

Science today has entered a period of unprecedented acceleration, symptomatic of modern life, itself in constant acceleration (Rosa 2014). Consequently, science and technology now influence many different aspects of our society's civil, political and cultural life. Even as it establishes norms and reveals new entities such as "stem cells", the "Ebola virus" or the "Higgs boson", science has also helped introduce new "risks", thereby blurring the notion of a clear divide between science, politics and society (Latour 1999).

The acceleration and diversification of scientific research in all fields on the one hand, and a closer affiliation with the social and political sphere on the other, is reflected in the historiographical approach to the history of science, a field that has long been in search of autonomy (Gingras 2007). When Auguste Comte, the father of sociology, proposed as early as 1832 the creation of a chair of "the general history of science" (not to be realized until the late nineteenth century), he underscored the need to treat the history of science as a separate field that could shed light on the present through the past. Yet it was not until the 1950s, after several decades of controversy over the nature of the Scientific Revolution of the seventeenth century, that the history of science would turn into a full-fledged discipline (Braunstein 2008).

Driven by the social sciences, anthropology and the ecology movement, the 1980s saw the history of science freed from the internalism/externalism argument that split practitioners as it took a new approach to issues, goals and methods. Abandoning grand overarching narratives in favour of local micro-history, analyses that examine the heterogeneity of scientific practices as well as material culture from a historical perspective focus on the dynamics of their dissemination, both nationally and internationally, and on the processes, often tacit, leading to the validation and the production of various forms of knowledge (Pestre 1995).

Even though the permeation of science and society has gained broad consensus among today's historians and sociologists of science, the diverse forms of these interactions call for further study, particularly in light of the participatory shift of the early 1990s, which helped change the relationship of the public with the production and dissemination of scientific knowledge (Pestre 2011). The emerging figure of the "expert citizen" made possible, in part, by increasingly easy access to the Internet, is emblematic of this new order of knowledge that alters the historically established boundaries between the expert and the public, itself a heterogeneous concept that has evolved over time (Bensaude-Vincent 2013).

As the contributions to this issue illustrate, in being more and more inclusive and interdisciplinary in its approach and content, the museum has become a nexus for creating and strengthening links between science, technologies and society. Serge Chaumier writes that museums have long been a place for the *production* of knowledge, a veritable laboratory and, in this sense, a driver of change in society. For

example, the classification of life in all its forms, often the most exotic, first in the cabinets of curiosities of the modern era, then in museums, served not only the purposes of knowledge, but also had practical applications in areas such as agriculture, medicine and industry.

In his article, Staffan Müller-Wille reiterates Chaumier's observation that natural history is often depicted as essentially a science of observation and collection. Müller-Wille, however, also reminds us that by the late eighteenth century, the static concept of the "Great Chain of Beings" dating from the Middle Ages had been supplanted by a vision of nature as an "archive" holding traces of the past rather than as a "book" giving direct access to knowledge. The institutional and social response to the transformation of natural history into the history of nature was the creation of new spaces (such as the Muséum d'Histoire naturelle in Paris and London's British Museum) to house collections that were constantly being added to by amateur and professional naturalists who travelled the earth in search of rare specimens. Such exchanges among learned experts and members of civil society, as Jean-François Gauvin points out in his article, demonstrate the deep historical roots of participatory science, which is today being revived and brought up to date.

In conjunction with its vocation as producer of knowledge, the museum also serves in the *transmission* of knowledge. Museums are, in the words of Chaumier, "vectors of a past" whose object is to "allow society to reinvent itself." They are therefore resolutely turned toward the future, rather than solely to the past. Science museums, as well as museums of civilization and other "museums of society", have led the way as cultural spaces that enable and encourage a fertile and lasting rapprochement of expert and amateur in a democratic spirit of openness, dialogue, and interpretation. Yet to what extent does the transmission of knowledge through museums reflect a process of scientific research and discovery that has become a theatre of controversies, of active search for consensus and of competition for resources?

Against what Polish epistemologist Ludwik Fleck (1979) denounced as "textbook science", the kind of static science that the average citizen would learn from a museum, on the one hand, and a clear demarcation between the scientist as producer of knowledge and the citizen as passive recipient of endorsed knowledge on the other hand, museums are increasingly recognizing the role of citizens as individuals who accede to science even as they remain critical of its aims and try to influence its course. This shift resonates with Fleck's thesis that the genesis of a scientific fact should involve "esoteric circles" (the producers of knowledge) and "exoteric circles" (the consumers of knowledge) that act not in isolation, but exert influence reciprocally.

As many of the articles in this issue attest, museums (and not only science museums) today no longer aim to make up for the public's scientific knowledge deficit—a deficit that is in any case impossible to overcome because structural in nature (Schiele 2015) — nor to simply present the "facts" that citizens should know to improve their "scientific culture", but rather lead them to discover, often through amusing learning exercises, the real world of scientific research. It is in fact this ludic aspect, itself very ancient, that facilitates learning and allows museums to promote a variety of citizen-based initiatives aimed at substantially building collections and databases made up of diverse entities (species, genes, molecules, etc.) in collaboration with a more or less learned public, a practice dating at least to the eighteenth century, as mentioned above. It is indeed such a practice that the Musées de la civilisation put into action by collecting video games. Curator Lydia Bouchard presents an overview of the recent reflections and actions taken by this institution in *Gallery*, and points in particular to the social impact of this type of entertainment, one that reveals some of the fundamental characteristics of our society that have now become the subject of video game studies.

The element of play often found in today's museum experience is illustrated in Serge Chaumier's description of the role of experimentation in an exhibition that is designed as a place of self-learning that no longer masks the way research is done. Becoming a scientist for a day, the visitor takes pleasure in doing actual experiments, an exercise that brings producers and consumers of science closer together. Jean-François Gauvin explores this ludic aspect more closely in his study of the 'gamification of *technè*'. He examines and exposes the relation between video games and scientific research through the different ways that participatory science helps bridge the gap between citizens and scientists, a process that can be seen in the various scientific initiatives in recent years that involve the public before becoming, in the context of participatory games, an essential element of science museums.

A consequence of the digital reproduction of artworks, Francesca Polacci underscores in her article that the freedom visitors have to use new tools such as Google Art Project (with street view) before visiting a museum takes on a playful connotation, because without giving direct access to knowledge, the progressive discovery of paintings seems to depend on the skill of the individual, who must actively pursue the quest for knowledge.

The playful dimension of new museum practices explored by most of the authors in this issue is of importance because it seems to characterize a fresh new way of learning and teaching, and is a growing subject in the study of contemporary science museums that employ the latest information technology tools, including the Internet. More generally, this underlying theme highlights the importance of *technè* (practice, know-how) in building *episteme* (science) and of using it as a driver of social change.

The complex process by which the visitor learns the language of museums through his own experience, as Jorge Wagensberg reminds us, can only occur if the museum makes the effort to "make visible a fragment of reality." With this key issue in mind, the author proposes a model of theoretical reflection soon to be presented at the Barcelona Hermitage that will constitute a genuine quest for a distinctive museum *grammar*, the language that Wagensberg says museums must adopt as their own, now and in the years to come.

In conclusion, it is clear that with the growing popularity of participatory or citizen science, the trend in today's museums is for citizens to become active and involved participants in the process of knowledge-building. These practices, which both represent and generate social change, must nonetheless be interpreted in the light of the history of science and, in the long term, not be viewed only as a reflection of our times but also as an opportunity to question anew the dynamics of the transformation of science in history and in society.

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