

# TACKLING TRANSPORTATION

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### *Artefacts series: studies in the history of science and technology*

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## *Series preface*

In the long history of the efforts made by science museums to promote the importance of their collections, the past decade has been among the most exciting. Whereas the competition from non-object-based science centres became ever stronger, interest in using objects to communicate insight into the history of our technological and scientific heritage gained new strength. For millions of visitors, artefacts provide a uniquely attractive and direct link to the past.

Museums also have a research mission. They are a vital force in the community of scholars, especially in the history of technology, and here, too, they have come to be better appreciated. Many outside their walls have come to share the belief that artefacts have played a role which is both inadequately understood and indispensable for a better understanding of historical and cultural change.

Initially, perhaps, it was the insight into technical detail provided by close inspection of the real thing that was generally of greatest scholarly importance. More recently however, studies of experiments and technology have widened the view to the complex role of artefacts within their larger geographical, economic, social and political setting. Rather than being treated in isolation, technological objects and instruments are coming to be seen as material expressions of human culture that shape, mediate and reflect the interactions among science, technology and society. Latter-day onlookers are therefore helped to see not just machines, but also imaginative worlds of the past.

Building on rapidly maturing scholarly interest, three of the world's great repositories of material heritage – the Deutsches Museum in Munich, the National Museum of American History in Washington and the Science Museum in London – are cooperating to support this series of publications. These volumes explore innovative approaches to the object-oriented historiography of science and technology. The series seeks to go beyond a strict technical description of artefacts on the one hand, and an overly broad social history on the other.

Collections reflect local, regional and national traditions and express their cultures and history. This character confers certain constraints, but also advantages. Museums are sensitive to, and reflect, the specific local meanings of objects, but they have the asset, too, of curators whose detailed knowledge of the collections is couched within a wider historical perspective.

Building on these dual strengths, the series is intended to initiate an international discussion which both emphasises local material cultures, and also draws upon recent research in the overall history of science and technology. The authors therefore include curators, but the series attracts into the discussion other scholars from a much wider orbit.

Many people have, of course, been concerned with the problems examined in this series; but all too often this has been in individual or institutional isolation. These volumes engage an international community that is large enough to develop research programmes and debates that will have enduring momentum and excitement.

Situated at the interface between museum, university and independent research organisation, the series addresses professional historians of science and technology, curators, those in charge of the day-to-day administration of museums and those who, so often passionately, simply enjoy visiting. As museums do in general, the series aims to build a bridge between historical research and the use and application of historical knowledge in education and the public understanding of science and technology.

Each volume focuses on a specific field of technology and science in its wider historical context. The first, and larger, part of each volume presents the honed products of presentation and debate at joint conferences. The second part consists of exhibit reviews, critical expeditions into the respective museum's landscape, bibliographical overviews on recent literature, and the like.

The initial collaboration between the three national institutions was made possible by their then directors: Neil Cossons of the Science Museum, Spencer Crew of the Smithsonian Institution's National Museum of American History, and Wolf Peter Fehlhammer of the Deutsches Museum.

## Notes on contributors

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**Bill Withuhn** has been Curator of Transportation at the National Museum of American History, Smithsonian Institution, Washington DC, since 1983. His first formal proposal for a new and expanded transportation-history gallery was in 1987. A team to implement this was assembled in 1996/97.

**Henry Wydler** has worked at the Verkehrshaus der Schweiz, Lucerne, since 1970. In 1979 he became Project Manager on the new railway section, opened in 1982, and in 1993 he was appointed Vice-Director and Curator of the air and space section.

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## *Artefacts and systems in transport: an introduction*

Since the early 1990s, transport history has received increasing attention in the world of scholarship. Critical surveys of the recent literature demonstrate that studies in transport history improved in quantity as well as in quality.<sup>1</sup> This trend is manifested by changes in the leading periodical in the field, the *Journal of Transport History*. As an example, consider a recent special issue on 'gender and transport history'.<sup>2</sup>

A number of national as well as transnational networks of historians from various fields have also emerged. 'Lessons from history' is the subtitle of one of these networks, which has brought together historians, economists, politicians and practitioners from more than 20 countries – from Finland to Italy, from Portugal to Estonia, with a particular goal of identifying the historical development of 'a European intermodal transport network'.<sup>3</sup> Others focus on the crucial role of the automobile in the modern consumer society with its high level of individual mobility.<sup>4</sup> The scholars involved in these networks, together with the European Commission, which is funding their research, share the conviction that detailed knowledge and rigorous analysis of concrete historical processes can significantly improve the understanding of current issues involved in the creation of transnational transport networks. Thus, historical knowledge can provide a useful source of orientation in an ever more complex society with an ever-expanding transport system.

The notion of system is at the centre of this fundamental reorientation of transport history. Rather than concentrating on the development of individual modes of traffic, there is an effort to analyse the interrelations of technological, political, economical and cultural factors. Transport is understood as a system of interacting modes (road, rail, inland navigation, air traffic, bicycle, etc.). By including material components and human actors, these systems come close to the sociological actor-network theory, and it is not by chance that one of the creators and a prominent advocate of this theory, Bruno Latour, has tested it with a case study on transport.<sup>5</sup>

Whereas Latour in his works constantly argues for a blurring of the differences between human and non-human actors, other scholars have identified transport history as a perfect test-bed for a separate approach currently popular in the social sciences: according

to their understanding, artefacts in transport systems represent the 'cyborgisation' of modern, if not postmodern, society.<sup>6</sup> If we understand a cyborg as 'a *cybernetic organism*, a hybrid of machine and organism', it becomes obvious that the history of transport since the late nineteenth century is more than any other part of society dominated by these hybrids of man and machine.<sup>7</sup> In artefacts of transport, and most significantly in the automobile, the blurring of the boundaries between man and machine has become a ubiquitous phenomenon. The cyborgisation of modern society with the means of transport was already observed in the 1960s, when Lewis Mumford stated that the car 'appeared as a compensatory device for enlarging an ego which had been shrunken by our very success in mechanization'.<sup>8</sup>

Academic historians, philosophers and sociologists of technology may reflect on the crucial importance of artefacts in modern transport systems. But museum people have to cope with problems resulting from the mere existence of these objects. More than in most other fields of technology, transportation artefacts dominate not only the space and imagery in an exhibition, but also the expectations and perceptions of its visitors. People tend to be overwhelmed by the attractiveness of a big steam locomotive, a shiny Mercedes-Benz Silberpfeil racing car, an elegant French Louis XVI stagecoach, a sunken Swedish warship of the eighteenth century or a Second World War jet fighter. Museum curators struggle with the physical dominance of these artefacts: the power of the artefact helps to attract interest, but at the same time endangers its integration into a larger system. One of the great challenges facing a curator is to use these objects in a way that demonstrates the systemic nature of transport.

For historians and curators dealing with transport issues, artefacts are thus of crucial importance in at least two ways. Firstly, they represent visible nodes in the seamless and often immaterial networks that provide mobility for goods, information and people. These nodes materialise as means of transport. Artefacts such as cars or mountain bikes are highly charged with human emotions; they are manifold coded components of complex systems. For a better understanding of these hidden elements of physical artefacts, historians and curators of transport have to apply a multi-perspective approach in their research, embracing a variety of theories of historical change. The controversy over historical interpretation of the bridges built by the famous New York architect and regional planner Robert Moses in the 1920s underlines the importance of open-minded scholarship, which allows for constant reinterpretation. In a seminal article Langdon Winner saw Moses' low bridges, which enabled private cars but not buses to reach the attractive area of Jones Beach on Long Island, as the materialised expression of a deliberate policy to segregate the black lower classes from the white middle classes. More recently Steve Woolgar and Geoff Cooper have rewritten the creation of Moses' bridges as a history full



of contingencies, and Bernward Joerges has tried to offer a middle-way interpretation of Moses' artefacts, situated between political control and pure contingency.<sup>9</sup> Whatever the 'right' interpretation might be, bridges are important nodes in transport systems – and beyond their character as aesthetical manifestations of engineering ingenuity they are highly valued symbols of humankind's will to bridge gaps in society.

Artefacts, secondly, enable us to identify the material culture of mobility. The history of technology has undergone a change of paradigm. It is more and more shifting the focus from the production to the use of artefacts. As we have learned from recent studies, technology most often is not shaped at the 'consumption junction', the interface between producers and consumers.<sup>10</sup> As a consequence, historical research more and more emphasises that technological artefacts are not primarily ready-made products, springing from the drawing boards of engineers and designers. They generally result from users' choices, and they are reproduced by the consumers themselves, as the history of transport most significantly shows. More than most other classes of artefacts, cars, bicycles and boats represent identities of individual persons. Furthermore, an individual not only chooses a vehicle to express an identity, but often makes changes in it to satisfy particular needs or ideas. Thus, artefacts of transport reflect modern consumer societies, and the careful examination of these artefacts sheds light on the emergence of modernity.

The authors of this volume tackle the interrelations between artefacts and systems in transport from a variety of angles. Gijs Mom's essay is an intriguing case study on the evolution of the automobile. Even more, it is an important contribution to the theoretical debate on the process of technical change. Based on a careful rereading of the vast literature on technical evolution and change, the author favours an approach which looks at interactions between alternative technologies. In his case of the early automobile, the two main alternatives were the gasoline car and the electric car. The article shows that artefacts were the medium through which innovations and technical knowledge were transferred between these two competing subsystems of automotive transportation. But it was technical properties and applicational functions, rather than the artefacts or parts of the artefacts, by which technology was transferred. This form of interartefactual transfer of technologies can be observed in three crucial elements of the maturing automobile: the battery, the tyre and the transmission. In all three cases, the modern gasoline car, driven by a combustion engine, profited from successful technical solutions, which were taken from the electric car. Mom calls this distinct form of technology transfer the 'Pluto effect', which was based on the seemingly anthropological wish of engineers to keep up with the latest state of the art in their field.

A different form of learning through carefully studying an artefact is demonstrated by Michael R Bailey and John P Glithero. Their case study in industrial archaeology has chosen one of the icons in the history of railway transport: Robert Stephenson's *Rocket*, which paved the way for a century and a half of steam locomotive development. By combining the examination of conventional archival material, i.e. written sources, with a complete dismantling of all parts of the locomotive, the authors try to reconstruct the biography of this individual artefact. As with the biography of a historic person, the two authors aim at finding out as many details about the life of their subject as possible. And as in conventional biography the 'life' of *Rocket* spans different phases: its youth, when it was designed and constructed; its period as an adult, when it was operated for inter-city traffic and later for linking several collieries in Cumberland; its old age, when it was displayed in exhibitions as a masterpiece of railway construction. But in contrast to a traditional biography, the body was not buried or burned; it has remained and serves as an important source for the biographer. By carefully examining and reporting all the modifications and improvements which *Rocket* experienced in its working life, the artefact sheds more light on the rapid development of locomotive engineering in the second third of the nineteenth century. The method of industrial archaeology thus provides an efficient tool to understand better technological change in one of the most important fields of industrialisation. It also enables the authors to come up with a qualified and convincing statement in museological controversy: how should an artefact be displayed? After discussing the advantages and disadvantages of all potential options for display, they propose a mixture of two forms: one side of the locomotive should be fitted with replica components enabling the visitor to follow its working life; the other side should be left in its present form representing the end-of-service condition of *Rocket*.

Automobiles are integral parts of the large technological system of road transport, and they are machines of individual owners or users. This dialectics of large systems and individual artefacts becomes most clearly visible in the driver's workplace and on the dashboard in the interior of a car. The driver's workplace serves as an interface between the systemic and the artefactual elements of automotive traffic. Similar to the keyboard of the personal computer, the workplace and dashboard allow the driver to communicate with the larger system. But unlike the keyboard of a PC, which is highly standardised and follows the model established by the typewriter,<sup>11</sup> car interiors show large variations in time and space. In his essay, Kurt Möser follows the development of car interiors from the open car of the early twentieth century to the enclosed automobile of the late twentieth century. He interprets it as an ambivalent process. On the one hand, the interior was a highly artificial environment, a 'technotop' in its best sense.

On the other hand, drivers were keen to convert the interiors of their cars from technotops into living-room-like environments, which met their individual demands as users. The ambivalence helped to bridge the opening gap between the systemic restrictions of road transport and the individualistic self-perceptions of their users. Here, a careful examination of existing historical artefacts allows us to gain new insights into the emergence of the modern consumer society and its ambivalences – and the museum with its stores full of relevant first-hand sources is the obvious place to undertake research.

The history of Anglo-American relations in high technologies in the twentieth century is a mixture of conflict and cooperation. Peter Lyth's essay concentrates on the crucial two decades after the Second World War, when Britain lost its position as the international leader in aviation technology. The critical artefact in this shift of technological leadership was the de Havilland Comet, the world's first civil aircraft driven by a jet engine. The British decline in aviation technology culminated in the misfortune of the Comet as a commercial airliner. The last attempt of Britain as an 'air-minded nation'<sup>12</sup> to challenge American technological dominance centres around the efforts to catch up in jet engine development, the most significant innovation in the history of long-distance transport. The turbojet airliner became the main artefact of a rapidly expanding large technological system, which revolutionised commercial air transport. It not only allowed airlines to grow by expanding their networks all over the world, it also helped to create international tourism, one of the fastest growing industries in the second half of the twentieth century.

Like its transatlantic allies, Britain profited from the 'intellectual reparations' Germany had to pay at the end of the Second World War. Special intelligence forces shipped tons of paperwork from German research centres to Britain. Among other technical innovations, these materials contained the swept-wing design concept, which revolutionised aviation technology in the postwar period. Leading German aerodynamicists and aircraft specialists such as Karl Doetsch and Dietrich Küchemann followed. The latter became a leading figure at the Royal Aircraft Establishment at Farnborough and a key member of the team that designed Concorde, Britain's most spectacular contribution to aviation technology since 1945. In his essay, Andrew Nahum stresses the importance of these German inputs for the British innovation system in the early postwar years. But, like Peter Lyth, he underlines the decline of British aviation industry in the long run. With orders from even British Airways, the national flag carrier, going to the United States, Britain's aircraft industry soon lost its leading position in the market.

Transport museums themselves are the subject under research in the contribution by Colin Divall. Recent scholarship has identified the museum as a cornerstone for the formation of the knowledge society

in which we live today. Museums are archives of shared knowledge within and across nations; they represent the collective mind of societies. During the Enlightenment, more and more collections and museums emerged, mostly founded by European court society. After the French revolution, bourgeois society transformed the museum into a public institution. Not surprisingly, formats for transport museums emerged and expanded along the lines of industrialisation, when the mobility of goods and people became a key issue. Often, exhibitions – most prominently London’s Great Exhibition of 1851 – stimulated the founding of these museums, which usually were devoted to one single mode of transport. It is important to note that the modern transport museum, combining artefacts and systems and telling stories about the social effects and implications of travel and transport, is a very young member of the worldwide family of museums. But its roots date far back into the nineteenth century. To trace these roots is not only an important exercise in the constant process of professional reassurance and self-reflexivity. It can also stimulate dialogue within the museum community and between museums and the public regarding how artefacts and systems of transport should be combined in future exhibits.

Three major museums of transport communicate their approaches in this volume: the Deutsches Museum with its ambitious attempt to create an ‘intermodal’ branch museum on land transport; the National Museum of American History of the Smithsonian Institution in Washington DC with its new long-term exhibition on the history of transport; and the Swiss Transport Museum in Lucerne.<sup>13</sup> Not by chance, the museums in Munich and Washington are following the systemic approach, which has become a key issue in historical studies on transport. Furthermore, both aim at contextualising the artefacts by telling meaningful stories. Artefacts are used as a means to communicate the results of latest research in the history of transport, to which the two museums prominently contribute with the work of their curators and researchers. Evidently, the world of museums and the community of historical scholars are closely connected: as Bettina Gundler and Bill Withuhn show, academic scholarship and museums have the same understanding of the subject under research and display, and they share the arsenal of theories and methods to perform historical studies. The museum at the lake of Lucerne, which Henry Wydler portrays as a hybrid of museum and science centre, is somewhat different. Whereas the two other museums have suffered from budget cuts during the last few years,<sup>14</sup> the latter institution has been forced to balance a budget with almost no public funding. This heavy constraint has limited the space for manoeuvre in realising ambitious exhibitions and in performing extended research activities alike. The museum’s management tries to follow a middle way by strengthening the ties to the academic landscape on the one hand, and by meeting the customers’ interest in ‘edutainment’ on the other.

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- 11 Cf. the seminal article of Paul David, 'Clio and the economics of QWERTY', *American Historical Review*, 74 (1985), pp332–7.

- 12 Edgerton, D, *England and the Aeroplane. An Essay on a Militant and Technological Nation* (London: Houndsmills, 1991)
- 13 During the conference at the Deutsches Museum on which this volume is based, Nicholas Néiertz, from the Musée des Arts et Métiers, presented a paper on the plans for the transport section arising from the complete renewal of this museum of science and technology in Paris. The author left the museum before the exhibition was finished, and the management of the museum decided not to publish the paper. An overview of what has been achieved by the Musée des Arts et Métiers can be found in the museum's catalogue; see also <http://www.arts-et-metiers.net/>.
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