Introduction

The study of material culture directs our attention to artifacts and structures, as well as the technologies they represent. The explanation of why some technologies survive while others do not broadens the analysis and forces us to investigate the economic, social and cultural aspects of technology. The economic factor does not always dominate, but it is always present and often interesting. This special issue of the *Material History Review* is devoted to the persistence of old technology, with a particular focus on its economic aspects. Why does an old technique persist in one company or country long after others have adopted a new and improved method? Can the reluctance to adopt technological improvements explain the slow growth, even decline, of employment in a lagging firm or country? These are old questions which survive, like the structures photographed by Ralph Greenhill in his superb photo essay in this issue, because they continue to be useful.

Old technologies sometimes respond to the challenge of the new with improvements that permit the co-existence of both. Indeed, the adaptability of many supposedly obsolete technologies challenges the very idea of "oldness." For example, in *Maritime Capital* (McGill-Queen's, 1990), Eric Sager and Gerald Panting demonstrate that specialization and productivity growth allowed the profitable operation of sailing ships in eastern Canada long after the introduction of steam navigation.

Elsewhere, the old technology is embodied in machinery and structures that, once erected, operate at relatively low annual cost until cumulative wear and tear render repairs prohibitively expensive. Many Canadian households, for instance, still use 1960s central furnaces because the potential reduction in annual fuel cost is insufficient to offset the capital cost of replacement by more efficient models. In comparison, during the 1860s and 1870s, iron rails wore down so quickly that they posed little obstacle to the introduction of steel rails by Canadian Railways (Ann Carlos, "Steel Rails versus Iron Rails: Evidence from Canada," *Explorations in Economic History,* 1984).

Old and new technologies often do not compete directly because of subtle differences in product quality. The smelting of iron with charcoal in eastern Canada, for example, survived long after coal became available, in part because special-purpose foundries were prepared to pay a premium for the distinctive properties of charcoal iron, as discussed by David McDougall in his article "The Grantham Iron Works" (*Bulletin of the Canadian Institute of Metallurgy,* 1983) and in my volume, *The Canadian Charcoal Iron Industry, 1870–1914* (Garland, 1980).

In other situations, the old and new employ a slightly different mix of inputs, allowing for spatial variation in input prices to play a role. Familiar examples are provided by the wood-intensive technology used in nineteenth-century North America and by the labour-intensive techniques adopted today in developing countries where capital is scarce but labour is not. A Canadian example is provided by Peter Wylie in "Technological Adaptation in Canadian Manufacturing, 1900–1929" (*Journal of Economic History,* 1989), which shows how the prices of various power sources prompted a significant adaptation of American industrial technology to Canadian conditions.

The nature of social relations can also explain an otherwise incomprehensible technological pattern. For example, the late nineteenth-century survival of handloom weaving on Canadian farms cannot be understood without reference to gender aspects of the social order which limited alternate employment for rural women (see Roelens Grants and Inwood, "Gender and Organization in the Canadian Cloth Industry," *Canadian Papers in Business History,* 1989; and "Labouring at the Loom: A Case Study of Rural Manufacturing in Leeds County," *Canadian Papers in Rural History,* 1990).

Even if a full explanation cannot be found, the "S-shaped" diffusion path may describe the phenomenon of persistence. The principle is that only a few people or businesses initially adopt a new technique and demonstrate its success; this leads to widespread adoption, although a small number of hold-outs remain. An example of the "S-shaped" diffusion path

can be found in the introduction of mechanical harvesters into Ontario between 1851 and 1871, as described by Richard Pomfret in "The Mechanization of Reaping in Nineteenth-Century Ontario (*Journal of Economic History*, 1976).

These and other considerations relating to the persistence of old technology were the subject of a special session at the Tenth International Congress of Economic History, held in Leuven, Belgium, during August 1990. *MHR* is pleased to publish revised versions of approximately half of the papers presented in Leuven in this issue.[1] In addition, Garth Wilson of the National Museum of Science and Technology has put together a rich section of reviews and research reports.

Three articles in this issue examine the use of wood in manufacturing. Brad Loewen surveys the complex interaction between the characteristics of individual woods used in cooperage and the demands of individual substances which were transported. Loewen's blend of artifact, ethnographic and documentary sources attracts attention for its methodological sophistication, as well as for the intrinsic interest of its content. John Summers considers the survival of wood for boatbuilding, and of the magazine *WoodenBoat*, in a fascinating review article that notes the important contribution of wood epoxy technology, a marriage of old and new. In a third paper, I explore the features of Quebec wood and iron ores which help to explain why charcoal iron furnaces in that province failed to adopt improvements essential for their survival.

Three authors consider manufacturing with various metals. Alun Davies provides an intricate look at an intricate industry, watchmaking in Great Britain, which declined largely because it did not introduce precision machine tools and assembly line techniques used elsewhere. Charles Allain describes the early business career of Alfred E. Peters who, during the 1870s, developed an early combination lock and went on to manage the Record Foundry, one of the longest-lived small businesses in Atlantic Canada. Larry McNally describes nail manufacturing in nineteenth-century Montreal, where water power co-existed with steam power, cut nails competed against wire nails, and independent craftsmen worked alongside multi-output factories owned by limited liability corporations. One factor contributing to technological diversity, according to McNally, was differential access to capital. A readable and informative excerpt from the memoirs of Randolph Hersey, a Montreal nailmaker, accompanies the article.

Manufacturing naturally attracts our attention in the industrial age, but some of the most interesting examples of technological persistence involve other sectors of the economy. Donald Davis uses Thomas Hughes' concept of technological momentum to consider the survival of street railways in North American cities. Jonathan Liebowitz re-examines Lynn White's celebrated comparison of the horse and oxen in a sweeping exploration of the circumstances under which oxen remained a preferred draft animal in West European and North American agriculture. Andre Millard provides fresh insight into "the battle of the systems," the competition between alternating and direct current as a central power source at the end of the nineteenth century.

I am particularly pleased to include the short photo essay by Ralph Greenhill, whose work is well known in the fields of industrial archæology, architectural history and photography. The arresting photographs provide the best possible illustration of technological persistence and remind us of several important examples.

I wish to thank Diane Newell whose comments in Leuven spurred me to rethink several aspects of persistence. Thierry Ruddel of the National Museum of Science and Technology made many of the early preparations for this issue and continued to provide informal guidance throughout the editorial process. A score of reviewers made an anonymous, but critically important, contribution by assessing manuscripts and recommending changes. As guest editor I worked most closely with Peter Rider of the Canadian Museum of Civilization, whose collaboration made the process enjoyable and more efficient that it otherwise might have been; Peter's many efforts are remembered and appreciated. Geoff Rider and Garth Wilson organized generous support for this special issue at the National Museum of Science and Technology. The Museum's commitment to the *Material History Review* reinforces its position as a Canadian centre for the study of technological history. And, of course, we all thank the authors for their splendid contributions to the study of technology in transition.

Kris Inwood
Guest Editor

NOTE

1. The following Leuven papers could not be included in this issue: Neemi Avkiran, "The Persistence of Double-Entry Techniques in Accounting" (La Trobe University): Gayle Fowler Mohanty, "The Putting Out System in Rhode Island, 1821–1829" (Charles River Museum of Industry); Will Hausman and John Neufeld, "After the Battle: AC versus DC in 1898" (College of William and Mary and University of North Carolina at Greensboro); G.R. Henning and Mary Henning, "From Sail to Steam: Export of Lumber Shipments from the Pacific Northwest, 1898–1913" (University of New England); Dianne Newell, "Reflections on the Persistence of Old Technology"(University of British Columbia); David-Thierry Ruddel, "Handloom Weaving in Quebec, 1820–1870" (National Museum of Science and Technology); Tim Sullivan, "The Survival of Small Manufacturers in the American Midwest" (Towson State University).