Analysis of Right Hemisphere Communication Deficits: Implications for Speech Pathology

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Introduction. Improving the ability to communicate is the foundation on which speech pathology is built. Treatment of brain damaged adults generally has been restricted to those with aphasia, dysarthria, and/or apraxia. Apart from dysarthric patients, the vast majority of patients under treatment have damage in the "dominant" hemisphere, and therapy has been limited to improving speech and/or language function. But speech and laguage do not represent the full measure of what we mean by communication. To communicate means more than to impart. It also means to participate, and it is this latter meaning which captures the essence of the speech pathologist's work. By concentrating our efforts on speech and language problems alone, we omit a large percentage of the patient population. These patients fail to participate -- to communicate fully -- despite their deceptively normal linguistic competence. Furthermore, it is evident that meaningful language performance itself is mediated in a variety of ways by the "non-dominant" hemisphere. The right brain damaged patient is critically in need of our services.

Two years ago the Clinical Aphasiology Conference sponsored a round table discussion on the functions of the right hemisphere and the role of the speech pathologist in treating this population. The focus of discussion was on auditory processing, visual/spatial disorders, and the language capabilities of the right hemisphere as they relate directly to speech and language (Collins, 1975). Without minimizing this direct role, the right hemisphere's influence on communication is larger. The efficacy of therapy can be evaluated only when we understand the true extent of the communication impairment in these patients. It is a problem that can be approached only by divergent paths and on multiple levels, taking account of: 1) those disorders that are readily seen to have a direct impact on the patient's ability to use language and, more importantly, to use it effectively; 2) those disorders that disrupt non-verbal communication; and 3) those disorders that appear to have little direct influence on language per se (even on communication in general), but which alter, sometimes subtly, the cognitive style that is critical to a fully functioning communicative system. Many of the disorders must be examined on more than one level; they can exert a direct and indirect influence on communication simultaneously.

In a description of the right hemisphere patient, Howard Gardner said: "The patient's command of grammar and of sound structure seem unchanged, but the relationship between his capacity to express himself in language and his knowledge of the world is impaired" (Gardner, 1975a, p.296). By looking at the various levels on which the right hemisphere contributes to communication, it is hoped that this paper will provide a fuller appreciation of the need for treatment by speech pathologists and some information that will help us step beyond the intuitive phase of intervention.

Cognitive Style. How is it that communication can be impaired, when language, our primary means of communication, appears to be intact? To understand this apparent contradiction it is helpful to look at the behavior of those aphasic patients who are often able to communicate, despite improverished language capacities. They employ gesture, facial expression, body language, affect, and intonation -- whatever is necessary to get their message across. They appear to know what they want to say and will go to great lengths to express their exact meaning. They seem sensitive to the situation, and to the experience of the listener, as well as to their own frustration.

In contrast, the right hemisphere patient appears peculiarly unconcerne about the impact of his message, insensitive to his situation, or to the environment. Continuing his portrait of the right hemisphere patient, Gardner says, "He resembles a kind of language machine, a talking computer that decodes literally what is said, and gives the most immediate (but not necessarily the implicitly called for) response, a rote rejoinder, insensitive to the ideas behind the question or the implications of the questione (Gardner, 1975a, p.296). These patients appear to miss nuances and subtleties. Their sense of humor, when present, tends to be caustic and inappropriate. While they relate readily to the denotative or literal aspects of verbal input, they often miss the connotative (Gardner and Denes, 1973). The loss of some critical cognitive and perceptual functions results in an excessive verbal dependency which can compensate only partly for what they have lost. Cognitive loss coupled with verbal dependency may account for the occasionally bizarre, irrelevant, and confabulatory nature of their verbal expression (Gardner, et al., 1975b). Even when these patients do not demonstrate all these symptoms, so long as well-known right hemisphere functions are disrupted, the patient's means of processing input and reachir conclusions will be different. Inevitably, his interaction with others will change.

Among the possible sequelae to right hemisphere disease are: body image distortions; constructional and dressing apraxia; visual memory and imagery problems; neglect of the left half of space; topological and geographic orientation disorders; facial recognition difficulties; impaired auditory processing; denial of illness; problems in affect and emotional appropriateness; as well as a reduced sensitivity to the external world. These disorders tend to indicate that the right hemisphere is unique in the way it processes information and produces solutions.

Before examining the specific visual, verbal, and affective disorders that contribute to and reflect impaired experiential processing, it might be useful to recall current concepts of the asymmetry between the two hemispheres in psychological and cognitive functions. In general, it has been postulated that the left hemisphere predominates in analytical, linear thinking and that the right hemisphere predominates in integrating information in a simultaneous rather than in a sequential manner (Gazzaniga, 1978; Ornstein, 1973). Galin (1974) points out that the two hemispheres seem to be specialized for different cognitive styles, with the right hemisphere specialized for a holistic or gestalt mode. Where the left hemisphere notes analytical details in a way that facilitates language function -- and that appears to interfere with perception of the overall gestalt -- the right is superior in grasping part-whole relations and seems to reason by a nonlinear mode of association. Joseph Bogen (1969) emphasizes that it is not

that the hemispheres are specialized to work with different types of material, but that they are specialized to work or process in different cognitive styles.

This apparent difference in cognitive style between the two hemispheres is critical to our understanding of how the right hemisphere patient interprets his environment and thus communicates his experience. It underlies many of the disorders discussed below.

Right Hemisphere Communication Disorder. Keeping in mind that a shift in cognitive style can occur in right brain damage, let us look at the specific communication disorders in these patients. They can be separated into four categories: 1) visual imagery; 2) figurative language; 3) affect; and 4) sense of humor.

Visual Imagery. Visual image making, visual perception, and visual memory are considered to be right hemisphere functions, but are seldom considered in the light of communication. Internal image making, unlike verbal production and comprehension, is relatively inaccessible to objective testing. It has been considered too inferential, subjective, and unmanageable to investigate systematically (Paivio, 1971). Visual image making denotes a cognitive function, and is, thus, distinct from agnosia or visual perceptual deficits. The mechanism by which it affects thought -- and indirectly, language -- is subtle, but a clearer understanding of it would provide substantive information on the right hemisphere's contribution to communication.

It has been reported that in patients with right parietal lesions and visual field deficits, visual thinking, dreaming and imagination are all impaired. And it is thought that creativity is a process of taking nonverbal images and transferring them across the corpus callosum into symbolic form. In Freudian terms, primary process thinking appears to occur in the right hemisphere.

The importance of visual perception, imagery, and memory should be investigated not only to understand their direct effect on a visual/linguistic function such as reading, but also to understand their less direct, but equally critical effect on verbal communication. It is worth recalling that data from child language development suggests that language development is preceded by the development of a representational system and that this system serves as a foundation for language (Guyer, 1975).

Communication disorders specific to difficulty in internal visualization are a) prosopagnosia and b) some forms of verbal reasoning.

Prosopagnosia: The term prosopagnosia refers to an inability to recognize familiar people by their faces. Although it has appeared in left posterior lesions, it is generally considered to be a right hemisphere disorder (Joynt and Goldstein, 1975). Sometimes these patients cannot recognize their own faces. It is a disorder which can lead to social embarrassment and acute feelings of isolation and confusion, not only for the patient, but also for those people whose faces he cannot recognize. As such, it contributes actively and directly to a communicative deficit. On another level, it may also be a reflection of a more subtle -- but no less influential -- deficit in cognition. It has been postulated to be a form of "simultagnosia" or a disorder in synthesizing separate elements into a composite whole (Benton, 1968). As a manifestation of a shift in cognitive style, in which integrating visual cues has been sacrificed, it

may contribute to our understanding of the impaired thought processes and, hence, impaired communication found in right damaged patients.

Verbal Reasoning and Spatial Relations. Verbal problem solving is an area of abstract reasoning not usually identified or treated in right brain damaged patients. Yet, the verbal problem solving abilities discussed here can be disrupted by right hemisphere disease because they are based on the patient's ability to use visual imagery effectively and to process spatial relations. An example of the kind of verbal problem solving that requires internal spatial representation is the linear syllogism. For example, "A is taller than B; B is taller than C; who is tallest"? Such input must be represented spatially -- pictures as an image in the brain -- to be solved.

In a study comparing right hemisphere patients with non-neurologically impaired controls, Caramazza et al. found that their subjects were relatively incapable of solving specific kinds of two-term series problems. Yet, the language function of these subjects had been charted as normal by their neurologists. It was their conclusion that, "...damage to the right hemisphere is at least sufficient to disrupt verbal problem solving. Moreover, as a corollary it would appear that the deficits associated with right-hemispheric damage extend beyond the concrete-visual-spatial realm to a more formal level (Caramazza, et al., 1976, p.45). The study makes it clear that some types of verbal reasoning depend on right hemisphere participation.

One might argue that we are rarely called on to solve linear syllogisms and that a verbal reasoning disorder of this type should be assigned a low priority. However, the linear syllogism is just one example of the kind of spatial ordering that is often called on when conceiving of elements relative to one another. Thinking about ordering or rating objective information along a continuum is part of our daily means of processing information and evaluating it. DeSoto et al. (1965) found that normal subjects used imagery to solve the ordering problems presented in a series of experiments in social reasoning and spatial paralogic. They conclude that their research supports the hypothesis that people rely on spatial representations in thinking about ordering information. Disorders in verbal reasoning and what are considered to be analytical abilities can thus result from right brain damage as reflected by impaired internal imagery.

Figurative Language. Results of two important studies suggest that other linguistic skills depend on right hemisphere function. In the first study, Gardner and Denes (1973) examined the ability of right brain damaged subjects to respond appropriately to the connotative as well as to the denotative or literal meanings of words. When right hemisphere patients were asked to match a word like "lady" to a curved or to a straight line, not only did they resist, but they often responded randomly if pressed. Gardner explained, "People and abstract geometric configurations represent two disparate realms to such patients, and they therefore balk at honoring formal or metaphorical links between them" (Gardner, 1975a, p.296).

Winner and Gardner (1977) also explored the implications of an impariment in metaphorical thinking in another study. The subjects, aphasic and right damaged patients, were asked to match a metaphoric sentence such as "He has a heavy heart" to its appropriate interpretation as expressed in a set of four pictures. The subjects were also asked to give verbal explanations of the metaphors. It was found that the aphasic patients chose

significantly more metaphoric or accurate pictures than the right hemisphere patients. For example, a right hemisphere subject would point to the picture of a man carrying a "heavy" heart, rather than to the picture of a sad person. Finally, the right sided group was able to give the appropriate verbal metaphoric explanations and did so even on the literal picture choices they had made. The authors say, "They appeared undisturbed by the dissociation between their pictorial choices and their verbal explications" (Winner and Gardner 1977, p.724). This is a good example of the deceptive nature of the patient's linguistic competence relative to his overall ability to communicate his experience. The results indicate that "...an intact left hemisphere does not of itself insure adequate comprehension of all linguistic messages." The authors conclude that right hemisphere patients exhibit a "qualitatively different mode of appreciation of metaphor, one which reflects their overall orientation to experience" (Winner and Gardner, 1977, p.725).

Affect. Disorders in affect disturb communication directly and reflect an emotional and possibly a verbal comprehension deficit. One of the most striking deficits resulting from right sided damage, particularly of the parietal lobe, is a loss of affect or emotionally conveyed responses in the verbal and non-verbal mode. Patients with this liability show a marked indifference to their problems (Heilman, 1975; Gianotti, 1972). They are often unable to demonstrate by facial expression the degree to which they understand or empathize with another person's message. Their non-verbal messages and witticisms are often inappropriate and are conveyed in a flat tone. Researchers are now investigating whether or not these patients understand emotionally toned or affective messages. In other words, does their lack of affect reflect a real comprehension loss or merely a problem in communicating their understanding?

Results of several studies seem to suggest the former (Schlanger, et al., 1976; Heilman, et al., 1975). Right hemisphere patients have been found to be impaired in the ability to identify the mood of the speaker, and Heilman (1975) found that patients with right temporo-parietal disease and neglect had a deficit in comprehending the message as well as in judging the mood of the speaker. In further studies, Tucker, et al. (1977) found that these patients also have a deficit in the expression of affective speech.

It may be, too, that impaired auditory processing plays a role in comprehending and producing affective messages. The right hemisphere is thought to have superior ability in tonal discrimination. It has been postulated, for example, that the success of Melodic Intonation Therapy with aphasic patients may be due to right hemispheric participation in prosody and rhythm.

Finally, the right hemisphere has been shown to be more active in processing emotional material in the intact brain (Diamond, et al., 1976; Gianotti, 1972; Schwartz, 1975). It is likely that patients who have right temporo-parietal disease with neglect may not be able to call upon the emotional reserves we expect in a normal person. If further studies confirm that these patients actually do not comprehend linguistic messages presented with an emotional overlay, it becomes obvious that the speech pathologist should intervene with guidance for the patient, family, and members of a rehabilitation team.

Impaired Sense of Humor. In an attempt to create a situation where the cognitive and affective aspects of communication would be fused, Gardner, et al. (1975b) investigated the comprehension of humorous material. He found that the ability to detect the most humorous cartoon from a set of four was impaired in both right and left brain damaged subjects; there were no significant differences between the two groups. In other words, right sided patients had as much trouble comprehending the messages as aphasic patients. Furthermore, the patient with right damage "...tended to exhibit one of two extreme reactions; they either laughed at every item, even when understanding was doubtful, or, more commonly, they evinced little reaction to any item, even when their understanding seemed adequate" (Gardner, et al., 1975b, p.409).

It was suggested that the cognitive reactions of the right hemisphere patients in this study appeared "dissociated" from their affective responses. Possibly because they have reduced sensitivity to the visual and spatial aspects of the perceptible world, Gardner noted that these patients become increasingly dependent on purely linguistic information.

Aside from this failure to comprehend humor, it has been my experience, and that of others, that right hemisphere patients often crack jokes of a morbid or off color nature, inappropriate to the situation, and evince almost no reaction when they do so.

Sense of humor, then, may be impaired or lost altogether. What is most striking about the patient who does not relate to his own inappropriate "jokes" is the sense of isolation he must be experiencing. What is most striking about the loss of humor is what it reflects about a mind that can relate only to the concrete and literal and has lost the ability to conceive of juxtapositions -- the ability to imagine.

Case Study. The impact of perceptual and cognitive deficits on communication in the life of the right brain-damaged patient is perhaps best illustrated by a case presentation. The case described below is of particular interest because the subject is a psychologist and is therefore able to approach some of his deficits from a professional viewpoint. What is remarkable, given his training, is that he had not identified most of his deficits, and had attributed changes in behavior to personality rather than to neuropsychological functions. Moreover, although neuropsychological testing revealed clinical signs of brain damage, his I.Q. was found to be approximately 130 (superior). Despite his superior verbal abilities, however, the patient suffers from a variety of perceptual and cognitive disorders which affect his ability to interact and participate. Perhaps most interesting is the Minnesota Multiphasic Personality Inventory which revealed a profile of clinical depression within the neurotic range. The neuropsychologist's final report (December, 1977) stated that the patient shows a high level of social introversion.

This last finding is particularly revealing, given the number of deficits the patient revealed in formal testing, his awareness of changes in his behavior since the stroke, and his misinterpretation of the sourse of his difficulties. Throughout the four hours of taped interviews, he stressed that he had always assumed many of his deficits were a product of his "crotchety old personality" and he was grateful for any information clarifying the source of his problems. Without further investigation, one cannot

attribute his depression to any single source, but one can speculate that intervention at the time of his stroke (thirty years ago) might have helped him understand his disorders and their effects and provided him with some means of coping with some of the behavioral changes affecting his ability to communicate.

History. In 1948, at the age of 25 the patient had a right hemisphere subarachnoid hemorrhage from a congenital aneurysm. After a year's hospitalization, he went on to complete his doctorate in vocational counseling and is currently on the faculty of a small university. His physical deficits include visual lower-left quandrant cut and paresis and spasticity in the left arm. Throughout testing and interview, he was cooperative and emotionally appropriate, although his affect was a bit flat.

Communication Disorders. The patient reported, and testing revealed, language ability within normal limits as tested by the Boston Diagnostic Examination for Aphasia. Deficits were found in visual imagery, strategy planning and rigidity, stimulus overload, and auditory perception.

Visual Imagery. The patient reported that he verbalizes almost all visual input. While describing a mild topological locomotion disorder, he said, "I have always thought of myself as having lost perceptual speed. But it's processing, which has this extra step of super-verbalization thrown into it, which has caused this reduction in speed. It is somehow comforting for me to know that."

His ability to verbalize visual material enabled him to attain a relatively good score on the Categories Test in the Halstead-Reitan Battery and on the visual sequential memory subtest of the Illinois Test of Psycholinguistic Abilities (ITPA). As he explained it, his procedure in the latter test was to give each symbol chip a name and to quickly memorize the names in order. In this way he was able to give an accurate response on the second presentation only. On the visual closure subtest of the ITPA, however, his score was 12 out of a possible 58. He also experienced "considerable difficulty" on the digit to symbol subtest of the Wechsler Adult Intelligence Scale.

Visual memory disorders make it difficult for him to keep a cognitive map in his head unless he can verbalize it. Only by doing so is he able to drive in his home town. He can only recall what members of his family look like by recalling gross descriptive cues, such as "this one has dark hair"; even then he cannot actually picture their faces. He was unable to visualize a word in his mind when asked, but could call up an image of an object -- in silhouette only.

He also has some degree of prosopagnosia. He reported that the only way he can recognize the faces of his clients when he meets them in a scheduled interview is by discussing their case history with them. Verbalizing the case triggers the visual association and facial recognition. He also is unable to keep characters separate in movies or T.V. shows. "...but what I can't do is recognize characters -- it's this business of recognition -- neither by voice nor by facial appearance, so that where following the plot is dependent upon discriminating between character A and character B who are both John Wayne-type males, or who are both attractive women, I'm pretty confused as to who is who...Oh, there's no way I'd know one of Charlie's Angels from the other -- no way at all."

Cognitive Style. Several of the patient's disorders affected communication indirectly, revealing a shift in cognitive style in which holistic

processing was often sacrificed for analytical reasoning. For example, he explained he was not able to do derivations on the blackboard in teaching elementary statistics. He attributed this to a "difficulty in keeping the whole thing in mind and where I am in the process..." He went on to say that when he was required to make a quick assessment of a situation in day-to-day life, he was "unable to take in the 'gestalt'," the entirety of the situation, and had to rely instead on deliberately analyzing each element before reaching a conclusion or an understanding of what was happening around him. Both of these problems may be caused by a type of "simultagnosis" and both interfere with his ability to interact with others.

The patient also has a low tolerance for competing stimuli in both the visual and auditory channels. He explained it as a "poor filtering mechanism." When overstimulated, he says, "Everything just goes blah." He cannot carry on a conversation while the T.V. or radio is on, nor talk effectively on the phone in competition with background conversation. Since most auditory input is processed in the contralateral hemisphere, it may be that his right sided auditory processing is impaired. Results of an auditory double simultaneous stimulation test were indicative of right sided brain damage. Furthermore, his score on the Speech Sounds Perception Test in the Halstead-Reitan battery was found to be within the brain damaged range. These auditory perceptual difficulties contribute to his feelings of sensory overload in the auditory channel. Certainly they contribute to an overall communication disorder.

Summary. The visual imagery and memory problems, auditory perceptual disorders, the patient's shift in cognitive style and the experience of sensory overload have contributed to impaired communication in a highly verbal patient. His linguistic capabilities are superior, and he has been able to compensate for many of his losses, as a less verbal patient might not be able to do so. It is clear, however, that his active, social participation in day-to-day affairs has suffered. We can only guess how much his depression is related to his ignorance of the nature of his deficits.

Conclusion. It is clear that perceptual and cognitive disruptions in visual imagery, cognitive style, affect and some forms of verbal processing can result from damage to the right hemisphere. Because they work a change in patterns of thought, emotional appropriateness, and/or environmental sensitivity, they can affect communication skills -- directly or indirectly. What is important for our purposes is not whether the patient has constructional apraxia, for example, but what can be inferred from that disorder about his perception of the world. If the goals of our profession are to improve communicative skills -- be they specifically linguistic or not -- then it appears that the first step is the development of an assessment tool that targets communication disorders unique to right hemisphere patients. The explanation of those deficits and the case study presentation in this paper should provide some guidance to therapists in identifying the disorders and explaining their implications to the patient and his family.

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