

## Massachusetts Leads the Way: The Evolution of Vision and Hearing Tests for School-Aged Children

### Vision

As early as 1926, volunteers were being trained to conduct vision screenings on American preschoolers. These tests, however, produced inaccurate and inconsistent results and were inefficient. In 1938, Albert E. Sloane, MD, and Philip W. Johnston, PhD, along with a team of health professionals in Massachusetts, began to study the problem and search for a better screening process. They were aware of the need for such a test, based on reports from preschool readiness conferences, where many deficiencies in both sight and hearing were being found. They searched for a test that would adequately determine visual compromise early in a child's education before it would result in impairment of the learning process. To this purpose they devoted years of research and development. Then even more time was spent field testing and training others in the use of their newly developed equipment, as well as in periodic instrument calibration.

All of this resulted in what became known as the Massachusetts Vision Test, which was officially approved by the Council on Physical Therapy of American Medical Association in 1943. This test detected defects such as myopia, hypermetropia, astigmatism and extraocular muscle imbalances in preschool and school aged children. The units in the test were made so that a non-reading preschooler could still be tested. The Massachusetts Vision Test was adapted and used by the armed forces in World War II and became the prototype for use throughout the nation. In 1968, using the Massachusetts Vision Test, about 27% of the children screened were found to have some visual deficiency.

As the head of Child Growth and Development, Division of Maternal and Child Health in the Massachusetts Department of Public Health from 1939 to 1974, Dr. Johnston continued to find ways to improve vision screening. In 1971, legislation in Massachusetts was passed to make preschool screening for both vision and hearing mandatory. Equipment, such as the products of American Optical and Welch Allyn, which represent the various stages of development of vision screening, are part of the Museum's special exhibit. Most of the early tests were called free space screening tests because they required 20 feet of space for testing; these machines were also affected by ambient light. More modern testing devices are called stereoptic devices and eliminate the need for 20 feet of space and provide adjustment for ambient light. The Keystone Telebinocular, Titmus Optical, and Bausch and Lomb are examples of such devices on display at the Museum.

An Automated Screening Device was developed by Dr. Johnston in the 1970's after considering how complex vision screening had become. *"Wherever testing is complicated and mandatory, nurses or technicians spend a good part of their working time in screening...an automated vision screener... allows the nurse to spend more time in more appropriate functions such as visiting the homes of impaired children, completing arrangements for medical care and discussing the visual condition of children with classroom teachers"* (Johnston, P.W. November 1968, Public Health Reports 83(11), 907). Dr. Johnston designed several visual screening devices, which operated in an automated fashion so that a child could virtually test him/herself



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### Hearing

During World War II, the United States Navy developed a series of hearing tests, which were used in the submarine service. Before, during and after the war, Dr. Philip W. Johnston and his colleagues in the Maternal and Child Health Division of the Massachusetts Department of Public Health were also working to develop more reliable, yet easy-to-use, hearing tests for use in the Massachusetts public schools.

Dr. Johnston served as a radar officer in the Navy and was familiar with the new tests developed during the war, but not totally satisfied with them. Hearing tests up until this time had used a “fading numbers test” for groups or a pure tone audiometer for individuals. Testing was time consuming and not highly accurate. Out of Dr. Johnston’s research, the Massachusetts Hearing Test was developed. Examples of equipment used for the various versions of this test are part of the Museum’s special exhibit.

The Massachusetts Hearing Test first used a phonograph record to reproduce sound in group testing situations. By 1948, after further research and experimentation by Dr. Johnston and his colleagues, a newer version of the test was developed which used an individual audiometer, group earphones and an impedance matching device. Children could respond to sound stimuli by underlining words on self scoring forms. As many as 40, or as few as 10, students could be tested at once. This new method greatly improved the ability of school nurses to test student hearing. In an early report prepared in the 1950’s it was stated that

*“...of those subsequently referred to an otologist as having a hearing loss discovered through the fading numbers test, 75% are returned as not having such a loss. Those uncovered by the Massachusetts test, on the other hand, are in almost 100% of the cases suffering from a hearing impairment, and require the attention of a doctor.”*

As scientifically engineered equipment has improved over the years, so too has the accuracy of the hearing tests. Nevertheless, today over 40 years later, in Massachusetts and throughout the United States modified versions of the Massachusetts Hearing Test are still used to screen children for hearing loss. In 1971, while Dr. Johnston was still with the Massachusetts Department of Public Health’s Division of Maternal and Child Health, the legislature enacted a law, which required all Massachusetts preschoolers to be tested for hearing.

