Computer animated and textured presentation of language : continuity of expressive meaning across deaf and hearing readers

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INTRODUCTION

We broadly and classically define expressive meaning in language as information conveyed about individual perspective on an external or consensus reality (cf. Proust, Dewey, Cassirer, Vygotsky, J. Britton and others). The narrator interposes himself/herself and filters or transforms the depiction of external events. The reader's task is to assume as close a relation as possible to this perspective-infused reality. The formal mechanisms for implementing expressive meaning are, as Nelson Goodman has showed, often metaphoric exemplifications of the depicted reality.

An underlying theme of the present work then is that continuity already exists between the hearing-impaired and hearing person's experience in such an extended expressive domain of language (cf. Bellugi, Grosjean). In the reading of printed language, this continuity has been broken by an asymmetry in the reception of sound. We believe continuity can be restored paradoxically, through endowing the visual aspect of words and particularly the lexical or content words with a rich temporal structure, but in a way that must not interfere with the syntactically constrained linguistic flow.

A model for such a print mode has been previously given and implemented through computer programming. This ,,textured" mode relies on the redundancy of word replications combined with extremely simple word movement-patterns that bear only a generalized metaphoric relation to the subtleties and complexities of the sound-shaping of the voice (Layzer, 1976).

More ambitiously, one might hope that such a restoration of continuity in expressive meaning in reading would act positively to enhance memory, comprehension and the quality of written expression as well.

1. Background of Relevant Prior Experience

Many disadvantaged postsecondary students of normal hearing have severe problems at a basic level of reading and writing, though recently some strategies have been developed which confront these problems and offer hope (1). The same problems are mutiplied by an order of magnitude for severely hearing impaired postsecondary students, where the sensory deficit presents a new and in fact dominant element that impedes fluency (2). In spite of remarkable achievements of language-gifted individuals and intense efforts by dedicated teachers and researchers, no systematic mode of attack has yet been found. A fifth grade level of reading or writing is a good attainment for the average over-18 hearing-impaired student of average intelligence (3). Yet there is a hopeful element of continuity in language achievement in a more general sense of language functioning. American sign language for example is a distinctively rich language with roughly comparable expressive or communicative power to that of English (4). Seemingly there is no direct way to channel this expressive power to improve skill in the reading of English, with its different and vastly more elaborate formal micro-structure.

Recently the author, in controlled studies, has found strikingly positive evidence that the reading and writing performance of deaf students is significantly improved in quality over the period of testing as a result of an animated technique of displaying text (5). These results when looked at in more detail seem to tie in rather well with an explanatory structure that was previously proposed. According to this mechanism the ,,texturing" of individual words strengthens logical elements of context but it also strengthens more purely expressive evocations of the persona of the passage, and the organic or living quality of the events and objects described (6).

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These evocations are thought of as metaphors of „signature" induced by the complex temporal properties of the presentation, metaphors which for the hearing person would carry connotations of voice and sound.

The results of the study suggest a still larger expressive structure, an expressive „fabric" which links memory, reading and writing together more closely as a unitary language skill in accordance with the proposals of the modern pragmatic school of language learning. Further strong suggestions from my results show that the reading experience can be so intense as to give a direct momentum to writing skills, including the acquisition of syntactic skills as well (7).

Initially though armed with artistic insights and premises, I was rather worried whether deaf readers would actually be able to *read* my presentation, let alone enjoy it. Preliminary showings to deaf school administrators, educators of the deaf, high school and elementary school students and poets were therefore very welcome. Just one example. At a very early demonstration arranged by the NYC Office of the Handicapped (1975) one of the few profoundly deaf educators present, actually a „community activist", spoke out clearly in favor of the texturing example as opposed to a different kinetic technique of mine also exhibited with a simpler text. It was new for the deaf. She said it was like a „vibration". This particular analogy, though to be sure consistent with my „speaker's voice" analogy was unexpected in its wide path of resonance. I made use of this clue along with synesthesic experiences related by the deaf author David Wright and literature findings of temporal memory ability of deaf children in a later article (1976) where I introduced the somewhat speculative concept of complex temporal „signature". I also made sure in the later controlled study to introduce a subjective question of the feeling of „vibrating — not vibrating" as one of my 36 adjectival semantic differential (SD) scales. Indeed results for this scale showed a consistent weighting in favor of the „film" group. Finally I was able to show a special weighting for a broader factor containing this scale that could be naturally identified with a complex temporal „signature".

Description of Texturing Technique. With the new technique, unlike the conventional printed page, each word becomes a space-time process of „texture" in which repetitions of the word unfold on the viewing screen (see Figure 1). Textures or movement patterns are created by Fortran programming and are used in conjunction with a simple script or „score" for specifying timing and texture. A television monitor is used as a convenient intermediate device.

Film Examples. Three silent films, in 16 mm color, were produced by Dr. Layzer based on texts of deaf authors. This work was supported in part by a grant from the U.S. Department of Education.

Background with Computer Media. The film MORNING ELEVATOR introduced in late 1971 was experimental not only in its texturing of words but also in its combining of the brief personifying text with a computer synthesized and programmed music setting. Commentary by Bailey notes its visual appearance as a kinetic descendant of concrete poetry (8). However, in addition to this implied „physical" quality I premissed (in the same conference) that the „texturing" of words was analogous to a speaker's voice „.... but to its personal, idiosyncratic qualities rather than to the rhythm of speech." (9)

Working over a number of years with the intractable computer in music composition and synthesis and then in artistic text design prior to the application for deaf students, I had learned to carefully observe the properties of the medium itself no matter how prosaic these properties seemed to be. I wrote and spoke about these quite real problems in several places. Where others overlooked or tried to avoid the „mechanical" properties of the computer media I took them into account as a kind of relief or „grain" against which the essential humanly-related content had to be conveyed (10). The concept of „grain" remains an essential one in the present application.

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2. Form and Content of Research Study

I think that aside from the fact of the new print mode bringing about an improvement in reading and writing, the study itself has an exciting story to tell. The story is partly a detective story which many teachers, especially those in College English departments will probably enjoy. This is the detective story of following, with the magnifying glass of modern statistical techniques, the trail of seemingly ephemeral ,,metaphors of signature" and of ,,expressive fabric". In fact, the expressive space can be made almost tangible, as in Figure 3 to be briefly discussed further on.

Parallel to this detective story, there is the human story of an unfolding of the student story-writer's commitment to the writing task, as seen in his individual writing and how this seems to entail a real improvement in syntactical ability, in intensity of verbal energy and a unification of an ,,external" imagery with an ,,internal" insight.

The third story is the realization, ultimately, when all the analysis is done, that one must be talking about universal aspects of language and the human condition. It is not a question of ,,high score" of ,,low score" but different perspectives whose true import can only be seen when all perspectives are put together. When this is done, one suddenly gets a glimpse of what goes into the mystery of creative motivation.

In telling the story it's natural to culminate interest as a climax on the small group of students that actually participated in the entire sequence of source passages, as indicated by the research paradigm sketched below.

As a minimum background, the following information should be supplied. There were actually four small groups on which testing was carried out. The first was a group of 36 young adults affiliated with the N.Y. League for the Hard of Hearing. Their hearing deficit ranged from moderate to profoundly deaf. The second, third and fourth groups with numbers respectively of 27, 17 and 14 were all profoundly deaf students at Gallaudet College.
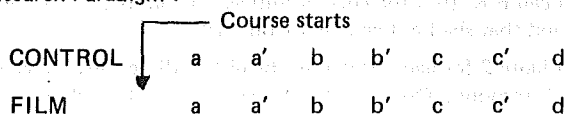
The test measures for all four groups were the same. But only in the second Gallaudet group (17 students) was an entire sequence of three source passages carried out and in a regular course (a one-week intensive summer course in English literature for first year freshmen). In the other groups only the first source passage was used, a simple but expressive text of personification. (See Figure 2). The third Gallaudet group was a confirmatory group of pre-college students, somewhat lower in English skills.

All writing samples were judged by a group of 20 judges from the Gallaudet teaching faculty, most in the English department. In the sequential study, the introduction of the three poetic passages occured as a natural part of the course. The teaching, I know through observation, was exceptionally high in both classes, control and film. Uniform procedures were followed in the two classes.

For help in arranging for in-class testing at Gallaudet and participation of Gallaudet judges, I was indebted to Prof. John Canney as a consultant who also taught the ,,film group" class of the full-sequence. He also offered useful criticism.

Informal Summary of Research Methodology and a Few Key Results

Main Research Paradigm :

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                  ┌──── Course starts
                  │
   CONTROL │        a    a'    b    b'    c    c'    d
            ▼
   FILM              a    a'    b    b'    c    c'    d
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The letters a, b, and c stand both for successive source passages and the testing sessions after exposures to the texts. These texts are tri-partite ; cloze, writing and semantic differential (SD). The prime testing sessions are simply follow up cloze tests with no new exposure to the source passages. At least 24 hours separates the follow up cloze test from initial reading of the source passage. Texts a, b and c are progressively more difficult. Furthermore, b and c are successive portions of the same longer poem (in our case from the longer poem Plettenberg's Bay by David Wright).

Key Results for Those in the Full Sequence Study

Cloze Test : Retentive Memory and Comprehension

Here we show the poem or film-poem first and then test on a passage with missing words (blanks on content words only not function words). If the reader feels an inner „resonance" for the missing word, she/he is more likely to get that word right. The result would be better memory and better comprehension. I found that scores were much higher for the film group on two of the three follow-up tests, a' and c'. Later we got similar results for a' with a different group (pre-college poorer readers). Therefore we're pretty sure that there is in fact a difference in retention (memory over long period) in favor of the film group.

The pattern of blanks is different in the follow-ups from the original pattern in all three parts. Other special notes : the teacher explained exotic sea-animals in the Wright passage (b) with the aid of pictures ; and in (c) explained one or two difficult words, or word-components, notably „budge" and „destiny". These special provisions were uniform in the two groups, film and control.

Response as Readers to Expressive Content of Source Passage. Semantic Differential (SD) Profiles

In comparing through their SD levels the film and control groups one difficulty was that „positive" and „negative" are arbitrary. I solved this in a natural way by defining the positive direction of a scale as one which had a positive statistical correlation (or linkage) with the pleasant (unpleasant) scale. The result was surprisingly dramatic. For the average on texts „b" and „c" : On 35 of the 36 scales the film group responded more positively than the control group.

It's specially encouraging that so marked an enhancement of expressive content occurs together with an increase of memory and comprehension. It supports the "dynamic mechanism" mentioned earlier : the hypothesis that an expressive momentum in reading is "driving" an enhancement of a general language skill. Our analysis of the *writings* showed a similar effect, an additional very encouraging result.

Students' Sequential Responsive Writing. I have also judged students' writing in a quite sophisticated way with a multidimensional scaling analysis involving the viewpoints of 20 judges. These results also provide valuable information probing the concept of expressive fabric itself.

The case of the Apparent Breakthrough of B.K. Here is an admittedly specially chosen example of the improvement in a writer's manifest quality of writing as the writer goes from first to last task, a to c. This writer, who is in the film group, we shall call B.K. (not the correct initials) . From the questionnaire cover sheet we know the writer is a "she" and that she has been deaf from birth.

The source poem is shown on the left of the Figure 2 for each occasion, the gist of directions is given in the middle columnar space and finally B.K.'s response. One sees that for source "a", B.K. draws no

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or little initiative from the situation. The sentence structure is rigid.

In the second task, the more difficult poem by Wright, the writing is even more sparse though it is in some ways better : clearer and more incisive. But now the writer maintains a positive *dislike* of the situation and shows no apparent empathy with the author.

In the third task, the paragraph is considerably longer than previous times. Miraculously it unfolds without much syntactic clumsiness into a definite, unified and complex point of view. Moreover this point of view does take into account some key elements of the expressive content of the source passage. Most importantly and striking, the writer's understanding of Mr. Wright's situation and her compassion for his trials seems to have deepened. (The actual instructions to students make clear that the third source passage is a continuation of the second.) This example shows the asset of a *sequence* of writing tasks rather than a single task to gauge the progress of an individual student, or indeed a group.

The color Circle of Stories. Corresponding to the discovery of the perceptual color circle centuries after its prediction by Newton, through modern factor analytic statistical techniques (11), I wished to explore the space of "story colors" abstracting primary qualities from their bewildering individuality and yet preserving a trace of the individuality since this itself is a primary expressive quality. Furthermore it was not the "colors" themselves that we were ultimately interested in but colors borrowed from the source passage, in its given mode of presentations, and transmuted by the reader into related colors in responsive writing.

In my application of the three-way INDSCAL procedure (12) the "group stimulus space" became the *space of the stories.* The "weight space" of individual perspectives becomes the judges space. The INDSCAL procedure would collect and concentrate the intuitive wisdom of 20 judges and so sharpen the map appearing in the space of the stories. INDSCAL has also a graphical feature which allows both spaces to be visualized more easily than from factor scores and numerical weights (13).

In my procedure judges evaluated the similarities of *pairs of stories.* My instructions to the judges were somewhat more elaborate. In essence, however, I asked the judges to judge similarity on the basis of a quality of the story which I called its "expressive fabric". Instead of defining this difficult concept, I asked the judges themselves to be guided by an intuitive impression of expressive fabric.

In the second part of the evaluation form I gave the judges 10 explicit criteria by which certain (desirable) aspects of expressive fabric could be judged and asked for ratings on each criterion *on each story.* The detailed criteria were placed into categories of IMAGERY, PERSONAL RESONANCE and SPIRIT OF PRETEND. In the introduction to this part of the form I offered a guideline that connected these categories : "how the writer enters the spirit of pretend and puts emotion and personal meaning into a range of sensory images". Notice that this guideline actually presents a kind of theoretical hypothesis : that detailed criteria under the category of "spirit of pretend" are in some sense connected with *motivating* attributes of the writing.

Some of the corresponding stories that go with this map are given in Fig. 4. The 10 rays form an "expressive cone" of high expressive power (14).

Continuity of Expressive Meaning. The judged stories illustrated in Fig. 3, 4 are for the first group tested, a wide hearing range (WHR) group whose hearing loss ranged from moderate to severe. This group more *generally* served to yield a structure of reference for the later testing of homogeneously deaf Gallaudet students. In this way one could estimate the dependence on hearing loss of the impact of the film presentation.

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It was possible to verify the presence of factors, in the factor analysis of the semantic differential (SD), which

a. corresponded to the hypothesized "metaphors of signature",
b. could be traced from the WHR group to the homogeneously deaf group,
c. were enhanced by the film presentation and
d. were in the control group of the WHR group associated with the appreciation of *sound* connotations or evocations for those with less severe hearing loss. Finally
e. the impact in the film group was greater for those with more severe hearing loss, for the same factors.

In the structure of the expressive fabric deduced from the creative writing of the students and illustrated by Fig. 3, with its cone of 10 expressives scales we are able to draw a satisfactory correspondence of structure to the structure revealed from the SD based on the subjective reading experience. Moreover the evident splitting of the cone into two bundles, which can be shown to correspond to factors of IMAGERY and PERSONAL RESONANCE corresponds nicely to the "internal" and "external" aspects of expressive meaning, in satisfying correspondence to the broad definition of expressive meaning enunciated in the introduction. (15)

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NOTES

1. Mina P. Shaughnessy, *Errors & expectations — A Guide For The Teacher Of Basic Writing*, (New York : Oxford University Press, 1977).

2. The dominance of hearing loss as a factor in reading-deficit is inferred from the large gap between the average reading level for hearing-impaired and normal hearing school populations. See S. DiFrancesca, *Academic Achievement Test Results of a National Testing Program for Hearing Impaired Students*, Washington D.C. : Office of Demographic Studies, Gallaudet College, 1971).

3. DiFrancesca, cited above.

4. See for example, Edward Klima and Ursula Bellugi, *The Signs of Language*, (Cambridge Mass. : Harvard University Press, 1980). Also, François Grosjean, "Psycholinguistics of Sign Language", in *Recent Perspectives on American Sign Language*, Harlan Lane, F. Francois Grosjean, eds., (Hilsdale, New Jersey : Lawrence Erlbaum Associates, Publishers, 1980).

5. Arthur Layzer, *Enhancement of Reading and Writing of Hearing Impaired Young Adults and Adolescents Due to Textured Print Mode*, (Final Report for Grant G007804224, 1978-1980, National Technical Information Service, March 1981). (Microfiche or hardcopy).

6. Arthur Layzer, "Computer Animated and Textured Presentation of Language for the Deaf", *American Annals of the Deaf* (Vol 121, 1976), pg. 38.

7. See Layzer, NTIS Report, 1981, cited above.

8. R.W. Bailey, "Computer Assisted Poetry" in L. Mitchell (Ed.), *Computers in the Humanities*, (Minneapolis and Edinburgh, Univ. of Edinburgh Press, 1974).

9. This reference is cited in Carole McCauley, *Computers and Creativity* (New York : Praeger, 1974).

10. Arthur Layzer, "Poets, Birds, Snow, Kites and the Computer" in *Arts and Society* (Fall, 1974) and "Some Idiosyncratic Aspects of Computer Synthesized Sound" in Proc. of the Amer. Soc. of Univ. Composers (Spring, 1973).

11. For an excellent summary of this color circle development and modern multidimensional scaling techniques, see R. Shephard, "Multidimensional Scaling, Tree Fitting and Clustering", *Science*, *210*, pg. 390-398, 1980.

12. J.D. Carroll and M. Wish, "Multidimensional Perceptual Models and Measurement Methods" in E.C. Carterette and M.P. Friedman (Eds) *Handbook of Perception* (Academic Press : 1974).

13. See Carroll and Wish cited above.

14. These points are covered in more detail in Layzer, 1981, cited above.

15. The study described here was partially supported by a grant from the U.S. Department of Education, Office of Special Education, The author wishes to thank Dr. J. D. Carroll for helpful suggestions on methodology and analysis during the study.
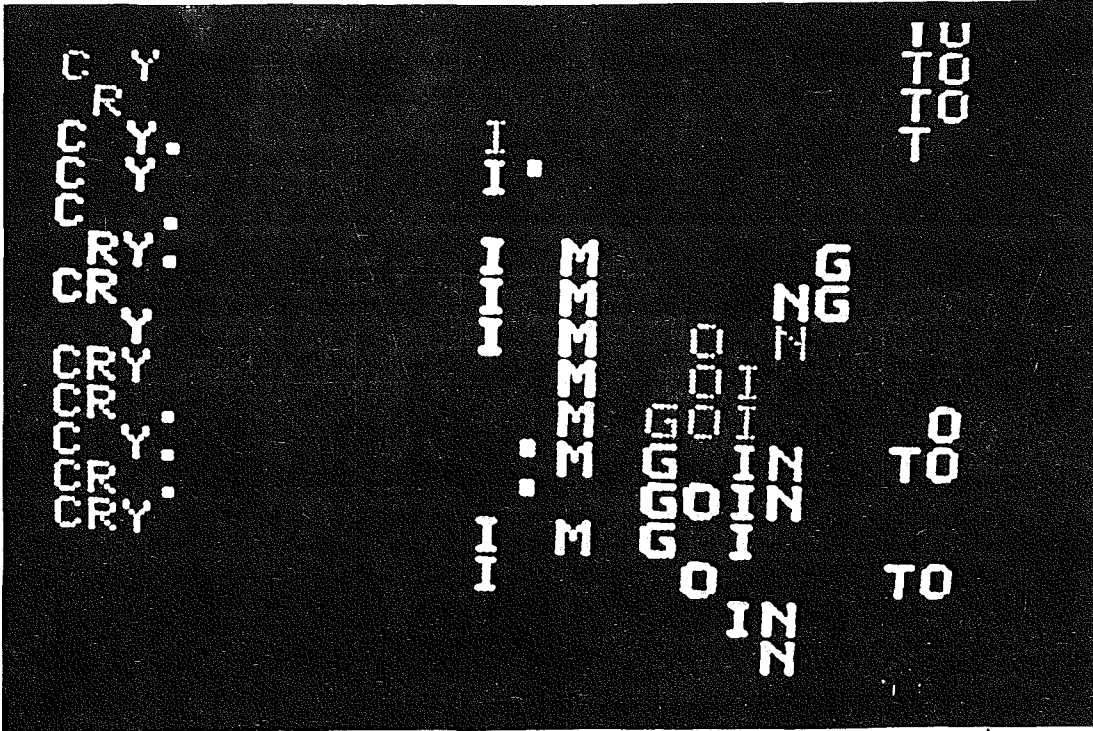

FIGURE 1.

A frame from one of the 16mm color films used in Dr. Layzer's study, based on a deaf student's poem. Repetitions of each word, generated by Fortran programming, unfold on the viewing screen. The sentence reads, "I'm going to cry."

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SOURCE PASSAGE	WRITING TASK	RESPONSES

I can't wait for spring
    to come here
My hair will grow more
    but in winter, my
hair always gets short
    I really detest it.
Help I in the summer time,
    someone cuts my hair off
I'm going to cry.
Kind people put some water
    on my hair,
My hair is getting a lovely color
I had a marvelous time
    with my hair,
but I don't have a body.
I'm happy all my life

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My father fishing from
    the cliffs above the sea
Far out he hurls his line ;
    I hear it hiss and swoop.
As I watch it fall, think
    I hear (but can't) the slap
Of the sinker as
    it hits the water far below.

Or I am bending
    over transparent shallows,
Where small fish swim and
    flowerlike sea-urchins bloom.
And there are volutes and
    conches ; but each is a home
Hermit crabs inhabit
    the desirable shells.

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The voices of children
    are light upon the sand
Where the wave posting letters
    of pebble and weed
With a destroying sigh
    wheels back to its huge bed
And winds in its rumour
    all the noises of the land

WRITING TASK

Imagine you are
grass or leaves
or part of nature
and tell more
about what happens
to you.

Perhaps you too
were once near the
sea or a lake. Tell
what happened to you
or what *could* have
happened to you.

(Some fragmentary back-
ground on David Wright is
given)
From this poem what do
you think David Wright's
feelings about his
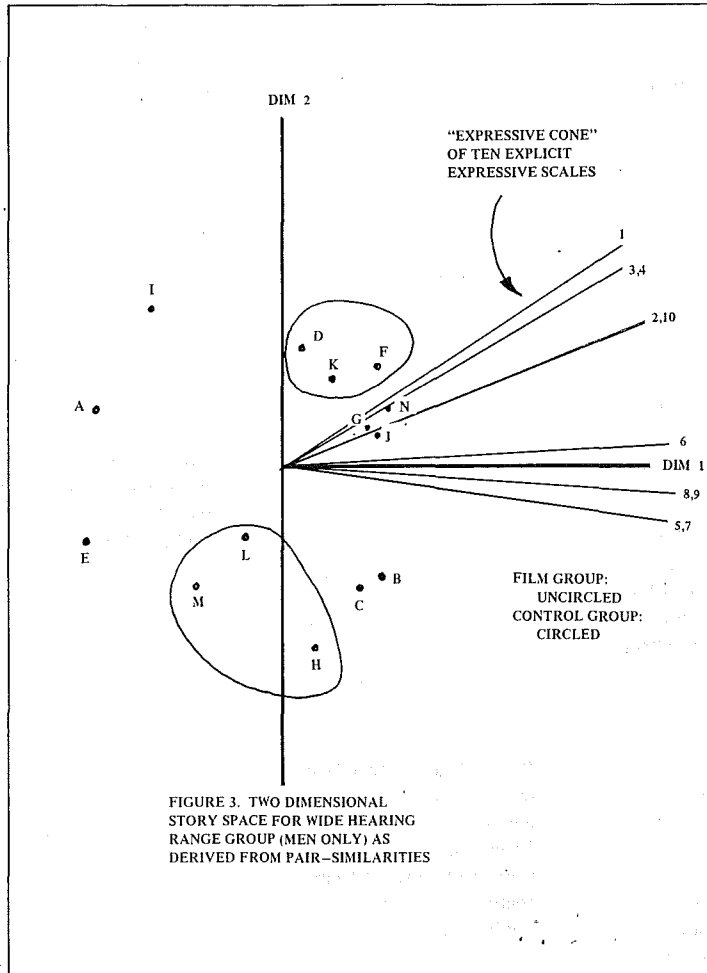deafness are.

RESPONSES

I couldn't imagine or feeling of grass
and leaves. I have no feeling for a
poems. Because I don't understand the
poem itself. But as my imagine of
grass. It seems like I am the grass
as I am in nature.

I never went for fishing. I never heard
anything the sounds he had before he
was deaf. I couldn't express my
feeling about fishing. I dislike fishing

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When later visited
   by unbudging deafness
That accident I turned
   into a destiny
I saw all movement
   vibrate fantastically
Till I could not hear
   my silence for its loudness

David trys to show his feeling of
hearing before he become deaf. As he
trys to remember the sounds of the
sea then also tell how his deafness
become. The poem sounds like that
he wrote was as if he wish he
never become deaf. I understood
how he feels of wishing to continue
to be hearing. Sounds like if he
was lost after becoming deaf because
he only remember the sounds.

FIGURE 2.
WRITING SEQUENCE
FOR AN INDIVIDUAL

FIGURE 3. TWO DIMENSIONAL
STORY SPACE FOR WIDE HEARING
RANGE GROUP (MEN ONLY) AS
DERIVED FROM PAIR–SIMILARITIES

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G—7   Someday I know that
            I will face the day
            my hair falls out
        but I will look forward to
        the springtime and
            always remember
                the lovely
                color

H—8   People always are changeable.
        Sometimes they put me down and
        sometimes they flatter or build my
        confidence. The keyword to this
        statement is jealousy.
            Maybe the grass wants to be long.
        Who determines the fact that the
        grass' good quality is to be neat
        and short. This is only what the
        people's values are.

I—9   DIE OUT. AFTER WINTER,
        START A NEW LIFE

J—10   Grass gives comfort and tickles the
        soles of the feet as people walk by.
        Leaves laugh and gently sway and
        fall to the ground below ; to their death
        and turn brown. Dead leaves turn
        savage and blow in the wind. They whip
        past happy faces and crumble into
        dust and are forgotten.

K—11   In the fall
        I loose my hair
        in preparation
        for the long winter sleep.

FIGURE 4.
SOME ACTUAL STORIES
IN THE STORY SPACE

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