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## **Exploring Scientific Instruments through ICT**

The Istituto e Museo di Storia della Scienza (IMSS) is one of the foremost international institutions in the History of Science. It combines a renowned museum of scientific instruments and an institute dedicated to research, documentation and dissemination of the history of science in the broadest senses. The Institute was founded in 1927 at the initiative of the University of Florence. According to its Statute, its function was that of collecting, cataloguing and restoring ancient instruments and devices of historical and scientific interest.

The IMSS is located in Palazzo Castellani, an ancient building in the very centre of Florence, close to the Ponte Vecchio and the Galleria degli Uffizi. It is heir to a tradition of five centuries of scientific collecting, which has its origins in the central importance assigned to scientists and scientific instruments by the Medici and Lorraine families.

The Museum owns more than 4,000 instruments (around 1,250 on display). Those ones belonging to the Medici collection are evidence of the cultivation of and interest in the experimental methods of the most famous mathematicians, astronomers and artist-engineers of the Renaissance. The cultural context in which celestial and terrestrial globes, armillary spheres, compasses, surveying instruments, astrolabes and quadrants were created was characterized by a strong link between artistic interests, astronomical studies and cartographic production.

Examples from this heritage are offered by the armillary sphere of Antonio Santucci (1588-1593), the only two telescopes of Galileo Galilei still existent, and the instruments of the Accademia del Cimento (1656–1657), one of the foremost European scientific academies of the mid-17<sup>th</sup> century.

The Lorena collections present an overview of the developments of scientific research up until the mid-nineteenth century, and include a huge collection of electrical machines, obstetrical waxes, geodetic instruments, weights and measures, chemistry equipment and mechanical clocks.

In the last decade the Institute has devoted considerable effort to the digitalisation of its cultural heritage. It is worth mentioning that the IMSS is one of the very few scientific museums in Europe to host an internal multimedia laboratory, where IT specialists work in direct contact with scientific experts to ensure the quality of contents transferred to multimedia support and/or displayed on the web.

Some of the projects chosen for digitalisation are the following:

- Website: [www.imss.fi.it](http://www.imss.fi.it)
- Online Multimedia Catalogue
- Multimedia Catalogue on DVD

- WHYRE: wearable computer of MUSE project
- The online series "The Instruments of Science"
- Repositories of digital material created in conjunction with exhibitions
- Digital Library

Among these resources, which are offered both in Italian and in English, those which have the strongest significance from an educational point of view are the Multimedia Catalogue and the online series "The Instruments of Science".

### **The Multimedia Catalogue**

The Multimedia Catalogue of the Museum was produced in both a DVD version and an Online version. It presents the more than 1,250 objects on permanent exhibition through colour images and detailed descriptions. It offers biographical data, "In Depth" information and contextual background related to the selected object. Due to the complexity of some of the objects, an aid for their comprehension is given through simulation animations and/or videos. In numbers the Multimedia Catalogue contains: 750 files of in-depth analysis, 110 videos, 55 animations (related to 178 instruments), and around 4,000 images.

In addition to being a significant resource for museum visitors, in our experience we have seen that the Multimedia Catalogue is a valuable instrument for educational purposes. In fact, it is a repository of structured information useful to teachers and students either for preparing beforehand or getting further information after a visit to the museum. It is also a resource that can be used for educational purposes independently of a visit, because of the interest of the topics discussed and the richness of information stored in the archives, which is classified according to the following categories:

**Glossary:** All of the "In Depth" entries (presented in alphabetical order)

[Inventors / Makers:](#) Biographies of the inventors and creators (in alphabetical order)

[Thematic Pathways:](#) Short multimedia presentations that reconstruct the historical contexts and thematic references of the objects on view, allowing for an exploration of the Collections by subject

[Objects:](#) The objects, ordered by typology

### **The Instruments of Science**

Another project, which the Institute is interested in developing, has a strictly educational aim. It consists of a series of interactive e-learning modules called "The Instruments of Science".

The idea behind creating this multimedia series was born from the evidence that the Museum holds instruments that are rather difficult to understand. Moreover they cannot be touched and in general they cannot be seen in use, because they are very precious and fragile. Thus the basic question was: how can we reveal the multifaceted significance of these instruments to the public, particularly to visitors from schools?

The multimedia applications are intended to provide all the information necessary for the comprehension of the most significant objects held in the collections. The tools are presented through the use of multimedia presentations explaining the history of the instruments, 3D explorations and interactive simulations, structured into three sections:

1. History, in which the historical aspects surrounding the instruments are described
2. Explore, in which the user can 'manipulate' the instrument through a real-time 3D rendering. It is possible to zoom in and out on the instrument and explore each single part
3. Simulation, in which the user is invited to utilize the Instrument to solve some concrete problems through interactive games. This section contributes to a better understanding of how the instrument works and what it was designed for

The first module to be completed is focused on "Galileo's Compass", an instrument which represents a formidable synthesis of both mathematical and geometric knowledge. Designed by Galileo in the last decade of the 16th century, it was a sort of pocket-sized calculator. With the seven proportional lines traced on the legs of the compass and the four scales marked on the quadrant, it was possible to perform many arithmetical and geometric calculations, ranging from calculating interest to extracting square and cube roots, from drawing polygons to calculating areas and volumes, from measuring gauges to surveying a territory. Between 1598 and 1604, Galileo instructed several European sovereigns on the use of his compass. The success of the instrument encouraged the scientist to divulge his invention still further. In 1606 he published 60 copies of "The Operations of the Geometric and Military Compass", a sort of handbook which he sold privately along with one of the instruments.

The "Galileo's Compass" web application is organized according to the three sections already mentioned: "History", "Explore" and "Simulation". They contain texts, images, historical documents, movies, 3D reconstructions and games. Students may take advantage of the material offered by consulting it both at school and at home, while teachers can find materials for their classes.

To design the tool the following aspects were especially taken in consideration:

- Intense collaboration between scholars and the multimedia team to ensure the correct presentation of contents;
- Attention to the choice of the most appropriate kind of symbolic representation for each kind of content;
- Organization of contents into different levels of complexity;

"Galileo's Compass" has been used within the Pencil Pilot Project as a reference to establish contacts with teachers of a local network and see how they can use and take advantage of this tool. We are expecting an evaluation on how it may aid in educational activities and possible suggestions on how to improve the educational efficacy of these online instruments, in particular the next one that will be implemented during the development of the pilot project: "Galileo's Microscope".

To conclude, with the series "The Instruments of Science", we aim at encouraging a greater interest in historical and scientific culture among students. We also aim to convey the idea of the relevance of the "objects" (in the sense of instruments) for the development of science and emphasize that each instrument has a complex network of meanings, both historical and scientific.

We try also to make the history of science more appealing and to encourage the use of new media to intensify the exploration of certain historical-scientific aspects of our culture often overlooked in the institutional curricula in schools.

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