

**From the itinerant lecturers
of the 18th century to popularizing
physics in the 21st century –
exploring the relationship between
learning and entertainment**

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Entertainment in science. An experiment of interpretation.

JÜRGEN TEICHMANN

The meaning of the concept of entertainment has changed over the centuries. Even today we will find in all languages a lot of different words which are connected to the idea of entertainment, ranging from joy, pleasure, delight to curiosity or even myth. Entertainment played and still plays an important role, not only in mediating science (to the public, to students) but also in the research itself. I believe that the best research and the best education will combine earnest curiosity and exciting fun.

Instrument Makers and Itinerant Lectures in the German Enlightenment

OLIVER HOCHADEL

While it is a commonplace in the historiography of electricity that itinerant lecturers and instrument makers were ‘somehow’ part of the ‘electrical flare’ of the eighteenth century, very little is actually known about them, about their background, their careers and their self-understanding.

Yet, research focusing on these practitioners of experimental physics outside the established institutions can contribute immensely to our understanding of the scientific culture of the enlightenment. The development of electrical machines, the supply for increasing demand for instruments and instruction, the creation of interest in electricity through public demonstrations, relied heavily on these men. Furthermore, these ‘scientific salesmen’ offered a perfect contrast, a foil for the natural philosophers from whom to distinguish themselves. Natural philosophers tried to discredit their extra-academic competitors, thereby forging their own image as serious, honest, truth-seeking, independent researchers. This essay focuses on this situation in the German Empire, tracing the steps of the itinerant lecturer Jakob von Bianchy on his way from court to college, from the workshop to the theatre, from Lake Como, to Vienna and Paris.

Hydraulics for Royal Gardens: Water Art as a Challenge for 18th Century Science—and 20th Century Physics Teaching

MICHAEL ECKERT

Hydraulics is an engineering specialty and largely neglected as a topic of physics teaching. But the history of hydraulics from the Renaissance to the Baroque, merits our attention because it was then more broadly conceived as a practical *and* theoretical science; it served as a constant bone of contention for mechanics and mathematics; its obvious practical importance from raising water in mines to the playful fountains in royal gardens illustrates the social role of science like few others do. The playful character of historic hydraulics problems makes it also an appealing topic for modern science education.

Popularization of astronomy – from models of the cosmos to stargazing

GUDRUN WOLFSCHMIDT

“Raritäten- und Wunderkammern” of the Baroque period were a microscopic image of the macroscopic world, in which astronomical instruments, orreries and celestial globes played an important role. The Gottorf globe in the ducal castle in Schleswig (1664) and, much later, the Atwood sphere in Chicago (1913) allowed demonstration of star rising and setting for several people sitting inside. An improved version of this idea, a more sophisticated device, was the projection planetarium, invented by Zeiss of Jena and inaugurated in 1925 in Munich. The “Urania” had already opened in Berlin in 1888, showing the real sky from a public observatory, as well as giving theatrical performances about the origin and evolution of the universe. And, since 1909, visitors to Berlin’s Archenhold Observatory have enjoyed stargazing with its impressive “20-m-long” refractor. All these models and instruments were successfully used for the public understanding of science and astronomy, and always created a strong attraction.

Devices Without Borders: What an eighteenth-century display of steam engines can teach us about ‘public’ and ‘popular’ science

LISSA ROBERTS

This essay details a public display of four steam engine models assembled in a Leiden orphanage courtyard in 1777. By examining the multiple purposes to which these engines were and could be put, alongside the various interests, goals and interpretations of their inventors, instructors and audience, the notion of a clear division between public and private as well as scientific research and popularization is questioned. In its place, the essay ends with a generalized image of modern science, its practitioners, users and audiences seen as a complex terrain in which relations and divisions are constantly asserted, contested and renegotiated.

Public demonstrations of chemistry in the eighteenth century in France

CHRISTINE LEHMAN, BERNADETTE BENSAUDE-VINCENT

The purpose of the paper is twofold: 1) To contrast the longstanding tradition of private and public courses of chemistry with the public demonstrations of physics. Whether taught in public institutions such as the Jardin du Roi or by apothecaries in their officines chemistry demonstrations were not for the entertainment of their audiences. Rather, they were intended to train people in pharmacy and natural philosophy. 2) By the end of the eighteenth-century, however, pneumatic chemistry prompted a new style of presentation and experimentation more similar to experimental physics, as shown by the famous experiment of water decomposition and recomposition performed by Lavoisier in 1785.

Science on the fairgrounds : from black to white magic

DANIEL RAICHVARG

During the 18th and 19th centuries, numerous “entrepreneurs de spectacles scientifiques” – a new category of “stall-keepers” - travelled around France, displaying their scientific shows to the public. They turned out to be physics demonstrators, magicians, mechanical engineers or curators of museums of anatomy. A general survey of these shows is not easy because we have but few documents to consider. Through a various set of texts and pictures, we’ll try to understand the general philosophy of these shows : the wonder, the novelty and the surprising are the key-ideas which prevail and not only the idea that these shows mostly deliver knowledge. But above all, we will see that these shows played an important part in popularizing the 19th century scientific achievement as well as achieving the 18th century goal of the Enlightenment. Finally, we may

question and discuss the 21st century answer to the question of science understood as entertainment: “science’tainment” as we say: “info’tainment”!

The Two Cultures of Electricity: Between Entertainment and Edification in Victorian Science

IWAN RHYS MORUS

Reviewing Fleeming Jenkin’s *Electricity and Magnetism in Nature* in 1873 an anonymous reviewer (probably James Clerk Maxwell) remarked that “at the present time there are two sciences of electricity – one that of the lecture-room and the popular treatise; the other that of the testing-office and the engineer’s specifications.” In this paper I want to look behind Maxwell’s remark and examine the relationship between the “two sciences” of electricity during the third quarter or so of the 19th century in terms of their instrumental technologies. How did apparatus travel between the lecture-room and the laboratory? How did skills cross between these different spaces? How did the earlier Victorian culture of electricity as “entertainment and edification” become transformed into late 19th century metrological culture? How did these cultures overlap and how did they differ? By addressing questions like these the paper hopes to contribute further to our historical understanding of the pedagogy of physics.

Revitalizing Ernst Mach’s Popular Scientific Lectures

MANFRED EULER

Compared to Ernst Mach’s influence on the conceptual development of physics, his efforts to popularize science and his reflections on science literacy are known to a much lesser degree. The approach and the impact of Mach’s popular scientific lectures are discussed in view of today’s problems of understanding science. The key issues of Mach’s popular scientific lectures, reconsidered in the light of contemporary science, still hold a high potential in fascinating a general audience. Moreover, Mach’s grand theme, the relation of the physical to the psychological, is suited to contribute to a dialogue between different knowledge cultures, e.g. science and humanities.

A Role for Historical Experiments: Capturing the Spirit of the Itinerant Lecturers of the 18th Century

DON METZ, ARTHUR STINNER

Gerald Rutherford (1964), one of the original authors of the Harvard Project Physics course which emphasized the history of science, expressed a view of inquiry which advocated the historical reconstructions of significant experiments. To implement this view we examine two modes of historical reconstructions; Heering’s (2003) replication method for historical experiments and our development of historical representations. Heering describes the replication method in three phases: the construction of the apparatus, the recreation of the experimental procedure, and the contextualisation of the experience. In our adaption of this process for the science classroom we recognize teachers have limited access to methods and resources in historiography. Consequently, the historical reconstruction is guided by a historical narrative. As it relates to a historical experiment the narrative has four parts; Introduction, Experimental design, Experimental results, and Analysis.

Flatland - an Analogy between Mathematics and Physics

KARIN REICH

Before the 19th century the idea of more than three dimensions was exceptional. During the 19th century, however, geometry was revolutionized and new branches were developed. This

revolution also created the idea of the possibility of a n-dimensional geometry or space; flatland, i.e. $n=2$, was a consequence of this new thinking. In 1884 the clergyman Edwin Abbott and the mathematician Charles Hinton published their still-famous flatland stories. In the 20th century authors also included modern physics as well as computer science in flatland stories.

Understanding physics today from history

Experimental practice as a tool for education and entertainment

FALK RIESS

History is very helpful in popularising physics, as the many efforts at the University of Oldenburg have shown. These include the replication of historical experiments, class demonstrations, public exhibitions and science theatre. Our "Theatre of Proof" is especially effective in teaching public understanding of science. We are now developing a program for a new kind of historical Science Centre, which is based on the use of replicas and historical "hands-on" exhibits.

Public experiments and their analysis with the replication method

PETER HEERING

One of those who failed to establish himself as a natural philosopher in eighteenth century Paris was the future revolutionary Jean Paul Marat. He did not only publish several monographs on heat, optics and electricity in which he attempted to characterise his work as being purely empirical but he also tried to establish himself as a public lecturer. From the analysis of his experiments using the replication method it became obvious that the written description is missing several relevant aspects of the experiments. In my paper I am going to discuss the experiences made in analysing these experiments and will suggest possible relations between these publications and the public demonstrations.

Teachers Should Not Only Inform But Also Entertain

FRITZ KUBLI

Teaching is, in many respects, an art. Teachers must strike the right balance between sometimes opposite demands. On the one hand, they should lead students to scientific insights; and on the other hand, their teaching should be attractive. Teachers should not only inform, but also entertain. Experiments and stories can help them to combine these two aspects. Students appreciate both, as they have stated in a series of interviews. This feedback gives some ideas about how to use experiments and stories in order to improve science teaching.