Proposal for encoding symbols for visual acuity charts
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30/12/2018

Introduction. It is common practice for Ophthalmologists, to diagnose eyesight problems with charts of letters of decreasing sizes; the patient recites the letters and if they fail at a particular scale, the doctor can estimate the severity of the issue.

The problem is that (for a wide variety of reasons) not all patients are familiar with the Latin alphabet. Pictographic symbols, while effective for small children, require a calibration so that the doctor knows that the kid can recognize the symbol, so as to avoid false negatives (for instance, a kid that has not seen a city would not recognize a building as such).

This has inspired the creation of visual acuity tests, that do not suffer from this shortcomings, by appealing to more universal notions of direction.

The two most popular are the "E" model and the "C" model, they are both proposed in this document.

Pictographic charts can already be represented by existing emoji characters in text presentation.

Nature of the characters. All of these characters can be treated as symbols. They do not form part of any orthography or script. Their function vastly restricts any glyphic variation possibility.

Inclusion in the standard would aid ophthalmologists who may want to create custom visual acuity charts. Word processors already allow for resizing letters, so this task would be possible using widely available software.

They have no set collation order, so code point order should suffice in the DUCET. Here they are ordered starting from the right pointing and rotating 90° clockwise, as it seemed the most natural ordering for me.

Both model seem to be used equally often by opthalmologists: https://jov.arvojournals.org/article.aspx?articleid=2122207#133663643 https://www.aaojournal.org/article/S0161-6420(14)01120-8/addons

E model. This charts are called "Snellen E" charts or "Tumbling E" charts. It consists of the letter E in four different orientations: right, down, left and up. Here is a table comparing those characters with already encoded letters and signs.

Proposed character	Similar characters
	E (0045) LATIN CAPITAL LETTER E E (0395) GREEK CAPITAL LETTER EPSILON E (0415) CYRILLIC CAPITAL LETTER IE ᴇ (1D07) LATIN LETTER SMALL CAPITAL E E (A4F0) LISU LETTER E Ｅ (FF25) FULLWIDTH LATIN CAPITAL LETTER E E (1D5A4) MATHEMATICAL SANS-SERIF CAPITAL E **E** (1D5D8) MATHEMATICAL SANS-SERIF BOLD CAPITAL E **E** (1D75A) MATHEMATICAL SANS-SERIF BOLD CAPITAL EPSILON
	m (006D) LATIN SMALL LETTER M ꬅ (1C85) CYRILLIC SMALL LETTER THREE-LEGGED TE ｍ (FF4D) FULLWIDTH LATIN SMALL LETTER M m (1D5C6) MATHEMATICAL SANS-SERIF SMALL M **m** (1D5FA) MATHEMATICAL SANS-SERIF BOLD SMALL M

Ǝ	Ǝ (018E) LATIN CAPITAL LETTER REVERSED E Ǝ (1D1F) LATIN SMALL LETTER SIDEWAYS TURNED M ∃ (2203) THERE EXISTS ⱻ (2C7B) LATIN LETTER SMALL CAPITAL TURNED E ꓱ (A4F1) LISU LETTER EU
Ш	Ɯ (019C) LATIN CAPITAL LETTER TURNED M ɯ (026F) LATIN SMALL LETTER TURNED M Ш (0428) CYRILLIC CAPITAL LETTER SHA ш (0448) CYRILLIC SMALL LETTER SHA ⏙ (23D9) METRICAL PENTASEME Ⱎ (2C1E) GLAGOLITIC CAPITAL LETTER SHA ⱎ (2C4E) GLAGOLITIC SMALL LETTER SHA ꟺ (A7FA) LATIN LETTER SMALL CAPITAL TURNED M

Rationale for disunification. The rationale for disunification is like so:

- The letters can be presented in a variety of styles (serif, sans, italic, bold) and advance widths, but the symbols require to be in sans serif presentation with a consistent stroke width, visible width, and a consistent advance width equal to the height.
- All scripts (except Lisu) have case mappings, which changes both the glyph skeleton and the height of the character.
- No single script has all four orientations of the glyph with the same root.
- No set of related symbols has all four orientations.
- The original Snellen chart has a glyph for the letter E that has serifs (unlike this symbol) (Fig. 6)

C model. Another model, designed with the same issues in mind, was designed by Edmund Landolt. It consists of a circumference with a small section missing; the patient then just has to indicate which direction is the missing section pointing towards. It is called the C chart or "Landolt C" chart due to its marginal resemblance to the Latin letter, however no currently encoded characters are confusable with them (it is better to think of them as rings).

There are eight possible orientations (four for the cardinal and four for the intermediate orientations) (Fig. 2), however charts can be composed of just the four cardinal directions for simplicity (Fig. 1). The exact glyph specification for the symbols can be found on ISO 8596.

Font design requirements. A font designed for visual acuity tests is supposed to have the following characteristics:

- It is strictly black and white (or the inverse)
- The stroke width should be consistent and in bold style
- In case of alphanumerics, only capital letters should be used
- It is preferred for the glyph to be as minimalistic as possible
- The width should be equal to the height
- The only perturbation to the glyphs that the font must accept (and enforce), is that of simple re-scaling

Names and entries. The name of the characters are based on the term "optotype" which is used to refer to any characters that are designed for visual acuity charts. These may be composed by alphanumerics, pictograms or more abstract symbols (like the ones proposed here).

Each character name is composed by its direction, an "E" or a "C" depending on the model and the word "OPTOTYPE". The exact phrasing of the names is not so relevant, the parts can be reordered and the "UP POINTING" could be changed to "UPWARDS".

I propose to place the characters in the block "Optical Character Recognition", since they have very similar semantics and glyph requirements. It may be necessary to address this in the text of the specification.

E Optotypes

Symbols used for testing visual acuity

2450 ⴹ RIGHT POINTING E OPTOTYPE

→ 0045 E LATIN CAPITAL LETTER E

→ A4F0 Ǝ LISU LETTER E

2451 ⊞ DOWN POINTING E OPTOTYPE

2452 Ⴈ LEFT POINTING E OPTOTYPE

→ 2203 ∃ THERE EXISTS

→ A4F1 Ǝ LISU LETTER EU

2453 ⊞ UP POINTING E OPTOTYPE

→ 0428 Ш CYRILLIC CAPITAL LETTER SHA

C Optotypes

Landolt rings

2454 Ꞔ RIGHT POINTING C OPTOTYPE

→ 1F785 ⬤ MEDIUM BOLD WHITE CIRCLE

2455 Ꞔ LOWER RIGHT POINTING C OPTOTYPE

2456 Ꞔ DOWN POINTING C OPTOTYPE

2457 Ꞔ LOWER LEFT POINTING C OPTOTYPE

2458 Ꞔ LEFT POINTING C OPTOTYPE

2459 Ꞔ UPPER LEFT POINTING C OPTOTYPE

245A Ꞔ UP POINTING C OPTOTYPE
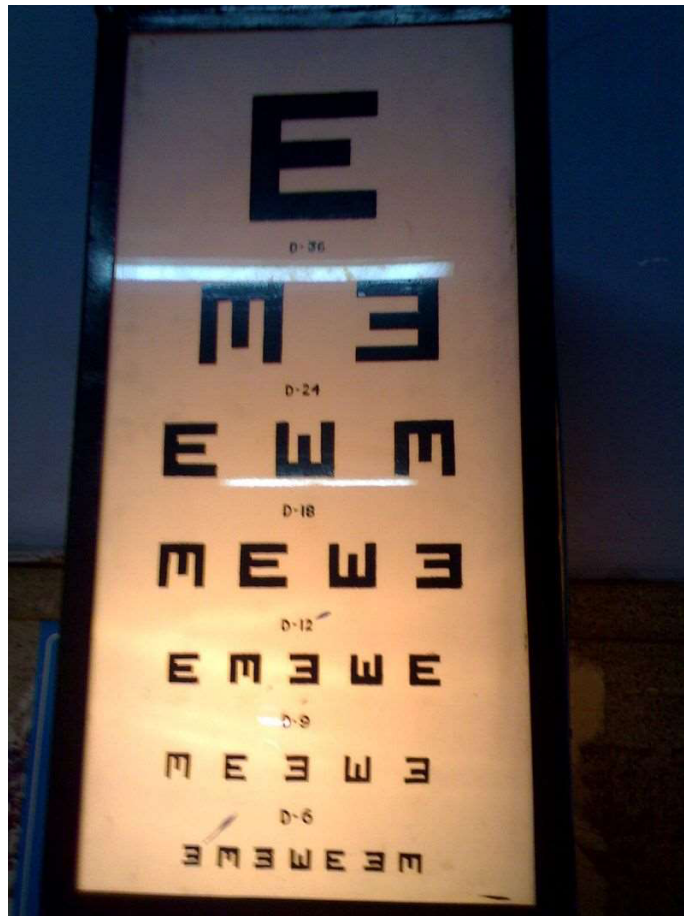
245B Ꞔ UPPER RIGHT POINTING C OPTOTYPE

Figures.
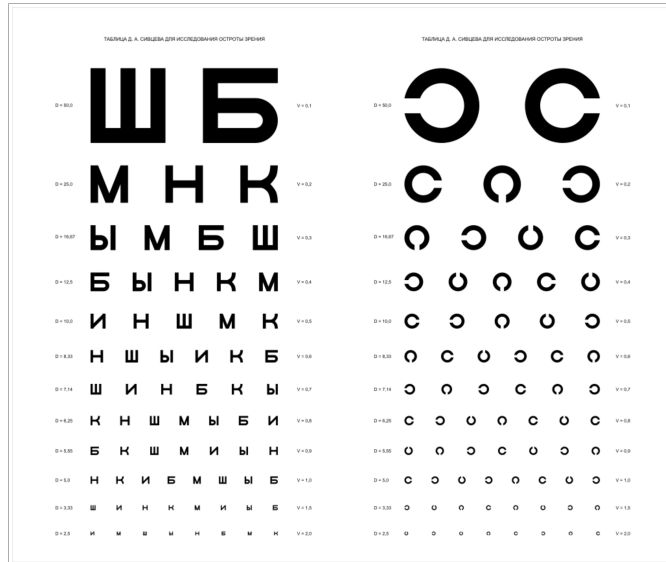
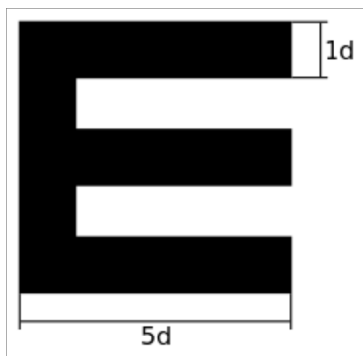**Fig 1.** Golovin-Sivtsev Table showing Landolt C's (popular in places that use the Cyrillic alphabet natively)
https://en.wikipedia.org/wiki/Golovin%E2%80%93Sivtsev_table
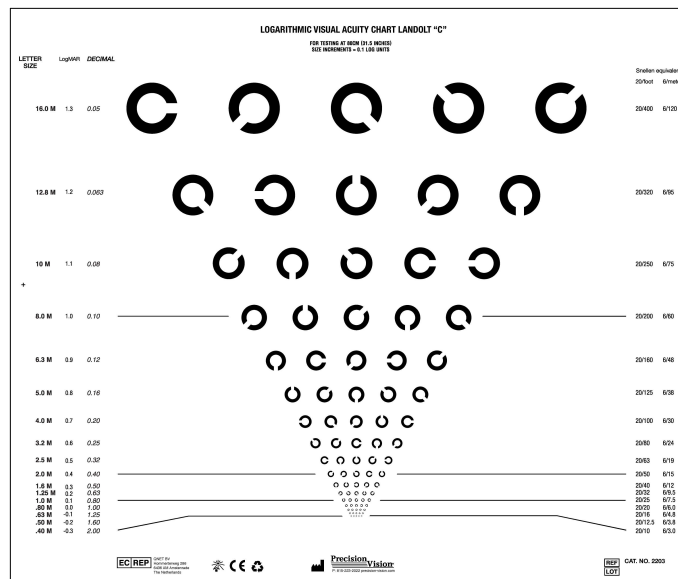
**Fig 2.** C chart with intermediate orientations
https://en.wikipedia.org/wiki/Landolt_C

Fig 3. E chart with an slight glyphic variant where the middle stroke is shorter
https://en.wikipedia.org/wiki/E_chart

Fig 4. Ideal proportions for the E optotype
https://de.wikipedia.org/wiki/Snellen-Haken
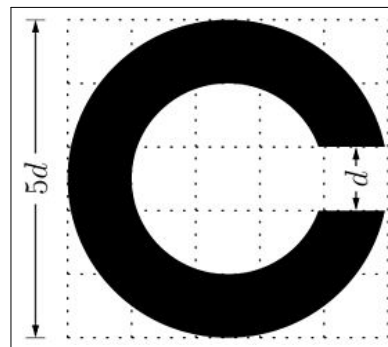
Fig 5. Proportions for the C optotype according to ISO 8596
https://de.wikipedia.org/wiki/Landoltring
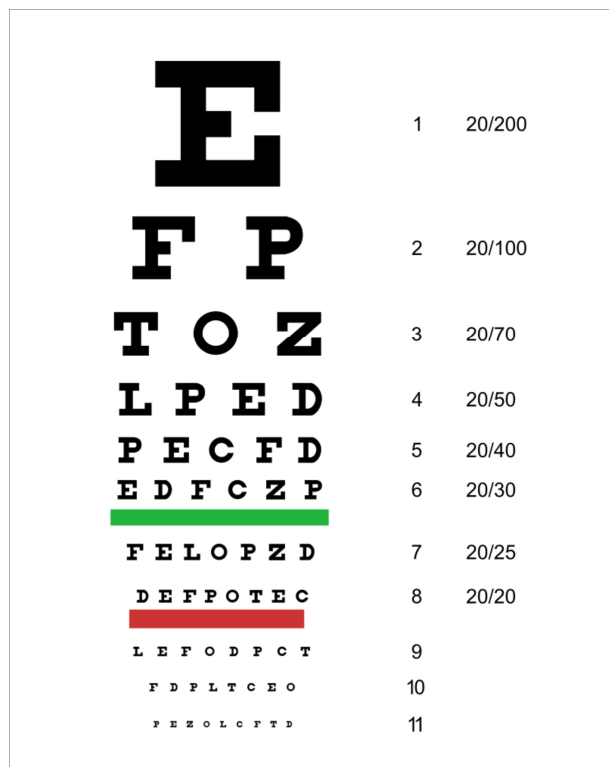
Fig 6. Original Snellen chart using a serif style font
https://en.wikipedia.org/wiki/Snellen_chart