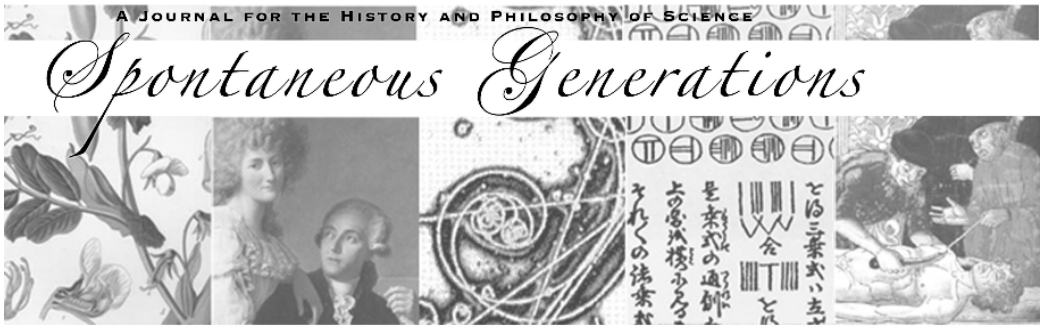

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"Visual Representations in Science"

Review of the 6th European Spring School on History of Science and Popularization: International Workshop, May 19-21 2011, Maó, Menorca, Spain.*

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In May 2011, a new edition of the European Spring School on History of Science and Popularization took place in Maó, the capital city of the Spanish island of Menorca. Since 2001, this biannual school, organized with the support of the Menorcan Institute of Studies (IME) and the Catalan Society for the History of Science and Technology (SCHCT), has focused on topics like museums, journalism, cinema, publicity, propaganda, and radioactivity in the public sphere. During three days, an international group of students and researchers (from a wide range of countries, such as Canada, the United Kingdom, Germany, the United States, Mexico, and Spain) had the chance to discuss and learn about the role of visual representation in science. The 6th Spring School was coordinated by Josep Simon (Université Paris Ouest) and Alfons Zarzoso (Catalan Museum of the History of Medicine).

The School included three plenary lectures, a poster session, a workshop aimed at preparing papers for a journal special issue,[1] a practical workshop, and plenty of time for discussion. Participants also had the chance to present images connected with their work in a session with short presentations of images followed by discussion. The workshop aimed at publication included a selection of papers by eight students and young researchers, which were chosen after reviewing more than sixty applications. These papers, which had been pre-circulated, were commented on by the three keynote speakers of the School and discussed by the School attendees.

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[1] Some selected contributions will be published in *Endeavour* and *Actes d'Història de la Ciència i de la Tècnica*.

The last day of the School included a practical workshop divided into two parts. In the first part, Nick Hopwood (University of Cambridge) led a practical workshop focused on the role of tridimensional models in the production of knowledge. In the form of a brainstorming session, an extensive list of possible uses, receptors, purposes, and characteristics of these models was offered. In the second part of the workshop, the meaning of some images chosen by School participants was debated by Daniela Bleichmar (University of South California), Klaus Hentschel (Universität Stuttgart), and the rest of the participants in the School.

There are many ways of classifying all of the visual representations presented at the 6th Spring School. Instead of following a chronological order or a disciplinary arrangement, our review follows the classification proposed in the concluding remarks of the School, presented by Simon and Zarzoso. Both organizers suggested three main narratives, with the aim of refocusing a rich field of studies. Whilst the *multimedia visual knowledge narrative* considered images as the main source of information, the *transfer of visual knowledge narrative* implied the circulation of professional skills and different backgrounds. The third approach involved a *standard visual knowledge narrative* which pointed out how and why certain images achieved a special status, allowing their use during a vast period of time.

A first group of papers included those that can be identified with a multimedia visual knowledge narrative. An image itself offers a great deal of information. This narrative allows us to look behind the image to provide a wide range of details that can be analyzed from different disciplines. In her keynote lecture, Daniela Bleichmar (University of Southern California) considered different interpretations of a natural history painting from the late eighteenth century. The picture, Quadro de la Historia natural, Civil y Geográfico del Reyno del Perú, included not only scientific knowledge, but also administrative information useful to the Spanish monarchy. On the one hand, it was an administrative map drawn in the indigenous miniature style. On the other hand, it included many botanical and taxonomical details regarding Linnaean nomenclature. Thus, this image can be considered not only as a picture but also as a book—with 240 images—and a cabinet with artistic, botanic, ethnographic, geographic, and scientific information. Sophie Brockmann (University of Cambridge) studied the continuities and changes in the systems of geographical representation in Central America from Spanish colonization to the formation of new, independent states. Geographical knowledge was included on maps, plans, sketches, or figures but also on reports, histories, or descriptions. While images were used to include route-base representations of space, texts included topography, demography, and travelling information that might be called "prose-cartography." Mirjam Brusius (University of Cambridge) showed the limited use of photography

in archaeological descriptions in the mid-nineteenth century in contrast to drawings or engravings. Photography slowly gained scientific and public status and was employed with an archaeological purpose. However, for a long period, in contrast to what standard histories of photography tell us, it was barely used and it had a low status as a tool of objectivity in scientific work. Museums—such as the British Museum—became decisive spaces for the shaping of photography as a scientific tool for the organization and study of collections.

Three of the posters presented also used a multimedia visual knowledge approach. For instance, Antonio Sánchez (CIUHCT, University of Lisbon) analyzed how early cosmography involved a connection between visual and material culture. Maps, atlases, nautical charts, and globes were not only cosmographical artefacts to measure the empire, but were also magnificent visual propaganda. José Ramón Marcaida (Centre of Humanities and Social Sciences, CSIC), considered a visual and scientific controversy concerning the idea of a new "feetless" American bird. He studied how different images of the bird of paradise were appropriated in natural history treatises, emblems, or allegories. In a very original poster, which involved an interactive map with information hidden under the picture, Alison Ksiazkiewicz (University of Cambridge) showed many features of a British geology map, such as the importance of the colours chosen to represent its different parts, and the need to make cartology relevant to the continent as a way to establish their territory.

Other posters used the multimedia strategy, but also employed other approaches. For instance, Alexander Wragge-Morley's (University of Cambridge/MPIWG) and Katy Barrett's (University of Cambridge) posters can be included in both multimedia and transfer categories, reminding us that the use of fixed categories usually involves risks, and that comprehensive categories are useful but not always exact. One of the problems is that, in some cases, the use of images does not belong to one specific category. Wragge-Morley used English natural philosophy images in a metaphorical way. Barrett argued how a controversy generated in a scientific context moved into the public arena. The image used by Barrett usefully showed "icons" that illustrate how people thought about the longitude problem and how the issue of longitude was used to remark contemporary social concerns such as debates over gender, politics or experimentation. This transfer of visual knowledge is key to the transfer approach, which involves different topics, actors, and scenarios.

In other cases, a narrative based on the transfer of visual knowledge was employed to explain the circulation of images. Hentschel's prosopographical study of spectrometry and Balmer's formula[2] showed that scientific practices were not intrinsically visual but they became visual over time. A wide range of practitioners belonging to the arts and the sciences facilitated the transfer of

[2] This equation is employed to study the emission lines in the hydrogen spectrum.

visual knowledge between different fields. These practitioners were connected with amateur photography, artisan practices, the polytechnic sphere, and visual physiology. Their significance included the sharing of knowledge from different areas, the establishment of patterns of recognition—visual thinking—and the improvement of visual training. Finally, these practitioners made it possible for visual culture to be considered an autonomous explanation of the world. Meghan Doherty (Mellon/ACLS) studied how illustrations of Saturn's rings included in the *Philosophical Transactions* were used as mediators between astronomers and instruments makers. Their international use involved the circulation in print and manuscript and between editors, engravers, astronomers, and instrument makers. Saturn's astronomical observation and the precision of astronomical measurements were improved in the seventeenth century, thanks to the cooperation between different experts and techniques of visual representation. Frances Robertson (Glasgow School of Art) discussed the different drawing styles used by the British engineer David Kirkaldy, who employed different styles in different contexts and with certain professional aims. One more example was given by Tom Schilling (Massachusetts Institute of Technology), who explored the difficulties that arise when confronting different forms of evidence. He analyzed a planning process for a uranium mine in Northern Canada to illustrate how visual representations and narrative styles were employed to mediate between different interests and many different actors. Quantification, closely related to geostatistics, contrasted with an "ecological knowledge," usually promoted by the local community, and which relied on observation. Nonetheless, as Schilling pointed out, both practices required a form of tacit knowledge that could only be acquired through local observation. Finally, Courtney Skipton Long (University of Pittsburgh) clearly showed the interdisciplinarity of visual representations. The speaker compared architecture and science in the nineteenth century describing the similarities between buildings and plants or animal species. The methodologies and discourses used by historians, architects, or artists can be used to study other debates, such as those about mutation in natural science.

The third narrative refers to the making of standard visual knowledge: that is, why certain images still remain among us while others do not. This narrative can be used to write the history of science. The work of Hopwood is exemplary in this sense. He argued that even though we are surrounded by images, only a few represent whole domains of knowledge. In his lecture he raised questions such as how and why some images succeed or fail, and more so, why some of them become canonical and are kept in textbooks for a vast period of time. For his purpose, he analyzed the controversial image of comparative embryological grids shown in the textbooks of Ernst Haeckel. The images showed embryos at different stages of development and made visible their similarities in the early stages and among species. Although these representations were the subject

of important scientific controversies, they were extensively used in textbooks, mainly in the United States, until the 1990s. Hopwood's focus on pedagogy was followed in the papers by Aaron Wright (University of Toronto) and Ari Gross (University of Toronto). Wright presented Penrose's diagrams as a "paper tool" or "theoretical technology." He argued that these "surveyable representations" provided a specific understanding to physicists whilst avoiding conceptual problems such as making finite the infinite in the field of general relativity. Thus, he linked material culture studies with those of visual representations. Furthermore, diagrams and the new forms of understanding they generated contributed to the growth of the discipline, in what Wright has called the "Renaissance" of general relativity. As Wright pointed out, the close connections between research and pedagogy facilitated the formation of new researchers. Thus, the making of relativity was not only based on a turn towards experiments and observations but also on the development of new ways of seeing. Gross explained why it is crucial to determine for whom visual representations are intended. Three characteristics must be shown by visual representations: they need to provide relevant information, scientific views of their uses must be included, and they need to follow certain standards of presentation. This determines why some virtual representations succeed and are selected over others. His paper shed light on this issue by focusing on two different methods of representing chemical compounds in the early 1860s: Kekule's "sausage diagrams" and Crum Brown's skeletal structural formulas. The utility of the diagrams, their different uses, and their representation of the "artificial" or "real" position of the atoms are some of the issues widely discuss by both nineteenth century authors. Also, it points out the importance of scientific reasoning. While Crum Brown's diagrams could be considered quasi-physical, and thus they could provide a more accurate representation of atoms, Kekule's diagrams were seen as more "artificial," which was used by Crum Brown to widely criticize them. Finally, Sebastian Pranghofer (Durham University) studied human embryo images to show the relation between science and religion and how Early modern images of the unborn or foetuses establish our perceptions of life, death and reproduction.

The 6th European Spring School provided many useful tools for introducing visual culture in our research. The rich variety of disciplines, periods, contexts, uses, practices, and methodologies tackled by the participants led to productive and stimulating discussions, offering new perspectives to both history and philosophy of science. Images are one kind of visual object. They can represent not only nature or artificial items, but also canonical or ephemeral objects. This may help us to understand why some images have lasted for a long period of time and how their development has been produced.

When working on visual representations, context and time play a crucial role. Different geographies connect a wide variety of uses of visual knowledge with

both people working on diverse areas and national cultures. In relation to time, we must consider continuities and discontinuities, traditions, and *longue durée* histories. In this sense, are visual representations useful for avoiding the "big picture" and for connecting histories?

During the Spring School, images from different disciplines such as geology, biology, chemistry, and architecture were used. Analysis of these images was very useful as it allowed us to pinpoint common features in the production, standardization, and circulation of visual knowledge. These different cultures raise an interesting question regarding the rules of how visual domains are created.

No less important than the analysis of the images themselves is to find out who the agents of creation are. They are involved in the production, circulation, and consumption of images. How should those agents be considered? While Hentschel employed a prosopographical approach to study the pioneers of spectroscopy, others such as Gross used a comparative biography of nineteenth-century chemists. Furthermore, Gross, as well as Hopwood and Wright, emphasized the importance of visual representations in science pedagogy.

Almost all papers tackled how visual domains are constituted. On the one hand, many authors have pointed out the relationship between visual training and education, both formal and informal. On the other hand, the relevance of tacit knowledge was scarcely discussed, even though Schilling's paper briefly addressed this question.

Visual knowledge involves the transit of techniques and methodologies between disciplines. Appropriation of visual cultures takes place from research, pedagogy, and popularization studies. The 6th Spring School showed the importance of an interdisciplinary and multidisciplinary dialogue clear and firmly contributed in promoting further interest in the role of visual culture in the history and philosophy of science.

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