

# Technical Report



A Test for Auditory Processing Disorders  
in Adolescents and Adults

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## Overview

*SCAN-A: A Test for Auditory Processing Disorders in Adolescents and Adults* enables professionals to obtain central auditory test results in approximately 20 minutes for adolescents and adults. It is an extension of *SCAN: A Screening Test for Auditory Processing Disorders*, published in 1986 to identify children 3 to 11 years who have auditory processing disorders and may benefit from intervention.

Unlike sophisticated imaging techniques that have been developed to identify lesions in specific anatomical structures in the brain that may result in auditory processing disorders, *SCAN-A* provides information about the functional disorders of communication related to specific lesions. Using the results of *SCAN-A*, you can identify a central auditory processing disorder (CAPD) and obtain information about an individual's ability to process auditory stimuli.

## Purpose of Central Auditory Testing

*SCAN-A* can be used to:

- describe auditory processing abilities for planning vocational, educational, and remediation goals for adolescents and adults with learning disabilities and/or language disorders,
- describe central auditory abilities, monitor recovery, and provide a framework for counseling families of individuals who have suffered a head injury or stroke, and
- describe functional impairment or study the effects of medical treatment of individuals with chronic central nervous system disease.

Though *SCAN-A* is designed for both adolescents and adults, the reasons for conducting central auditory testing and the resulting rehabilitation plans differ between the two age groups. You may use

*SCAN-A* to determine if central auditory processing difficulties are contributing to an adolescent's academic problems or behavior disorders. If so, test results provide the information needed to develop an individualized educational plan or appropriate remediation.

For adults, you may want to determine if an auditory processing problem is impeding the individual's ability to perform well on the job, or if a problem exists as a result of disease or trauma. Central auditory tests enable a clinician to identify the social and vocational needs of individuals and provide information about "functional disorders of communication." For persons with learning disabilities that include central auditory disorders, documentation of the auditory needs will help employers make reasonable accommodations in the workplace in compliance with the Americans with Disabilities Act (1991).

# Subtests

SCAN-A includes four subtests that represent functional auditory abilities in everyday listening situations:

- **Filtered Words:** the subject is asked to repeat words that sound muffled. The test stimuli consist of monosyllabic words that have been low-pass filtered at 750 Hz.
- **Auditory Figure-Ground:** this subtest evaluates the subject's ability to understand words in the presence of background noise. Monosyllabic words were recorded in the presence of multi-talker speech babble noise at the +4 dB signal-to-noise ratio.
- **Competing Words:** the subject hears two words

simultaneously—one word presented to each ear. The test stimuli consist of monosyllabic word pairs presented to the right and left ears. For the first set of 2 practice word pairs and 15 word pairs, the subject is asked to repeat the words presented in each ear, repeating the word heard in the right ear first. For the second set, the subject repeats the words presented, repeating the word heard in the left ear first.

- **Competing Sentences:** pairs of sentences unrelated in topic are presented to the right and left ears simultaneously. The subject is instructed to direct attention to the stimuli presented in one ear while ignoring the other.

## Test Design

SCAN-A was designed to test auditory processing ability while de-emphasizing the cognitive and memory aspects of audition. The research design included a sample of normal adolescents and adults to investigate the reliability and validity of the test for individuals who do not have auditory processing problems.

The test can be administered using equipment readily available to qualified professionals involved in identifying individuals at risk for auditory processing disorders.

## Specifications of the Audiocassette

A male speaker, chosen for his clear articulation and Midwestern U.S. dialect, recorded the words for the audiocassette. During the recording, the speaker was instructed to say the carrier phrase, "Say the word," and the stimulus words in a natural manner and at the same intensity. Each word was monitored to zero with a VU meter as it was read aloud. Stimuli were recorded at 5-second intervals, resulting in approximately 4-second intervals between stimuli. This rate gives the subject adequate time to respond without prolonging the test.

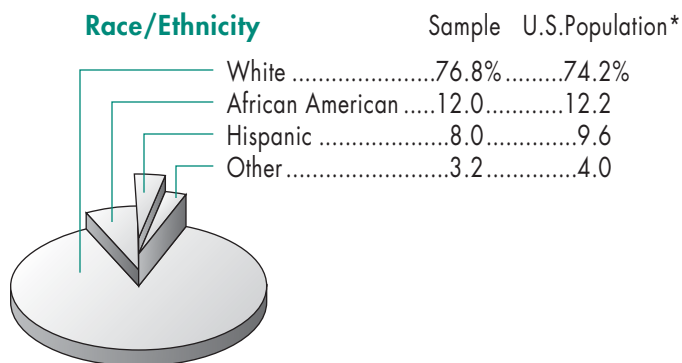
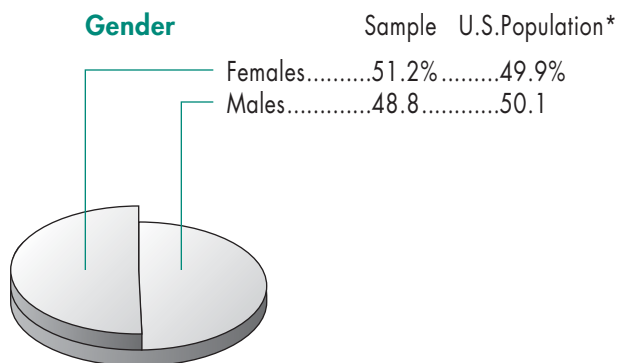
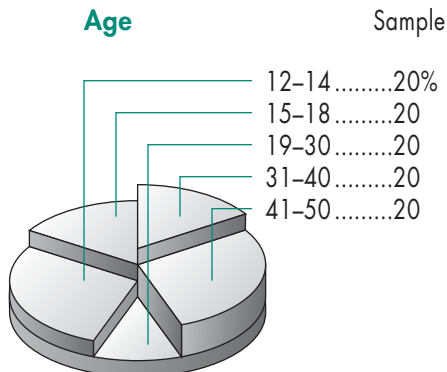
Tape machines used for recording and tape-to-tape transfers were MCI Model JH110B 2-track 1/4" studio recorders. All recordings were done at a tape speed of 7 1/2 i.p.s., using 185 nanowebers per meter reference operating level. Dolby™ Type "A" Noise Reduction equipment was used to reduce tape hiss and print-through. Program peak levels were limited/compressed using Valley People's Model 700 Gain Brain equipment.

# Test Development

Subjects for SCAN-A testing, who were examined by 50 audiologists in university clinics, private practice, and military hospitals and clinics, were required to have pure tone audiometric testing at frequencies 500, 1000, 2000, and 4000 Hz. Subjects whose thresholds were higher than 20 dB HL at any frequency were not included in the sample. Subjects whose hearing test results indicated threshold differences

between ears of 10 dB or more for two or more frequencies also were not included.

The field test study included 125 subjects between 12 and 50 years old from 21 sites located in the four major regions of the U.S. The graphs below show the breakdown of subjects by age, gender, and race.



The means and standard deviations of SCAN-A subtest and total raw scores confirm the original hypothesis that the auditory system of normally developing individuals is typically mature by age 12, and

that results of central auditory tests are the same for individuals ages 12 through 50.

\*1990 Census of Population, U.S. Department of Commerce, Bureau of the Census. Figures are based on subjects aged 12 through 50 years.

# Reliability and Validity

Evidence of reliability is provided by data showing that the SCAN-A scores were homogenous (internal consistency) and dependable and stable across repeated administrations (test-retest reliability). The SCAN-A reliability coefficients were obtained using Cronbach's coefficient alpha with a total test internal consistency reliability coefficient of 0.77. A study to assess the stability of SCAN-A results over time was conducted. Thirty-eight subjects participated in the test-retest study during a five-month period. The test-retest reliability coefficient for the Total Test score was .69 and the standard error of measurement was 2.8.

A test is considered valid to the extent that it measures the abilities it is intended to measure. Research conducted with SCAN-A provides evidence that SCAN-A includes tasks related to auditory processing abilities and that it differentiates between individuals who have normal auditory processing abilities and those who have impaired abilities.

A discriminant analysis was performed to determine how well SCAN-A differentiates between individuals with normal auditory processing abilities and individuals with impaired abilities.

Twenty-five subjects between 12 and 18 years old with CAPD were matched with subjects with normal auditory processing abilities on the basis of age, gender, and race. Clinicians identified subjects as CAPD using other speech-language tests, audiological tests, or clinical judgment. A signal detection model was applied in the discriminant analysis of SCAN-A to determine whether or not SCAN-A correctly differentiates individuals previously identified as having an auditory processing disorder. SCAN-A correctly identified individuals as CAPD or non-CAPD 86% of the time.

Although the primary purpose of SCAN-A is to measure auditory processing, the four subtests provide measures of specific aspects of speech recognition commonly associated with auditory processing. Studies of the relationships among SCAN-A subtests indicate a moderate correlation between the Competing Words subtest and the Competing Sentences subtest, suggesting that the two subtests measure different but overlapping aspects of auditory processing. The low correlation between the Auditory Figure-Ground subtest and the other SCAN-A subtests suggests that the Auditory Figure-Ground subtest taps a different auditory processing skill than the other subtests.

## Summary

*SCAN-A: A Test for Auditory Processing Disorders in Adolescents and Adults* enables professionals to obtain reliable central auditory test results to assist you with diagnosing central auditory problems. You can use test results to plan educational and vocational goals and to monitor progress.

Because of the careful, thorough procedures utilized in developing this test, it serves as a premier instrument for identifying auditory processing disorders in adolescents and adults.

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