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Introduction

Dimitris Koliopoulos · Anastasia Filippoupoliti

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During the last three decades, the science museum has been transformed from a "traditional museum of objects" to an environment which interacts with the broader public aiming, on the one hand, to promote the specificities of scientific knowledge and, on the other, to raise discussion on the public image of science and, in particular, on the relationship between science and culture, a relationship which nowadays has been ruptured (Lévy-Leblond 2004). As a non-formal education setting it occupies a dominant place between two seemingly opposing poles.

The first pole is defined as the broader public, headed by the school group as a central yet traditional visitor group, which demands a museum environment that will create the necessary learning conditions for science cultivation and also an aesthetic environment that will aid the better understanding of *science* as an idea, practice and product. The other pole is defined as the special public, namely the researchers, to whom the museum should offer intellectual tools to generate further scholarship.

Studies from the fields of science education, history of science, scientific museology and museum studies are currently tackling this subject of the museum needing to 'serve two masters'. One specific theme that has been less treated is the role that the history of science could play in the popularization and education offered by the science museum in contrast to discussions that have been developed in the past decades about introducing elements from the fields of history and philosophy of science to the science curriculum (Matthews 1994).

The idea for the present special issue departed from a special symposium on the role of history of science in the museological landscape of the twenty-first century that was convened in July 2011 during the *11th International and 6th Greek History Philosophy and Science Teaching Group Joint Conference* in Thessaloniki, Greece (Seroglou et al. 2011). The symposium unfolded perspectives of history of science as an exhibition theme, a methodological tool and a narration tool in the modern museum space and developed

D. Koliopoulos (✉)
University of Patras, Patras, Greece
e-mail: dkoliop@upatras.gr

A. Filippoupoliti
Democritus University of Thrace, Alexandroupolis, Greece

arguments regarding its role as an exhibited theme to communicate science to the public and a methodological context for science teaching in school-museum partnership. The symposium inquired, also, on the educational role of science museums and the relationship between museum content and educational programmes containing material concerning elements from history of science. Some questions emerged from the point of view of science education, for example, on how do such museums use the history of science, or how research in science education can intervene and describe, investigate and explain the tensions between the type of popularization offered by the science museum or/and educational objectives and school educational objectives.

Following the important issues raised during the above-mentioned symposium by the invited museum professionals, science educators and historians of science, the present special journal issue of *Science & Education* aims to continue discussion on the subject by bringing new reflections on this interdisciplinary subject. This special themed-issue consists of five essays each of which highlights an important perspective of this complex relationship formed at the interstices of the above-mentioned research fields. The scene is set by a fictional dialogue among the nine muses of Ancient Greece conceived by French philosopher *Jean-Marc Lévy-Leblond*. Originally published in French, his essay "*The Muses of Science: A Utopian Oracle*" constructs gradually a discussion on the intersections of art and science and consequently poses a remark on the challenge that modern science museums face in bridging the interpretative gap between the fields of art and science. The article stages in a creative way a plot among the muses that argue about a number of attributes that a science museum should acquire. In that context, the position of history of sciences is predominant and—as expressed by Clio, the muse of History—the author vividly argues 'May History then in this Museum of Science receive its well-earned due—that science may continue to advance along its path'. Firstly, newly-acquired knowledge stems even from the far past; secondly,—as the author argues—'the past holds the key that will unlock our present and prize open our future' and thirdly, old and erroneous theories comprise the womb in which the (provisional) truth will emerge. According to Lévy-Leblond, history of science as exhibited in the science museum should keep alive the opposition between the unity of scientific knowledge and the epistemological discontinuities leading to the development of that knowledge.

The next two essays tackle the subject of introducing history of science as a research subject in the science museum, and not solely as a mere narrative of the scientific past. That requires important changes in the ways science museums regard historic knowledge as well as in the ways historians of science interpret the material culture of science in museums (Taub 2009). As a consequence, in communicating effectively the history of science, attention need to be paid in the documentation methods applied to museum object acquisitions. The material culture of science held in museums (particularly the historic scientific instrument collections) provides insights into the development of experimental inquiry, theoretical speculation, research and teaching practices, technical application and innovation, as well as the socio-historical and cultural contexts in which objects have emerged. The importance of careful reading of the multiple biographies of an object can aid not solely the exhibition practice but also contribute to science education and communication in museums. The essay by *Marta Lourenco* and *Samuel Gessner* 'Documenting Collections: Cornerstones for more History of Science in Museums' examines the importance of well-documented collections of scientific instruments and the significant role that this plays in and developing educational programmes. The authors draw their arguments from recent collaborative work with historians of science at the University of Lisbon in a research programme that aimed to discuss the consequences of the 'material turn' for both museum professionals and historians of science. Just as well-

documented objects are essential to the museum professional, so too are accurately-designed science exhibits.

In contrast to formal education where the main evidence that relates to the history of science is the (authentic or not) text, in the science museum it is mainly the historic object and its associated museum setting that bear scientific knowledge. The simultaneous transformation of scientific knowledge to popular knowledge, to a communicative device and to an exhibition scenario is, indisputably, a task much more complex than that of the transposition of scientific knowledge to school knowledge (Guichard and Martinand 2000), particularly if that knowledge is related to the history of science. The seminal role of historic reconstructions of scientific devices is the subject of *Pietro Cerretta*'s essay entitled 'The Gravity-Powered Calculator, a Galilean Exhibit'. In this case, the author studies an exhibit held at the Exploratorium Science Centre in San Francisco, a reconstruction that is part of a collection of exhibits specifically created to procure more active involvement from museum visitors. The author argues for developing exhibits that should offer to visitors a comprehensive explanation both in historical and epistemological terms. In arguing so, he proposes the re-interpretation of this particular exhibit so that it offers an explanation more closely focused on the historic facts missing from the initial design.

Successful museum communication relies much on effective exhibition design; yet it also relies on the provision of science education programmes that are designed according to collaborative pedagogical methods that develop projects between the museum and its public. *Lidia Falomo, Gabrielle Albanesi* and *Fabio Bevilacqua* discuss the role of history of science in museum education in the essay 'Museum Heroes All: The Pavia Approach to School-Science Museum Interactions'. The authors discuss a series of museum education projects that have been collaboratively designed by the Pavia History of Science Group, the University of Pavia museums and the local schools in the Pavia province. The authors, mainly, set the issue of interconnecting school and museum as a proper strategy for the effective education of pupils and teachers in sciences with the aid of history of science. They note, also, that science education does not regard solely high-school students or science education trainees, but children of younger ages as well, as long as their cognitive capabilities, such as the ability to produce analogical reasoning, are taken into account. In consequence, the authors raise in an indirect way the necessity of bringing current research trends from the field of science education into the discussion.

In the last essay written by the guest editors of this issue, 'Informal and non-formal education: History of Science in Museums', we provide a detailed review of the current literature of history of science in science museums and explore the opportunities for the further use of the history of science in science museum education practice. One of the main outcomes of the review is that the role of history of science in informal and non-formal science education is heterogeneous and fragmentary and, in consequence, it is necessary to raise new research questions and construct new lines of research to investigate the subject in a more systematic way. For that, it is necessary, yet not a sufficient condition, to create an honest and equitable collaboration among the various research traditions, which up to the present had but a few chances to meet fruitfully. The present special issue hopefully would make a contribution towards that end.

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