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How does knowledge accumulate? Circulation processes in a long-term perspective

IN MY PAPER, THE MAIN ARGUMENT IS that the study of the circulation of knowledge will possibly benefit by taking account of the cumulative character of knowledge, while, on the other hand, the subject of knowledge accumulation, which is now primarily explored by economic historians, has probably something to gain by the added expertise of science and scholarship historians.

Science and scholarship historians experienced some interesting conceptual changes during the past decades. They moved from the traditional view on the development of scientific knowledge as a series of self-initiating, self-actualising and self-sustaining epistemological revolutions, to a far more sophisticated approach in which science was considered a practical activity, not only located in the social, economical and cultural context of the place and period, but also in the routines of everyday life. This turn to micro-history was part of a trend in the historical debate, as well as of what was happening more generally in the humanities. At the same time, the scope was broadened from the science practised by people in white coats in laboratories (or their forerunners) to the production of knowledge more generally, including forms of tacit and practical knowledge produced by craftsmen and other non-scientists.

As a result, a great amount of research has been devoted to the local, situated production of knowledge, greatly enhancing our understanding of knowledge as a form of practice. However, as James A. Secord noted in his keynote address to the 2004 Halifax conference,¹ the focus on local details has drawbacks too. The same implicit epistemological lesson, that knowledge is ineluctably local and variable, is repeated endlessly. Sometimes a few practitioners are studied, whose wider importance is assumed rather than demonstrated, and there is a danger that historians of science may be depending too much on the willingness of other historians to take account of their work in general surveys. Secord argued for thinking about knowledge creation as a form of communicative action, not only focusing on the production, but also analysing audiences and readerships and their responses. “Knowledge moves and circulates, and we still poorly understand how”, as he put it. We must recognise that questions of *what* is being said (by scientists) can be answered only through a simultaneous understanding of *how*, *where*, *when* and *for whom*. Our aim must be to understand some of the generic regularities involved in the circulation of knowledge, and how they change according to time and circumstance.

To the questions of *what*, *how*, *where*, *when* and *for whom*, one more can be added, namely: *leading to what?* Interestingly, this question has been the concern of historians of science only to a limited extent, but is increasingly attracting the interest of economic historians, especially the ones who concern themselves with drawing the big picture of economic growth in a global perspective. During the past decades, these economic historians developed a new growth theory, which identified the accumulation of knowledge as the most important force behind growth. Whereas the traditional factors of production (land, capital, labour) suffer beyond some point from decreasing returns to scale, in the end resulting in a stationary state, the cumulative character of knowledge makes it possible to generate a process of cumulative and ever accelerating growth. The problem is, however, that growth did not spread equally over the world. In economic history, this is one of the major themes: the Great Divergence between

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¹ Cf. James A. Secord, “Halifax keynote address: Knowledge in Transit”, *Isis*, 2004, vol. 95, p. 654–672 (the revised version of the plenary lecture delivered on 6 August 2004 on the fifth joint meeting of the British Society for the History of Science, the Canadian Society for the History and Philosophy of Science, and the History of Science Society); <http://www.journals.uchicago.edu/ISIS/journal/issues/v95n4/950409/950409.web.pdf>.

Europe and the rest of Eurasia during the 19th century. Why did Europe industrialise in advance of the great Asian civilisations, despite being a comparative backwater in the 12th century? According to Dutch economic historian Jan Luiten van Zanden and others, the rise of global inequality is linked to the process of knowledge accumulation.² As man obviously had a limited capacity for storing and processing information, almost unlimited accumulation of knowledge presupposes that people specialise, and that they cooperate via the exchange of their produce in order to profit from each other's knowledge. This coordination process is therefore fundamental for understanding the long term process of economic growth.

Consequently, for both historians of science and economic historians it finally seems to come down to one shared question: how does knowledge circulate? The starting points and scopes are, of course, different. Economic historians seek to answer a big question in their field and consider knowledge as a production factor for economic growth. Their concept of knowledge includes almost everything, from ultra-practical implicit know-how knowledge to the kind of knowledge science produces.

For historians of science — at least in the view of James Secord — the main focus is on the daily practices of the scientist, the way he or she communicates his or her findings to what audience, and the way these are received. By studying this process in different situations, periods and places, Secord hopes to find “generic regularities” involved in the circulation of knowledge. But — and this is my point — what is omitted in Secord's otherwise most stimulating research agenda is what economic historians think of as the most crucial quality of knowledge, namely: its capacity to accumulate.

In my paper I want to make an argument for studying processes of circulation of knowledge also in a long term perspective, presupposing that the joint circulation processes have a cumulative effect. I do not want to revert to the old teleological, finalistic and triumphalist approach which has long dominated the historiography of science. On the other hand, however, I believe that although there have been splendid accomplishments in the study of the local production of knowledge, something has also been lost, namely: the big picture. That was what James Secord rightly said in Halifax, and his proposal to direct our attention to the communication of science is interesting and certainly worth implementing. But in my opinion, adding the long-term diachronic perspective of knowledge accumulation would make the circulation theme even more interesting and, additionally, would provide extra focus. Moreover, it gives historians of science the opportunity to contribute their expertise to a historic problem of great significance, namely: the question why some parts of the world become richer each year while other parts become poorer. If knowledge is a key factor in that process, historians of science surely must have something to say.

Elaborating on the problem of accumulation of knowledge I will argue that knowledge accumulates in two ways.

Firstly, to use a computer metaphor, through the expansion of the internal memory. In other words, the heads of people. Assuming the capacity per head did not change much over the last millennia, the growing stock of knowledge had to be divided among more heads, which was made possible by population growth. Dividing the storage, people concentrated on more and more restricted segments of expertise, as is shown for example by the emergence of the trade of scientist in the early modern period and the ongoing subdivision and fragmentation of the sciences since then. This process of subdividing influenced the way knowledge circulated. Specialisation generates the need for coordination, aggregation, synthesis and dissemination of information.

Secondly, we need to consider the role of the external memory: libraries, archives, museums, encyclopaedias, databases and so on. As the stock of knowledge grew, codification took place, access systems were designed and formal institutions like libraries were created to store and manage the growing external knowledge system. To have access to previous stored information has always been crucial to scholarship and science, and became more crucial as specialisation progressed. Information brokers like librarians became an important link in circulation processes.

² Cf. Jan Luiten van Zanden, “On global economic history. A personal view on an agenda for future research”, p. 11-13; <http://www.iisg.nl/research/jvz-research.pdf>.