging study with positron emission tomography in which the brain activity of normal subjects was monitored while they performed comprehension tasks requiring the attribution of mental states and tasks that did not. Only the theory of mind task produced activation in the left medial frontal gyrus (Brodmann's area 8). The localization of the brain regions involved in the attribution of mental states, therefore, would appear feasible.

Neuropsychological theories have been proposed to explain the wide range of symptoms associated with autism: poor socialization, deviant language and communication skills, and repetitive social behavior. For example, Karmiloff-Smith, Klima, Bellugi, Grant, and Baron-Cohen (1995) suggest that a cognitive "module" may be responsible for social cognition, especially those processes relating to certain aspects of face perception and theory of mind. An important aspect of the various types of language and face-processing abilities relevant to social behavior (the pragmatic use of language, sensitivity to eye-gaze and facial expression) is their temporal co-occurrence. According to Karmiloff-Smith et al. (1995), there exist separate, domain-specific predispositions for discriminating stimuli relevant to faces, language, and theory of mind, but the computations in the different domains eventually give rise to a superordinate modular-like organization concerned with the pragmatics of social interaction in general (cf. Brothers & Ring, 1992). In support of this theory, Karmiloff-Smith et al. (1995) adduce dissociations among theory of mind, language, and face processing across different abnormal phenotypes. For example, in Down's syndrome, a serious deficit in face processing and the use of morphology in language can coexist with good performance on theory of mind tasks. In autism,

on the other hand, theory of mind and the pragmatic use of language are impaired, whereas face processing and language remain intact.

Theory of Mind in Deaf Children

While the evidence supporting a neurological basis for the social behavior characteristic of autism is strong, acceptance of this interpretation need not imply that theory of mind itself is necessarily modular and hardwired. It has been suggested that in autistic children something may be amiss with the brain system responsible for the production of joint-attentional behavior, that is, giving, showing, pointing, and so on (Baron-Cohen, 1992). Such behavior, arguably, is a necessary but insufficient condition for true theory of mind. Moreover, to accept that the prevention of joint-attentional behavior inhibits theory of mind in no way pre-empts the possibility that such prevention need always have a neurological basis.

Until recently, studies of a variety of different subject groups, including Down's syndrome, had found evidence of theory of mind in all but autistic children. The possibility of a delay in acquisition of theory of mind for reasons other than neurological damage, therefore, remained only a theoretical possibility. Recent work, however, has produced evidence to suggest that in prelingually deaf children of hearing parents also, the acquisition of theory of mind may be delayed.

Using a variant of Baron-Cohen's Sally-Anne false-belief task (see below), Peterson and Siegal (1995), found that the performance of a sample of prelingually deaf Australian children was not significantly better than that of the autistic children tested by Baron-Cohen, Leslie, and Frith (1985). There were two groups of subjects. The procedure for the first group was as follows. E and an interpreter sat across a table from S. On the top of the table, on E's left, was a square box, beside which was a toy dog. On the right was a round basket, beside which was a doll called Sally. There were two trials. In the first, Sally hid a marble in her basket and left the room, whereupon the dog transfered the marble to her box. On Sally's return, S was asked, "Where will Sally look for her marble?" Then came two control questions: "Where is the marble

really?" and "Where did Sally put the marble in the beginning?" In the second trial, the dog placed the marble in the experimenter's pocket, but otherwise the procedure was as before, with the same three questions.

The procedure for the second group was identical to that used with the first group, except that instead of asking "Where will Sally look for her marble?" the question became "Where will Sally look *first* for her marble? Peterson and Siegal (1995) describe this modification as "conversationally-supported questioning."

Two out of 12 children passed the test with the standard questions. Seven out of 14 passed the "conversational" version of the test. Of the 26 children in the study, therefore, only nine (i.e., 35%) passed either version of the test. (If the percentages are weighted equally, the mean is 33%.) The children who passed the false-belief test were similar in age and in their scores on the Goodenough and Matrices tests to those who had failed the false-belief test.

The success rate in the deaf group as a whole on the theory of mind task was lower than in the Down's syndrome children studied by Baron-Cohen, Leslie, and Frith (1985): 12 out of 14 of the Down's syndrome children passed the belief question on both trials. (Moreover, there was no conversationally-supported questioning in the Baron-Cohen study.) On the other hand, the deaf children were not significantly different from the 20 autistic children in Baron-Cohen, Leslie, and Frith (1985), of whom 16 failed the belief question on both trials. Nor were they significantly different from another autistic sample studied by Prior, Dahlstrom, and Squires (1990).

Peterson and Siegal (1995) suggest that deaf children's failure to acquire theory of mind is a direct result of their being deprived of conversations about mental states (cf. Olsen, 1988). Harris (1996), however, argues that the crucial factor in promoting awareness of differences in belief is not the explicit mention of the vocabulary of belief and thought; rather, children learn from taking part in conversations that people are recipients and providers of information. Information-bearing conversations, which involve a continual back-and-forth shuttling from one viewpoint to the other, serve as a constant demonstration that partners in a conversation differ in what they know and believe about a shared topic, from which it eventually becomes clear that people differ in what they know and think.

Certainly the circumstances of the children studied by Peterson and Siegal (1995) would lead one to suspect that they may have lacked the opportunity for conversation in their infancy. Profound, prelingually deaf children are likely to have had little access to conversation, at least until they join a community of native signers in primary school (Wood, Wood, Griffiths, & Howarth, 1986). Peterson and Siegal's subjects were 26 signing, prelingually deaf Australian children of normal intelligence, 8–13 years old, who, for the reasons given above, could be expected to have had limited experience of conversation during their early years.

In total communication classrooms (Denton, 1976), teachers often communicate in signed English or fingerspelling, supplemented by speech with visible lip movements. Some argue that classroom practice under the total communication system may actually suppress conversational initiative: "Some exchanges which go under the guise of conversation in classrooms suppress linguistic development rather than enhance it" (Power, Wood, & Wood, 1990, p. 9).

Peterson and Siegal (1995) observe that autistic children are also deprived of exposure to the social functions of language, albeit for different reasons. The pragmatics of language are largely a mystery to autistic children, who seem unable to impute mental states to other people on the basis of what they say and do. There is evidence in support of that claim from a study by Tager-Flusberg (1992), whose longitudinal investigation of autistic children demonstrated a specific impairment in their descriptions of epistemic states, that is, believing, knowing, dreaming, imagining, and so on. Peterson and Siegal (1995) point out that a purely neurological hypothesis cannot account entirely for failure to acquire an understanding of mental states and that, in autistic children, the lack of access to conversation may combine with their neurological defects to impede their understanding of false belief.

Apart from having difficulty with the theory of mind test, the deaf children studied by Peterson and Siegal (1995) did not show any of the other symptoms of autism. Nevertheless, there are other interesting

similarities between deaf and autistic children. One of the most striking behavioral features of childhood autism is the lack of pretend play. Leslie (1987) holds that the neurological deficit associated with autism results in the inability to form, and to understand, metarepresentations, which are necessary for pretend play and for the understanding of false belief. There is evidence that deaf children also indulge in less make-believe play (Darbyshire, 1977) and less cooperative play (Higginbotham & Baker, 1981) than do hearing children. Lederberg, Rosenblatt, Vandell, and Chapin (1987) argue that deaf children's ability to participate in symbolic play depends to some extent on linguistic ability and nonverbal communication skills (coordinated attention, turn-taking, facial expression, gesture, and eye gaze) that facilitate pretend play. Interestingly, such skills are also absent in autistic children. Moreover, deafness may result in experiential deficits in children's understanding of social events and in their subsequent ability to participate in pretence. For example, school is an important place where hearing children gain important information about social behavior. However, it is often the case that the education of deaf children concentrates on teaching language skills at the expense of other social skills. For hearing children, books are an important source of information about other people's thoughts, motivations, and desires, but deaf children, being poor readers, are unlikely to gain as much information about these concepts from books as do hearing children. Thus, not only are deaf children conversationally deprived at home but also their educational experiences are likely quite different from those of hearing children. Such experiential shortfalls may give deaf children a less extensive knowledge of social situations than hearing children have. This inexperience may be reflected in inadequate representation of events and difficulty in understanding social relationships.

Interestingly, the two children with deaf parents (whose first language was Auslan) both passed the false-belief test. Those children, having had sign language ab initio, would have had the conversational experience Peterson and Siegal (1995) believe necessary for the development of theory of mind.

Although the Peterson and Siegal (1995) experiment produced an interesting result, there are several reasons for suspending judgment on the crucial question of whether prelingually deaf children really are delayed in their acquisition of theory of mind. Anyone familiar with the research supporting a stage theory, such as that of Piaget (1960), would be reluctant to pin faith on a single measure as an indicator of whether a specified stage has been reached. It would be highly desirable to test deaf children on a selection of theory of mind tests, rather than depend on a single task as a touchstone.

Since, through their acquisition of sign language, prelingually deaf children of hearing parents eventually do gain extensive conversational experience, there is good reason to expect that their development of theory of mind is delayed, rather than prevented altogether. Recently, some evidence has become available to support this view. Clark, Schwanenflugel, Everhart, and Bartini (1996) investigated how deaf adults of hearing parents rated the similarity of pairs of cognitive verbs. Participants were asked to decide whether the words in a pair were "alike or different, based on how you would use your mind when you do that mental activity." The results of a multidimensional scaling analysis showed that deaf adults organized cognitive verbs according to the degree of certainty implied by each verb; words such as remember and memorize were located at the certainty end of the scale, whereas words like guess and estimate were at the opposite, uncertainty, pole. Verbs were also organized in terms of the information processing they implied; words such as like and see were at the perceptual/input end, whereas reason and estimate were at the output/conceptual end. Clark et al. (1996) found that this organization of mental verbs in terms of the certainty and information processing they imply is consistent with data collected from hearing subjects in an earlier study (Schwanenflugel, Fabricius, & Noyes, in press, described in Clark et al.), suggesting that deaf and hearing adults have similar theories of mind.

Considered with the results of the Peterson and Siegal (1995) study, those of Clark et al. (1996) raise the interesting question of whether further work investigating deaf children's organization of cognitive verbs would give some indication of how they come to understand the relationships among such mental verbs as think and know.

Conclusion

The main import of the considerations in this article is that story comprehension, whatever the medium through which the story is presented, requires the ability to view the emerging scenario from the varying perspectives of the story characters, both in their cognitive and emotional aspects.

There have been some useful investigations of the hypothesis that lack of phonology impairs the efficiency of "low-level" cognitive functions such as short-term memory, with the result that prelingually deaf children have difficulty in retaining sufficient story material for comprehension. This may also partly account for deaf children's difficulties with syntax and other aspects of the English language. But, a fortiori, there are grounds for suspecting that the circumstances of the prelingually deaf child may also result in a delay in the acquisition of theory of mind.

The circumstances of deaf children deny them the opportunity to interact with others and to benefit from stories during the preschool and early school years. As a result, the difficulties facing the deaf child who is trying to understand a simple story may be more broadly based than has hitherto been supposed.

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