

From Witelo to optical tomography

Grzegorz Karwasz

Didactics of Physics Dept., Nicolaus Copernicus University, Torun, Poland

How one can join the history of science to modernity, asks “Nature” in the editorial No 470 (03Feb2011). The Science Museum in London with the recent mixing interactive experiments to history collections gives a possible answer. The itinerary exhibition on optics, “Fiat Lux! From Witelo to optical tomography”, organized in Torun, is a similar proposal but on a “portable” scale.

The modern meaning of “Opticks” had been established by Isaac Newton in his treatise of 1704. In 1604 Johannes Kepler wrote “Ad Vitellionem Paralipomena” but it was “Polish-Turingen son”, Witelo, who brought optics to Europe in the Middle Ages.

An imaginary portrait of Witelo (1237- ~1300) hangs on the wall of *forties* in the Bo’ Rector Palace in Padova. Witelo, who was born in Silesia, taught in Viterbo and Paris and his ten-volume “Perspectiva” was the “bible” of optics until Kepler. Compared to Copernicus, Witelo still used an axiomatic way of reasoning, similar to that of Euclides. “Perspectiva” has recently been translated into Polish, after more than 20 years work lead by Andrzej Bielski from the NCU in Toruń.

But how to make the Medieval, scholastic-like physics fascinating for contemporary youngsters? The Regional Museum in Torun and the Institute of Physics of NCU have organized an interactive exhibition, “Fiat Lux – playing with light”, now touring Poland’s regional musea. Witelo and the reconstruction of his experiments is the beginning of an interactive journey through geometrical optics. To begin speaking about colour, we recall Goethe’s contrast between good and evil and the paintings by Impressionists. The path ends with a contemporary invention from Torun – the refraction tomograph which performs a 3D examination of the eye in a fraction of a second. The winning features are the use of a broad-spectrum light source and Michelson’s (another Pole!) interferometer to convert the reflected light signal from the optical frequency into the space domain.

This exhibition is far from being just physical. In volume IV Witelo discussed the single and two-eye perception of tri-dimensional objects. To see objects from all sides was also an old dream of Picasso. A laser technique sculpts objects inside a glass block allowing us to see a cat from three sides at once. The 3D cat, closed in the glass, is projected onto walls, like in Physics the unknown *quantum state* is projected by the measurement operator onto the space of possible results. For kids we show, instead, the cat’s nose follows the visitor, but only if the cat’s face is inverted (i.e. it is *concave*). Call it illusion, but we’ve got the cat’s smile without the cat! Witelo would comment: “This is the *judgment function* of our reason which says that we see a 3D object even if only a part of it is perceived.”

With forty interactive exhibits in the Medieval cellar of the town-hall, the Torun exhibition is the first attempt in Poland to link art, history and physics.

Currently, “Witelo” exhibition is in Grudziadz, the town where Copernicus wrote his treatise on monetary issues, known nowadays as Gresham’s law. In April the exhibition moves to another Copernicus landmark, Frombork, where he wrote “De revolutionibus”.

“Conserve the past”, *Nature*, No 470 (03Feb2011) Editorial

G. Karwasz et al. “Fiat Lux! From Witelo to optical tomography - an interactive exhibition”

http://dydaktyka.fizyka.umk.pl/nowa_strona/?q=node/188



The medieval cellar of the Town hall in Toruń, where the first edition of “Fiat Lux” was organized in 2008. Reconstructions of historical instruments are mixed with interactive stands.



Reconstruction of instruments for studying laws of reflection and mirrors, following drawings by Witelo (prof. Andrzej Bielski)



Schrödinger's cat: a 3D object is projected onto walls – two (or even three) complementary faces are visible. The inverted picture (i.e. concave) acts as an optical illusion.