SPEECH DISCRIMINATION AUDIOMETRY USING EXTENDED ARABIC PHONETICALLY BALANCED WORDS

THESIS
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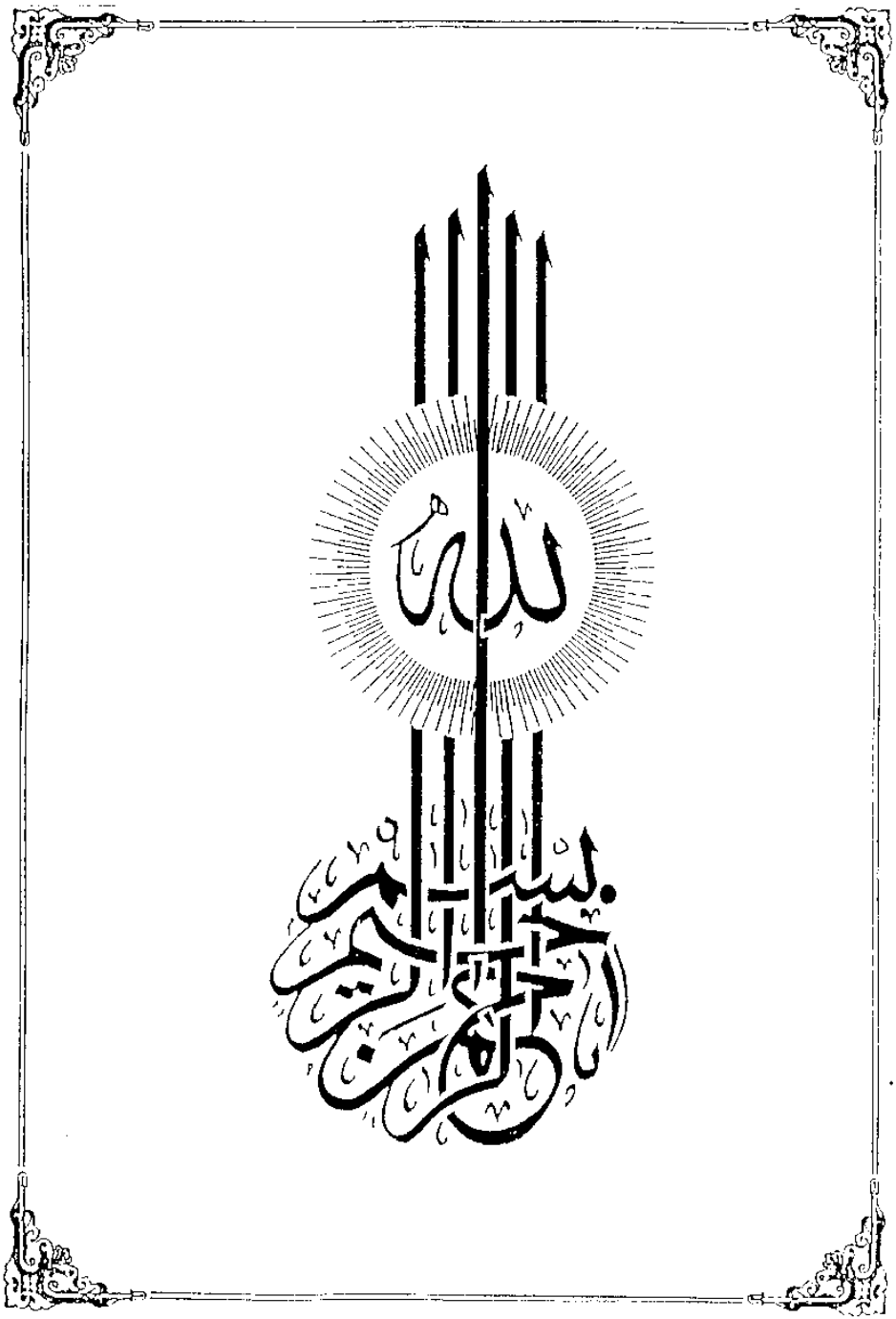

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Hearing to pure-tones constitutes a very small and insignificant part of the ordinary auditory experience of most individuals. By far, the most important sounds to which we listen in civilized life are the sounds of speech (Hirsh, 1952).

Thus, assessment of hearing for pure-tones provides valuable information regarding sensitivity, but only limited information concerning receptive auditory communication ability (Penrod, 1985).

A valid estimate of the ability to communicate should utilize speech as the test stimulus. The desire to obtain this valid measure led to the development of speech audiometry. There are basically two aspects of speech audiometry. The first is the measurement of speech reception threshold (SRT) which is the lowest intensity level at which 50 percent correct identification of speech occurs, this measure allows an estimate of the degree of hearing impairment Hirsh (1952). The second phase involves the measurement of speech discrimination, that is, the ability of the listener to make fine distinctions among similar speech sounds at suprathreshold intensities (Tillman and Olsen, 1974).

Speech audiometry has become a basic tool of audiologic evaluation. Speech can be used to measure auditory sensitivity, to evaluate the functional state of the auditory system at suprathreshold levels, to predict the outcome of otologic surgery, to assess the value of therapeutic procedures such as lip reading and auditory training and in the selection of hearing aids (Goetzinger, 1978).

Speech audiometry does, in general, provide a measure of the linguistic sense of what is perceived. It is, therefore, important that speech-hearing ability be tested using lists of words in a language that is known to the patient. Arabic is one of the most widely spoken languages in the world. Few Arabic speaking people speak other languages. There is, therefore, the need for Arabic word lists to assess the auditory adequacy of these people.
Soliman (1976) selected 5 lists of 50 phonetically balanced (PB) Arabic words and were used in speech discrimination audiometry. Alusi et al (1974) had constructed Arabic PB word lists to be used for determining speech-hearing ability. Ashoor and Prochazka (1982) chose PB monosyllabic classical Arabic word lists to construct a Saudi Arabic speech test.

The problem is that the number of the lists is not large enough for testing the increasing number of follow-up

patients with hearing impairment in the past few years. As a result familiarity of the words develops in test-retest necessitating the availability of more Arabic PB word lists.

This work was designed to develop and study the validity and effectiveness of new Arabic PB word lists.

REVIEW OF LITERATURE

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Historical Background :-

Evaluation of an individual's speech understanding was carried out long before the advent of discrimination tests and electronic audiometers. It was simply done with the use of whispered and live-voice techniques in which the distance from subject to test administrator was varied (Penrod, 1985). Bryant (1904) used a phonographic acoumeter as an attempt to exercise control over the test stimulus. Campbell (1910) used ten lists of 100 monosyllables employing 20 common consonants followed by the vowel /i/ to assess consonant intelligibility over the telephone. Crandall (1917) used consonant-vowel (CV) and vowel-consonant (VC) syllables to assess consonant intelligibility over the telephone. Test materials were constructed to approximate the frequency of use in everyday written materials.

Fletcher (1922) at the Bell Telephone Laboratories (BTL) used Standard Articulation Lists comprised of 8700 syllables divided into groups of 50 items. Each group was composed of an equal number of the basic vowel and consonant sounds. Fletcher and Steinberg (1930) at BTL developed the New Standard Articulation Lists in which only consonant-vowel-consonant (CVC) syllables

were used with approximately equal representation of each sound on these lists regardless of its actual frequency of occurance in the language. The syllables were preceded by an introductory sentence. In addition, Fletcher and Steinberg (1930) at BTL devised five sentence intelligibility lists, each list made of 50 items using interrogative and imperative sentences to test the listener's speech understanding ability. Egan (1948) and Hirsh (1952) reported 2 problems with the use of these lists, the questions often required specific knowledge of the New York City area and many of the items were difficult.

Egan (1948) at the Harvard Psycho-Acoustic Laboratories (PAL) devised 24 lists of 50 items each. These lists were known as phonetically balanced (PB) word lists. The the appearance of a sound in the list, with respect to its proportion of occurance in everyday speech, was confined to the first part of the word. The criteria of the lists were : common and monosyllabic words, equal in range and average level of difficulty, equal phonetic composition and representative of English speech. Recordings were made of eight of the lists (lists 5 to 12) at Central Institute for the Deaf (CID). Eldert and Davis (1951) indicated that these recordings were too unfamiliar for many of the patients and they were of low reliability. Hirsh (1952) reported that the

recordings were not suitably standardized. Davis and Silverman (1978) criticized the articulation of the talker on these recordings.

Hirsh (1952) modified the PB lists to become CID Auditory Test W-22. All the words were monosyllabic, none appeared on more than one list and were familiar and representative of English. The four lists were tape-recorded with a carrier phrase. The recordings were rather easy even for many individuals with sensorineural hearing loss (Silverman and Hirsh, 1955; Carhart, 1965; Linden, 1965 and Geffner and Donovan, 1974). Campbell (1965) reported that the recordings were not all equivalent with respect to word difficulty. On the other hand, Elpern (1960) and Ross and Huntington (1962) reported that the differences among lists were minimal and insignificant clinically.

Sliverman and Hirsh (1955) developed the CID Sentence Lists. They were representative to colloquial speech. Harris et al. (1961) revised the lists in an attempt to provide a greater homogenity of sentence length while maintaining the colloquial speech criterion. These lists were known as the Revised CID Sentence lists (R-CID). Ulrich (1957) devised a sample of continuous discourse. The sample was in the form of a 15-minute lecture,

"The food Resources of Africa,". It contained all the speech sounds in the relative proportion occurring in written English. This sample was scored in terms of information gained. Giolas and Epstein (1963) indicated that it was too time-consuming and the development of equal forms was a difficult task.

Lehiste and Peterson (1959) constructed ten lists of 50 words which confirmed closely to the phonemic balance of the entire group of monosyllables. The materials used were all of the consonant-vowel-consonant variety and were referred to as CNC words. Peterson and Lehiste (1962) published ten revised lists of CNC materials. The revision was done to eliminate unfamiliar words that appeared in the original versions.

Tillman et al. (1963) developed two new phonetically-balanced 50-word lists which were recorded and designated as Northwestern University Auditory Test. Tillman and Carhart (1966) also developed four phonetically-balanced 50-item lists which were recorded by both male and female talkers and became NU Auditory test No. 6 (NU-6). Kalikow et al. (1977) devised a sentence test called Speech Perception In Noise (SPIN) test.

Multiple Choice - type tests

Black (1957) was the first investigator to use a multiple choice format. Fairbanks (1958) developed Rhyme test using 50 sets of five rhyming monosyllables. House et al. (1965) developed the Modified Rhyme Test (MRT). It consisted of six equivalent lists of 50-words each.

Speaks and Jerger (1965) introduced the Synthetic Sentence Identification (SSI) test which used artificial or synthetic sentences. Artificial in the sense that they were not real sentences and synthetic in the sense that the sequence of words that comprised the sentence followed special rules of syntax. There were 24 closed-message sets representing three levels of approximation to a "real" sentence. Sentence length and informational content were controlled. Jerger et al. (1968) indicated four advantages of the SSI test over the conventional PB testing. First, the message set was closed. Second, the scoring system was unambiguous. Third, each test item was multiword sentence rather than a single word. Fourth, the generation of equivalent forms was easily accomplished.

Schultz and Schubert (1969) developed a Multiple Choice Discrimination Test (MCDT). Owens and Schubert (1977) reported on the development of California Consonant