

**The colour of the light filtered through different glasses: evaluation and experimentation**

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Colour is really important in the project because it is not only a physical parameter, but also an ergonomic and perceptive one.

Light allows us to see colours, entering into rooms through glasses, whom characteristics deeply affect the colour of the light inside buildings, their perception, feeling of privacy, space, comfort,...

Looking to the information given by glass producers, it is possible to see that the only chromatic data produced is the chromatic rendering (Ra), moreover this index is calculated referring to artificial light, instead of natural one. Other chromatic indexes are not in use. These are: gamut, an octagonal area drawn on CIE 1931 diagram, whose vertex represent the point of colour of the first eight colours used for Ra's evaluation of the radiation filtered though the glasses, which represent the pleasantness and visual acuity of the room, and the colour temperature, which depicts the colour of the room.

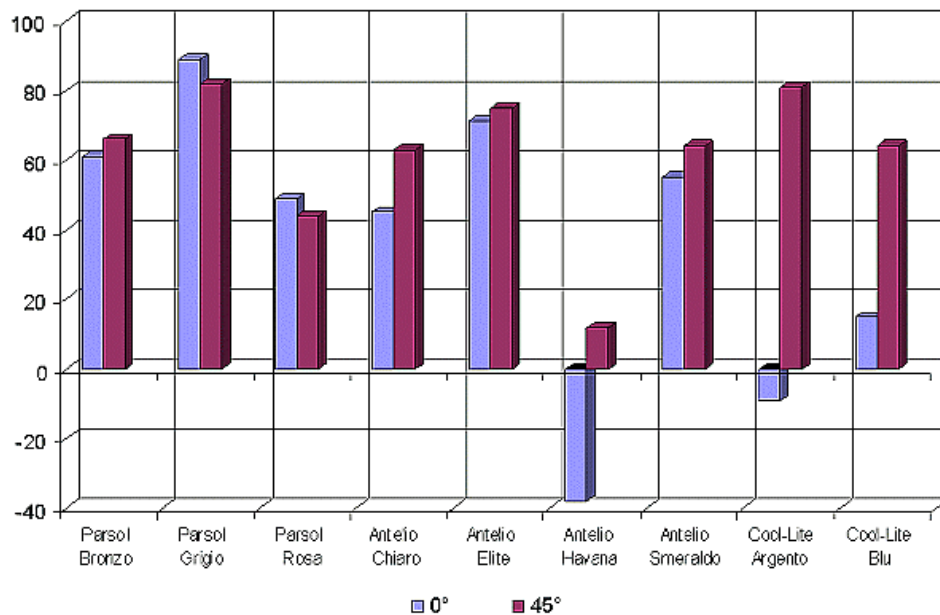
In Istituto Elettrotecnico Nazionale Galileo Ferraris we make a research in order to give a colorimetric characterisation of glasses. We measure and calculate light transmission, colour temperature, gamut and colour rendering for different angles of incident radiation on coloured and reflective glasses. We decide to take care of the angle of the light as sunshine arrive on the window in different ways and the answer of the glasses is different as well.



The spectrophotometer used for experimentation.

With the help of a spectrophotometer and of a gonireflectometer we measure the different properties of sample of glasses, 400X400X6 mm, for every nanometer in a range of wavelength between 320 and 860 nm, with angle of 0-10-45-60°. We directly arrive to TCc and TL.

In order to calculate colour rendering index, it has been necessary to enlighten the 14 CIE test colours with a referent source, operation, which have been simulated on a computer. CIE procedure pushes to refer the calculation to the standard source whose TCc is closer to the TCc of the radiation under exam. Meanwhile, CIE underlines the fact that only illuminant D65 gives an idea of the colour under natural light, that's why we decided to calculate colour index a second time using D65, in this way we defined ***the daily rendering index, Rad.***



Daily chromatic index.

Daily rendering index values are lower than standard's one, in some cases they even go under zero (for example streetlights' standard colour rendering index is negative).

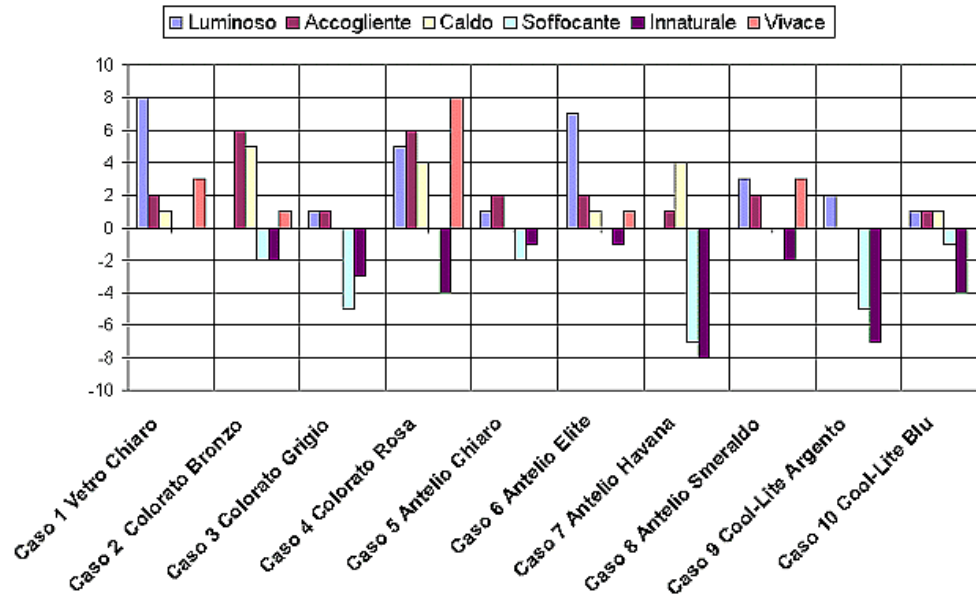
After this also gamut has been calculated a second time referring to D65, in this case the differences between illuminant's area and sample's area are bigger than when referring to the closer source.

a subjective analysis proves that people's appreciation of rooms follow daily rendering index values, this has been proved.

The same types of glasses studied in laboratory have been put on a model of an office in scale 1:10. The colours of the model were previously studied in Istituto Elettrotecnico Galileo Ferraris. Some students answered to a questionnaire, made on this purpose, in the period of three weeks.

The questionnaire gives an idea of appreciation, rate of light perceived, perception of the space, privacy, relation among inside, environment and glasses.

Looking to the result we can say that people prefers glasses with a high coefficient of transmission and, even if green and rose glasses make the rooms full of colour, grey glasses are the best, both under experimental and sensorial point of view.



Result of the questionnaire: the perception of the world outside.

After this study we have proposed a new card containing all the data needed in order to have a complete idea of the product "glass": Rad, TL, TCc, spectral curves and gamut at 0 and 45° and, of course, all the energetic parameter in use.

It was also possible to relate different rooms with different glasses, following the literature pushing to use a colour in the room, depending on the action that have to take place there. We simply chose the glasses with the higher partial daily rendering index for the suggested colour.

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