Is It Worse Doctor?

David Sculfor BSc (Hons) MCOptom
Consultant Optometrist and
Head of Optometry
Buckinghamshire Healthcare
NHS Trust

Is it worse doctor?

- Common question
  - Usually as the patient enters the room ☺
- What does the patient think 'worse' means?
- What do we think worse means?
- Has 'it' really changed?
  - e.g. visual acuity

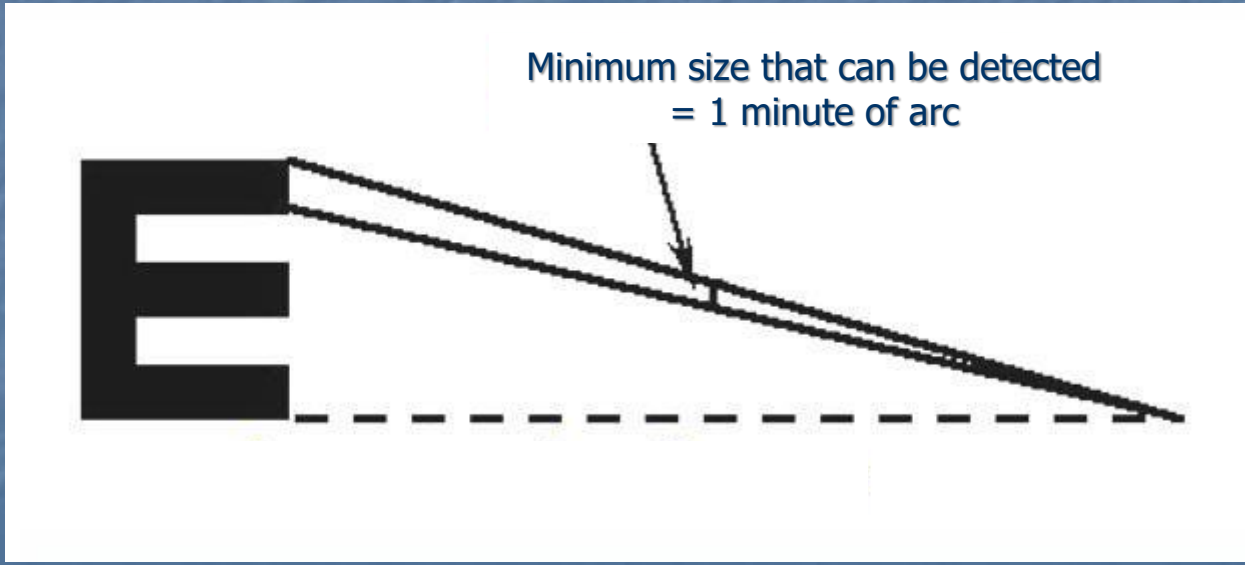
Agenda

- Visual acuity measurement
- What are we measuring?
- Why and how do we measure it?
- Chart types
- Live measuring
- Has it changed doctor?
- Causes of variation
- Can we do better?

What are we measuring?

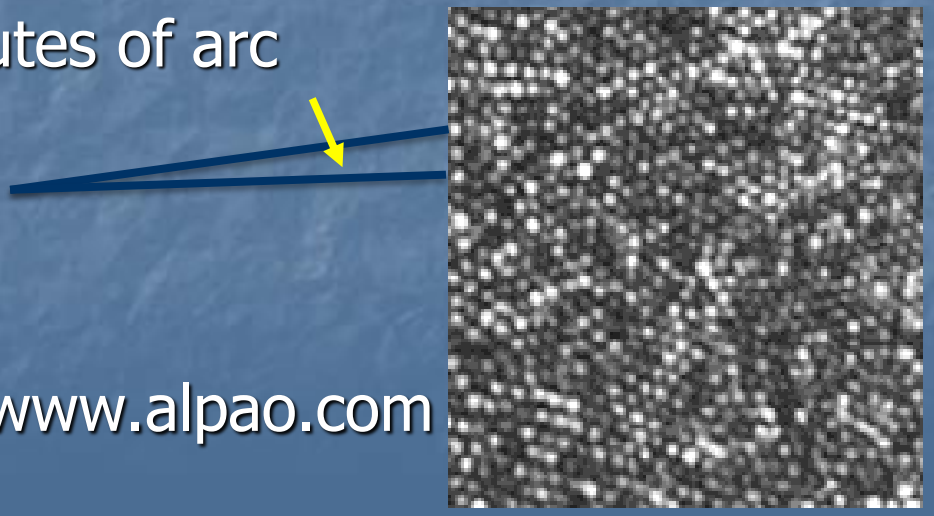
Limit

- ~~Ability~~ of visual system to see fine detail
  - High contrast – plain black on white



How low can you go?

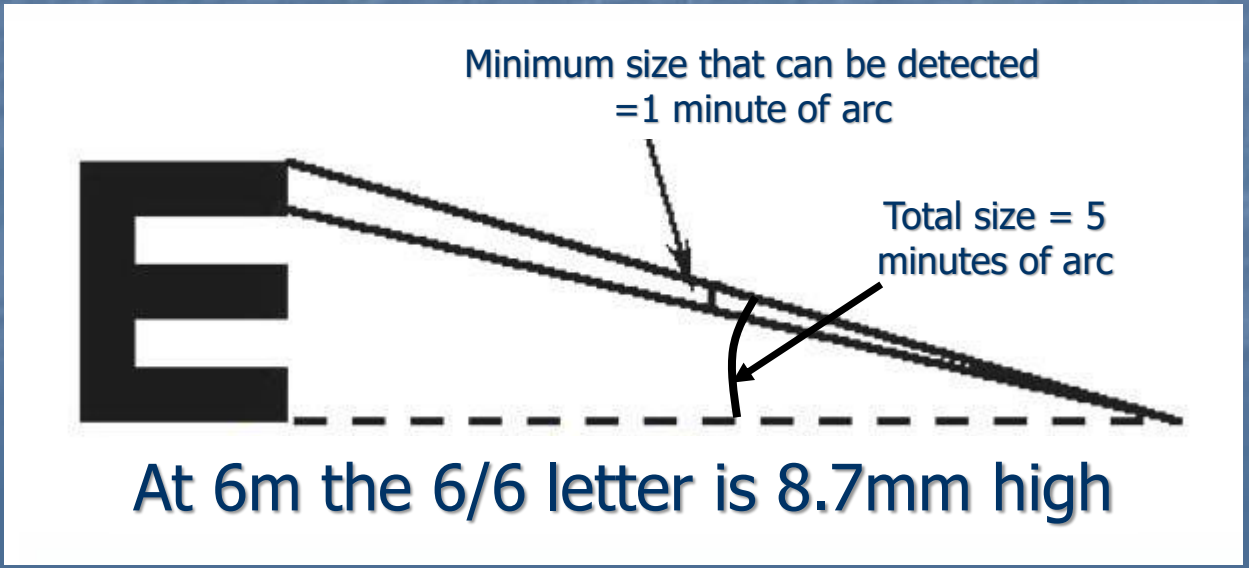
- Theoretical limit due to
  - Optical properties of the eye
    - 45 minutes of arc
  - Separation of cones at the fovea
    - Also 45 minutes of arc



www.alpao.com

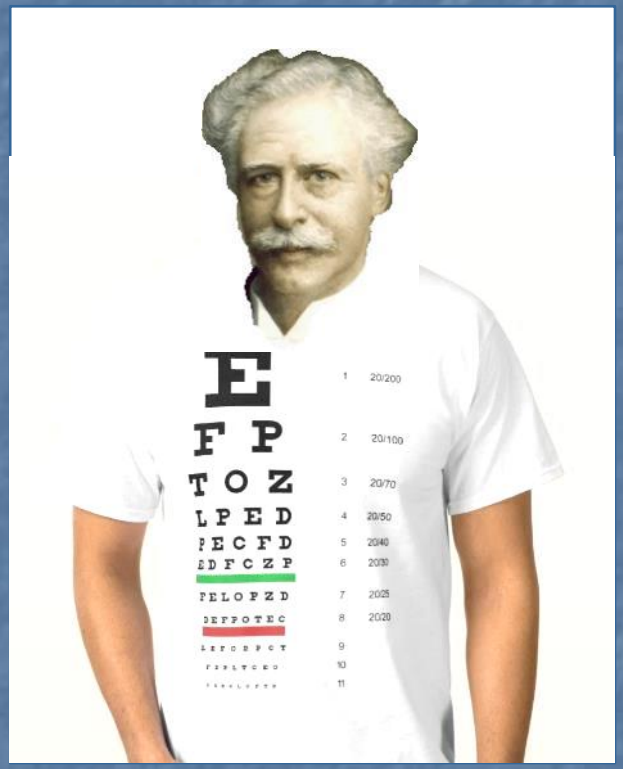
Measuring acuity

- Part of the DESP screening protocol
- Used in M1 maculopathy definition
  - 6/12 or worse with retinopathy within 1DD
    - Probably not very good
- Letter charts commonly used



Are letters any good?

- Familiar task
- 26 letters so hard to guess, but…
- Some letters easier to read than others
- Approx equal legibilty
  - BS4274 – DEFHNPRUVZ
  - Sloan – SDKHNOCVRZ



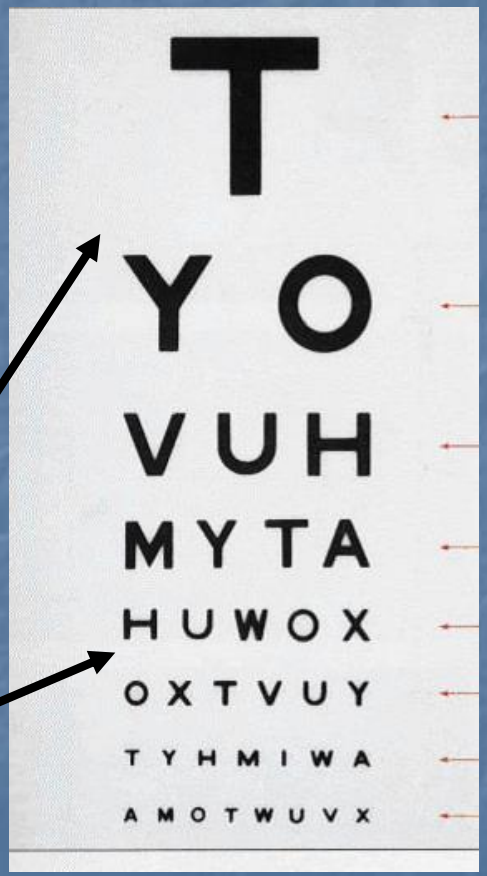
Herman Snellen
1834-1908

www.zazzle.co.uk

Well done Herman, but…

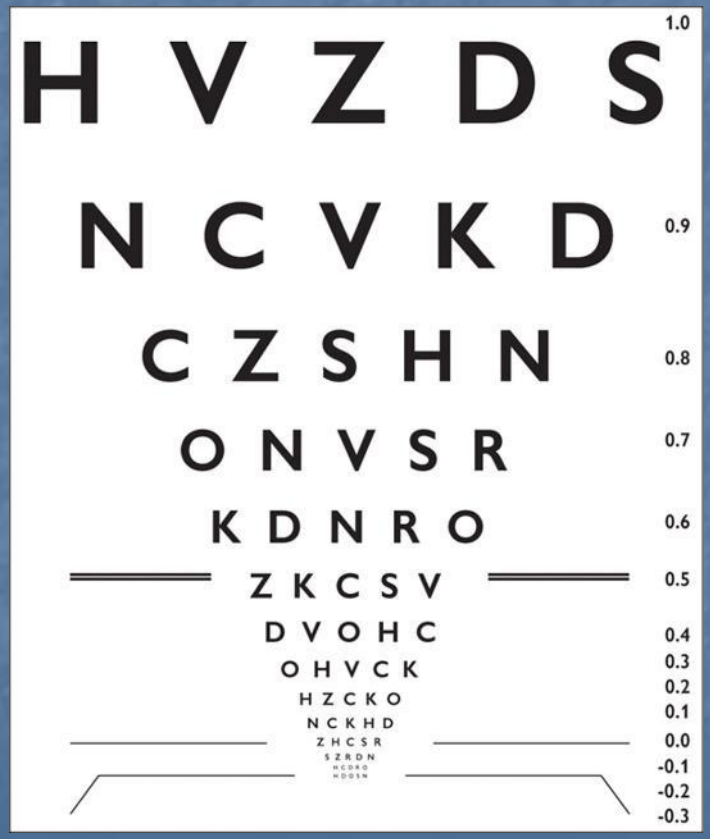
Snellen chart has serious flaws

- Crowding phenomenon
  - Number of letters on line
    - From one to eight
  - Spacing between letters
  - Spacing between lines
- Irregular jump in size
  - 6/60 to 6/36 = 40% change
  - 6/12 to 6/9 = 25% change
- Recording system



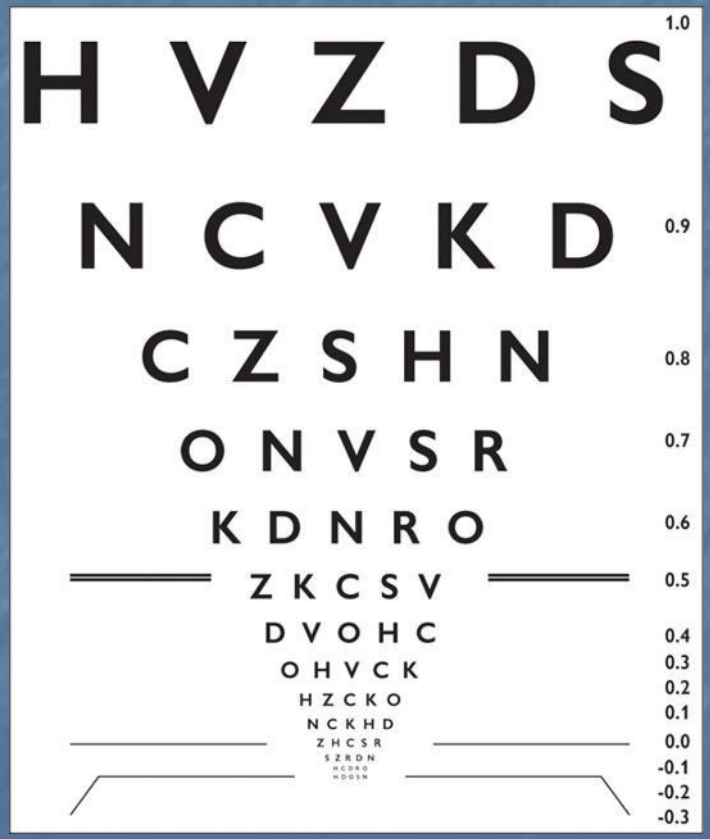
LogMAR charts

- LogMAR = $\log_{10}$ Minimum Angle of Resolution
  - Minimum gap that can be detected = 1 min of arc
    - Log_{10} 1 = zero so 6/6 on logMAR chart scores 0.00
- Standard scoring not intuitive
  - Score -0.02 per letter
  - E.g three letters on 0.2 line gives score of 0.24
  - Better than 6/6 gives minus score so 6/5 = -0.10



Advantages of logMAR chart

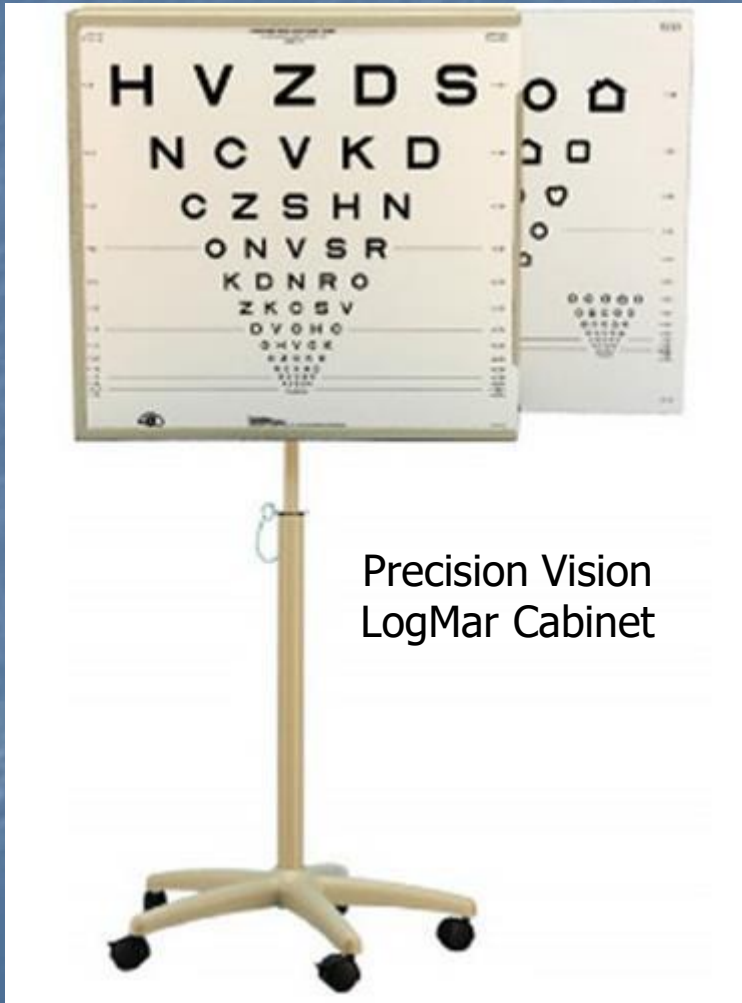
- Same task at every size
  - 5 letters per line (crowding)
  - Equal mix of letter difficulty on each line
  - Each line 33% smaller than one above
  - Spacing between lines equal to letter size below
  - Vision below 1.00 (6/60)?
    - Halve the test distance and add 0.30 to the score



Why don't we use LogMAR more?

Disadvantages (not major)

- Big chart 60cm square
- Slower as more letters to read
- Scoring clunky
  - But you get used to it…
- More M1 false positives
  - Maybe because of poor technique



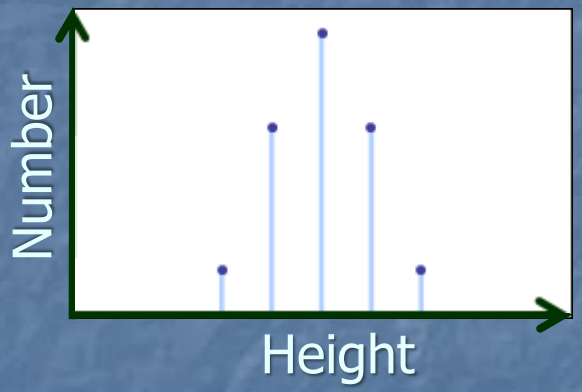
Precision Vision
LogMar Cabinet

Why do measurements vary?

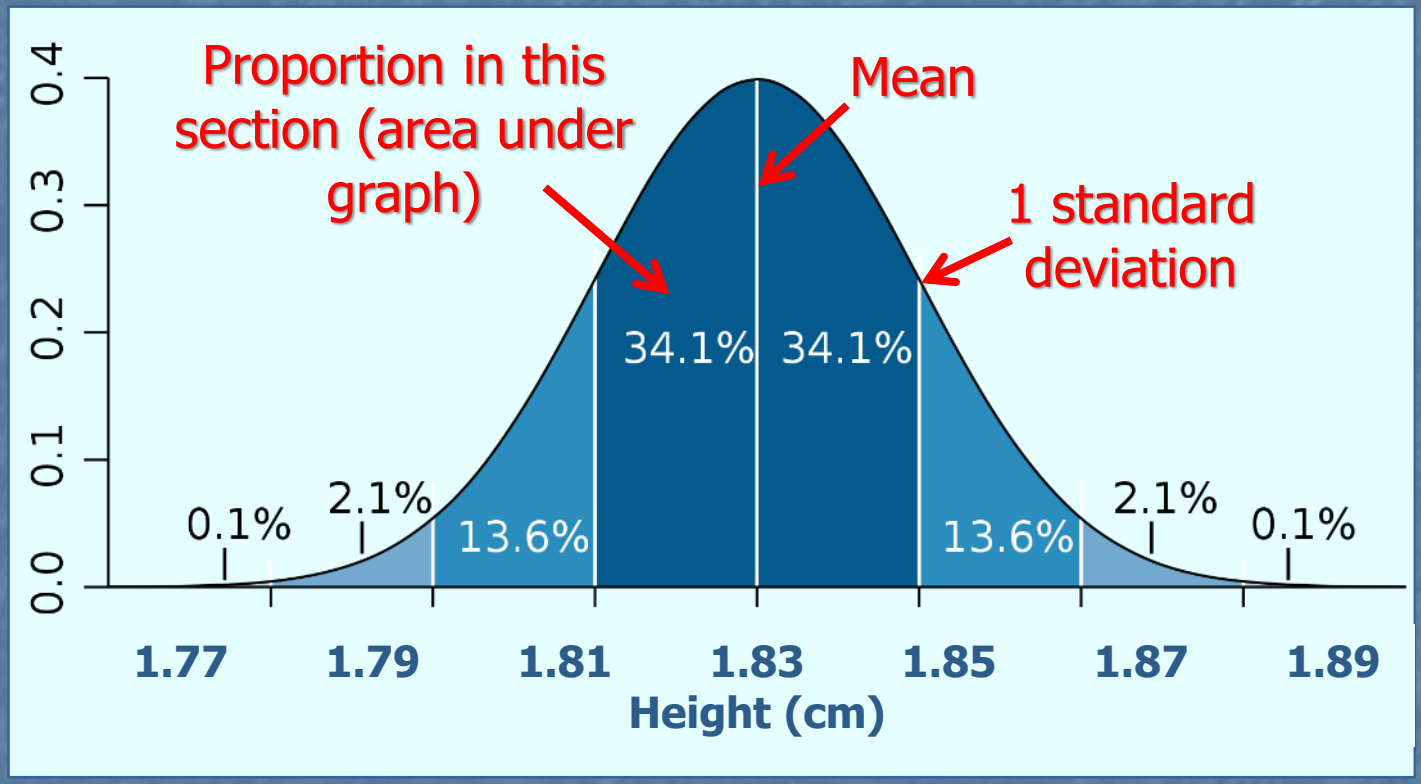
- There is no such thing as an absolutely accurate measurement
- Repeat test 10 times one after the other
  - Same subject, operator and equipment
- Will we get the same result each time?
  - Very unlikely, yet the subject hasn't changed!
- Called test-retest variability (TRV)

Distribution curves

- Physiological measurements tend to show normal distribution (or similar)



So how tall am I?

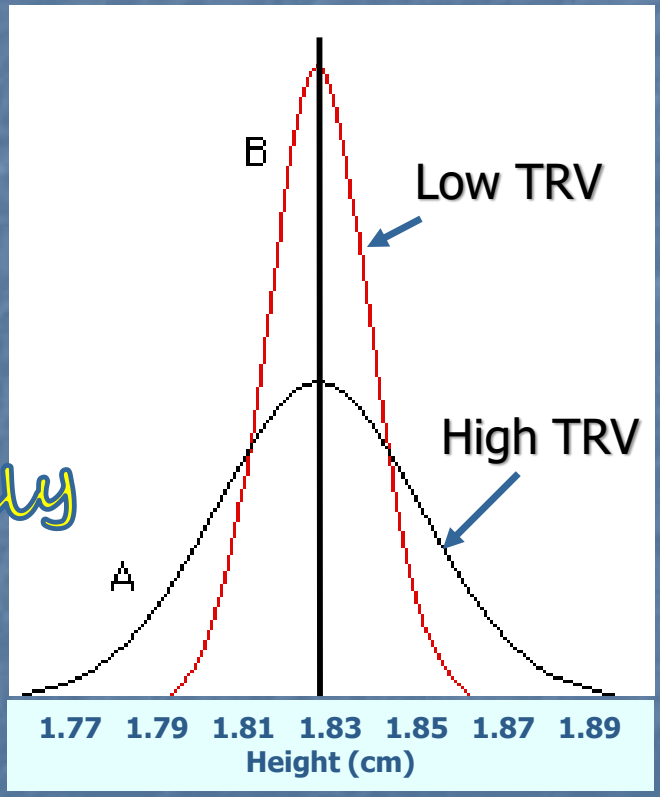


95% certain that my true height is between 1.795cm and 1.865cm

TRV – Test-retest variability

- Test-retest variability
  - Higher TRV = lower ability to detect change
  - If the test itself varies how do you know whether change is genuine or just chance?
  - 'Change' must at least exceed the TRV

probably

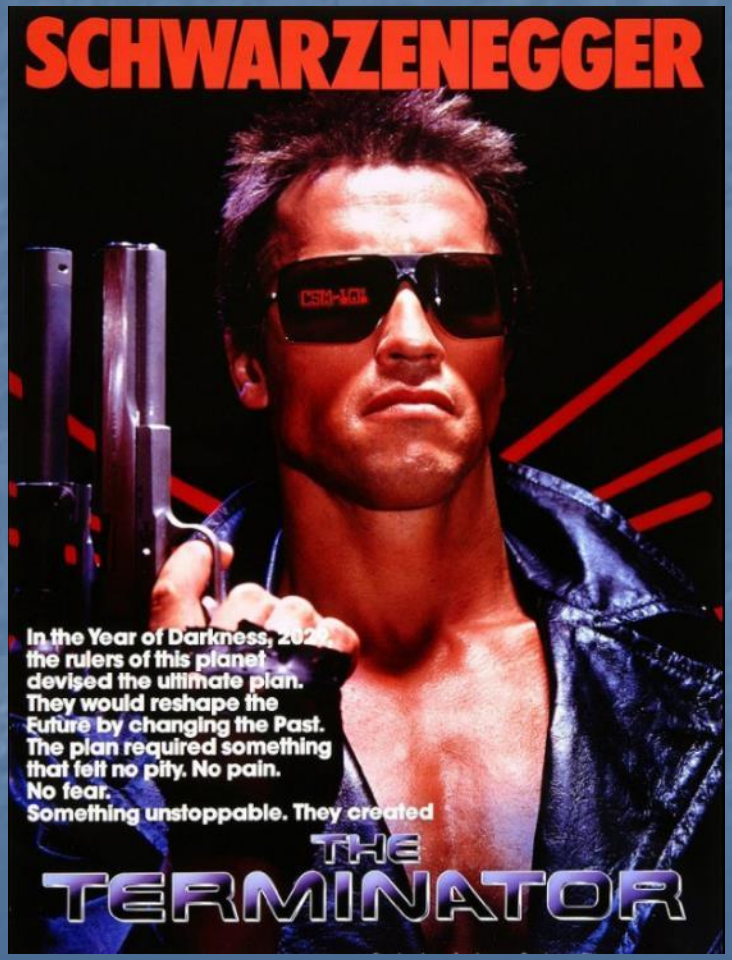


Has my vision changed doctor?

- To be reasonably certain (95% confident) the ‘change ‘ is genuine (significant)
  - LogMAR +/-0.07 to 0.20 = 3.5 to 10 letters
    - +/-0.15 = 7 or 8 letters for children
  - Snellen +/-5 to 16 letters
    - Worse for patients with pathology
- And that’s under ideal test conditions…
- But don’t ignore a trend

Can we do better?

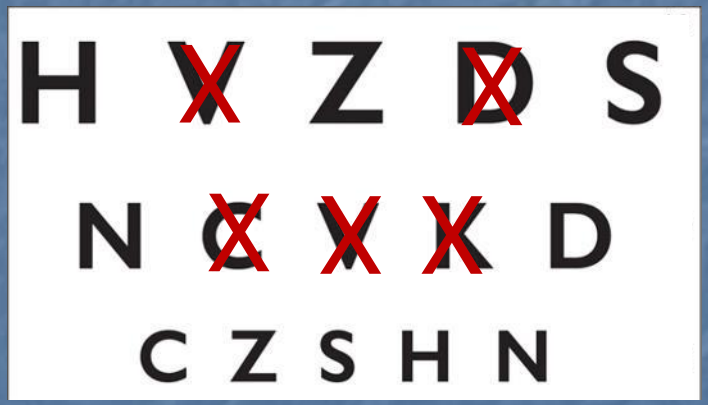
- Causes of variation
  - Glasses (varifocals)
  - Test distance
  - Illumination
- Repeat test, even dilated
- The Terminator



The Terminator

At what point do you allow the patient to stop attempting to read letters?

- logMAR
  - Not until they get at least half the letters on a line wrong



VA =0.86 LogMAR

- Snellen
  - No established method

  - Complete line and any number on next line?
  - From 6/18 down
    - Continue if up to 2 errors on a line?

Take home messages

- Don’t read too much into small apparent changes in acuity
  - But don’t ignore a trend!
- Consider switching to LogMAR charts
  - Ideally electronic
- Agree on and implement a termination point