Clinical Implications for the Auditory Comprehension Test for Sentences

Barry M. Klor

Howard University
Washington D.C.

It has been demonstrated previously (Klor, 1976a; 1976b; Kearns and Hubbard, 1977) that there exists no one test of auditory-verbal sentence comprehension that exerts systematic control over the linguistic parameters comprising its stimulus items. This obvious limitation has reduced the amount of information regarding which linguistic elements might be providing the aphasic patient with the greatest difficulty. It is believed that if this information were available, it could be employed to design a better program of treatment for the aphasic individual.

It was the intent of the ACTS (Shewan, 1969; Shewan and Canter, 1971; Klor, 1976a; 1976b) to try to alleviate this deficiency in testing. The ACTS was constructed to allow the diagnostician to systematically view the parameters of sentence length, vocabulary, and syntax as these parameters were singly manipulated through three levels of item difficulty. This was accomplished through the following manipulation of linguistic elements:

Length: This parameter was based on the concept of "critical elements", i.e. those words considered essential to sentence comprehension (nouns, verbs, or adjectives) and the number of syllables per sentences. Length level one (L_1) included 3 critical elements and 7 syllables, e.g. "The girl is reading the book". Length level two (L_2) included 5 critical elements and 11 syllables, e.g. "The little village lay in the deep valley". Length level three (L_3) included 7 critical elements and 15 syllables, e.g. "The old farmer leads the white horses from the house to the road".

Vocabulary: The parameter of vocabulary difficulty was based on the relative frequency of occurrence of a word as based on the Thorndike-Lorge word count (Thorndike and Lorge, 1944). Level one words (V_1) were all found within the 1000 most commonly occurring words. Level two vocabulary words (V_2) were reported to have 25-35 occurrences per one million words. Level three words (V_3) had a frequency from one to 15 occurrences per one million words.

Syntax: Syntactic complexity was determined through the number of transformations occurring within the sentence (Chomsky, 1959; 1965). Level one syntax (S_1) was comprised of no optional transformations. These were displayed as active-declarative sentences. Level two (S_2) syntax items were represented by one optional transformation, either the negative or passive construction. Level three syntax items (S_3) were designed with two optional transformations, i.e., the negative-passive construction.

The ACTS is a short test of auditory-verbal comprehension, as it contains 21 items. Despite its rather abbreviated nature, it has previously been demonstrated to possess strong statistical validity and reliability (Klor, 1976a; 1976b). With this brief background in the construct of the ACTS, a discussion of the test as a clinical tool and some of the clinical issues that may confront the diagnostician will follow.

Quantitative Aspects of the ACTS

The first measure of performance can be assessed through total number of items correct. The maximum score is 21 and the minimum score is 0. However, this total score should be interpreted relative to the mean scores obtained by both normal and aphasic groups.

The normal group (N=30) achieved a mean score of 20.1 with a standard deviation of 1.0 point. The range of scores for the normal group was between 17 and 21 points. This indicates that the ACTS was easy for most of the normal subjects. Twenty-seven of 30 normal subjects scored 19 or above. Those scoring below 19 were found to have formal education levels of eight years or less. Making this allowance for formal educational experience, the following interpretations are suggested in determining normal versus aphasic performance:

(1) A normal score can be considered to be 18 points or above. This is an arbitrary decision based on the criterion of using a cut-off approximately two standard deviations below the mean for normal subjects.

(2) Any score lower than 18 for a subject with a formal education of eight years or more may be considered suspect, suggesting a comprehension deficit that warrants further analysis by the clinician.

(3) For those subjects having a formal education level of less than eight years, a cut-off at 17 points is suggested.

(4) Comparisons to other aphasic groups, or to aphasic subgroups (Broca's Wernicke's etc.) are possible, as means and standard deviations for all 150 aphasics, as well as these sub-groups are available for the ACTS.

Another aspect of the quantitative interpretation of the ACTS accounts for the effects of guessing on total score. In so far as a total score based purely on chance is equal to five points, a scale was established so that comprehension might be assessed without contamination by guessing. This scale sets five score points (items correct) to be a scale score of zero and allows approximately six scale points for each total test score (raw score) beyond that. Thus, a score of five raw score points cannot be misinterpreted as depicting comprehension abilities that in fact, may not exist.

Quantitative score provides the diagnostician with the first method of interpretation of the ACTS. However, the test was designed such that qualitative differences could be evaluated and serve as a possible guideline toward further testing and therapeutic application.

Quantitative interpretation is based on the sensitivity of the ACTS parameters to reveal deficits specific to these parameters. Although aphasic subjects, as a total group and considered in subgroups, exhibited essentially equal depressions across all three test parameters, it should not be assumed that there are not individuals who demonstrate irregular parameter profiles characterized by specific impairments in comprehending some types of sentences.

The selected subject profiles displayed in Table I illustrate the fact that each parameter can have a differential effect on individual subjects' performances. For example, subjects A and E performed rather well on the vocabulary and length items, but exhibited great difficulty with syntactically complex sentences. Subjects B and C demonstrated particular difficulty with sentences using less familiar vocabulary. The inability to successfully decode sentences of increased length is displayed by subjects D and F. Such

differences, as revealed by the ACTS, warrant in-depth follow-up testing to further assess these deficits.

TABLE 1. Patient Profiles of Length, Vocabulary, and Syntax Parameters on Selected Aphasic Subjects

Subject	Parameter[a] Length	Vocabulary	Syntax
A	5	4	1
B	4	1	4
C	4	0	4
D	2	6	5
E	5	5	1
F	0	4	3

[a]Total possible score on each parameter is 6, obtained by adding the three level two and level three items: L_2 and L_3 for length, V_2 and V_3 for vocabulary, and S_2 and S_3 for syntax.

The ACTS has three levels of item difficulty for each test parameter, which can be used to provide the aphasiologist with qualitative differences among aphasics. As would be expected, most individuals demonstrated a consistent decrement in the number of correct responses as item difficulty increased. Those that did not exhibit this pattern illustrate the ability of the ACTS to measure specific comprehension deficits.

One example of this can be seen in Table II. Subjects G and H demonstrated somewhat random performance across the various levels of difficulty. This is suggestive of an attention deficit in addition to overall reduced comprehension capacity. These subjects may be exhibiting what Brookshire (1972) referred to as "intermittent auditory perception". A second type of processing deficit, as suggested by Brookshire was also revealed by the length items on the ACTS. The deficit is referred to as "slow rise time". It implies that some aphasic patients demonstrate processing abilities that gradually improve over the course of an auditory-verbal stimulus. Thus, short utterances may go unprocessed as the processing mechanism "tunes in" too late. With stimuli of increased length, the processing mechanism should have time to "warm up" and process the message. Several such cases were revealed by the ACTS length items as seen in Table II. Both subjects I and J exhibited gradual improvement in performance with a concomitant increase in sentence length. It is believed that the ACTS is the type of structured test that may allow aphasic patients with different processing difficulties to be evaluated.

TABLE II. Subject Profiles on Selected Levels of Item Difficulty

Subject	$L_1V_1S_1$	L_2	L_3	V_2	V_3	S_2	S_3
G	1	1	0	3	1	1	2
H	1	0	1	2	0	1	3
I	1	2	3	2	2	0	1
J	1	2	3	1	0	1	2

maximum score = 3

Further qualitative analysis may be conducted with regard to the error pattern demonstrated by the aphasic. All responses are recorded on the ACTS score sheet. This allows the examiner to determine which critical element is providing the aphasic with the greatest difficulty and what grammatical part of speech that element represents. For example, in the item, "The girl is reading the book.", the foil pictures depict "a boy reading a book", "a girl holding a book", and "a girl reading the newspaper". Depending upon which error response is elicited, the error can be traced to the noun/subject, verb, or object. The examiner may then be able to isolate aphasic error patterns on specific grammatical units. This, in turn, may be employed as a basis for intervention.

The ACTS is a unique test in the several ways indicated earlier. It is also a practical test. The ACTS samples auditory comprehension performance that may be interpreted in the schema of various theoretical orientations to aphasia. For example, the psychometrically based aphasiologist may use the ACTS as a quantitative measure of comprehension to indicate the relative severity of the deficit. Furthermore, subtle qualitative item analyses may be performed by the examiner. For the aphasiologist inclined toward linguistic methodology, the ACTS may be employed in the differential diagnosis of syntactic, grammatical, and vocabulary errors. The ACTS has application for the diagnostician interested in a more traditional syndrome classification, i.e., Broca's, Wernicke's, etc., as all 150 aphasics were classified into such groups and data is available on each group. Finally, the ACTS is an appropriate measure of functional comprehension abilities as it correlated .80 ($p<.001$) with the functional comprehension scale found in the Minnesota Test for the Differential Diagnosis of Aphasia (Schuell, 1965). This relationship was interpreted to be strong and it was believed that the ACTS represented much of what speech and language diagnosticians and clinicians consider important in functional comprehension. It is the author's belief that the correlation would have been higher had prosodic features, reductions in rate, and non-verbal cues (gestures) been employed in the test administration.

It is obvious that the realities of clinical work with adult neurological disorders require diagnostic measures, which aside from being dependable, are

relatively efficient in terms of time needed for test administration. A strength of the ACTS is its ease of administration. No properties other than the response picture booklet, test form, and pencil are required. The average time of administration of all 21 items and four pre-test items is 12 minutes.

It can be seen from this discussion that the ACTS is a practical, functional tool for assessing auditory comprehension deficits in aphasia. Coupled with other receptive and expressive tasks, it is believed that an appropriate diagnosis of aphasia may be possible and specific treatment plans can be designed to help the aphasic adult.

Bibliography

Chomsky, N., Syntactic Structures. The Hague: Mouton and Co. (1975).

Chomsky, N., Aspects of the Theory of Syntax. Cambridge: The M.I.T. Press (1965).

Kearns, K., and Hubbard, D.J., A Comparison of Auditory Comprehension Tasks in Aphasia. A paper presented at the Seventh Annual Clinical Aphasiology Conference (1977).

Klor, B.M., The Standardization of a Test for Sentence Comprehension in Adult Aphasics. Unpublished Doctoral Dissertation, Northwestern University (1976).

Klor, B.M., A Test for Sentence Comprehension in Aphasia. A paper presented at the American Speech and Hearing Association Convention (1976).

Shewan, C.M., An Investigation of Auditory Comprehension in Adult Aphasic Patients. Doctoral Dissertation, Northwestern University (1969).

Shewan, C.M., and Canter, G.J., "Effects of Vocabulary, Syntax, and Sentence Length on Auditory Comprehension in Adult Aphasic Patients". Cortex 7: 208-226 (1971).

Thorndike, E.L., and Lorge, I., The Teacher's Word Book of 30,000 Words. New York: Columbia University Press (1944).

Discussion

Q. Now if you did get this differential between Broca's, Wernicke's and Amnesics, how can you account for the fact that no one else has gotten that?

A. Quantitatively several people have gotten it. Parisi and Pizzamiglio demonstrated a quantitative hierarchy on a semantic test. Shewan and Canter showed it on their tests. Pizzamiglio and Appiciafuoco showed it with their tests. General communication disorders - get a quantitative, numerically based hierarchy. Amnesics scored 14.8, Brocas 12.5, Wernickes 9.0, globals 5.0 (which is at chance level). We have accounted statistically for guessing by including items, and there are 4 choices on each picture. So getting one-quarter of them by guessing, you can get

a score of at least 5, so using 5 as the 0 point; using 21 as a hundred; you can account for guessing in that respect.

Q. Did you equate for severity?
A. The milds do very well in all 3 parameters.

Q. In terms of the differential and diagnostic classification, can you discern Broca's from Wernicke's?
A. I can't say, because I don't know from the data. The only time we used Brocas, amnesic and Wernickes was in one analysis. Other than that, the statistics were done on 150 aphasic adults.

Q. How did you define the Broca's and Wernicke's?
A. What we did was basically use the things set forth by Benson, Goodglass, Gleason and Hyde's article (1970). They have a little section in their article for certain clinical manifestations to look for and clinically we looked for that and tested for that. I did not just administer the ACT, I also administered an articulation test, a word finding test, spontaneous speech sample and a couple of other things so I had a pretty good idea, and the reliability between by diagnosis and test scores, audio tapes, etc. was about 90.

Q. A few years ago I was testing a kid on the Wechsler and there was a sentence repetition test - there was one sentence that said, "It is raining outside". The child is supposed to respond and I gave him the sentence and he looked at them and gestured to the window with his head and said, "It is raining". Now this is a correct response, isn't it? No, according to the test he was wrong. My reaction was the same as yours. "It is raining outside" is a test item on the Wechsler and the child said, "It was raining" and pointed outside. You are putting a lot of credence in length and I am wondering if you are considering things like the MMU that Roger Brown talks about, the number of imbeddings, how the right branching were internal and maybe concepts contained in the sentence.
A. No, I have not, it is something to look at.