The Return of Speech 4-1/2 Years Post Head Injury: A Case Report

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INTRODUCTION

This presentation will document the sudden, unexpected return of speech to a 34 year old head trauma patient after 4-1/2 years of almost total mutism. Jim was a right handed student completing a Ph.D. in Biological Sciences at the University of Colorado. In September 1975, he was struck by an automobile and suffered left subdural and intracerebral hematomas, right massive edema and immediate respiratory arrest. Following two left parietal craniotomies and an eight-week coma, he presented with right hemiplegia, hemianopsia and total loss of communication skills.

Baseline testing with the Porch Index of Communicative Ability (PICA) at 3.7 months post onset elicited an overall percentile ranking of 19 (Table 1). Except for limited and variable auditory comprehension, gestural expression and gross copying skills, the patient was unable to communicate. Oral and verbal apraxia, total aphonia and suspected cognitive impairments persisted. The patient was treated daily for the next five months. At 9 months post onset (Table 1) his overall PICA percentile had risen to 38, representing improving auditory and gestural skills, emerging reading comprehension and copying skills at the single word level. Subsequently, the patient was discharged.

During the next two years, the patient received a variety of traditional therapies, administered across varying time intervals between at least 4 discharges and readmissions to the hospital. At 35 months post onset (Table 1) PICA percentile had risen slightly to 45. Auditory comprehension was now adequate for activities of daily living, and reading comprehension was reliable at the single word level. Jim had achieved volitional control over phonation and was able to speak 3 words: "mom, no, and I." He could copy words and write his name. The patient's performance on the Colored Progressive Matrices (Raven, 1962) ranked in the 85th percentile for aphasic subjects and the 55th percentile for normal controls using the norms of Wertz et al. (1978). The patient presented a marked Broca's aphasia characterized by moderate language impairment and severe oral and verbal apraxia. Jim was communicating by pointing to pictures, printed words and drawings accompanied by an idiosyncratic, unintelligible gestural system.

HANDI-VOICE

At 44 months post onset, the patient was evaluated for training on the Handi-Voice 110, a battery operated, speech synthesizer capable of

Table 1. Months post onset (MPO), date, overall and modality scores and percentile equivalents for PICA evaluations of the patient.

MPO	DATE	OVERALL	%	GESTURAL	%	VERBAL	%	GRAPHIC	%
3.7	1/14/76	7.15	19	10.47	47	2.0	1	6.15	31
9	6/21/76	9.30	38	13.86	78	2.0	1	8.10	57
35	8/23/78	10.21	45	13.97	80	4.75	25	8.83	65
52	1/7/80	10.82	52	13.86	78	9.48	43	7.67	52
55.5	4/23/80	11.25	57	13.59	71	11.73	53	7.82	54
60	9/4/80	12.72	77	13.93	79	13.15	66	10.83	79

reproducing the English language via direct access to a fixed and programmable vocabulary by depression of a 128 cell, pressure sensitive grid. The 473 item vocabulary is comprised of words, phonemes, syllables, letters, and short phrases. To access a vocabulary item, an individual cell, programmed to one of four color coded levels, must be depressed. Ideally, the patient must learn the location of some or all of the vocabulary items, make use of the 15 operational modes (for example, entry and retrieval from memory) and utilize the device's phoneme-programming capability. After 7 months training, 3-4 hours per day, Jim was able to program complete sentences with the device. Spontaneously, he conversed in a telegraphic fashion, embellished by the use of memorized phrases or sentences.

(At this time, a video-tape was presented, illustrating the patient using the Handi-Voice.) Jim described subject-verb-object relationships depicted in black and white drawings. Table 2 lists the total number and type of entry for each of the five sentences presented on tape. Within each sentence, the numbers 1 through 4 represent the vocabulary level programmed prior to the retrieval of the word or phoneme which followed. The patient was then shown engaging in a brief conversation, encoding his name and other vocabulary quickly and accurately.

Table 2. Number, type, and vocabulary level of items programmed on the Handi-Voice 110 during picture description.

ENTRIES	SENTENCE
11	4-THE-1-WOMAN-IS-HURT-4-ING-4-THE-1-MAN
8	4-THE-1-BABY-IS-CRY-4-ING
13	4-THE-1-BOY-IS-4-R-O_1-W-ING-THE-3-BOAT
13	4-THE-1-BOY-IS-3-DRINK-4-ING-THE-J-OO_1-S
11	1-DAD-IS-4-M-OH_1-ING-THE-L-AW_1-N

The influence of the Handi-Voice on Jim's communication skills is reflected in a comparison of PICA scores before Handi-Voice training, at 35 months post onset, and after Handi-Voice training at 52 months post onset (Table 1). Specifically, the increase in the verbal modality from 25 to 43 percentile points represents the device's effectiveness in circumventing the patient's apraxia; similarily, it became a medium in which the patient's expressive aphasia could be observed.

ONSET OF SPEECH

Throughout the course of his treatment, Jim was frequently urged to attempt speech. On April 7, 1980 at 2:00 PM, 4-1/2 years post onset, the patient quite unexpectedly responded by speaking, counting from one to ten with the clinician and shortly thereafter saying his name and speaking short phrases.

(At this time, a videotape was presented, showing the rapid evolution of motor programming skills from onset through one, seven, and thirty days.)

By 4:30 of the same afternoon the patient had repeated or spoken 97 different words, some in short phrases. Jim exhibited instances of literal and verbal paraphasia, phoneme reapproaches and other characteristics of a phoneme programming disorder. The patient spoke with a deep, resonant voice having almost animated prosody. Within one month Jim had spoken over 500 different words. He was able to describe pictures with complete sentences that earlier had taken 7 months training with the Handi-Voice. Examples of the patient's vocabulary which were presented on videotape and elicited in either model, initial phoneme cue, or spontaneous contexts are listed in Table 3.

Table 3. Examples of vocabulary elicited in either model, initial phoneme cue, confrontation naming or spontaneous contexts.

(onset) 4-7-80, 2:00 PM	4-7-80, 4:30 PM
numbers one through ten	red shirt
Jim	blue jeans
good	clouds
fine	sun
hi	wind
beer	wind was blowing
(one day out) 4-8-80	**(seven days out 4-14-80**
toaster	play music ?
clock	Barbara Streisand
washer	John Denver
radio	Rocky Mountain High
coffee pot	
Goodnite Ladies (singing)	
(30 days out) 5-8-80	
patient says full name	
swell	
I can speak	
mother, no sister is hurting the boy	
brother, sister is hurting the boy	
drinking	
boys, boys, one, juice	
boy is drinking juice	
boy is rowing the boat	
Monday	
I can talk	
blast off	

Figure 1 shows overall PICA percentiles across months post onset. With the onset of speech at 55.5 months out, the PICA percentile had risen to 57 (Table 1), surpassing the level achieved three and a half months earlier with the Handi-Voice (52%). Specifically, the verbal modality had increased 10 percentile points. Four and one-half months later, at 60 months out, the

patient had achieved the 77th percentile (Table 1). The verbal modality had risen an additional 13 percentile points and the graphic modality had suddenly risen 25 points. Astonishingly, the patient had experienced nearly one-third of his measured recovery between 55.5 and 60 months post onset.

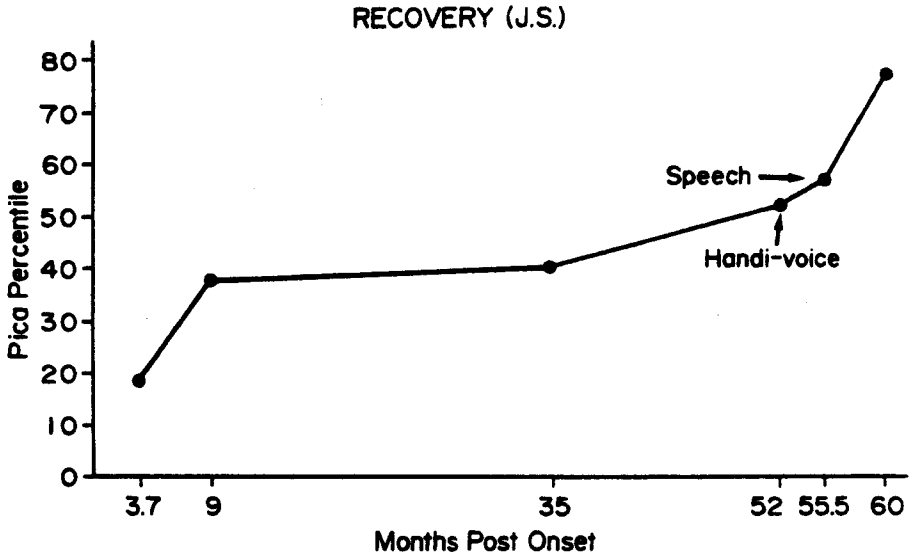

Figure 1. Overall PICA percentiles across months post onset.

Currently, Jim is living in his own apartment and operates a newspaper stand. The patient communicates using a combination of spoken language, writing, synthetic speech, gesture, the dictionary and a communication booklet. He is best described as having a moderate aphasia. Although certain psychosocial deficiencies persist, Jim is living and communicating independently.

DISCUSSION

To my knowledge, this is the first time a recovery of this type has been reported. Obviously, this case does not verify the effect of a treatment nor should it encourage generalization to the recovery of other patients. The significance of this case is that it represents an exception to our logic concerning the recovery of communication skills in head trauma patients. After 4-1/2 years of almost total speechlessness, the patient wasn't supposed to talk, yet he did.

The sudden return of speech might suggest a functional component in this case. However, error patterns and responses to cueing represent a qualitatively typical reestablishment of phoneme programming skills, compressed into a late, very brief time frame. Initially, we attributed the patient's mutism to an efferent, anterior type of apraxia often associated with Broca's aphasia. We were mistaken. CT scans at 49 and 57 months post onset both revealed a large craniotomy defect in the left parietal area, a large area of decreased density in the left parietal and temporal lobes, and an

area of encephalomacia in the right temporal lobe. No focal or generalized abnormality was ever associated with the inferior, left third frontal convolution, or anywhere in the left frontal lobe. Kertesz et al. (1979) and Naeser et al. (1981) have found considerable agreement concerning the geometric center of lesions producing acute, chronic or partially recovered Broca's aphasia: all contain at least a portion of the inferior third frontal convolution of the dominant hemisphere.

Perhaps Broca's area retained its programming capacity but was isolated from posterior association areas, analogous to Geschwind's (1972) version of "disconnection." However, as Buckingham (1979) explains, classical disconnection theory only accounts for the inability to speak after a verbal command. "Disconnection" cannot account for total mutism. Posterior, lesion-centered concepts such as secondary apraxia (Canter, 1969), afferent-motor aphasia, or ideational apraxia (Luria, 1970), are more compatible with the site of lesion and the relative fluency of the patient's present speech, but usually are not associated with patients who are speechless, aphonic and have right hemiplegia.

Mohr (1980) has suggested that damaged tissue in the region of the dominant hemisphere surrounding Broca's area may interfere with the physiological processes required in the act of speaking. Perhaps this patient's speechlessness should not have been attributed to apraxia per se, but to inability to gather the physiological momentum required for overt verbal expression. Regardless, such inferences do not explain why Jim's condition changed 4-1/2 years post onset.

The fact that speech returned following months of intensive training with a speech synthesizer elicits several interpretations: coincidence, cause and effect, or a more negotiable explanation: facilitation. Stemming from Luria's (1970) concept of "intersystemic reorganization," Collins et al. (1976), Helm (1976) and Skelly et al. (1974) have demonstrated the facilitative effects of nonspeech modalities on motor programming behavior.

If the Handi-Voice did facilitate the return of Jim's speech, its role has relevance to the much discussed relationship between language and motor programming, and the parallel arguments of Darley et al. (1975) and Martin (1974). The Handi-Voice may have directly facilitated speech because it stimulated subvocal or implicit rehearsal of the phonetic patterns that the patient associated with the phonemic characteristics of synthetic speech. From a more divergent point of view, and one which relates to Mohr's (1980) comments on the synergistic relationship of language and motor programming functions, the Handi-Voice may have enabled Jim to select, sequence, and encode elements of language into a covert, comprehensible form, which in turn encouraged him to use his residual language skills. Eventually, this increasing intensity of language activity may have achieved enough inertia to activate a dormant, yet relatively intact motor programming system.

One can argue that all or none of these inferences are relevant to the patient's recovery. However, one cannot dispute the fact that after 4-1/2 years, speech finally returned.

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DISCUSSION

Q: How is the patient "living independently?"

A: Near the onset of speech we had placed Jim in an apartment setting for handicapped individuals. We made various attempts to place Jim in a job setting. The one which finally worked out involved operating a newspaper stand. As a matter of fact, Jim is making enough money in this setting to support himself.

Q: How much of an effort did you make in initially trying to elicit speech?

A: Well, it varied depending on the time post onset. Initially, we worked intensely. We worked exclusively on eliciting phonation for about one month. Once phonation was established, we were finally able to elicit three words, "mom, no, and I." Eliciting verbal or speech activity from this patient was our primary goal during the first two years of treatment. After that time we concluded that the patient would not regain his speech. When the Handi-Voice became available, we recalled the patient for training.

Q: What was the relationship between the onset of voice and the use of the first three-word vocabulary?

A: We attempted to establish phonation in the patient during the first several months post onset. He began to have some volitional control of phonation at about nine to ten months out. At that point we attempted to coordinate voice with articulation. Eventually he was able to produce three words. However, he didn't learn these all at once. I don't recall the actual time points when each word was elicited.