MAXIMIZING INPUT TO THE APHASIC PATIENT: A REVIEW OF RESEARCH

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A dozen years ago Hildred Schuell drew upon her experience as a working clinician and stated her convictions about what it takes to help an aphasic patient. She said, "It is our basic premise that an aphasic patient is aphasic because there is a lesion in his brain that interferes with processing of verbal messages. . . . The clinical evidence in aphasia indicates that the language storage system is at least relatively intact . . . but the integrity of previously stored patterns is not a sufficient condition for complex discriminatory and selective behavior . . . Converging evidence from many lines of research indicates that repeated sensory stimulation is essential for organization, storage, and retrieval of patterns in the brain, and it would be strange if language patterns operated according to some other principle.

"It would seem that sensory stimulation is the only method we have for making complex events happen in the brain . . . . the first principle of treatment for aphasia should be the use of intensive auditory stimulation, although not necessarily stimulation through auditory channels alone." Her second principle was that of the adequate stimulus. "We must insure that the stimuli we use get into the brain" (38, pp. 336-339).

Thus Schuell encapsulated what we must do to help the aphasic patient. She went on to spell out some of the things we ought and ought not to do: not to talk too fast; to use meaningful rather than non-meaningful stimuli; to use high frequency rather than low frequency words; to control the length of the stimulus, essentially, to make it shorter; perhaps to increase the loudness of the auditory signal until an optimal level is found; and perhaps to manipulate the duration of an auditory stimulus. Her suggestions grew out of her clinical experience, and it was rich indeed.

What we propose to do today is review what has been learned in recent years about getting the stimuli into the patient's brain. How do we maximize input to the aphasic patient?

I have tried to review the research literature in aphasia and related areas published during the last 20 years. (I have examined The Journal of Speech and Hearing Disorders, The Journal of Speech and Hearing Research, Cortex, The British Journal of Disorders of Communication, Brain and Language, Brain, Neurology, and other possible sources of information.) I have abstracted three kinds of information: first, I have covered all of the reports of experimental procedures applied to the issue of facilitating input to the patient. Second, I have included reports made by patients either in their own writings or in published interviews of groups of aphasic patients concerning their problems and their treatment. Third, I have included one or two non-experimental and non-patient generated reports which have come from people who have worked with patients over a period of years and who, like Schuell, have drawn on their clinical experience to present certain generalizations. I will group the outcomes of this search into eight

categories: characteristics of the stimulus and the setting in which it is presented, aspects of load, the role of context, certain aspects of timing, the schedule of stimuli presentation and reinforcement; matters of attitude; and the content of the therapy itself.

As you of course know, there are many ways to measure whether one is succeeding in getting a stimulus into the brain. Sometimes we measure recognition and comprehension as demonstrated by a matching or pointing response, at other times by a verbal response such as naming, completing a sentence, or producing a sentence. I have not confined my scrutiny to any particular mode of input or response. I have tried to take a look at everything that has been said about everything that we do to provide input to the brain.

Characteristics of the Stimulus

First we will consider some characteristics of the stimulus. Goodglass (22) in his analysis of the grammar of aphasic patients has developed an interesting construct that perhaps sets the keynote for this section: the notion of saliency. Saliency he defines as "the psychologic resultant of the stress, the informational significance, the phonological prominence, and the affective value of a word." The data appear to indicate that the patient's comprehension of language and more especially the patient's fluency in initiating language depend upon the saliency of words; the patient apparently needs a salient word in order to initiate speech; when he is asked to repeat phrases, some opening with non-salient function words and some with salient substantive words, he has more trouble initiating phrases with the former than with the latter. The implication is that in therapy we might help the patient initiate speech by making it easy for him to get hold of a salient word. Repetition is easier if sentences are constructed so as to allow a quick clutching of this salient word. Saliency appears to be a germinal notion which can help us think about several aspects of the stimulus.

The redundancy of the stimulus seems to be related to saliency. Gardner, Albert, and Weintraub (21) studied a group of 46 patients' comprehension of words, the patient pointing to pictures in response to each of five different conditions of presentation: the presentation of the word alone at normal speed (cat), incorporation of the word into a neutral sentence spoken at normal speed (You see a cat that is nice), incorporation of the word into such a neutral sentence spoken slowly, incorporation of the word into a sentence containing a related word, a redundant element (You see a cat that is furry), and incorporation of the word into a sentence containing a final unlikely word, "counter-redundant," calculated to impede comprehension (You see a cat that is sour). The patients performed markedly better when the word was spoken in isolation (one can't make a stimulus much more salient than that), or when a semantically "supporting" word was included in the sentence, or when the utterance was spoken slowly. The investigators suggested that in therapy one might adopt a sequence such as the following: "begin with the word alone, move next to the word in a slowly enunciated, semantically redundant utterance, then gradually eliminate redundant semantic cues and increase the rate of speaking."

Redundancy has been studied with reference to visual stimuli as well. Bisiach (8) studied naming in nine aphasic patients using pictures of what he called "decreasing perceptual redundancy": realistic pictures of objects, outline drawings of the same objects, and so-called mutilated drawings which were outline drawings interrupted by superimposed jagged or curved lines. The

patients did best in naming the realistic pictures. Bisiach suggested that naming difficulty varies with the amount of information transmitted through the visual channel. To him realistic pictures are more redundant, outline drawings contain information coded in a more economical manner, and mutilated drawings contain such economically coded information further disturbed by the superimposition of distracting foreign graphic elements. Anything done to reduce the redundancy or to change the signal-to-noise ratio leads to more trouble in naming.

Does it follow that objects are better stimuli than drawings because of increased redundancy? Benton, Smith, and Lang (4) compared the naming performance of 18 aphasic patients in response to the presentation of objects, large line drawings, and small line drawings. Their patients recognized the pictures all right, but the objects seemed to these investigators to carry more "redundant information which facilitated retrieval of the name, possibly by arousing a larger number of associations." They discussed and further developed some ideas advanced earlier by Goodglass and Kaplan: the cluster of associations engendered by the perception of an object may be considered to constitute the "concept of the object," and it is this concept that activates the speech processes of the aphasic patient. At certain critical levels (for instance, words of low frequency or in the case of a more severe naming deficit) the weaker concept produced by a two-dimensional representation may fail to effect retrieval of a name while a stronger concept produced by the three-dimensional object is successful. Even though they found a significant difference between naming of objects and naming of small line drawings, they felt that the difference was too small to be of much importance clinically.

Some further research done in a series of studies at the University of Wisconsin indicates that the difference is even less real than Benton et al. suggested. Stoler (46) compared life-size photographs with reduced-size photographs and found no difference in the effect on aphasic patients; he also compared naming of objects with naming of photographs of the same objects and again found no difference. Christenson (16) compared naming and recognition performance of aphasic patients as follows: he compared an uncluttered stimulus (a photo on a black background) with a cluttered stimulus (the same photo with five to nine other photos surrounding it) and found no difference; he also compared presentation of objects in isolation on a neutral background with in-use presentation of the same objects being worn or manipulated in some meaningful way; again no significant difference was found between these two methods of presentation. Finally Corlew and Nation (17) studied the naming performance of 14 aphasic patients using the ten items from the PICA presented in one condition as objects, in the second condition as reduced-size uncolored line drawings. They reported no differences between objects and pictures either on initial confrontation naming or on spontaneous self-correction of initial responses.

We see, then, that the data are not in agreement, but they seem to indicate that the stimuli yield relatively unimportant differences. One might, however, play safe and use the more realistic, more redundant stimulus material in preference to something more abstract or removed from everyday life and usage.

At least one author, apparently herself an aphasic patient (33), has suggested the use of color to increase the saliency of the stimulus. She has suggested that in some of the boring work in aphasia therapy the clinician may find that visual materials printed in a variety of colors rather than simply black on white can heighten and maintain the attention of the patient. Apparently she herself found the use of color stimulating and attention-holding. Rolnick and Hoops (37) also report that patients are bothered by visual presentation of words and sentence stimuli in excessively small print. Even if their patients didn't have identified visual field defects, most of them wanted larger print.

Will using alternative modalities help? If it is naming we are interested in, we should note that apparently the modality used for presenting the stimulus does not significantly affect the performance of the patient. Goodglass, Barton, and Kaplan (23) studied the performance of 27 aphasic patients on the tactile naming of objects, the naming of objects where the patient only heard their characteristic sound (auditory naming), and the naming of objects where the patients only smelled their characteristic odor (olfactory naming). When they compared the performance of the patients on visual naming with these three other types of naming, they found no significant differences. With few exceptions the naming scores of the aphasic patients were less than one standard deviation apart in all of the modalities, leading the investigators to conclude that a modality non-specific process intervenes between stimulus presentation and naming.

For a while we thought that we might really be onto something that would improve the expressive performance of aphasic patients, namely, the use of an intense auditory masking noise during the presentation of materials to elicit speech performance. First Birch and Lee (7) and then Birch (6) reported improved performance on the part of 10 of 14 aphasic patients when a 60 dB 256 Hz tone was presented binaurally while they were performing naming and reading tasks. However, Weinstein (55) failed to confirm this finding; he found that this sort of simultaneous stimulus led to poorer performance in some patients; 10 of 18 patients did better in quiet than they did with noise. Schuell also reported having tried this out and having found it not helpful, indeed sometimes hurtful (38, p. 340). Finally Wertz and Porch (58) administered six tests from the Eisenson battery to 15 aphasic patients while simultaneously presenting a saw-tooth noise at a level 70 dB above the patients' threshold for a 500 Hz tone. They reported that the patients were correct on 68% of the tasks in quiet and 66% of the tasks during noise, a non-significant difference. The performance of the patients was quite variable on the various tests so they were unable to generalize concerning the effect of masking noise. They did find that latency of response was significantly shorter in the noise condition.

Perhaps the performance of patients with this kind of noise depends upon the nature of their auditory problems. Stanton (44) has reported that delayed auditory feedback had a beneficial effect on the performance of aphasic patients with significant auditory input problems but a negative effect on patients whose trouble is "exclusively" in verbal output. In another study Siegenthaler and Goldstein (42) found that aphasic patients generally perform with reduced efficiency when there is background noise. They studied both auditory and visual figure-background perception in 30 adult aphasic patients. The auditory performance involved response to auditory signals buried in a noisy background (a continuous babble of a male voice recorded seven times on top of each other and played backward); visual perception was tested with a hidden figure test. On both tests the patients showed a generally lowered perceptual performance in comparison with normals. Performances on the two tests were not related, indicating that the two sense modalities operate independently. The point for us is that whatever the modality, background noise apparently reduces the efficiency of the patient's performance.

Patients tell us the same thing. Skelly (43) has reported the results of interviewing 50 aphasic patients and Rolnick and Hoops (37) have reported interviews with six other patients. The aphasic patients they talked to commented on the destructiveness of noise on their performance. Some patients indicated that they could not follow T.V. programs unless they were alone, and they couldn't do their homework if there were people around talking. Patients tell us that competing signals interfere with auditory and visual reception.

Finally, Albert and Bear (1) report that in intensive work with one word-deaf patient his performance on sentence and digit comprehension improved when he could see the speaker's lips. Studying a group of severely impaired aphasic patients Green and Boller (24) found that patients' responses to various kinds of questions were not significantly different whether the speaker was behind the patient or in front of him, but performance was somewhat better when the speaker was in front. Perhaps their most interesting finding was that the voice channel has a significant influence: when stimuli were presented by a live speaker, patients made more correct and more appropriate responses than when the presentation was via tape recording; this difference was statistically significant and held up with regard to both front and behind presentation and on all kinds of sentence stimuli. They reported that on tape recorded presentation patients often imitated the stimulus rather than responding meaningfully to it.

In summary, we want to make our stimuli as salient, prominent, unambiguous, and clear as possible. Auditory stimuli can be increased in saliency by the isolated presentation of the word signal, or in combination with other related words that add redundancy to the signal. Presentation of the auditory stimulus by the live clinician is to be preferred to presentation by tape recording; visibility of his mouth as he faces the patient is helpful. Visual stimulation is perhaps slightly enhanced by use of real objects rather than abstractions of them, that is, drawings, especially small drawings, and color in visual materials may heighten interest and better hold attention. In all modalities the more prominent the signal and the lower the background noise level, the better.

Syntactic and Semantic Complexity

A good many research reports indicate that in their expressive performance aphasic patients use words of higher frequency and reduce their use of less frequent words in the language; the sentences they produce tend to be simpler than those of non-aphasic patients. With regard to input we find similarly that patients respond differentially to stimuli which vary in syntactic and semantic complexity. A series of studies (2, 29, 30) have shown that as the syntax of stimulus sentences increases in complexity, the performance in response to these sentences by aphasic patients is impaired in terms of both speed and comprehension. The comprehension of visually presented sentences is faster and more accurate for active declarative sentences than for passive, negative, or passive-negative sentences.

Shewan and Canter (40) further tested this out by presenting to 27 aphasic patients sentences representing various levels of length, vocabulary difficulty, and syntactic complexity. The effect of syntactic complexity was tested by using sentences which included simple active declarative; a single transformation, either negative or passive; and two transformations, both negative and passive. The patients performed significantly more poorly than a group of normals and the investigators reported that syntactic complexity constituted the most difficult parameter; increments in this parameter led to more impaired performance than increments in either length or vocabulary difficulty.

Lasky, Weidner, and Johnson (28) reported that their 15 aphasic patients demonstrated better comprehension of sentences presenting active affirmative than negative constructions and did better with passive affirmative sentences than with active negative sentences. In a related study Weidner and Lasky (50) found that when 20 patients were asked to answer yes-no questions, follow directions, or repeat sentences of increasing length, errors increased as sentences increased in length and grammatical complexity.

Green and Boller (24) found that the form in which a test item is presented affects the patient's response. The 16 patients they studied did better in responding to yes-no questions (Are you wearing a necktie? Can you light a fire with wet matches?) than they did to information questions (How is your eyesight? Where were you born?). They also varied the directness of the wording, using directly worded instructions (Point to the ceiling) and indirectly worded commands (I would like you to point to the ceiling). They also included a condition where the directly worded item was preceded by an introductory sentence (Here's something: point to the ceiling; Tell me something: do you have any trouble walking?). The patients did not perform significantly differently on these three conditions when only correct responses were counted, but when a different measure of response was used, namely the general appropriateness of response to the stimulus, the more direct wording or the presentation of the stimulus accompanied by an introductory sentence enhanced the response.

With regard to the words used in auditory stimuli, Siegel (41) found that aphasic patients made more errors on adjectives than on verbs or nouns, more errors on long than on short words, and more errors on words of high abstraction level. Although Siegel did not study word frequency thoroughly, he found more errors on the more infrequent than on frequent words. Weigel-Crump and Koenigsknecht (51) experimentally applied the principles preached by Schuell with regard to auditory stimulation of aphasic patients. One of the features of the words they stimulated their patients with singly and in sentences was the frequency of the words in the language; they used more frequent words as well as shorter stimulus units and a slow rate of presentation. Their results indicate that the kind of therapy advocated by Schuell works, the patients improving significantly in percent of correct responses on a naming task after periods of intensive therapy.

In summary, to get through to the patient most surely, we should use frequently occurring words, avoiding also those of high abstraction level. The instructions we give and the stimulus sentences we use for practice should be syntactically simple, not involving multiple transformations, expressing their point directly rather than indirectly.

Avoiding Auditory Overload

The amount of information presented to the patient at one time appears to influence his comprehension significantly. We are well familiar with the use of the Token Test for revealing minimal degrees of aphasia; as we progress from Part I, where the patient must process two bits of information, to Part IV, where he must process six bits of information, we see increasing deterioration of performance. A number of studies present experimental verification of the fact that as stimuli increase in length, performance is increasingly impaired in aphasic patients.

Some of the studies already alluded to (with regard to syntactic and semantic complexity of the stimuli) have dealt with the matter of load as well. Weidner and Lasky (50) used four auditory subtests from the Minnesota Test for Differential Diagnosis of Aphasia (identifying two and three pictures in sequence, answering yes-no sentences read to them, following oral directions, and repeating sentences of increasing length); their 20 patients demonstrated more errors as the sentences in the various subtests increased in length (as well as in grammatical complexity). Shewan and Canter (40) included among their control parameters the factor of sentence length, defined in terms of

the number of critical items and the number of syllables involved in each sentence. Length was detrimental to the performance of their 27 aphasic patients although it was less detrimental than syntactic complexity. We have also mentioned that Weigel-Crump and Koenigsknecht (51) controlled for length of stimulus in their experimental verification of the efficacy of Schuell-type stimulation therapy; they used short stimulus units, controlling as well for frequency of words and rate of presentation; they found that when materials were planned in this way patients improved.

In their interviews of aphasic patients, both Skelly (43) and Rolnick and Hoops (37) found their patients offering advice about the length of sentences people should use. Rolnick and Hoops' patients asked speakers to use short sentences. "If you say a long sentence, a lot of times I forget it from the beginning." Skelly's patients warned against speakers asking too many questions at once; a second question or a too-quick repetition of the first may interfere with the patient's processing of a given question. Her advice, "Reduce the barrage, and ask one question at a time."

Further, Holland and Sonderman (27) suggest that perhaps it is input overload that makes it impossible for aphasic patients to make very good use of explanations of their errors which we may offer in an attempt to help them avoid them. They report that their subjects did not appear to benefit from auditory analysis of incorrect responses on tasks similar to those in the Token Test. Instead of listening to the explanation they usually went ahead and made some other response. "Since impaired comprehension prevented the correct response initially, a longer auditory chain, that is, the explanations of the error, probably confused rather than aided the subject in making the correct selection."

In summary, we should limit the number of bits of information the aphasic patient must process by controlling length of unit and reducing the number of units presented at once. Reduce the load. Reduce the barrage.

The Role of Context

Can we help the patient understand what we present to him by providing pre-stimulation or additional stimulation simultaneously with the target stimulus? Can we find something that will help "tune the patient in" to the task? If he fails to understand or perform, can we help his future performance by prompting him following a failure? All of these are issues that have been dealt with by some investigators.

We have mentioned Green and Boller's (24) finding that patients comprehended and performed better when the stimulus sentences were preceded by an introductory alerter like "Tell me something" or "Here's something."

Barton, Maruszewski, and Urrea (3) asked 48 patients to name 25 one-syllable nouns in different ways: naming pictures, coming up with the name at the end of an open-ended sentence (You cut with a _____), or describing the item represented by the noun and asking the patient to name what was described. Performance was facilitated by the open-ended sentence. Naming the picture was the next easiest task, and naming to description was the hardest. The investigators concluded that naming performance was task-related as well as dependent upon the characteristics of a patient's particular disturbance.

Wiig and Globus (59) took a somewhat different tack in asking 11 patients to name 20 picturable nouns. They used four conditions: in one the target word was accompanied by a clue word of high association strength (as based on Michigan Word Association Norms) and of logical semantic relationship (representing the name of the category to which the target word belonged, that is: superordinate; representing a member of a category, which category the target word represented, subordinate; or similar, as "car" is similar to the target word "auto." In another condition the clue word was of high association strength but of infra-logical relationship based upon such things as location, part of the whole, or some preceding response. In a third condition the clue word was of low association strength and logical semantic relationship, while in the fourth condition the clue word was of low association strength and infra-logical semantic relationship. The results are a bit complicated to review; I will only report that there was a pattern of progressive facilitation from words of low association value but logical semantic relationship, to words of low association value and infra-logical semantic relationship, to words of high association value and infra-logical relationship, to words of high association value and logical semantic relationship. Briefly, we conclude that accompanying words of high association strength which are logically related to the target words facilitate retrieval and encoding of target words.

Weigl (52, 53) has developed an approach in therapy called "deblocking" which is based on the factor of context. He says the performance of a patient can be facilitated in a modality in which he is having trouble by earlier presenting him a stimulus through a modality in which he is not having trouble. For example, if the patient is having trouble with auditory recognition, he may be helped in his recognition of a given word by having pre-stimulation with the same stimulus through the visual channel. Or if the patient is having trouble naming words, he may be helped by simply hearing the words at some prior time. Weigl and Bierwisch (54) have proposed that the patient doesn't even need to hear the target word at a prior time; he may be helped if he simply hears some related word that will lead him toward the appropriate semantic field in his search through the lexicon.

In a sort of development of Weigl's ideas, McDearmon and Potter (32) have recently suggested the clinical use of certain kinds of prompting materials,what they call representational prompts of symbolic or realistic nature which can facilitate patient's responses in naming, reading, or matching. By symbolic prompts they mean such things as the written word, the printed word, or the spoken word, while realistic prompts include such things as real objects, miniature objects, models, photographs, drawings, tactile sensations, odors, and tastes, as well as demonstrations of the use of objects. They have suggested the simultaneous presentation of stimuli in two modalities, gradually fading the prompt stimulus. So one might use visual words to assist the patient in naming of pictures, or visual words to help him match pictures to objects; one might use writing by the clinician or by the patient to assist the patient in naming pictures, or one might use oral gestures (as in lip reading) to help the patient name. They present no data showing how their patients have responded to such prompts, but they assert that they increase informational redundancy and may evoke responses not elicited by fewer stimuli.

Podraza (36) has recently tested out some of these notions. She tested the relative effectiveness of five conditions of picture naming

with five aphasic patients. The basic condition involved presentation of a picture with no pre-stimulation. The second condition involved presentation of the picture together with pre-stimulation of the initial phoneme plus schwa; the third condition involved pre-stimulation with an open-ended sentence of the kind used by Barton et al.; the fourth condition involved pre-stimulation with the target word together with two foils completely unrelated to the target word semantically or phonologically (e.g., fish, shade, cheese); and the fifth condition involved pre-stimulation with three words all semantically related to the word represented by the picture to be named (e.g., watch: time, wrist, clock). Podraza had found that normals did best with open-ended sentences, next best on pre-stimulation with the target word accompanied by two unrelated foils, and least well on pre-stimulation with the initial phoneme of the target word. But the pattern of performance was quite different with aphasic patients. Their performance in naming was facilitated to about an equal degree by pre-stimulation with the initial phoneme, an open-ended sentence, and the target word accompanied by two unrelated foils. No particular hierarchy of improvement emerged within these conditions. The patients' performance was not facilitated by the prior hearing of three semantically related words.

Finally we should mention the study of Brookshire (13) on the effect of prompting on the spontaneous naming of pictures by 10 aphasic subjects. He provided patients with many presentations of target pictures and every time they failed to name a target picture the examiner said the name and the subject repeated it. Brookshire found that spontaneous naming of the training pictures was slightly but not significantly improved by prompting. Prompting did not move patients from poor performance in early sessions to errorless or nearly errorless performance in the final session, and performance on probe words which were never prompted was often as good as or better than performance on training pictures which were prompted. He concluded that prompting has a slight facilitating effect on spontaneous naming of items presented under prompting conditions but that these effects do not generalize to unprompted items. He concluded that prolonged use of prompting procedures is not an efficient or effective way to ameliorate naming deficits.

We have a study in progress (Waller) in which we are endeavoring to determine whether presenting the patient with preliminary information about the paragraphs he is to hear or the sentences he is to respond to will facilitate his retention of the material in those paragraphs and sentences and help him to carry out commands, answer yes-no questions, or recall details of the paragraphs. We believe that providing context should help the patient's comprehension; it is a tricky matter to test experimentally in order to be sure that it is the contextual material that facilitates comprehension, retention, and recall or whether it is something else.

In summary, alerting statements and clues provided by open-ended sentences and the initial phoneme of target words probably facilitate patients' comprehension and response. Simultaneous stimulation or pre-stimulation with highly associated words and so-called representational prompts in other modalities may facilitate performance, but we lack strong experimental verification of the efficacy of such deblocking procedures. Simply prompting the patient with the target word when he fails to evoke it is not an efficient therapy technique.

Variations in the Time Dimension

Our patients tell us that they need more processing time in order to grasp what is going on and to respond appropriately. The patients interviewed by Rolnick and Hoops (37) urged that speakers talk more slowly. One complained, "It moved too fast for me to know what you meant." Their comments do not make it clear whether what they want is to have the speaker draw the words out or increase the intervals between words or perhaps use some special kind of phrasing. Skelly's (43) patients thought they would have understood what the speakers said to them better if they had spoken more slowly. They also indicated that they needed more time to prepare and produce responses. Having to hurry was like having sand thrown in their gears.

We have several experimental investigations which confirm the impressions of the aphasic patients in performing many kinds of language tasks--naming pictures, answering questions, following instructions, making same-different judgments about syllable pairs, identifying items as belonging or not belonging to a series, and repeating digits and sentences. Let's look at a dozen of these studies in chronological order.

Ebbin and Edwards (18) tested 24 aphasic subjects on a speech sound discrimination task. Subjects were presented 25 syllable pairs separated by no time delay or an interval of 200 msec. Same-different judgments were improved when the time interval between the members of the pairs was increased, more with some patients than with others. The investigators suggested that clinicians would do well to detect just how interval-sensitive their patients are.

Parkhurst (34) compared the responses of aphasic and non-aphasic subjects to spoken commands of varied length and complexity where the rate was manipulated by electronically compressing or expanding the speech signal by 35%. The aphasic subjects performed significantly more poorly in the compressed speech condition for all types of sentences. Some subjects improved in the expanded condition on longer, more difficult sentences.

Swinney and Taylor (47) presented eight aphasic subjects and matched normal subjects with 2, 4, and 6-digit strings followed by a single digit and recorded the latency of the subjects in stating whether the single digit was in or out of the original list. The aphasic patients had an error rate 20 times that of the normals, mainly because of two patients who performed extremely poorly. When their data were eliminated, the remaining six patients still presented three times as many errors as the normals. The latencies were greater for the aphasic patients than for the normals and, like the normals, greater for the longer series of digits. The investigators concluded that aphasic subjects conduct a slow search of memory, quantitatively different from that of normals, and different, too, in that it is a self-terminating serach, not exhaustive as in the case of normals.

Brookshire (11) asked six aphasic subjects to name pictures or read words projected on a screen. In one experiment the stimuli were exposed for 3, 5, 10, or 30 seconds, or at a rate determined by the subjects. He found gradual improvement in naming as the exposure time grew longer. The subject-paced condition resulted in the highest rate of correct responses per unit of time. Brookshire found a rapid gain in improvement between the 3- and the 5-second exposures and less of a gain between 5 and 30 seconds. He recommended a 5-second interval as optimal. In a second experiment the stimuli were exposed for three seconds, but exposures were

spaced by intervals of 0, 3, 5, 10, or 30 seconds. Brookshire found little difference between the 0, 3, 5, or 10-second intervals but a significant increment in correct responding at a 30-second inter-trial interval. The effects of increasing inter-trial time were much less than those of increasing exposure time. In two other experiments Brookshire found that his patients performed better in conditions of only 10- and 30-second exposure than they did in the experiment in which they also had exposures of 3 and 5 seconds. It was apparent that the short exposures introduced stress which interfered with performance, and this interference was not confined to the short exposure condition but persisted into longer exposure conditions.

Weigel-Crump and Koenigsknecht (51) in their experimental verification of the efficacy of Schuell-type therapy did all of their presentations at a slow rate, and they reported that therapy led to gains in naming performance which increased steadily as more sessions were held, with generalization as well to items not drilled on in therapy.

Sheehan, Aseltine, and Edwards (39) studied the responses of 30 patients to questions on 14 different kinds of language tests in which the stimuli were presented in three conditions: in one condition they interpolated 150 msec. between each pair of phonemes in words; in a second condition they inserted the same amount of cumulative time between words, thus producing slower speech, and in a third condition they used normal speech rate. They reported that only their younger patients, those under 50, improved, and their improvement was only in the first condition, the interpolated silences condition, where the spacing was between phonemes rather than between words. They stated, "A possible explanation (of why slower speech didn't help) is that when the original master tapes were generated a great deal of care was taken to insure clear, unslurred, uncluttered speech. It is possible that speaking slowly cannot improve on such speech." They felt that the interpolated silences condition perhaps helped the patients perceive the correct sequence of phonemes (a task that Efron (19) found difficult for aphasic patients) and thus led to their understanding the words better.

Albert and Bear (1) working with their single patient with word deafness found that sentence and digit comprehension improved markedly at rates reduced to 1/3 or less of normal. He did better when digits were presented with 3-second than with 1-second intervals, and his understanding of sentences was much better at a rate of 45 words per minute than at 150 words per minute.

Liles and Brookshire (31) studied the performance of 20 aphasic patients on a modified version of the Token Test where they inserted 5-second pauses at various points within some of the spoken commands. Insertion of pauses generally resulted in substantial improvement in ability to carry out commands. They compared presentation with pauses with a standard condition without pauses. On Parts II and III of the Token Test, where patients must process three and four bits of information respectively, differences between the pause and non-pause conditions were significant. In Part III, where the patient must process four bits of information, the placement of the pauses turned out to be rather important; if the pause was presented early, it helped; if late, it didn't. It appeared that something like this was happening: the patient could retain perhaps only a couple of items in immediate memory; pauses were effective when they broke strings of three or more bits into strings of two or fewer. Pauses which left strings of three or more intact

didn't help. On Part V of the Token Test Liles and Brookshire did not obtain a significant difference between the pause and non-pause conditions. This part of the Token Test is linguistically different from the rest and requires processing, as they say, of both referential and relational information. Luria has indicated that pauses do not help the patient deal with relational information which he doesn't understand in the first place. Apparently in the Liles and Brookshire study we have a demonstration of the fact that pauses help the patient deal with lexical items but not with the grammatical components of sentences.

We have already mentioned the study by Gardner, Albert, and Weintraub (21) of the recognition by 46 aphasic patients of words presented alone, incorporated into neutral sentences, incorporated into sentences containing related words, and incorporated into sentences containing counter-redundant words. They varied the rate at which these materials were presented. Patients performed markedly better when the utterances were spoken slowly. They performed poorly on the condition where a neutral sentence was spoken at normal speed but much better when the same sentence was spoken slowly.

Lasky, Weidner, and Johnson (28) presented sentences to 15 aphasic patients in different time conditions: at 150 words per minute with 1-second interphrase pause time, at 150 words per minute without pauses, at 120 words per minute with 1-second interphrase pause time, and at 120 words per minute without pauses. They inserted pauses between the boundaries of the major constituents of the sentences, for example, The boy / is hitting / the girl, and The dog / is chased / by the cat. The patients understood the stimuli better when the sentences were presented at slower than normal rate; the addition of interphrase pauses further aided comprehension; and combining slower rate of presentation and interphrase pauses produced the greatest improvement in comprehension. They found no significant interactions between syntactic complexity, rate, and interphrase pause time, but apparently there was an additive effect. Their advice to clinicians is to slow the input, insert pauses, and at the same time simplify the syntax.

This as yet unpublished study was an extension of a study by Weidner and Lasky (50) in which they presented 20 aphasic patients with four auditory subtests from the Minnesota Test for Differential Diagnosis of Aphasia; identifying two or three pictures named, answering yes-no to sentences read to them, following directions, and repeating sentences of increasing length. The original stimuli were recorded at a rate of 120 words per minute, then were slowed to 110 words per minute or accelerated to 150 words per minute. Performances at these two rates were compared. The patients who scored below the 50th percentile on the PICA did somewhat better on all four tests at the slower rate, and patients who scored above the 50th percentile improved even more.

Cermak and Moreines (15) studied five different groups of patients--aphasic patients, alcoholic Korsakoffs', non-dominant hemisphere patients, alcoholics, and controls--comparing their performance on tasks involving the detection of repeated letters, repeated words, rhyming words, and words from the same category during the reading of a word list. The number of intervening words between the repeated items had a greater effect on the aphasic patients than it did on the other four groups, but when the rate of presentation was slowed, the aphasic patients showed considerable improvement while the others maintained the same level of performance.

We conclude this section with a reminder that Wepman (56) has advised us as clinicians to note how long it takes for a patient to integrate a

given stimulus. The patient receives the stimulus with his "shutter" open; as he is preoccupied with dealing with it his shutter is closed to other stimuli. Wepman advises us then to plan therapy according to the rate of shutter openings which the patient displays. Therapy should serve to reduce the time between shutter openings.

In summary, we maximize auditory input by speaking slowly, slowing our overall rate, pausing at appropriate intervals to reduce the number of bits of information the patient must retain at one time, and also reducing the rate of phoneme production by prolonging words. In presenting visual stimuli we should extend the exposure time and also extend the intervals between exposures. And we must allow more than average time for response to all stimuli, auditory and visual.

Scheduling of Stimuli Presentation

A number of studies tell us how we ought to set up a program of therapy and how stimuli within therapy sessions might best be scheduled. Many clinicians have concluded from their experience that the more intensive the therapy, the better. Pizzamiglio and Roberts (35) present data derived from teaching 20 aphasic patients some writing tasks. The patients had to supply the final word in sentences or name pictures, using an automated language retrieval unit and typing in the answers. One group was worked with daily, a second group on alternate days. The group having daily sessions made faster progress than those having less frequent sessions. The idea of massing therapy sessions is not new, but these investigators demonstrated that there is indeed payoff in it.

We have made several allusions earlier to the report by Weigel-Crump and Koenigsknecht (51). Their study constitutes a kind of experimental verification of the usefulness of the type of therapy program suggested by Schuell. They selected a group of words to be worked on and presented each word ten times in isolation, then in five simple sentences, and then ten more times in isolation. These were frequent words and the sentences were short and presented at a slow rate. Following such stimulation the patients were asked to say the words and supplementary techniques were used to elicit them, including gestures, associated words, synonyms, carrier phrases, and prompting initial phonemes. Every stimulus elicited a response but no response was forced. Eighteen such therapy sessions were carried out, one hour each, two or three a week. After six such sessions the patient's scores rose from 0 to 61% correct responses, after six more sessions to 74%, and after all 18 sessions to 84%; latencies were also decreased. The investigators reported progress not only on the words and categories worked on but on words and categories not worked on. Such generalization demonstrated to them that therapy is a mechanism for improving the general retrieval process and not a setting for teaching vocabulary via rote memorization.

Helmick and Wipplinger (26) went about stimulus repetition therapy with a single patient in a somewhat different way. They stimulated the patient with 15 words in a maximum stimulation condition with 24 consecutive stimulations on odd-numbered days; with another group of 15 words they stimulated the patient in a minimum stimulation condition consisting of only six consecutive stimulations. The words were used in different activities including identification, context cuing, differentiation, tracing and copying. They used a continuous verbal reinforcement schedule. They

found no difference in the results between the minimum and the maximum conditions, but both conditions resulted in improvement in naming. There was also some generalization to words not worked on. They concluded that large amounts of stimulus repetition do not enhance naming skills more than small amounts, but that the application of a systematic stimulation program does enhance naming skills.

We have some information about how to plan the sequence of tasks in therapy. In a study not directly related to language stimulation of aphasic patients, Engmann and Brookshire (20) taught visual discriminations and concluded that the method of presenting stimuli to aphasic patients should proceed from simple to complex. The results of their study suggested that the use of only single stimuli presented successively was wise at the beginning stages of training. Following the successful completion of this stage one might move to simultaneous presentation of two or more stimuli and subsequently move on to successive presentation of two or more stimuli. They felt that this would lead the aphasic patient from a simple to a more complex task and thus minimize the number of trials needed for patients to learn a given task.

A study by Brookshire (12) of nine aphasic subjects on a picture-naming task presented black and white pictures representing nouns three syllables or fewer long all appearing within the first 4,000 words in the Thorndike-Lorge list. Sets of easy-to-name pictures as predetermined for each subject were alternated with sets of predetermined difficult-to-name pictures. Exposure to difficult items interfered with the patient's subsequent ability to name what had been demonstrated to be easy items for him before, and exposure to easy items facilitated the patient's naming of difficult items which followed. In both directions the performances of the patients were better or worse than would have been expected on the basis of the subject's pre-experimental measures. Brookshire explains that placing the patient in a task where he experiences a high proportion of failures may generate emotional responses capable of disrupting his performance. These effects decay slowly over time with gradual recovery of ability to respond. There are clear clinical implications: therapy programs should try to keep error rates low; further, if one is trying to get a picture of a patient's true ability, test procedures should be arranged so as to progress from easy to harder items.

In a later study dealing with non-language stimuli, Brookshire and Lommel (14) made a related finding: brain-damaged patients (both aphasic patients and right-hemisphere damaged patients) usually progressed through the task without incident until they failed a level. Following failure, their performance often was disrupted so that it was necessary to revert to what should have been extremely easy levels of the task before their performance recovered.

The obvious conclusion is that we should schedule input in such a way as to help the patient avoid failure. The study by Cermak and Moreines (15) gives us a further clue as to how to set the stage. You may recall that they had five groups of patients detect the appearance of repeated letters, words, rhyming words, or words from the same category during the reading of a list. The number of intervening words between these repeated words had a greater effect on the aphasic patients in all conditions than it did for other groups. Here again it follows that we should determine what the patient's limits of performance are; then we should schedule therapy tasks in such a way as to operate within these limits and not create unnecessary failure.

What should we do if the patient's progress seems to be stalled on a given task? Brookshire (9) developed some insight in a study of aphasic patients performing a visual discrimination task. We might generalize from his findings, which included the following statement: "If an aphasic patient fails to respond appropriately in early trials of clinical tasks, continued drill without a change in the task is likely to have little value. In this study, performance of non-learners improved only when the conditions were changed by manipulating the discriminative stimuli or by changing the consequences for certain kinds of responses. Consequently, in clinical activities, when a patient fails to respond correctly in early trials on a task clinicians should not continue with extended drill with the same task but should change the task by changing discriminative stimuli, response consequences, or both." Brookshire saw that the patient's behavior is much influenced by initial experiences. Therefore, he suggests that when we start working with a patient in therapy we should study his responses in simple learning tasks before we casually start him at what may be too high a level on more complex speech and language tasks.

Toubbeh (49) offers comments which sound very like Brookshire's. It is not clear whether he is reporting on some of his own work or is reviewing the literature. He discussed how aphasic patients do on learning paired associates (unrelated words), a difficult task for them. He feels that increased practice when a patient has failed is detrimental. Failure has a devastating effect. As the number of errors the patient makes increases, there appears to be a conscious inhibition of all incoming stimuli pertaining to that particular task.

And finally Brookshire (10) has a word for us about the timing of reinforcement. Working with nine aphasic patients on a non-language task, he concluded that "the performance of sizeable numbers of aphasic patients is likely to be adversely affected by even relatively short delays between responses and their consequences, delays which do not affect performance of non-aphasic individuals."

In summary, we see that massed therapy is to be preferred to less intensive therapy. Therapy should provide much repetition of stimulus material, though perhaps the amount of repetition originally recommended by Schuell is not more effective than lesser amounts. Materials should be graduated in difficulty and their presentation planned to maximize success and minimize failure, which tends to disrupt subsequent performance. Reinforcement should not be delayed.

The Importance of Attitude

When we talk to aphasic patients as Skelly (43) and Toubbeh (48) did, we learn that some things clinicians do can be detrimental to patient performance. Skelly's 50 aphasic patients made it clear that clinicians should avoid presenting hints of impatience, such as sighs, tight mouth muscles, shoulder or eye movements, or restless drumming of fingers. The patients are highly aware of such non-verbal communication. They also admit that they are readily daunted by a bellicose or indifferent manner on the part of the clinician. Toubbeh warns us that inattention on the part of a listener can also be devastating to the patient.

Stoicheff (45) presents what are probably the only experimental data available on the subject. Studying three groups of aphasic patients, 14 in each group, she examined the differential effects of encouraging, discouraging, and neutral instructions on word reading and picture naming tasks.

Whereas the three groups, each of which was subjected to a different condition, were matched at the onset of the study on ability to perform the tasks, at the conclusion of three days of exposure those subjected to the discouraging condition performed significantly more poorly than those in the encouraging condition. The patients in the discouraging condition also rated their own performance more poorly than did those in the encouraging condition, and their motivation to participate had obviously been impaired by the condition to which they were subjected. It is interesting to note that the effect of these conditions was accomplished on a group of patients who had been aphasic on the average 12 1/2 months, and their exposure to the conditions was brief. Early experiences of patients may be even more important than those that were explored in this study.

In summary, attitudes of acceptance, patience, encouragement, and optimism facilitate patient performance; input to patients is inhibited by expressions of impatience, hostility, indifference, inattention, and criticism.

The Content of Therapy

Finally we have some observations as to what the content of therapy should be. We are well familiar with the advice that Schuell gave us about working on words using rich repetitious stimulation. Weigel-Crump and Koenigsknecht (51) demonstrated in their study that such stimulation using single words and words in sentences leads to improvement on the part of the patient. But naming practice alone without the drill and stimulation that Weigel-Crump and Koenigsknecht used does not lead to improvement in performance as shown by Brookshire (11). He demonstrated that simple naming practice did not improve naming performance of aphasic subjects.

Some clinicians have strongly advocated that the word level is not the correct level at which to provide stimulation. Beyn and Shokhor-Trotskaya (5) providing abundant stimulation to a group of 25 patients excluded substantive words from their practice, working with words having a predicative character and expressing complete ideas such as "no," "there," "good," "tomorrow," "thanks," and "hello," subsequently moving on to complete sentences. They were able to prevent in their patients a telegraphic style of response characteristic of most motor aphasic patients they had worked with previously. Hatfield (25) reported similar work, concentrating drill on sentences. As her patient emitted phrases and sentences, she took them down and "tailored them into a simple, concise, and correct form to serve as a model for him to read back, copy, or answer questions on." Whereas it was hard to evoke single words from the patient, considerable contextual speech was developed by concentrating on other than the word level. This clinician also strongly advises tying speech work into occupational therapy and other real-life activities observing "His speech is much more fluent than usual because he is engaged in creative activity (basket making) and is therefore mentally relaxed...One could contrast this with the lack of motivation in the situation where the patient is merely asked to name two-dimensional pictures of objects for which he has no immediate need." With other patients this clinician incorporated speech activity with real-life activity such as home redecorating, discussing samples of fabrics, wall-paper choices, and the like. Keeping a diary was the technique used in practicing writing. This clinician stresses "speech in action" and advises working with sentences rather than words, paragraphs rather than sentences, situations rather than paragraphs, wholes rather than parts.

Wepman (57) similarly urges us not to work on names or other specific language activities but rather to emphasize content, ideas, not words. Because the patient displays a paucity of ideas, concreteness, and limited associations, he wants us to stimulate him with and get him talking about things he he interested in. His advice is for indirect rather than direct therapy.

When the patient makes errors what should we do? Shall we correct him? Schuell asserted that this does not help. Brookshire (13) has shown us that simply saying the word for the patient whenever he misses it does not particularly help. Such prompting has only slight facilitating effect on the spontaneous naming of items presented under prompting conditions and these effects don't generalize to unprompted items.

Tikofsky and Reynolds (48) suggest that if the patient is making many errors of perseveration, it may be useful to point this particular type of error out to him. In a study of non-verbal learning (Wisconsin Card Sorting Task) they discovered that unless perseveration errors are specifically pointed out to the patient, they will tend to persist. It is conceivable that pointing out this kind of error may be useful and lead to improvement in level of performance. Holland and Sonderman (27) have shown us, as earlier mentioned, that patients do not appear to benefit from analyses presented to them of incorrect responses. They appear not to listen to them; in fact the message given in such an explanation probably only further confuses them because it it too long, too complex, too much of an input load for them to handle.

In summary, input may profitably be devoted to word stimulation, but we would probably do well to work with larger units. With at least some patients we should move away from language-centered drills, rather fostering language use by concentrating on ideas and real-life activities out of which language grows.

Our review is complete. I will not attempt still another summary, for I have given you eight summaries. We have seen that there are now extant data which tell us things to do in order better to get something into the patient's brain and some things to avoid doing. The data are not in complete agreement, but the agreement is substantial. We can use them as guides in our clinical approach to aphasic patients and gratefully recognize that they help our work be less intuitive, less the exercise of an art, more scientific, more defensible, and more effective.

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