SSW Reports

The SSW Test - 50 Years Young

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Editorial Introduction by Kim Tillery

This issue is in recognition of the SSW test being 50 years young! Of course, Jack does not know that this issue contains the 1st article he published on the SSW test in 1962 and an interview with Jack that both were published in the *Canadian Hearing Report* in October 2012. The publisher has graciously allowed these articles to be reprinted in this issue of the *SSW Reports.* In 34 years of the existence of the *SSW Reports* we have read about the SSW test and many other facets of central auditory processing disorders! What a special moment it was to ask some pointed questions to Jack Katz. As always, he shared some professional and personal views that are inspiring and insightful. Congratulations Jack, Ackie, and the SSW test!

Interview with Jack Y.Y. Katz

How did you get into the field of Audiology?

Miss Carlin was a wonderful English teacher at Erasmus Hall High School in Brooklyn. One day she told us that she had many years of experience counseling students and that we should write an essay about ourselves and from that she would give us some suggestions for what we might study for the future. I wrote that I was lazy, but liked people and didn't like to do the same thing over and over again. I am not sure what else I wrote, but on my paper at the top was written, "Speech Correction". I had no clue what that meant so I asked my older brother and he didn't either, but he said that a friend was going into that field. So I called her and liked what I heard, but was still not very clear what it was. When I got to Brooklyn College and said that I was thinking of majoring in Speech Therapy they told me that I couldn't because my speech was not good enough. I had to take three classes to improve my speech so I went to the Speech & Hearing Clinic and there I learned more and more about the field. In those days we trained in both Speech and Hearing so in graduate school (when politics threatened my continuation in Speech) I simply switched to Audiology in which I was doing quite well.

The SSW Test is 50 years old – how did it begin?

I already had an M.S. in Audiology and Speech but I still had to take practicum in the Ph.D. program. The audiologist at Mercy Hospital of Pittsburgh told me that she was going on vacation and asked if I would like to replace her for a month. I jumped at the chance because

Irma and I just had our first child. One day one of the young ENTs asked me if I was aware of the work being done in Germany: identifying brain tumors using hearing tests. I could not believe what I was hearing because we were taught that you cannot assess the auditory system above the level of the VIII N because there is too much decussation. I said I did not know about the Germany work and he said that he would bring in the article. The next day he showed me a 2 paragraph description of the work of Joseph Matzker, an ENT doctor, who divided a word into a high-frequency band to the one ear and low-frequency band to the other ear. If the person could combine the bands centrally they could get the word, but those with temporal lobe tumors could not. I was fascinated because audiology had only gotten to the level of the VIII N at that time. But the last line was a downer. It said unfortunately the test did not work if the person had a hearing loss. Out of my mouth I heard myself say "Why don't they use spondees?" When I realized what I had said, I exclaimed, "You know that's a good idea. Would you like to work on that with me?" He said, "No, no you go ahead". That night I had the midnight and 2 AM feedings for my infant son who was recovering from surgery and had to be fed every two hours through the day and night. As I was feeding him I started to get excited about the ideas popping into my head. I could not do what Matzker had done because I had no equipment. So I thought of having one spondee to one ear and another one to the other ear. Then I thought, "Wow, what if they were staggered so the second and third monosyllables would be competing in time in opposite ears, this would give us all sorts of comparisons. When the baby was fed I started writing feverishly. I thought it would look more scientific than Matzker's approach if we counterbalanced items starting in the right and then the left ear. Then I figured the efficiency of having the first word and the last word to form a third spondee. In that way if a person missed one competing word they could fill it in with another word incorrectly. After the 2 AM feeding I made a list of 36 of the 40 word items. Interestingly, all the little things that were used to look more scientific turned out to be valuable auditory processing disorder (APD) measures or helpful in other ways.

The Handbook of Clinical Audiology is in its 6th edition –what was the initial impetus?

It was about 1968 when we went on a family vacation. As usual I brought a yellow pad to write down any ideas that came to me, as I surely would not remember them when I got home. One day when things were quiet I took out the pad and started to write an idea for a study. But then I got stymied because I did not have some basic information. So I turned the page and started working on another idea. But, then I needed other information and could not progress with that project either. I thought, "What we need is a handbook where all the basic information is contained in one place". Then I wondered, if there were such a handbook, whose chapters I would like to read. My first two choices were Neil Goetzinger for a chapter on word recognition and Bill Hodgson on evaluation of young children. Pretty soon I had a list of chapters and quite a few authors whose chapters I would love to read. The title came next. When my brother was in college he came home one day with the *Handbook of Chemistry*. He was so excited and held onto it like a brick of gold. So I thought the book should be a 'Handbook'. The title is 'Clinical

Audiology' instead of 'Audiology' because I have always loved the practice of audiology and wanted that to be the focus.

What is your opinion as to whose role it is to administer auditory training?

Up until now this was a moot point. Audiologists have been slow in getting into this work so probably 90% or more of the training was by SLP's. But in a very brief period there has been such a spike of interest from all quarters in APD and even therapy that there is reason to think about who should really be doing this therapy. I think that both Audiologists and speech-language pathologists have important strengths when it comes to auditory training. SLPs have a stronger background in phonetics, articulation, language and in therapy. But for a number of years as language has become so dominant in SLP training I understand that articulation and phonetics have been de-emphasized both in training and in services. While audiologists have not generally had much therapy training in recent years; their knowledge of the auditory system and function, as well as otitis media and central testing, have given them an important understanding of the processes. Other advantages for audiologists are in areas such as administering dichotic listening and speech-in-noise training as well as audiologic equipment. On the third hand SLPs can do speech-in-noise work without benefit of an audiometer and may be more comfortable in providing memory training.

Both groups and teachers of the hard-of-hearing could do a proper job of auditory training for APD. Right now with the huge demand I am truly grateful for any trained person who will help to serve the many people who are not receiving services. We see what a disaster the lack of services has been for so many children and adults with APD and hope we can do better in the future.

What is your advice to upcoming or new professors who teach clinical audiology or speech pathology?

Thank you for this question. In medical school if you take a course on a particular topic you can be quite sure that the person who teaches it does that kind of work. They are master practitioners or master surgeons. So when the student gets information, illustrative cases and content as to what to do when there are complications; they benefit from the professor's professional experience. At one university a hearing scientist who had a meager background and no experience as an audiologist was teaching clinical audiology courses to audiology students. How could that be justified? Would it be okay for a clinical audiologist with a meager background in hearing science; teach hearing science courses? My advice to new professors is to keep your hand in clinical services. It means so much to the students when you say, "You know, last week I tested a child who …". Students need role models rather than lectures from someone who is a few pages ahead of them in the text.

What is the future of electrophysiology in audiology?

There is no limit to the 'potential' for the use of electrophysiological procedures in audiology. But not in the foreseeable future will they replace the behavioral audiology procedures. Audiologists can quickly and inexpensively measure real-life behaviors and measure real-life responses. However, the electrophysiological methods have a huge contribution to make about where and how the system is working. It can tell us about pre-conscious functions. In addition, when individuals cannot reply then physiological measures become so much more important. I should also mention that we have given up some excellent behavioral tests because we assumed that physiological procedures would make them obsolete. For example, tone decay and SISI tests of old were not fully replaced by immittance. I hope that we will be more careful before we delete any more procedures.

What does the SSW detect that other tests do not?

Wow, first let me plead ignorance about the other tests, but I will do my best. In an earlier question, I noted that all the little things we did to make the SSW look well-thought-out; actually provided valuable diagnostic insights. Who would have thought that counterbalancing the SSW items (half of the test words start in the left ear while the other half starts in the right ear) would give us powerful indicators (e.g., Ear and Order Effects)? Who could have imagined that a significant difference for errors on the first 2 words of the item vs. the second 2 words could tell us, in a brain damaged population, who likely has an anterior cortical problem and who has a posterior temporal problem with the opposite pattern? In APD cases those signs help to differentiate individuals who have Tolerance Fading Memory (TFM) and Decoding (DEC) APD problems. Who could have imagined that staggering the spondees would give us insight into corpus callosum lesions (or Integration (INT) type of APD cases) and the importance of having norms for reversals of the word items? Most importantly, the SSW gives us 23 signs of APD and their categories so we do not have to depend on any one score. Rather we see how the significant signs reinforce one another. In such a complex problem as APD some people can beat one or two aspects of our tests but we are likely to have a number of others that demonstrate the problem. There are two other important tests of the battery and the Buffalo Model Questionnaire – Revised that help us to avoid making a mistake in the evaluation by providing additional criteria and an independent assessment by parents and teachers.

Is there anything that you have done that has not received international acclaim?

Yes, many, many things. When I was in the Boy Scouts I won a burping contest. It received almost no recognition anywhere. Oh, you mean of a professional nature. One thing was the Continuous Tone Masking test, that divided cochlear and retrocochlear hearing performance, not that VIII N responses were more severe than cochlear, but rather that their responses go in opposite directions with the normal range situated between them. Another thing is *SSW Reports* that does have Canadian subscribers, but is not widely known. *SSW Reports* deals with central functions and is in its 34th year of publication.

What is your middle name?

If you did not know the answer you would not have asked this question. I never had a middle name, but when we lived in Turkey I came home one day and announced that I used to be, "Jack *cabuk cabuk* Katz (*cabuk* – pronounced 'chahbuk' which means 'fast' in Turkish). But, now I have become Jack *yavas yavas* Katz (pronounced 'yah-vash' that means "slow"). That is, I was now going to start doing things s-l-o-w-l-y. Those words are often said twice, at the appropriate speed, in Turkish to emphasize them. Sometimes when I sign my name I include my new middle initials "YY" (to make up for not having even one of them all those years). It was a lot of fun for those who knew the story. Then one day I realized that my name *is indeed YY*. I was named after my grandfather who was Yakov Yisroel. So now when I sign my name 'Jack YY Katz' I am also honoring my grandfather.

Is there another topic you would like to add to this interview?

Thank you. When I was a child there was no early intervention and in schools there were no Speech Language Pathologists (in fact there was no consideration of language in 'Speech Correction'; as it was known). There was no specialized reading help and there was no such thing as a learning disability or phonics. I have had APD all my life and had a great deal of trouble with speech, language, reading, spelling etc. When I was 15 years old I told my parents that I was going to quit school when I was 16. They were heartbroken. I told them that I had enough and was not able to read or spell well etc. I naïvely said that I would buy a store and have a secretary who could read for me. One, day Mr. Cohen, a house painter, with whom my father worked, came to see me. "ME! Mr. Cohen came here to see <u>me</u>?", I asked. Yes, as it turned out, he came to tell me that I couldn't quit school! He said it was so important that I had to continue and try again. Every time I repeated my reasons he came back with one more answer with the same theme, "You can't quit school!" After an hour I realized that Mr. Cohen would never leave until I told him that I would not quit school. And fortunately I didn't quit. I can only imagine what my life would have been like if I had quit at 16 with all those problems and such weak academic and communicative skills.

I am mentioning this now because this is a different world, but the same thing is happening to some children and they don't have a Mr. Cohen (by the way a few months later he died of a lymphoma). I have worked with two teens that were so frustrated and disheartened that they also were 'finished', but they were finished with life itself! Both are still alive, one with a good outcome and one not so good.

Tragically, 40 years ago some people said that there was no such thing as APD. I wonder, because of that, how many people suffered so badly with this problem who could have improved with a little help? When it was clear that auditory information could not just jump to the brain and be understood the story changed to, "Well if there is such a thing, it's not important". How many more children and adults suffered and did not reach their potential because of such loose

talk. And now we hear that there is no such thing again and this time it is because APD is really a language disorder. Well if it is a language disorder why do so many children we see come to us with years of language training and still struggle? And why when we do APD therapies do their problems improve so quickly? What reason will they come up with next? After 40 wasted years we need professionals to say, "Enough, let's start helping these people".

This is the first publication of the *Staggered Spondaic Word (SSW)* test by Dr. Jack Katz. In 50 years, this single central test has been reported on in numerous peer-reviewed articles, manuals, hundreds of workshops, the *SSW Reports* quarterly publication (in its 34th year), and a text book (Arnst and Katz, 1982). It is one of the most widely used central tests in the United States and Canada, and has been adapted in many other countries.

The Use of Staggered Spondaic Words for Assessing the Integrity of the Central Auditory Nervous System

Jack Katz, Ph.D.

Introduction

Audiological measures for localizing lesions in the peripheral hearing mechanism are presently more precise and reliable than those which have been designed to assess impairments in the central auditory pathways. Bocca, Calearo and Cassinari (1954) presented a preliminary report on a method of identifying temporal lobe tumors. Since that time there has been considerable interest in the higher auditory functions from both theoretical and diagnostic points of view. The attention focused on this complex area of the central nervous system has led to several new theoretical concepts and clinical methodologies which offer potential value (see Refs. 1, 3, 7, 10, 11, 13, 16, 17). Further contributions of audiology to the localization of central nervous system pathology will probably result from the addition and refinements of test procedures which reliably indicate the site of lesion.

The literature consistently reveals that conventional pure-tone and speech audiometry do not identify "cortical hearing" impairments. Audiologically, hearing disorders of this type may be uncovered by demanding the evaluation of unusually difficult material by the patient. In so doing, a heavier burden is placed upon the higher auditory mechanism. Weakness in integrative behavior is manifested in the in-

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ability to utilize the stimuli appropriately. Bocca and his associates have presented logical arguments for employing disorted speech stimuli in an effort to compel the use of integrative or synthetic processes of the central auditory system. These investigators employed several techniques for distorting speech material. They have utilized methods of (a) low frequency spectrum attenuation, (b) speech acceleration, and (c) speech switched periodically from ear to ear at a rapid rate.

Matzker (1959, 1960) employed two speech procedures: a rapid switching technique, and a frequency filtering method; he also investigated a pure-tone localization test. His results support the conclusions of Bocca. Matzker indicates that audiological procedures may be of considerable importance in diagnosing and locating disorders of the central nervous system. Walsh and Goodman (1955) and Miller (1960) studied the PB word lists and found that under certain conditions cortical damage could be inferred. Jerger (1960), and Jerger, et al (1961) utilized versions of several of the test procedures of Bocca, Matzker, and Walsh and Goodman. The resultant assessment battery included difficult speech measures and two types of sound localization methods.

Analysis of the literature suggests that there are three or four general approaches to identifying central auditory lesions with speech stimuli. (a) One method is to challenge the higher pathways of hearing by presenting less than a complete message to a subject and thus require the use of synthetic processes. This category includes methods which delete segments of a verbal message or limit its frequency spectrum. (b) Another means of affecting a breakdown of a "hidden" hearing disorder is to administer more than the required amount of information. In this case it is necessary for the subject to separate and integrate the stimuli into meaningful and non-meaningful portions. This may be illustrated by competing message techniques, in which irrelevant information is presented to the contralateral ear, or by the use of a background noise. (c) A third general technique of assessing central functioning is a complex presentation of speech. This method provides all of the information which is necessary and sufficient to supply the correct answer; however it is transmitted in a complicated manner. Tests which rely upon rapid ear-to-ear switching, and accelerated or decelerated spech are illustrative of the complex presentation method. (d) A fourth approach combines two or more individual procedures in order to obtain a more demanding test.

Limitations of Current Difficult Speech Techniques

Several promising audiological procedures and variations have been proposed for signifying lesions of the central nervous system. However,

most often it is not clear from these measures at what level in the pathways the breakdown occurs. In addition, etiological groups are not necessarily consistent in their test behavior. Thus, improved specificity and reliability are of major importance to present-day investigators.

It is logical to assume that speech material which is ambiguous or has few distinguishable elements will suffer considerable loss of intelligibility when "sensitized" by any of the current difficult-speech methods. These subtle stimuli which are then further processed by any of the current techniques become particularly incomprehensible to individuals lacking central integrity. This inability is primarily demonstrable in the ear contralateral to the affected hemisphere. But even though at first glance such an approach seems ideal, nevertheless, methods which employ ambiguous speech stimuli incorporate an element of undesirability. The more precarious or unstable the speech material, from the standpoint of intelligibility, the greater the probability of artifacts due to individual differences which may be totally unrelated to central disturbance.

Since most of the techniques investigated to date have employed relatively unstable speech stimuli, namely, English monosyllabic words or their equivalents, it is not surprising that consistent normative data are lacking. As a result of the heterogeneity of the test items, and of the great amount of variability among individual listeners, little emphasis in difficult-speech tests has been placed on the absolute test score. Rather, in cases of suspected unilateral central pathology the performances for the two ears are compared wherever the test's structure permits. In some cases the analysis of some assessment procedures is necessarily based on a comparison of separate unilateral test conditions with a binaural condition.

Because of the expenditure of testing time necessary to cope with factors of unreliability, investigators have been unable to shorten their diagnostic measures. Several researchers have utilized rather extensive test batteries to provide the added reliability and accuracy in diagnosis. Since all of these approaches tend to be time-consuming, they may increase the possibility of psychological and physiological fatigue in the patient.

In addition to variables inherent in particular subjects such as age, intelligence, attention span, etc., most of the current methods are difficult to interpret in the presence of peripheral aural pathology. Since peripheral hearing loss has an unpredictable influence upon the test procedures, the possibility of confounding important information concerning the status of "cortical hearing" is enhanced. Particular uncertainty and equivocal findings would arise when distortions, such as reduced word discrimination ability, could be demonstrated by conventional techniques.

One would hesitate on the basis of current techniques to make a diagnosis with individuals exhibiting less than normal hearing for the frequencies within the speech range and also very good word discrimination ability. With few exceptions the distorted-speech techniques employ ambiguous, unstable speech stimuli. It can be seen that without material which is impervious to individual differences and unscathed by peripheral auditory distortions, serious limitations are placed on the procedure. Stable speech stimuli might provide greater certainty in diagnosis because of the likelihood of clearcut normative data and relative resistance to associated or coincidental auditory deviations of a peripheral nature.

Recent work by Calearo and Lazzaroni (1957) and by Bocca (1961) tends to show that improved test reliability occurs with more stable speech material. A group of normally-hearing individuals with considerable scatter on tests of intelligence, vocabulary, and memory were administered a switched-speech test using Italian trisyllabic words and short sentences. The findings of this investigation revealed that the three variables studied did not affect test results. There was evidence of excellent integrative ability for each of the three subgroups in the study. Any switching rate from one ear to the other was found to be acceptable. Bocca suggests that Calearo's test for the detection of malingering, which utilizes short sentence material, is an excellent tool for identifying higher auditory lesions. The switched-speech test may also provide greater specificity in diagnosis.

Stability of Speech Materials

The difficulty in identifying a word is related to considerations of familiarity, phonetic structure, length, stress, part of speech, etc. (see Giolas (1960) and Owens (1961) for discussion). If the word has rare usage, ordinary sound elements, and a common pattern it will be more difficult to identify. Thus a commonly used word with unique structure and stress will be intelligible at a weaker level than an unfamiliar word with less specific features. For these reasons English monosyllabic words require greater sound intensity for reception than short sentences or spondaic words. For the purpose of this study, spondaic words are those composed of two monosyllabic words with equal stress on each. Spondaic words and sentences contain greater redundancy and therefore much information can be omitted without noticeable reduction in intelligibility.

The stability of spondaic words is revealed by the fact that there is a reliable relationship between their reception thresholds and pure-tone thresholds in the speech frequencies. Even at intensity levels only slightly above the average threshold for the speech frequencies, nearly

perfect intelligibility of spondaic words may be expected. This relationship is essentially unaltered when auditory sensitivity is reduced. This estimate is also appropriate even in cases in which moderate difficulty in discriminating monosyllabic words is present. This stability, common to spondaic words, provides a high degree of test-retest reliability (see Ref. 5). Differences as small as four or five db in spondaic word reception thresholds may be considered significant. It appears likely that the advantages in Calearo's switched-speech test are due to the use of more stable speech stimuli.

The Staggered Spondaic Word (SSW) Test

General Description

A staggered spondaic word (SSW) test has been devised which approaches the problem of assessment of the central pathways in a manner similar to that of Calearo and Bocca. Some new features are present in the SSW test which accentuate its potential value. The SSW test incorporates the stability of English spondaic words and the demanding features of a competing message technique in order to study insufficiency of the higher auditory nervous system. In addition, further "sensitization" is obtained by the introduction of two complex presentation methods. The proposed test requires that the patient attend first to one side, then to both sides *simultaneously* and then only to the second side, with different information presented concurrently to each ear. The procedure requires no more than 20 minutes and offers both quantitative and possibly important qualitative information.

Test Pattern

Specifically, the author proposes partial overlapping of words presented separately to each ear. That is, two spondaic words such as *upstairs* and *downtown* are combined to form one item. *Upstairs* is transmitted to the right ear and *downtown* to the left. The test provides competition, or concurrent stimuli in the two ears, for the monosyllabic words trials *stairs* and *down*, while trials *up* and *town*are presented normally, in a non-competing fashion. The program of transmission of the item may be clarified by the following diagram:

Ear	*Time*		
	1	2	3
Right	up –	stairs	
Left		down –	town

The two spondaic words which comprise each item in the SSW test were chosen on the basis of the following criteria:

1. Fairly familiar words.
2. Competing trials of approximately equal duration.
3. Noncompeting trials form a third spondaic word.

Two practice items precede the actual test items. The practice items are similar to the test items except that they do not overlap in time. The carrier phrase "Are you ready" introduces each item and is presented to the ear which will receive the initial word. The ear receiving the first word is alternated.

Administering the Test

The test material is delivered separately to each ear by use of the two channels of a stereophonic tape recorder which are led independently to a pair of earphones. The tape recorder also provides independent volume control for each ear and permits the precise time relationship between the words to be preserved. Each ear is stimulated at a constant level above its individual threshold. It is not yet clear which particular threshold is most appropriate. It may be that the average threshold for pure tones in the speech range (500, 1000 and 2000 cps) or perhaps just the threshold for 1000 cps may be preferred to the speech reception threshold for spondaic words (see Jerger (1960) Ref. 8 and Miller (1960) for discussion). However, in order to avoid possible inaccuracies it might be safest to employ the speech reception threshold.

The subject might be instructed:

> *You will hear a series of words. Listen carefully and repeat* **all** *of the words that you hear. You will have plenty of time to respond, so just say the words as accurately and as clearly as possible. Do not respond until all of the words are presented. If you are not quite sure of a word, take a guess. Now tell me what you are going to do.*

Analyzing Test Data

The structure and composition of the SSW test is such that it can provide various quantitative and qualitative bases for analyses. The 40 items, which represent 160 monosyllabic words or 160 bits of information, may be scored and scrutinized in several different ways. Diversified data concerning a symptom would thus be provided by the complex response pattern. For example, by tabulating the percentage of

correct responses for the right ear with and without competition, and the left ear in noncompeting and competing conditions, nine meaningful percentages may be obtained. The total percentage correct indicates an individual's overall success on the test. A comparison between the 80 words presented to the right ear and the 80 presented to the left ear is most revealing with cases having unilateral lesions. Differences between competing and noncompeting trials may be considered separately for each ear, or together in cases of bilateral disorders. Analyses of these scores may indicate error patterns on the SSW test which may be due to peripheral distortions and those to central disturbance. The analysis of error pattern on the four possible monosyllabic responses to each item, regardless of the ear affected, could be expected to offer further versatility and diagnostic power to the SSW test.

There are 16 ways in which a patient can respond to each test item, ranging from all four monosyllabic words correct, to all incorrect. At the present time one might with due caution suggest that the individual who consistently responds incorrectly to, for example, the third monosyllabic word is functioning differently from one who consistently fails both the second and third words, or indeed from a patient who demonstrates no consistent error response. Further reliability might result from a pattern analysis based on operationally related response categories. Thus, by combining similar error patterns the score obtained would be based on a sample size from two to seven times the original number for any one error-type.

From the foregoing it may be inferred that the test procedures which supply only one or at the most a few sensitive scores representing an individual's entire response to difficult speech material may ignore important variations among etiological groups. On the one hand, test procedures which supply several scores can offer a wealth of opportunities for exploration by the diagnostician. We can but assume that lesions at various points in the higher auditory pathways will produce different effects on auditory perception, even if they are only subtle changes. One is encouraged in this assumption by the specificity of audiological procedures for the analysis of peripheral disorders. On the basis of such previous experience it would be logical to assume that variations in central functioning will manifest themselves, just as have peripheral lesions, with the advent of more sophisticated diagnostic techniques.

Case Studies

Six case studies are presented here to indicate the performance trends of normal subjects and of selected central- and peripheral-disturbance groups. These individuals are thought to be rather representative of

their subgroups. Information concerning the speech average for pure tones, speech reception threshold, discrimination score and Staggered Spondaic Word Test results are shown in Table 1.

Discussion

The case studies presented provide some insight into the sensitivity and versatility of the SSW test. The patients who represent groups of central lesions demonstrate considerable difficulty on the test. It is indeed remarkable that these individuals who behave so normally on conventional audiometric measures should show such marked deviations from normal subjects on the SSW test. Case 2, of unilateral central trauma, demonstrates the vivid effect upon the contralateral ear, while the homolateral ear yields almost normal data. This contralateral affectation is consistently revealed in tests of higher auditory behavior.

It is of interest to note that the competing condition tended to be more difficult for all subjects. Nevertheless, the contrast between the competing and noncompeting conditions were most striking with central dysfunction. Although, Case 5, with peripheral damage, had a poor SSW score for the right ear, he differed from the other subjects by exhibiting a discrimination loss for conventional words and difficulty on the non-competing trials as well. We might infer that moderate discrimination losses will reflect themselves on both competing and non-competing words on the SSW test. The incorrect responses of patients with central dysfunction on the proposed test might be expected to be far out of proportion to the discrimination loss particularly for the non-competing trials.

Information concerning the reliability, the effects of age, and the effects of intelligence on the SSW test is not available at the present time. However, there is reason to be optimistic concerning these factors. Children as young as eight years of age have been administered the test and have shown normal adult responsiveness. This technique has not been given to children younger than eight years of age.

It is of value to describe the ease with which normal subjects perform on the SSW test. Individuals without significant neurological or otological histories make very few mistakes. In fact, sophisticated listeners often challenge the statement that the two competing trials completely overlap one another; but the timing accuracy of the tape recording is easily verified. The reason for this auditory illusion remains unexplained; it is perhaps related to the facility with which the intact brain is in fact able to handle competing or even conflicting information presented simultaneously at the two ears.

TABLE 1.
Case Studies of Six Patients Given the Staggered Spondaic Word Test

					SSW Test % Correct		
	Ear	PT AVE	SRT	DS	Non-Com.	Com.	Total
Case 1. Normal (control) male, 12 yrs. No significant medical history	R	-10		100	100	98	99
	L	-10		100	100	98	99
	Mn	-10		100	100	98	99
Case 2. Trauma (central) male, 24 yrs. Fell from a fast moving vehicle on right side of head at age 5. Unconscious 8 days. Residual scars on right side of head only (temporal, parietal and occiptal regions).	R	-10	-4	100	98	92	95
	L	-10	-6	100	90	62	76
	Mn	-10	-5	100	94	77	86
Case 3. Cerebral Palsy (central) female, 11 yrs. Predominantly, right spastic involvement	R	0	6	100	98	30	54
	L	-3	4	100	100	70	85
	Mn	-2	5	100	99	50	74
Case 4. Older Age (central) male, 60 yrs. No significant medical history.	R	-5	0	100	98	52	75
	L	-3	0	100	100	70	85
	Mn	-4.	0	100	99	61	80
Case 5. Sensory-Neural Hearing Loss (Peripheral) male, 39 yrs. Noise exposure in service in WW II.	R	13*	10	72	72	58	65
	L	10*	8	84	100	92	96
	Mn	12	9	78	86	75	80
Case 6. Conductive Hearing Loss (Peripheral) male, 42 yrs. Progressive hearing loss found to be otosclerosis.	R	26**	28	100	100	100	100
	L	40**	36	100	100	98	99
	Mn	33	32	100	100	99	100

* For 2 best frequencies
** Approximately 30 db air-bone gap
PT AVE : Mean Threshold at 500, 1000, and 200 cps
SRT : Speech Reception Threshold for spondees
DS : Discrimination Score for live voice PB W22 lists at 40 db above SRT
Staggered Spondee Word Test Results at a Level 30 db above SRT
Noncompeting condition : Monosyllables (Times 1 and 3)
Competing condition : Monosyllables (Time 2)
Total : Percentage correct of all monosyllables

Summary

An audiological technique termed the Staggered Spondaic Word (SSW) Test is proposed for the assessment of lesions in the higher auditory pathways. This "competing-message" technique employs bilateral, partially overlapped spondaic words.

Spondaic words are employed in order to utilize their ability to pass through the peripheral auditory mechanism comparatively unscathed by concomitant or coincidental hearing loss and/or distortion. The stable speech material should also provide greater intra- and inter-subject consistency within various auditory disorder groups.

The SSW test offers the diagnostician many sources of information concerning the individual's ability to cope with a speech stimulus presented in a complex manner. The brevity of the complete SSW test (20 min.) renders it feasible as a potential clinical tool. On the basis of the analysis of early test results with various populations, no serious alterations in the theory underlying the proposed test have been necessary.

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