

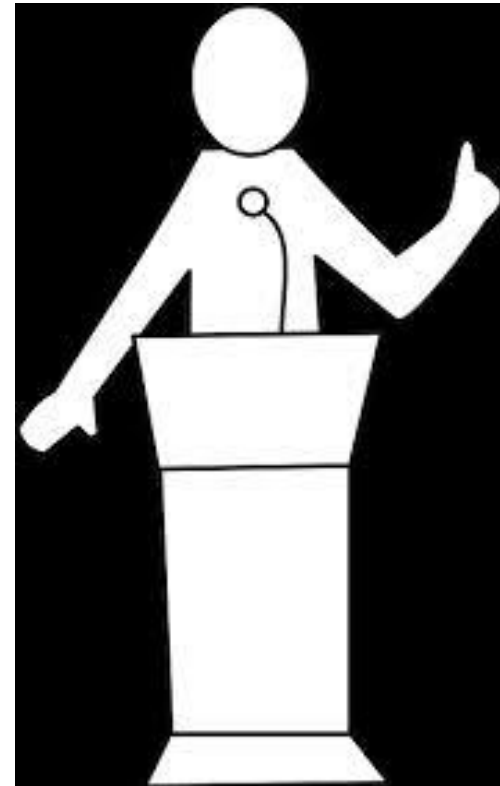


P. Kay Nottingham Chaplin, Ed.D.

- Director – Vision & Eye Health Initiatives – Good-Lite
- Vision Screening Consultant – School Health Corporation
- Member – Advisory Committee to the National Center for Children's Vision and Eye Health at Prevent Blindness

Disclaimer

- Current Director – Vision and Eye Health Initiatives at Good-Lite and School Health Corporation
- Will see “great” and “really awful” eye charts manufactured by The Good-Lite Company and marketed through Good-Lite and School Health Corporation, but focus is not to push product from the podium
 - Focus is to use power of podium to encourage appropriate and evidence-based vision screening as part of a strong vision health system of care



Learning Objectives

1. Describe 3 components of a standardized eye chart for optotype-based screening.
2. Describe 3 steps to consider when using devices for instrument-based screening.

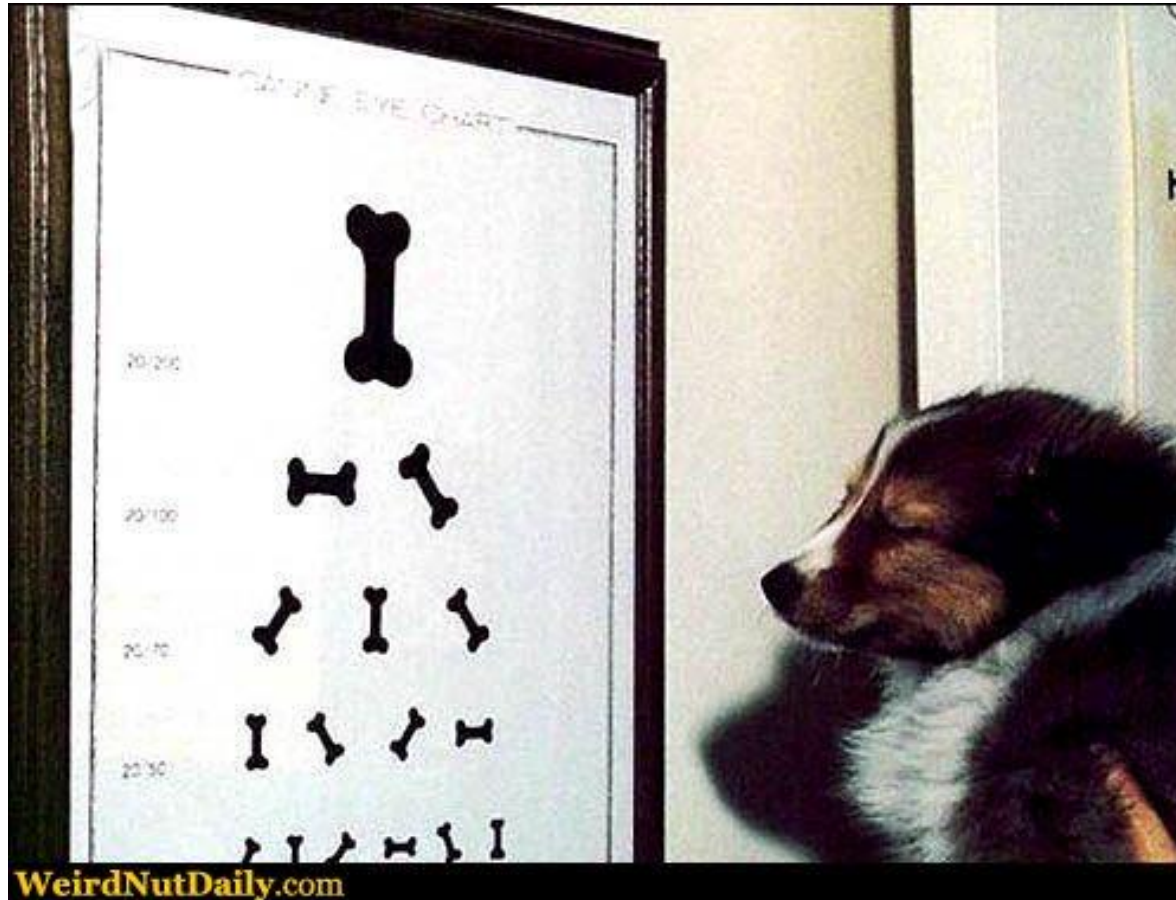


2 Types of Vision Screening

- ✎ Two types of vision screening:
 - Optotype-based
 - Instrument-based
 - Or combination
- ✎ Optotype = name of picture, symbol, letter to identify
- ✎ Optotype-based screening measures visual acuity
- ✎ Instrument-based screening measures for presence of amblyopia risk factors:
 - Significant refractive error
 - Asymmetry of refractive error
 - Misalignment of eyes
 - Presence of cataract



Optotype-Based Screening - (a.k.a. Test of Visual Acuity)



Threshold screening

- ## Critical line screening

-



Single, Surrounded LEA Symbol

- Research supports using single, LEA Symbols optotypes surrounded with bars at 5 feet for children aged 3 to 5 years



Vision in Preschoolers (VIP) Study Group. (2009). Findings from the Vision in Preschoolers (VIP) Study. *Optometry and Vision Science*, 86(6), 619-623.



∞ Many of you use threshold eye charts as a test of visual acuity– this session will focus on threshold eye charts

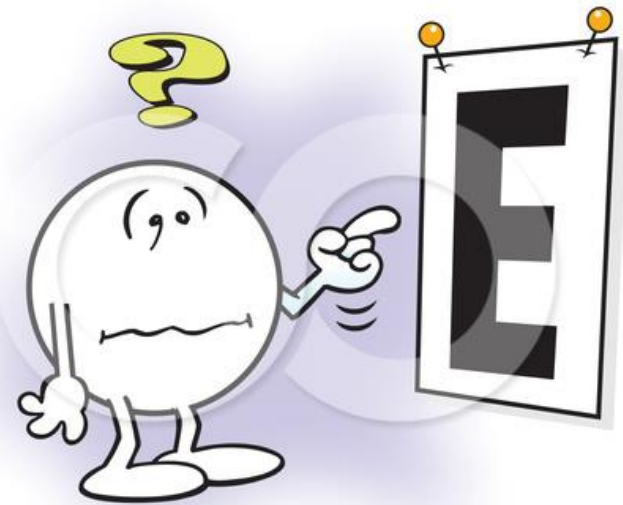


Importance of Appropriate Test of Visual Acuity

- “Visual acuity scores can be significantly affected by the chart design.” (p. 1248)
 - Bailey, I.L. (2012). Perspective: Visual acuity – Keeping it clear. *Optometry and Vision Science*, 89(9), 1247-1248.
- Excluding optotype size, “each visual acuity level on a test chart should present an essentially equivalent task”. (p. 740)
 - Bailey, I. L., & Lovie, J. E. (1976). New design principles for visual acuity letter charts. *American Journal of Optometry & Physiological Optics*, 53(11), 740-745.



- Standardized eye charts meeting national and international eye chart design guidelines offer this equivalent test task.
- Many commonly used eye charts do not.
- If you use an eye chart for optotype-based screening, how do you know if the chart is standardized?



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National and International Distance Visual Acuity Eye Chart Recommendations

- **1980 - National Academy of Sciences-National Research Council (NAS-NRC)**
 - Recommended Standard Procedures for the Clinical Measurement and Specification of Visual Acuity
 - Committee on Vision. (1980). Recommended standard procedures for the clinical measurement and specification of visual acuity. Report of working group 39. Assembly of Behavioral and Social Sciences, National Research Council, National Academy of Sciences, Washington, DC. *Advances in Ophthalmology*, 41:103–148.
- **1984 - International Council of Ophthalmology (ICO)**
 - Visual acuity measurement standard.
 - www.icoph.org/dynamic/attachments/resources/icovisualacuity1984.pdf
- **2003 - World Health Organization Prevention of Blindness & Deafness (WHO)**
 - Consultation on Development of Standards for Characterization of Vision Loss and Visual Functioning
 - Prevention of blindness and deafness. Consultation on development of standards for characterization of vision loss and visual functioning. Geneva: WHO;2003 (WHO/PBL/03.91).
- **2010 – American National Standards Institute, Inc.**
 - ANSI Z80.21-1992 (R2004) Approved May 27, 2010
 - Performance standard for the optical design of optotypes used in clinical visual acuity measurement systems



Optotypes approximately equal in legibility

Horizontal between-optotype spacing = 1 optotype width

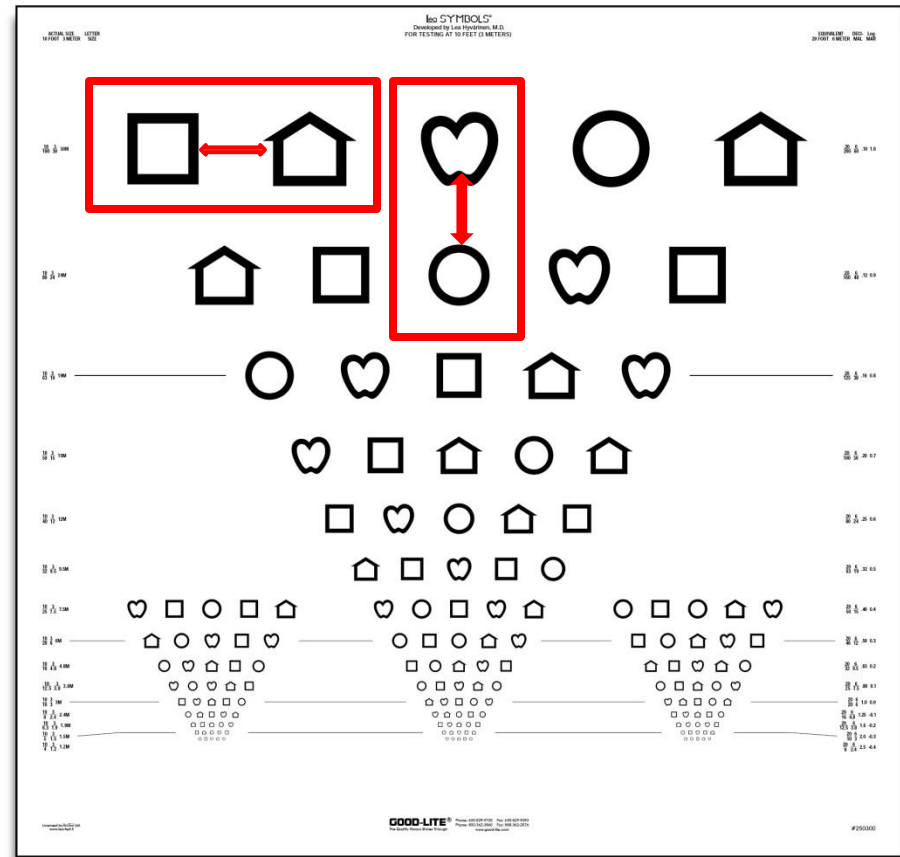
Vertical between-line spacing = height of next line down

Geometric progression of optotype sizes of 0.1 log units (logMAR, ETDRS)

5 optotypes per line

Optotypes black on white background with luminance between 80 cd/m² and 160 cd/m²

Similar recommendations across guidelines

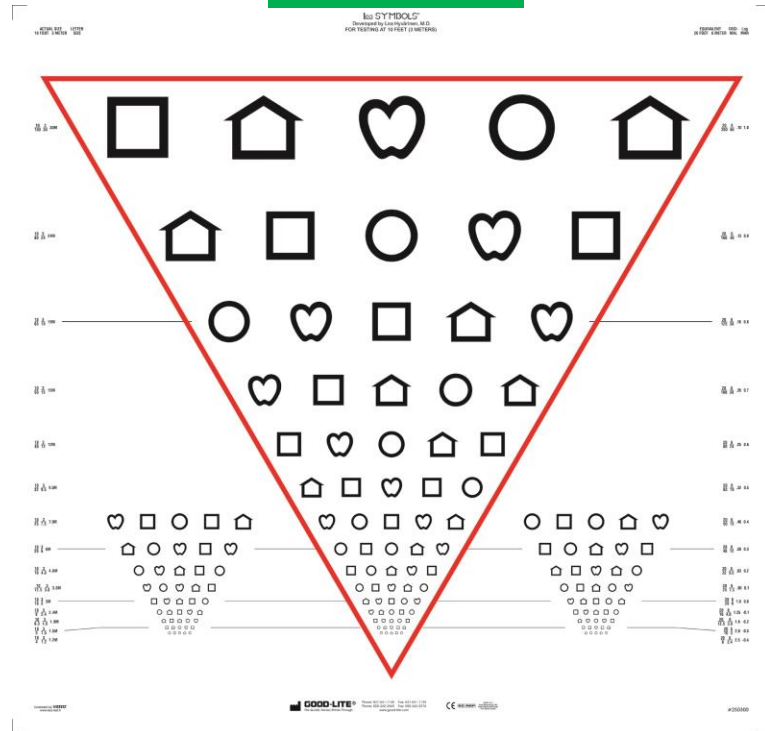


Design guidelines = “ETDRS Design”

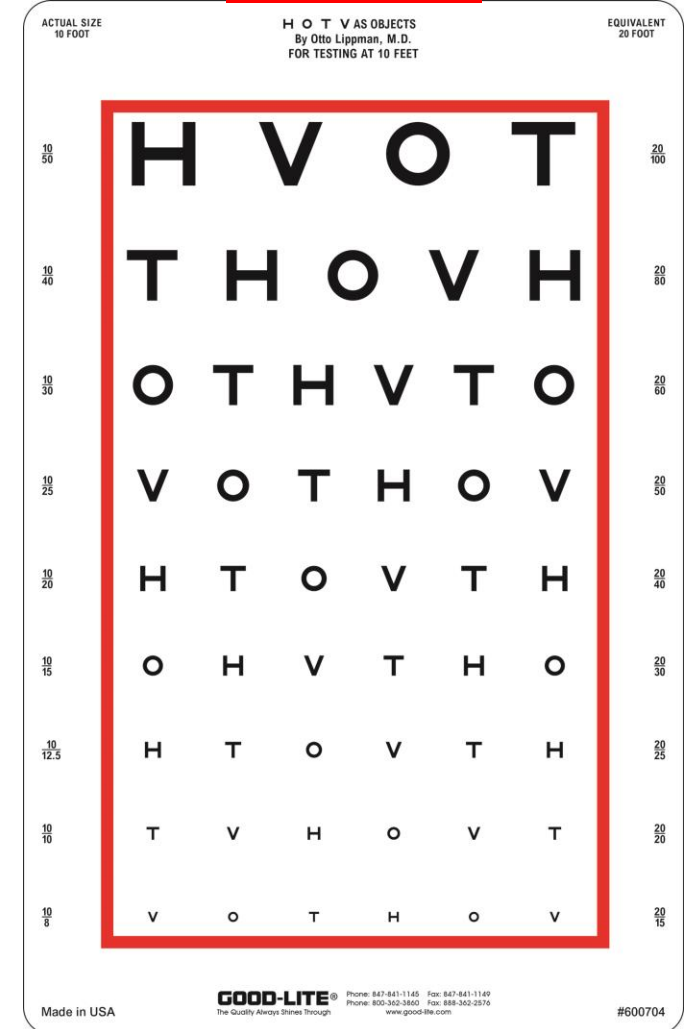
∞ Tips:

- Line outside optotypes = inverted pyramid, NOT rectangle
- 20/32 vs. 20/30
- 10 feet vs. 20 feet

YES

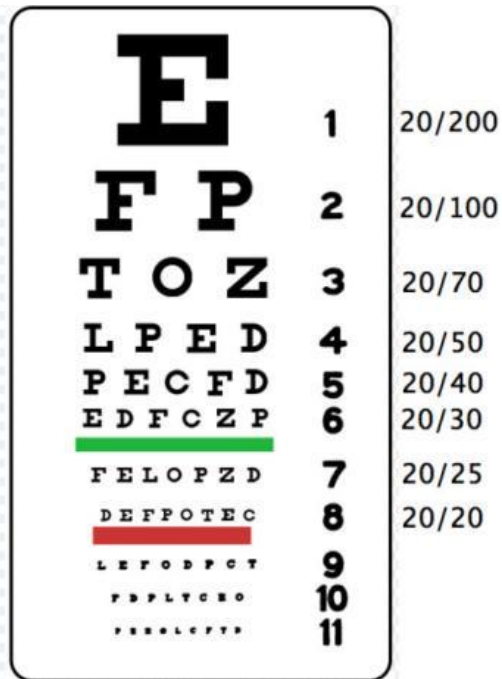


NO

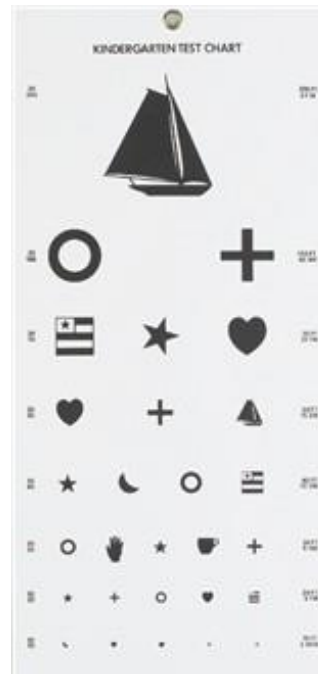


Challenges With 5 Common Eye Charts

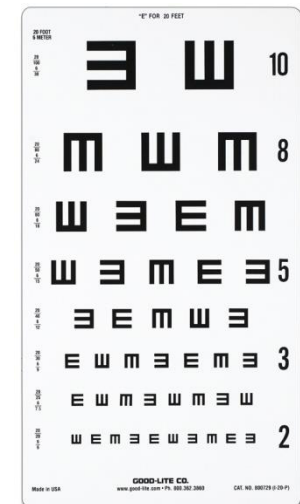
Snellen Letters



Kindergarten Test Chart



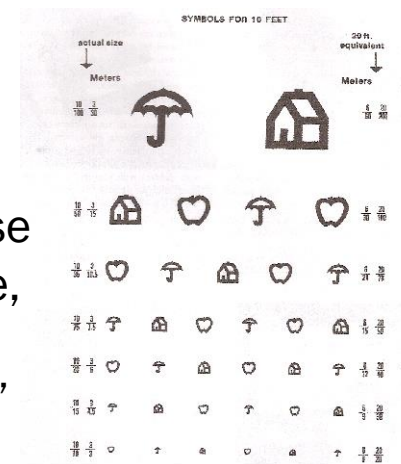
Tumbling E



Allen Pictures

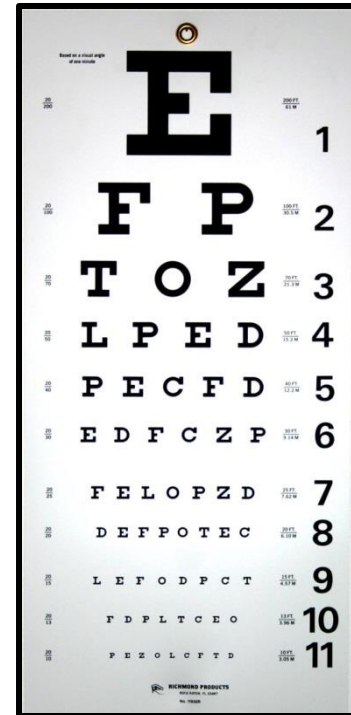
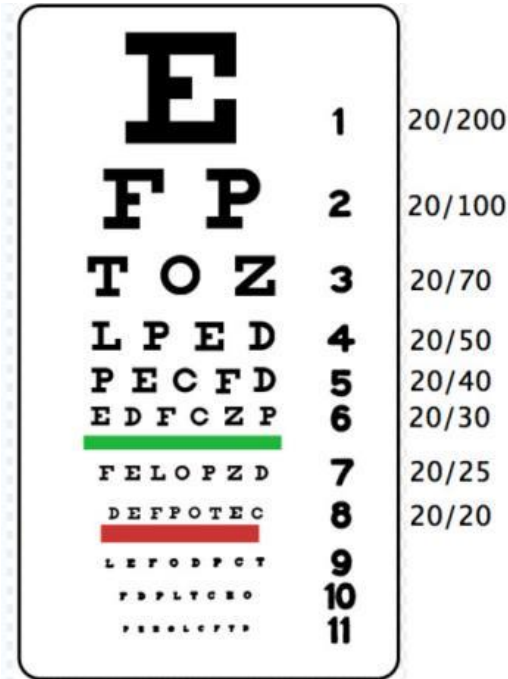


Lighthouse or "House, Apple, Umbrella"



2 Challenges With “Snellen Charts”

- ✂ Do not meet national/international eye chart design guidelines
- ✂ Are not standardized
- ✂ Some optotypes are easier to guess than others



Kaiser, P. K. (2009). Prospective evaluation of visual acuity assessment: A comparison of Snellen versus ETDRS charts in clinical practice (An AOS thesis). *Transactions of the American Ophthalmological Society*, 107, 311-324.



“Sailboat” Chart Lacks Scientific Evidence

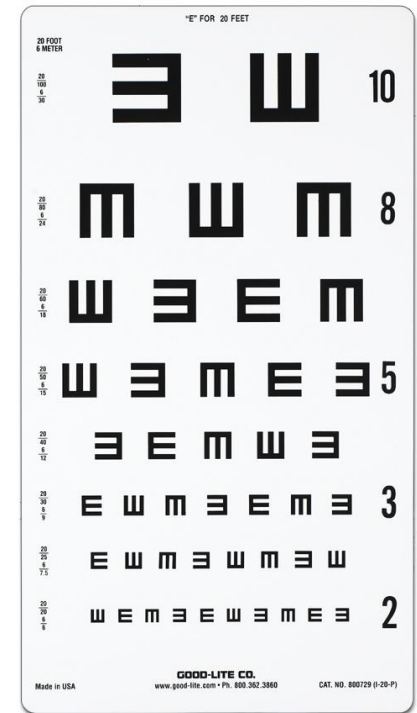
- ✂ Does not meet national/international eye chart design guidelines
- ✂ Optotypes of different sizes on same line
- ✂ NEVER on recommended list of eye charts from American Academy of Pediatrics
- ✂ Chart’s history and developer unknown
- ✂ No supporting research to validate



2 Challenges With Tumbling E

1. Children's orientation and direction challenges with directional optotypes
 - a. Emerging cognitive skill
 - b. Up/down emerges before left/right
 - c. Usually in place by ages 8 or 10 years

2. Ability to guess optotype at threshold



Elkind, D. (1961). Children's conceptions of right and left: Piaget replication study IV. *The Journal of Genetic Psychology*, 99, 269-276.

Hyvärinen, L., Näsänen, R., & Laurinen, P. (1980). New visual acuity test for pre-school children. *Acta Ophthalmologica (Copenhagen)*, 58(4), 507-11.

- “Because of the difficulty in inducing children and stupid illiterates to name the position of the Snellen E, or to hold its duplicate in the hand in the same direction as the character on the chart, the author constructed a set of test-type for illiterates in
- **1886”...**

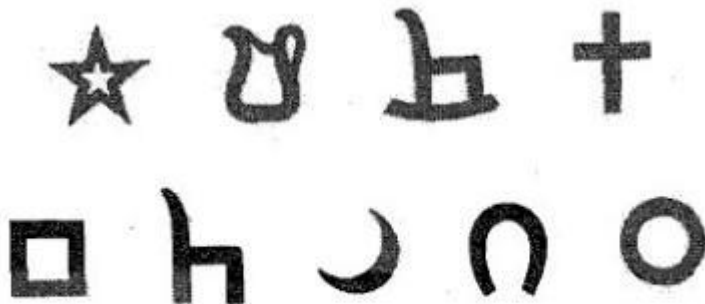


Fig. 11. The illiterate tests of Green and Ewing, 1886.

Ewing, A. E. (1920). Test objects for the illiterate. *American Journal of Ophthalmology*, 3, 5-22.

3 Challenges With Allen Pictures

1. Asking young children to make a “whole” picture from “parts”
2. Cultural bias
3. Calibrated against Snellen 30-ft E, not Landolt C (international standard)

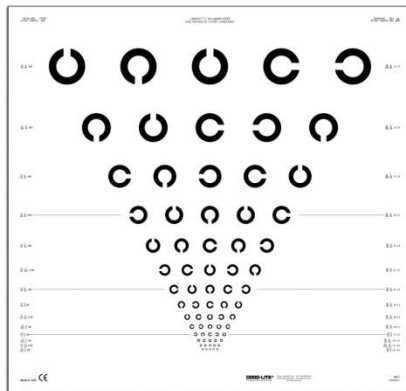
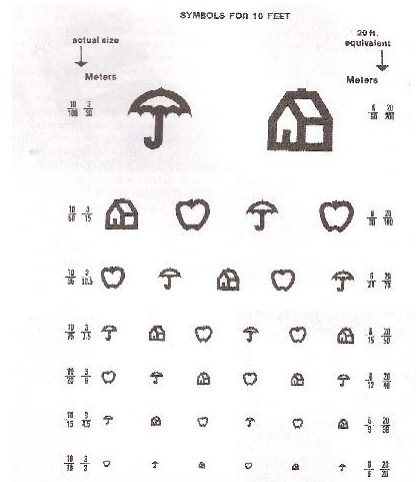


Fig. 1 (Allen). Preschool vision test characters. Actual size with 30-foot E.



Lighthouse Chart

- ✎ Optotypes easy to guess
- ✎ Poor visual acuity results when compared with international Landolt C standard



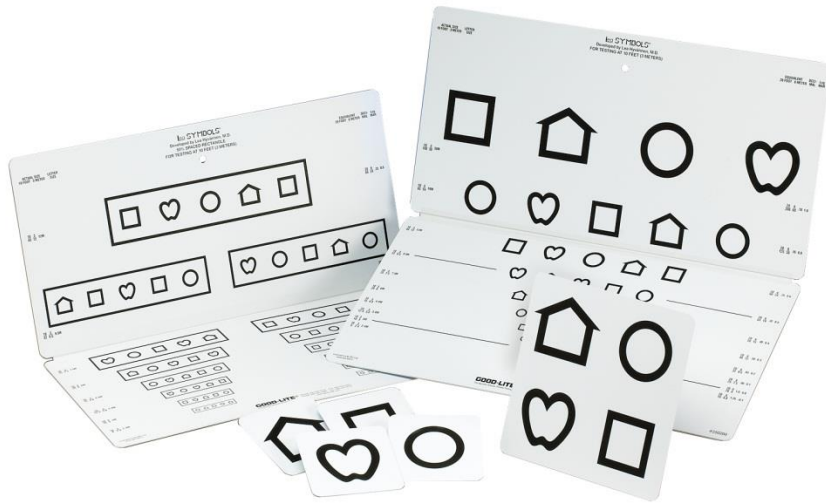
- ✎ Not on list of charts recommended by:
 - American Academy of Pediatrics
 - American Association of Certified Orthoptists
 - American Association for Pediatric Ophthalmology and Strabismus
 - American Academy of Ophthalmology

Candy, T. R., Mishoulam, S. R., Nosofsky, R. M., & Dobson, V. (2011). Adult discrimination performance for pediatric acuity test optotypes. *Investigative Ophthalmology & Visual Science*, 52(7), 4307-4313.

Eye examination in infants, children, and young adults by pediatricians. (2003). *Pediatrics*, 111(4), 902-907.

Preferred Optotypes for Pediatric Eye Charts

LEA Symbols

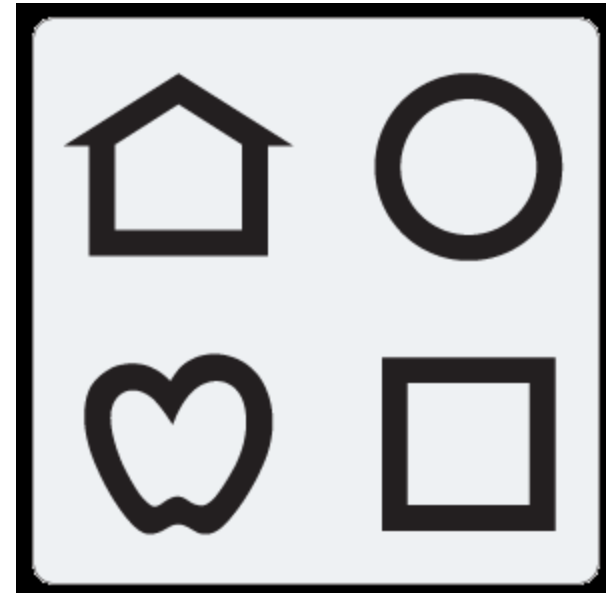


HOTV



LEA Symbols

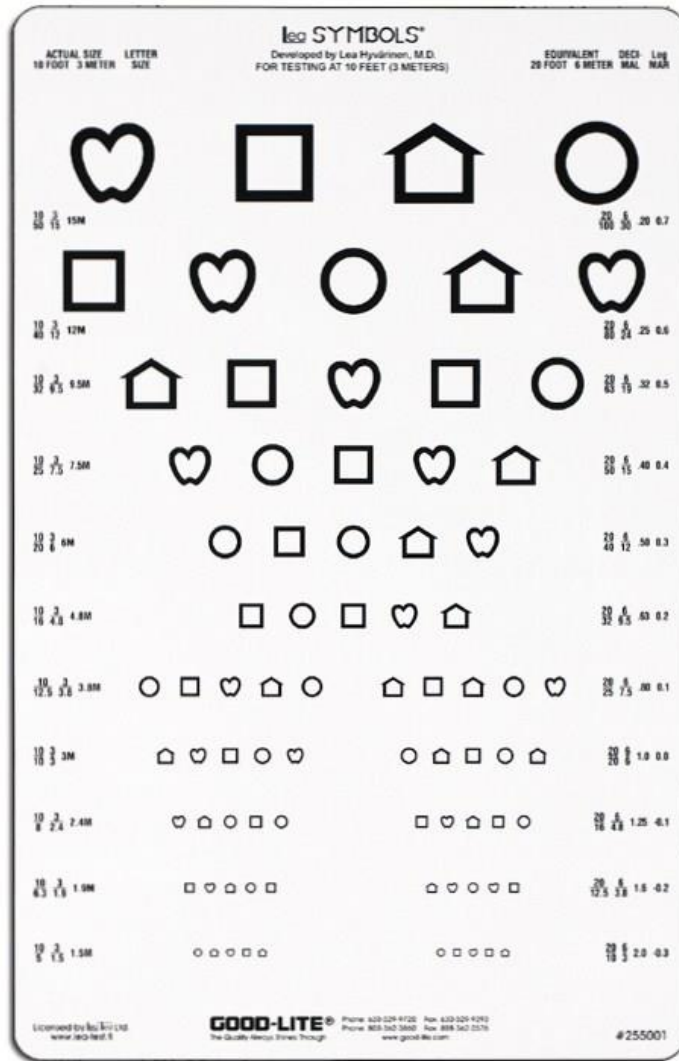
- Only pediatric eye chart with optotypes that blur equally at threshold
- Culturally neutral
- Children call optotypes what they want
 - i.e., Square may be an iPad
 - Circle may be hula-hoop



Beware of . . .



“Linear-Spaced” Eye Charts



- 100% spacing between optotypes (1 optotype-width)
- Unequal spacing BETWEEN lines



“Wide-Spaced” Eye Charts



- Between-optotype spacing >100%
- Unequal spacing BETWEEN lines
- Basically contains lines of single optotypes



No Single Optotypes or Flashcards Without Surround Bars for Typically Developing Children

- Visual acuity results, on average, 3 lines worse on charts with lines vs. single, non-crowded optotypes
 - For example, 20/32 with single, isolated optotype and 20/80 with line chart



Youngson, R. M. (1975). Anomaly in visual acuity testing in children. *British Journal of Ophthalmology*, 59(3), 168-170.

Hilton, A. F., & Stanley, J. C. (1972). Pitfalls in testing children's vision by the Sheridan Gardiner single optotype method. *British Journal of Ophthalmology*, 56(2), 135-139.

A Historical Review of Distance Vision Screening Eye Charts

What to Toss, What to Keep, and What to Replace

P. Kay Nottingham Chaplin, EdD, West Virginia

Geoffrey E. Bradford, MD, West Virginia

Vision screening protocol and equipment guidelines differ among schools across the United States. Budget cuts are forcing many school nurses to reevaluate their vision screening programs, as well as items in their vision screening toolboxes. School nurses tasked with inventorying those toolboxes to determine which items to toss, keep, or replace are oftentimes perplexed by the copious choices featured in vendor catalogs and websites. For school nurses who want their vision screening toolboxes to include eye charts, national and international eye chart design guidelines are available to help ensure selected eye charts are standardized. A national consensus policy exists that recommends specific eye charts. And, a large body of vision screening literature is available to help school nurses make informed decisions. Current documents suggest that LEA Symbols are appropriate for young children and Sloan Letters are a better choice than "Snellen" charts for older children.

Keywords: preschool vision screening; school-aged vision screening; LEA Symbols; HOTV; Sloan Letters; eye charts; eye chart design recommendations

The first state-supported vision screening program in a school setting started in Connecticut in 1899 with a distance visual acuity Snellen chart as the testing tool (Appelboom, 1985). Though some school nurses across the United States have added vision testing devices to their toolboxes during the last 112 years, the time-honored eye chart continues to hold a primary and prominent space in those toolboxes.

Technology-based vision screening tools include computerized vision screening software, instruments with slides, autorefractors, and photoscreeners. The choice of vision screening tools oftentimes depends on a budget line item and a school nurse's comfort with using instrument-based technology.

Budget cuts are forcing many school nurses to reevaluate the vision screening tools they use or replace. Effective distance wall charts may be a better fit for a tight budget.

Distance Visual Acuity Optotype Charts as Gold Standard

Optotype (letters, numbers, and pictures) charts continue to serve as the most common test for assessing visual acuity in clinical practice (Ehrmann,

Fedtko, & Radić, 2009). In schools, distance visual acuity eye charts have been the gold standard for decades (Proctor, 2005). Eye charts "are time-honored, considerably less expensive than vision testing machines and other similar equipment, and effective for screening, if appropriately selected and used" (Proctor, 2005, p. 33).

Challenges in Choosing Optotype Distance Visual Acuity Charts

Countless eye charts have emerged since Herman Snellen introduced his optotypes in 1862 (Bennett, 1965). The "Snellen" chart concept has withstood the test of time, although this chart, as well as others, has design challenges that may reduce the accuracy of screening vision in children. Selecting appropriate eye charts is challenging because no one particular national standard exists to provide guidance on selecting distance visual acuity eye charts to use in the school setting.

Eye chart recommendations differ among the 38 states, and the District of Columbia, with school vision screening requirements (The Vision Council, 2009). Vendor catalogs and websites offer

Nottingham Chaplin, P. K., & Bradford, G. E. (2011). A historical review of distance vision screening eye charts: What to toss, what to keep, and what to replace. *NASN School Nurse*, 26(4), 221-228. <http://nas.sagepub.com/content/26/4/221.abstract>

Instrument-Based Screening



Instrument-Based Vision Screening

✧ Instruments

- Require no child response or interaction



✧ Machines, such as Titmus

- Not considered an instrument
- Use slides or cards
 - Require child response or interaction

Neely, D. E. (2013). The eyes have it: Advances in vision screening should lead to early diagnosis, treatment of preventable blindness in children. AAP News, 34(5), 14-15.



Current Recommendations

| Child Ages for Optotypes and Instruments | | |
|--|----------|------------|
| AGE | OPTOTYPE | INSTRUMENT |
| Preverbal children | | X |
| Preliterate children | | X |
| 6 months to 3 years | | X |
| 3 to 5 years | X | X |
| >5 years | X | |

Miller, J. M., Lessin, H. R., American Academy of Pediatrics Section on Ophthalmology, Committee on Practice and Ambulatory Medicine, American Academy of Ophthalmology, American Association for Pediatric Ophthalmology and Strabismus, & American Association of Certified Orthoptists. (2012). Instrument-based pediatric vision screening policy statement. *Pediatrics*, 130(5), 983-986. Retrieved from <http://pediatrics.aappublications.org/content/130/5/983.full.pdf+html>



Current Recommendations

∞ Children aged 3 to 5 years:

- Instrument-based screening has not been shown to be superior or inferior to optotype-based screening.

Schmidt, P., Maguire, M., Dobson, V., Quinn, G., Ciner, E., Cyert, L., . . . Vision in Preschoolers Study Group. (2004). Comparison of preschool vision screening tests as administered by licensed eye care professionals in the Vision in Preschoolers Study. *Ophthalmology*, 111(4), 637-650. Retrieved from <http://download.journals.elsevierhealth.com/pdfs/journals/0161-6420/PIIS0161642004001629.pdf>

Instrument-Based Screening

- ✎ Most experts believe cannot convert instrument measurement to visual acuity
- ✎ If use instruments, have test of visual acuity as back-up
 - Forgot to charge battery
 - Device malfunctions
 - Cannot achieve a reading
- ✎ Head Start children in Vision in Preschoolers Study
 - Could “nearly always” participate in instrument-based screening if unable to participate in optotype-based screening, and vice versa

Vision in Preschoolers Study Group. (2007). Children unable to perform screening tests in Vision in Preschoolers Study: Proportion with ocular conditions and impact on measure of test accuracy. *Investigative Ophthalmology & Visual Science*, 48(1), 83-87. Retrieved from <http://www.iovs.org/content/48/1/83.full.pdf+html>

- ✓ Welch Allyn SureSight
 - ✓ Calibrated every 18 months
 - ✓ Set in child mode
 - ✓ Set in “minus” calibration until you can upgrade to recent software
 - ✓ Upgrade software to Version 2.25



- ✓ PediaVision Spot
 - ✓ Updated with most recent software
 - ✓ Discuss referral criteria with local eye care professional



- ✓ Plusoptix S09, S12R, or S12C
 - ✓ Updated with most recent software
 - ✓ Discuss referral criteria with local eye care professional



Thank You for Your Time and Attention!!!!



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