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ANSI in 1999

AMERICAN NATIONAL STANDARD
Method for Measuring
the Intelligibility of Speech
Over Communication Systems

ACCREDITED STANDARDS COMMITTEE S3,
BIOACOUSTICS

ABSTRACT

This standard is a revision of the American National Standard Method for Measurement of Monosyllabic Word Intelligibility, ANSI S3.2-1960 (R1982). The standard provides three alternative sets of lists of English words to be spoken by trained talkers over the speech communication system to be evaluated. The selection of the particular set of word lists depends upon the purpose and constraints of the test situation. Trained listeners record the words they hear. The fraction of the words they identify correctly is the measure of the intelligibility of speech over the system. The system may consist of the air and the room or outdoors in face-to-face communications; the equipment and environments used in telephony, public address systems, or ordinary radio; or complex systems of environment, equipment, and air, wire, fiber, radio, and water paths used in some military, space, remote, or emergency communications. The standard specifies test materials that have been thoroughly validated. The standard also specifies methods for selecting and training the talkers and listeners; for designing, controlling, and reporting the test conditions; and for analyzing and reporting the test results.

AMERICAN NATIONAL STANDARDS ON ACOUSTICS

The Acoustical Society of America provides the Secretariat for Accredited Standards Committees S1 on Acoustics, S2 on Mechanical Shock and Vibration, S3 on Bioacoustics, and S12 on Noise. These committees have wide representation from the technical community (manufacturers, consumers, and general-interest representatives). The standards are published by the Acoustical Society of America through the American Institute of Physics as American National Standards after approval by their respective standards committees and the American National Standards Institute.

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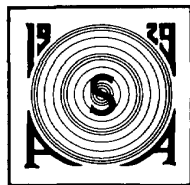
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FOREWORD

[This Foreword is not a part of American National Standard Method for Measuring the Intelligibility of Speech over Communication Systems, ANSI S3.2-1989.]

Since the first rhyme test of intelligibility was described (Campbell, 1910), many tests have been devised to measure intelligibility of speech over communication systems. Research during the 1930s on the factors affecting intelligibility of speech over the telephone and, during the 1940s, over military communication equipment led to a desire, particularly by the U.S. armed forces, for a standard method of measuring the intelligibility of speech over communication systems. In 1953 the American Standards Association and the Acoustical Society of America began work on a standard which became the American National Standard Method for Measurement of Monosyllabic Word Intelligibility, ANSI S3.2-1960 (R1982).

The present standard is a revision of ANSI S3.2-1960. The earlier standard uses the phonetically balanced word lists that were developed for this purpose during World War II. The present standard adds two rhyme tests that were developed and validated since the older standard was adopted. The earlier standard did not specify how to measure speaking level; the present standard specifies the methods of ANSI S3.59. The present standard also includes guidance based on 30 years of development of intelligibility testing methods and their application to digitally processed speech.

The scope of the new standard is limited to the measurement, using trained talkers and listeners (whose native language in both cases is English), of the intelligibility of entire communication systems, i.e., the talkers' environment, the transmission path (air, wire, fiber, water), and the listeners' environment. The relative performance of parts of systems, e.g., rooms, telephones, encoders, helmets, or some speech synthesizers, may be compared by testing them in whole systems.

The standard is not suitable for evaluating speech recognition devices, but it may be a useful contribution to the development of a standard for this purpose. The standard is not suitable for evaluating the quality of speech over a communication system, nor for evaluating the ability of the listeners to identify the talker or his or her emotional state, nor the extent of speech or hearing disorders.

This standard has been developed under the jurisdiction of Accredited Standards Committee S3, Bioacoustics, using the American National Standards Institute (ANSI) Accredited Standards Committee Procedure. The Acoustical Society of America provides the Secretariat for Accredited Standards Committee S3, Bioacoustics.

Accredited Standards Committee S3, Bioacoustics, under whose jurisdiction this standard was developed, has the following scope:

Standards, specifications, methods of measurement and test, and terminology, in the fields of psychological and physiological acoustics, including aspects of general acoustics, shock and vibration which pertain to biological safety, tolerance, and comfort.

FOREWORD

At the time this standard was submitted to Accredited Standards Committee S3, Bioacoustics, for final approval, the membership was as follows:

L. A. Wilber, *Chairman*
J. L. Fletcher, *Vice-Chairman*
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U.S. Department of the Navy, Naval Medical Command ● J. Page, L. Marshall (*Alt*)

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M. E. Hawley, *Chairman*

G. R. Garinther	R. W. Peters	J. C. Webster
T. J. Moore	W. D. Voiers	C. E. Williams

Suggestions for improvement in this standard will be welcomed. They should be sent to **Accredited Standards Committee S3 at the Standards Secretariat, in care of the Acoustical Society of America, 335 East 45th Street, New York, NY 10017-3483. Telephone (212) 661-9404.**

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American National Standard Method for Measuring the Intelligibility of Speech Over Communication Systems

1 SCOPE

The scope of this standard includes the measurement of the intelligibility of speech over entire communication systems and the evaluation of the contributions of elements of speech communication systems. The scope also includes evaluation of the factors that affect the intelligibility of speech.

In this standard the intelligibility of speech over a speech communication system is measured by comparing the monosyllabic words trained listeners receive and identify with the words trained talkers or speech coders speak into a communication system that connects the talkers (or speech coders) with the listeners. The standard requires the intelligibility measurements to be made with talkers and listeners who are native speakers of English and who have no speech or hearing defects.

Limitations. This standard is not intended for use in evaluating automatic speech recognition devices; the sets of speech materials specified in this standard have not been shown to be appropriate or valid for testing systems that include such devices.

This standard is not intended for use in evaluating the intelligibility of speech synthesized by rule (text-to-speech synthesis); the sets of speech materials specified in this standard have not been shown to be appropriate or valid for testing such systems.

This standard is not intended for use in evaluating the articulatory abilities of talkers with speech disorders or for use in evaluating the speech discrimination abilities of listeners with hearing deficiencies.

This standard is not intended for use in evaluating listeners' abilities to identify talkers or their emotional state. Neither is the standard intended for use in evaluating the overall quality of a speech communication system.

2 PURPOSE

The purpose of this standard is to establish uniform methods for measuring the intelligibility of speech over communication systems. The measurement process involves *talkers*, in their environment, who speak

test words into a *transmission path* to *listeners*, who receive and identify the speech in their environment. Figure 1 shows a simple block diagram of such a measurement system.

This standard is intended to be particularly useful to the following groups:

- Preparers of specifications for the performance of speech communication systems, equipment, and facilities;
- Architects and consulting engineers who design spaces and equipment for speech communication;
- Developers, designers, and manufacturers who wish to describe the performance of speech communication equipment; and
- Evaluators of the performance of different talkers, environments, transmission paths (including communication equipment), listeners, or usage procedures for speech communication systems.

Others who may find portions of the standard helpful include *users* of speech communication systems, people who select and train such users, designers, or selectors of the environments in which the systems and equipment will be used, and people who wish to adopt or to modify parts of the standard to suit purposes which are outside its scope.

3 APPLICATIONS

The standard is intended for use in measuring the intelligibility of English speech in either indoor or outdoor spaces with or without speech communication equipment. Examples of the spaces are offices, vehicles, enclosures, auditoriums, and amphitheaters. Examples of the equipment are public address systems, telephones, intercommunication systems, radiotelephones, underwater telephones, broadcast systems, and special systems for speech communication. The standard also is intended for use in evaluating the contribution of the individual components of the communication systems, such as microphones, loudspeakers, headsets, and electronic equipment—and the contribution of the methods of using the components—to the intelligibility of speech over the communication systems.