# Optics history as effective instrument for education in optics and photonics

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## ABSTRACT

The education problem in optics and photonics is to draw young generation on the side of light, optical science and technology. The main goal is to prove the slogan that “physics is a small part of optics”: during the thousand years optics formulated the clear worldview for humanity. In fact optics is itself presents multidisciplinary collection of independent scientific arias from one hand and was a generator of new fields of knowledge from the other hand. Optics and photonics are the regions where the fundamental problems of our reality have to be solved. The mentioned functions belonged to optics during the period of civilizations development. This is a basic idea of books serial by S. Stafeev and M. Tomilin “Five Millennium of Optics” including 3 volumes. The first volume devoted to optics prehistory was edit in 2006 in Russian. Its main chapters devoted to relations between Sun and Life, the beginnings of human intelligence, megalithic viewfinders, gnomons and ancient temples orientation, archaic optical materials and elements. It also consist the optical riddles of that period. The volume II is devoted to Greek and Roman antiquity and is in the process of publishing. It consist the chapters on the beginning of optics, mathematical fundaments and applied optics evolution. Volume III would be devoted to Medieval and Renaissance optics history. The materials are used at our university in a course “The Modern Natural Science Conceptions” for students and graduate students. In our paper the possibilities of optics history as effective instrument for education in optics and photonics are discussed.

**Keywords**: optics prehistory; medieval and renaissance optics; ancient images, megalithic viewfinders, gnomons and temples orientation; optical theory, materials and elements; eye and vision.

## 1. INTRODUCTION

Optics and photonics have exciting history closely tied with modern science. For receiving the harmonious education in this field it is necessary to trace the development of optics from early beginning up to current state. Such panorama of optics development arise deep interest of pupils to the subject of investigation and give fundamental knowledge. Sun light as main source of energy and basis of life was the most important object of investigation during the whole period of civilization evolution. Vision as the main source of information about the surrounded world determined the evolution of human intellect. The direct sky objects observation during thousand years helped to predict nature cycle changes and to fix man in time and space. Control of Sun, Moon and planets trajectories gave the calendar to many nations. Many megalithic facilities and observatories were built for this and religious purposes. Viewfinder as one of the first optical instrument was created as the result of ancient visual observations. Other ancient optical elements such as mirrors, lenses and magic spheres were the result of handicraft activity in metallurgy and jeweler’s art. Transparent crystals processing and glass-making create the basis of ancient optical materials.

During the prehistoric period optics had a syncretic stage with ancient philosophy and religion and had a magic context. Greek and Roman antiquity was characterized by serious interest to nature of light and mechanisms of vision. The famous Greek thinkers founded the basis of geometric optics, catoptrics, dioptrics and meteors. The contribution of outstanding scientists Euclid, Archimedes and Ptolemy to optics produced a strong influence on following ages. The main achievement of middle ages was the invention of glasses, while

the main achievement of Renaissance was the development of perspective theory, demonstrating the optical knowledge penetration into fine arts technology.

In our paper the general context with selected illustrations of two our books is presented to give the common impression of collected information on civilizations history seen by optician eyes.

## 2. FIVE MILLENIUM OF OPTICS: PREHISTORY



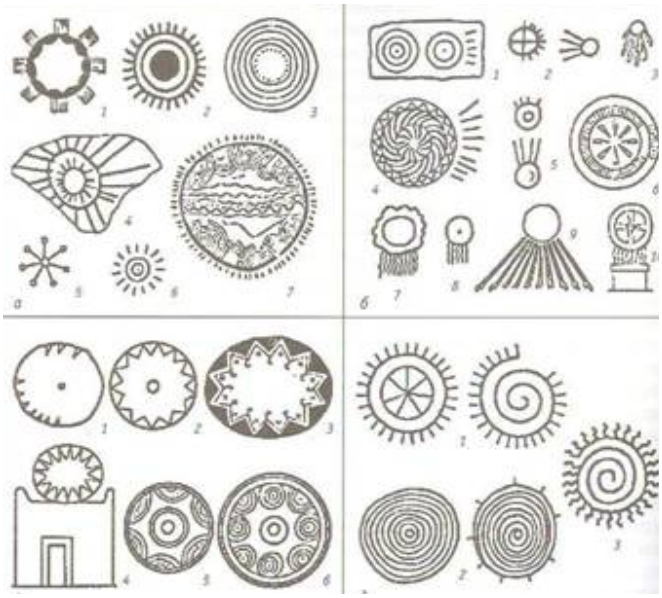

Fig.1. Sun symbols of different nations and times



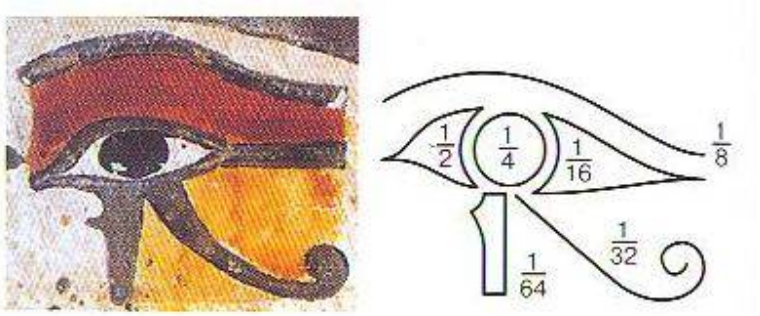


Fig.2. Horr eye and its interpretation as fractions

| Fig.3. Calendar marks on bones from pal eolith. | Fig.4. Stone menhir with seculated viewfinder aperture |
|---|---|



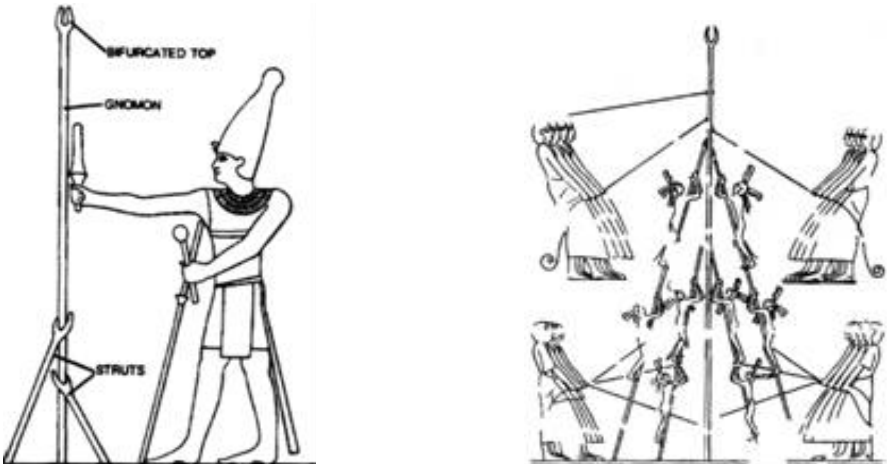


Fig.5. Gnomons in ancient Egypt

Fig.6. Ancient Egyptian mirror

Fig.7. China magic mirror



Fig.8. Ancient crystalline lens from Ninevia, VIII BC.



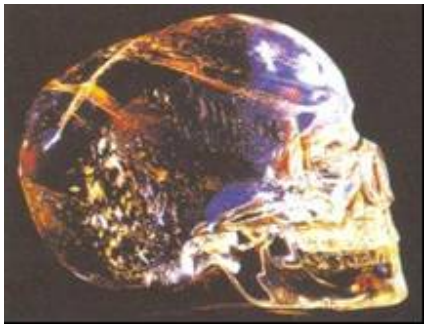

Fig.9. Ancient telescope? Fig.10. Quartz scull illustrate HT handling

## 3. FIVE MILLENIUM OF OPTICS: ANTIQUITY



Fig.1. Narcissus and his reflex.

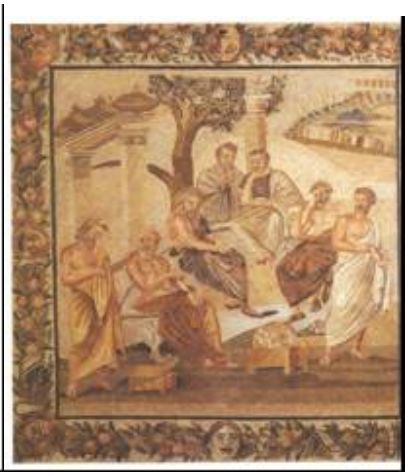

Fig.2. Plato Academy.



Fig.3.Ocular beams

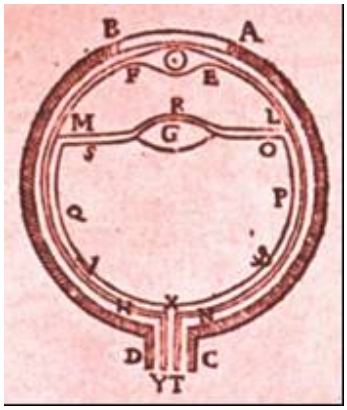


Fig.4. Galen's model of eye



Fig.5. Antique mosaic with the scene of Archimedes death

Fig.6. Antique mosaic with rainbow



Fig.7. Fragment of vase decoration

Fig.8. Intalia

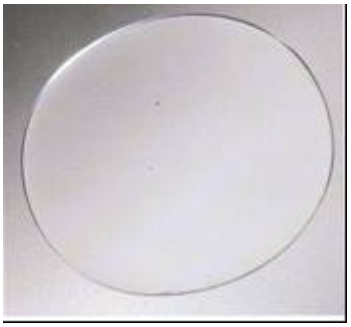

Fig.9. Antique crystal lens

Fig.10 Fragment of antique vase decoration

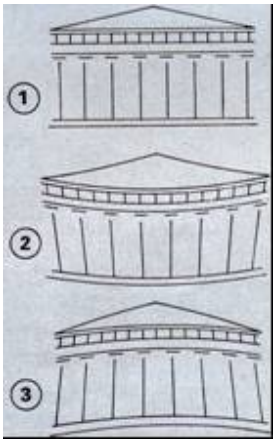


Fig.11. Optics in architecture



We hope that brief review will give the common impression about the context of our books. The conference on education and training in optics and photonics at Technium OpTIC at St. Asaph is a good opportunity to discuss possible profit of translating two volumes of “FIVE MILLENIUM OF OPTICS” into English. The authors use the study of optics history for education in optics and photonics themselves and recommend other specialist to follow their practice.