CHAPTER 3

Universities as Curators of Knowledge

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Every society relies on some form of knowledge, which tends to be organized differently depending on the cultural and historical context. Curating knowledge was once the preserve of mediaeval monasteries and their libraries. This function passed to universities as they were established across Europe. At the same time, these institutions provided a home for thinkers who questioned received wisdom, effectively clearing a path for scientific progress. Modern and open democratic societies need a body of knowledge that is at once individual, collective and socially relevant. The following piece looks at how the Digital Era affects the interplay between knowledge and critical thinking, and the role currently played by universities.

SANCTUARIES OF KNOWLEDGE

In describing the rediscovery of the Roman philosopher Lucretius's work on atomic theory, *De Rerum Natura*, Stephen Greenblatt (2011) takes us back to the monastic world of the Middle Ages. We picture the monasteries as guardians and sanctuaries of knowledge, in keeping with the mediaeval tradition. This was often literally the case: their huge collections of manuscripts form the foundation of current knowledge. The Abbey of St Gall, whose architecture, administration, school and herb garden served as a blueprint for many monastic communities, not only saved lives, but also fostered learning. The role of abbey libraries was to take care of the knowledge they held: to curate it, in other words.

While the monks working in the scriptorium copied time-honoured Christian texts, with some scribes barely able to understand their content, the revolutionary ideas recorded in Roman manuscripts (such as Lucretius's

tract) rotted in the cellars of abbey libraries — until Poggio, an "enlightened" former papal secretary roaming the country on a donkey no less, came across the treasure trove. This tale of discovery is told with great flair by the historian Stephen Greenblatt.

Then came Gutenberg and the flourishing riverside print and paper industry. Amsterdam, Mainz, Frankfurt and Basel used the Rhine to produce, clean and transport the new media. Suddenly information and knowledge became inexpensive and much more accessible. Libraries evolved into sanctuaries of knowledge for secular and private use. Although the collections included theological works, many of the earliest books printed had a more practical use: dictionaries, commercial and legal guides, as well as every conceivable tract on medical and herbal remedies.

A FORUM FOR COLLECTIONS AND DISCOURSE

Libraries soon came to house grand collections. In the baroque era — a period of revolutionary advances in optics, medicine and mechanics — library shelves were filled not only with books, but also mineral collections, exotic snail shells from across the globe, geometric models made of wood and wire, herbaria, skeletons and all sorts of mummified specimens.

The collectors, who gradually became highly qualified experts in their specialist fields, started to argue among themselves about the ordering and categorization of individual species. These discussions were formalized into regular meetings of "learned societies and colleges", which eventually evolved into our current academic system. It was common for collectors to be appointed professors at the new universities, which developed from these collegiate (in some cases monastic) communities, or were established by federal or regional rulers for their own utilitarian ends.

ENLIGHTENMENT THROUGH ORDER

The collections, and books describing and interpreting them, attempted to establish a new world order through empiricism. They therefore stood in stark contrast to most of the works held in libraries at the time, which still focused on religion and stayed faithful to biblical traditions. The university collections contained a mass of conflicting ideas — as they still do today. After all, the task of science is to continuously question itself. The American pathologist Theobald Smith (1929) formulated this task in the 20th century as follows:

Research is fundamentally a state of mind involving continual re-examination of doctrines and axioms upon which current thought and action are based. It is, therefore, critical of existing practices.

New (empirical) knowledge is usually needed to create a new order. Such knowledge offers new perspectives on the existing arrangement of the collection, and encourages its re-interpretation. One characteristic of a new order is that is embraces more elements in a categorization system than its predecessor. The new world view becomes more complete, its representation more comprehensive and its explanatory model simpler and more consistent.

PRESERVING THE OLD, FOSTERING THE NEW

Science and technology have helped to create an unprecedented quality of life for many people. Engaging in science involves the research and creation of new scientific knowledge through subjective experience. The tasks can be summed up as follows (Abel, n.d.):

a) Posing of the "Why?"
b) Searching for systematically ordered answers
c) Taking a methodical approach
d) Validating claims through reasoning and evidence
e) Breaking the strangleholds of ideology and false authority.

All these five points require a suitable environment. Initially only a human brain is needed to ask questions. But when it comes to questions of chemistry, for example, a laboratory is needed, while any exploration of historical events requires a library or a collection of relevant objects, whether it be churches, paintings, ossified seed pods or sundials. Exploring the "Why?" of the universe requires modern audio-visual aids, along with sophisticated technology such as satellites and spacecraft.

Systematizing these bodies of knowledge by bringing them together in the institutions we now know as universities and research institutes has proved to be a rational approach. As well as imposing a strict methodology, they provide something even more important: the schooling of the next generation of thinkers who will critically engage with and augment our established knowledge, and enrich our scientific understanding. The existing order is not only taught, but at the same time continuously reformulated and questioned. This is only possible if these universities can exist within a democratic system that allows unrestricted freedom of expression.

The key element is therefore to ensure knowledge dissemination. Teaching at universities is thus a crucial element, along with the publication of research and debating its social relevance. As with the advent of the printing press 600 years ago, digitalization and the Internet play a revolutionary role in the dissemination of knowledge, as well as placing it in a critical and social context. And this knowledge is now being cultivated, processed, digested, questioned,

refuted, believed and understood through these new media, exactly as it was six centuries ago. Now, just as then, we need places where these processes are transparent and accessible. The current situation is not straightforward — nor was it back then. There are many obstacles to overcome before a scientific discovery can be (provisionally) validated and incorporated into the repository of knowledge for society to draw upon.

Galileo incurred the wrath of the cardinals not because he placed the sun at the centre of our planetary system, but because he wanted to publish his work in Italian, in other words for the benefit of the "common people". True to Galileo's ideal, universities must make all their knowledge available to the public and be prepared to challenge the prevailing world view. Knowledge, and the ability to process it, is the capital of universities. Only by continuously nurturing this capital and putting it to good use can we increase the prosperity of an open society and its fitness in competition with other societal forms (Hanushek & Wössmann, 2015.)

TRANSLATION AND INTERPRETATION (NEW CONTEXTS)

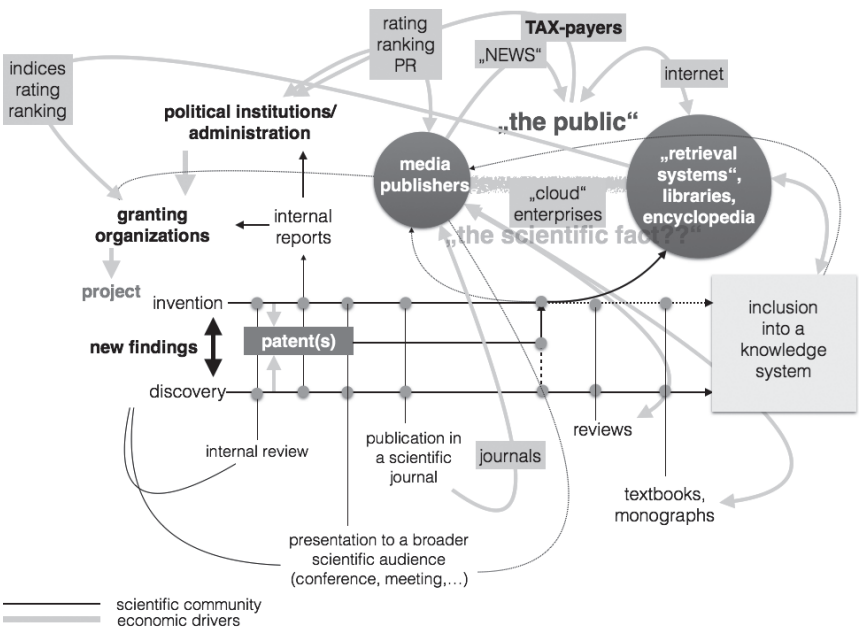
Knowledge exists only with the context from which it was derived and in which it can be applied. A discovery such as the second law of thermodynamics, which defines entropy and posits that the universe evolves along an arrow of time, is not a fundamental law of nature, but has never yet been empirically disproven in our experiential world. Such principles, laws and empirical rules hold true over long periods, possibly for ever. The end goal was thought to have been reached on many occasions. When Max Planck began his studies, physics was assumed to be a closed book. During his lifetime (1858–1947) the formulation of quantum mechanics created an environment in which statistical relationships dominate, a series of traditional physical concepts makes no sense, and established laws cease to be valid.

Such contexts are so alien that they require not only a new order, but first a translation. As the term implies, this means crossing over to a different world, where another language is usually spoken and must be learned to find one's way around. On returning, the task is to tell others who were unwilling to make the journey about the world on the other side: to convince them of the realities over there, to come up with metaphors and comparisons that illustrate arcane relationships. These translation processes are fundamentally important for ordering knowledge and the associated world models. Universities should ideally be institutions that foster an exchange between different worlds, languages, models and ways of thinking. For this to happen, the barriers of a particular discipline need to be overcome, but not torn down entirely. Ordering principles can also be transferred to other contexts. Experiments can be

conducted to show whether the new principle holds up. As David Wotton (2016) wryly remarks, it was the view through a telescope that put an end to Ptolemy's geocentric model of the solar system, not Copernicus' theory.

ENRICHING KNOWLEDGE AND MAKING DISCOVERIES

Every "Why?" question challenges the established view of the world. Like young children, science never seems to stop asking questions. It is precisely this child-like curiosity and positive naivety that creates a thirst for knowledge and continuously questions the existing world view. As already emphasized, this does not overthrow this world view, but rather enriches it, because questions inevitably inspire reflection. They enhance our knowledge of the world. They not only help us understand it better, but also — through technology — allow us to find our way around it more easily. These knowledge-based advances have eliminated diseases such as smallpox and polio, democratized mass communication to an unimaginable degree and revolutionized our mobility to such an extent that they have "shrunk the world" for many. Facilitating personal experience through first-hand encounters — the pyramids can be visited at reasonable cost and are no longer the preserve of a tiny intellectual and financial elite — has to be one of the biggest achievements of modern, knowledge-based technology.



After *The Public Life of Scientific Fact*. See Gerd Folkers & Valdimir Pliska (presented at the 8th Villa Lana Meeting, Prague, 13 January 2006).

The process of enriching knowledge through curating is anything but trivial. The chart on page 23 schematically illustrates the "public life of scientific facts". The inclusion of acquired knowledge in the form of facts and their preservation as universally valid findings, as well as their public perception, has to overcome many hurdles. That is intentional. Every hurdle, or to take an analogy from the field of chemistry, every stage in a distillation column, represents a purification or clarification step. The illustrated system for arriving at a new observation — as the result of a "Why?" question — is the "engine room" for the examination of knowledge through academic processes as called for in the previous section.

Be it a discovery or an invention: it is first allocated to the "new" category and initially evades classification — except to the "new" category itself, of course. In contrast to the categories in everyday use, however, the "new" category is completely undefined and is not used or arranged within our normal scheme of thought and action.

Before a new idea can be released to the public, it must first be validated by one or more experts. This validation may involve the drafting of a research proposal, open discussion in a research seminar, the selection of a keynote speech for a conference or indeed be the subject of dialogue with one's research supervisor. Here "the new" throws up problems that fall within the domain of experts. So, what makes someone an expert? Their ability to categorize. However, experts have their own selves to contend with: it is virtually impossible for them to make an objective judgement that is not influenced by their emotional attachment to their expert knowledge. Objectivity requires a willingness to exclude certain experiences, opinions and views, and therefore draws on the same emotional power that the expert is trying to escape from. Absolute objectivity would be inhuman in the truest sense of the word. This implies that the expert attempts, in a kind of pendulum action, to bring the new (which is potentially beyond the scope of their expertise) into the centre of their knowledge and experience. This is a fundamental mechanism that evolves from a structure that Ludvik Fleck (Rheinberger, 1929) characterized as follows in an essay back in 1929: "*Natural science is the art of shaping a democratic reality and then being directed by it — thus being reshaped by it. It is an eternal, synthetic rather than analytic never-ending labour. Eternal, because it resembles that of a river that is forever forging its own bed. That is the true, living natural science. One must not be oblivious to its creative-synthetic and social-historical elements.*"

Science itself shapes its exponents, and they in turn shape science. Self-referential, autopoietic processes such as these are key aspects of chaotic, non-linear behaviour and allow an ambivalent picture — as Fleck goes on to conclude — of science to be projected "in public": a scientific activity that is clearly ordered and directed by logical conclusions and subsequent actions, as well as a contrasting attitude of an initially loosely oriented, experimental, probing and even playful approach (Folkers, 2013).

However, scientific knowledge must be "trans-subjectively valid" if it is to survive (Janich, 1997). This allows it to transcend the subjectivity which the individual scientist inevitably has, as a result of their personal experience of scientific experiment and through reflection on the question to which they have found the answer. Not until the findings have been generalized by formulating a new theory, or have been adapted to an existing theory that can be defined as meeting the criteria of "valid" or "correct", can there be any talk of science.

At the same time, the entire process is influenced by a vast number of economic and consequently also political factors. The higher the public profile of the newly established knowledge, the more likely its value is to be realized. New values — in the true sense of the word — are thereby created. New technologies and their commercialization happen more rapidly in the case of more prominent "publications". Findings overshadowed by the higher-profile scientific journals take longer to be recognized by the market, but their economic potential is nevertheless powerful. The new gene-editing technology CRISPR-Cas9 is a case in point. After years of attracting minimal publicity, prestigious universities are now squabbling over patents. The prominence of the discovery's publication and its potential (or actual) successful commercialization in turn serve as an important medium for universities, by attracting investors.

If a university can demonstrate that its research results are instantly marketable, this tends to enhance its reputation among taxpayers, and ultimately among politicians as well. As some universities are more successful at this than others, resourceful entrepreneurs, primarily publishers, have built up a rating system based on the number of publications, and in so doing have produced controversial rankings for universities. Any refinement of this system is of course permitted, allowing these rankings to be broken down into individual authors and even main authors, co-authors, lead authors, "responsible" authors and other permutations. As expected, this ranking is broadly reflected in the allocation of research grants as well, which in turn serve to finance new discoveries. Thus, the circle is completed. Universities' most important task is to make sure this knowledge production does not create a vicious circle. Any type of economic, political and ideological influence poses a potential threat to the creation of knowledge and to universities' role as its curators.

RESISTING IDEOLOGICAL STRANGLEHOLDS

In his seminal work on the development of a scientific fact, Ludwik Fleck characterizes such "thought-inhibiting" phenomena as the expression of "thought style" and "thought collective". No one disputes the fact that

science and its many disciplines are built on a fixed structure of axioms, laws and theories. Not a random, but rather a methodical approach is the core of scientific investigation. The "scientific method" is the doctrine. And this very approach must be formulated in such a way that the actual scientific task — critical questioning of the prevailing world model — is not only allowed, but held up as a guiding principle.

There is still much room for improvement here. We have certainly moved on from institutional or state ideologies, such as the Stalinist biology of Lysenko, the Nazi ban on Fleck's writing, or the trial of Galileo. But today's ranking hype is an ideology in itself. It reduces scientific achievements to allegedly quantifiable parameters such as the number of publications, their regularity and their citation frequency. The ratings credited to the authors influence their standing in their own "thought collective" and within their institutions.

There is a strong temptation here to look for affirmation rather than disagreement, to form a citation cartel, to mention exclusively positive results in the manuscript and to narrow perspectives instead of trying to break free from the constraints of a single discipline. This problematic attitude gives rise to publication bias and potential misrepresentation and, at worst, "alternative facts", although it inevitably boosts the author's own academic standing and furthers their career.

The nature of science after the Enlightenment offers all the tools needed to combat these negative influences. The purpose of peer-review processes is to prevent such excesses, as the knowledge itself would otherwise seem barely credible, and with it the science as well. It is the duty of all scientists and their institutions, universities and research institutes, to continuously review and improve the peer-review process. The anonymity of this process is quite understandable and desirable, but — dominated by the thought collective — it can often block new ways of thinking for years. For a university's quality management to be effective, compliance, space and time are needed to configure these review processes and establish a strong style of governance.

Moreover, self-correction processes often fail to have an effect where the genesis of the data is simple, but their measurement generates a lot of noise and often occurs in small sample sizes (Holcombe, 2015). To counter this, a form of "social control" is common in a number of specialist areas, where manuscripts are passed around and discussed in small groups as working papers before being submitted to an academic journal. On the other hand, modern media allow comments to be made as soon as an article is published with global access. Some scientific institutions managing large publication databases promote these opportunities.

UNIVERSITIES: CURATORS OF KNOWLEDGE IN THE DIGITAL ERA

There is good reason why university structures have held up so well on the knowledge market for around 1,000 years, if we take the founding of the University of Bologna ("independent of the Pope and the Holy Roman Emperor") as a starting point. Processing knowledge — its reflection and transformation, and creating new perspectives from an empirical method as an integral component of teaching — seems to have proven itself as an effective approach, both in terms of effort and reward, for making massive improvements to our quality of life. Education and prosperity appear to be closely linked to one another (Abel, 2009).

Curating — literally caring for — knowledge was one of the maxims of the monastic libraries and still holds true. But the technical advances of the digital era have fundamentally altered the way in which knowledge is created and disseminated. This inevitably has consequences for universities, which have lost their once dominant role and now find themselves in competition with a host of other knowledge providers. As knowledge is democratized and made accessible 24/7 and worldwide through online platforms, encouraging value-based critical and creative thinking is becoming an educational USP for universities.

However, there are also significant changes ahead for the knowledge business as a whole. Certain concentrations of power in the publishing industry and the resulting criticism of a one-sided measurement of scientific achievements have released forces of reform that culminated in the Open Science movement. Questions of cross-disciplinary management of research data, from methods of assessing scientific achievements to the establishment of new publication channels, are now being discussed. New Open Access platforms have been announced by the medical research foundations the Wellcome Trust and the Bill & Melinda Gates Foundation. A third major player has now entered the arena, with the European Commission launching its own publishing platform (Enserink, 2017) to add momentum to the renewal process.

The new media and artificial intelligence are prompting a fundamental change in education and research. It may take a while, but machines may eventually be capable of asking "Why?" questions, searching for systematically ordered answers and adopting a methodical approach in doing so. Even so, the task of validating the findings of artificial intelligence through reasoning and evidence will remain an essential part of our culture of discourse. Humans will also continue to set themselves apart from intelligent machines in terms of their capacity for empathy, intuition and abstraction. We have a wealth of emotional intelligence that will prevent us from ever being replaced by robots.

Just as when book printing with movable type was introduced, the digital revolution will undoubtedly bring radical changes to our society. Luther's pamphlet is being nailed to the portals of the digital world, so to speak. Digital illiteracy is synonymous with social decline. The curators of knowledge are responsible for ensuring that this knowledge remains accessible under all circumstances, and that it can be continuously renewed and improved.

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