Chapter 16
The History of Science and the Globalization of Knowledge

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Abstract The paper discusses the relation between the history of science and the history of knowledge, including their normative dimensions. It conceives of science as involving cultural abstractions that result from reflections on concrete practices and experiences accumulated along historical trajectories which can only be understood from a global perspective. The approach is illustrated by a sketch of those aspects of a global history of knowledge that shaped the emergence of modern science.

Keywords Globalization • History of knowledge • Abstraction • Normative thinking

16.1 Beyond the Paradigm of Western Science

The history of science has been dominated by the history of Western and in particular European science. Its paradigmatic topic has been the Scientific Revolution of the sixteenth and seventeenth centuries. This Scientific Revolution supposedly gave rise to modern science, not only with specific discoveries but also by establishing a general scientific method comprising the formulation of hypotheses that are then tested by experimentation or observation. Modern science and the scientific method were supposedly developed in Western Europe, first in astronomy and then in physics, and from there conquered the geographical world and the world of knowledge. Even in the traditional account, however, it has been admitted that some of this expansion was achieved by force, by trying to enforce the laws of physics on biology, for instance, or by the colonial expansion of Western science, often accompanied by the violent suppression of other forms of thinking.

Today, this picture is criticized and rejected on the basis of much more fundamental arguments. Philosophers of science have tried in vain to identify the scientific method allegedly at the core of scientific rationality. And historians of

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science no longer see the Scientific Revolution as the historical breakthrough that fundamentally changed the practice of science at large. Science no longer seems distinguishable from other forms of cultural practices. It has ceased to be a paradigm of universal rationality and presents itself as just one more object of study for cultural history or social anthropology. Even the most fundamental aspects of the classical image of science—proof, experimentation, data, objectivity or rationality—have turned out to be deeply historical in their nature.

Kostas Gavroglu and his colleagues have made fundamental contributions to challenge and revise the traditional views of European science and its spread (Gavroglu 2007, 2012; Patiniotis and Gavroglu 2012). They have shown, in particular, that even within Europe science did not simply "spread" from center to periphery but that globalization processes of science are premised on an active appropriation of new knowledge leading to a transformation of its cognitive and institutional structures.

These insights have opened up many new perspectives on the study of the history of science, which is actually turning more and more into a history of knowledge. It thus includes not only academic practices, but in addition also the production and reproduction of knowledge far removed from traditional academic settings, for instance, in artisanal and artistic practices or even in family and household practices. More importantly, non-Western epistemic practices are also considered without being immediately gauged against the standards of established Western science. "On their own terms" is the slogan under which Chinese science is currently being analyzed, without a constant evaluation of what it lacks in comparison to Western science (Elman 2005). Similarly, the worldwide circulation of knowledge is now considered not just as a one-sided colonial or post-colonial diffusion process, but rather, to put it in the language of Kostas Gavroglu, as an exchange of knowledge in which each side is active and in which knowledge is shaped as much by dissemination as by appropriation.

In recent years, the migration of knowledge has become an active field of research. With few exceptions, the emphasis has been placed mostly on local histories that focus on detailed studies of political and cultural contexts and emphasize the social construction of science. While this emphasis has been extremely useful in overcoming the traditional grand narratives, and also in highlighting the complexity of these processes and their dependence on specific cultural, social or epistemic contexts, it has led to a somewhat distorted and highly fragmented picture of science.

This picture does little justice to the overwhelming societal, economic and cultural significance of science in a globalized world. Rather than representing one of the major and still unexplained economic and societal forces in the modern world, science dissolves into a plethora of highly localized and contextualized activities, which are scarcely connected to each other. It has become a mark of political correctness to provincialize European science as representing just one among many, equally justified points of view within a global culture.

Such well-meaning political correctness does not enable historians and philosophers to compensate for the destruction of indigenous cultures, for the genocides, for the lack of gender equality, in short, for the immense damage and crimes committed in world history in the name of Western rationality and science. The

golem of science cannot be tamed by underestimating it, let alone by overestimating our own influence as its witnesses.

But what can we do to avoid ascribing the powerful role of science in the modern world, for better or worse, to its intrinsic rationality, to the superiority of a universal scientific method, or to some kind of capitalist, technocratic conspiracy responsible for its triumphal procession as a driving force of modernization? Neither piling up ever more local studies, nor offering softened versions of the original universalist point of view will do. What is needed is a truly global perspective accounting for the universalizing role of science in today's world as well as for its ever-shaky claims to rationality on historical grounds. Such a global perspective must begin with the insight that the place of local knowledge in the global community is not just a residual niche but rather a matrix. Local knowledge constitutes the substratum of all other forms of knowledge, generating the global diversity also of scientific knowledge.

16.1.1 The History of Knowledge and Its Dimensions

The history of science can only be understood against the background of a global history of knowledge (Renn 2012). The fragmented picture suggested by current cultural studies has induced us to underestimate the extent to which the world has been connected—for a very long time—by knowledge. One might even go so far as to claim that, just as there is only one history of life on this planet, there is also only one history of knowledge.

Is there a theoretical perspective from which such a claim may be substantiated? This question leads to the second part of this essay, which deals with fundamental concepts such as knowledge and institutions and their normative dimensions. In the history of science it is not common to explicitly define such notions but I believe it is important in connecting historical studies to current discussions in the social and behavioral sciences. I will first define knowledge and then institutions, in both cases making reference in an essential way to the fundamental human capacity for symbolic thinking. I will also emphasize the crucial role of external representations, that is, of the material culture serving as the external medium for human thinking and social behavior, such as language, artifacts, art, writing or other symbolic systems (Damerow 1996).

Knowledge is conceived of here as the capacity of an individual or a group to solve problems and to mentally anticipate the corresponding actions. Knowledge arises from the reflection on material, socially constrained actions. Given the fundamental human capacity for symbolic thinking, the dissemination and transmission of knowledge relies crucially on external representations such as, for instance, symbols for counting objects. The reflection on actions involving such external representations may in turn create higher-order forms of knowledge, such as an abstract concept of number. These higher-order forms of knowledge are removed from the primary actions but in ways that are dependent on the contingent

material and social nature of the external representations, for instance, on the specifics of the symbol system employed. The dissemination and transmission of knowledge takes place in the context of knowledge systems that rely on societal institutions.

Institutions, such as the family, the state, a school or an enterprise, are a means of reproducing the social relations existing within a given society and in particular the societal distribution of labor. The coordination of individual actions mediated by institutions presupposes behavioral norms and belief systems such as habits, religion, law, morality or ideology. A behavioral norm is the capability of an individual or a group to act in accordance with institutionalized cooperation. The interactions of an individual with others mediated by an institution and their representation by a collective belief system are constitutive of both an individual's identity and of his or her relation to a communal identity. Belief systems result from the reflection of institutionalized actions and implement the regulative framework of institutions in the minds of individuals. They allow individuals to interpret and control their own behavior and that of others in the framework of the societal group to which they belong, forming the basis of normative judgements and their legitimization.

What is the relation between knowledge and institutions? There are some striking similarities and differences. Institutions represent the potential of a society or a group to coordinate the actions of individuals and to thus interact with their environment. As an "action potential" they bear close relations to knowledge but there are important differences. There is no knowledge without the mental anticipation of actions, while institutions must regulate collective behavior without such direct mental anticipation of the collective actions and their consequences.

Institutions involve knowledge on various levels. They must embody and transmit knowledge in the sense of the capacity of individuals to anticipate actions that are compatible with the coordination regulated by institutions, as well as knowledge on social control and knowledge on how to resolve conflicts. Just as institutions have to rely on knowledge, knowledge has to rely on institutions. Institutions form the basis for knowledge systems, which in turn become the condition for the stability and further development of institutions. Institutions, however, do not think. Since institutions mediate collective actions, they have to rely on shared knowledge and engender distributive thinking processes.

As in the case of knowledge systems, external representations also play a key role in the functioning and development of institutions. All kinds of material aspects—persons, animals, places, artifacts, symbols or rituals—may become part of the external, material representations of an institution. They now represent a normative social order, defining a field of actions compatible with the regulations of an institution.

Institutions regulate human interactions to cope with certain regularly occurring problems such as those related to cooperation, the distribution of labor, the redistribution of resources or the resolution of societal conflicts. Such regulations externalize problem-solving capacities; they contribute to solving societal problems because the coordination of individual interactions can be partly discharged to the handling of external representations of an institution, such as following a command

chain, dealing with paperwork in an administration, exchanging goods for money on the market or applying written law to a violation of norms. The external representations thus reduce the knowledge required to solve problems of collective interaction.

As in the case of knowledge, external representations also engender processes of abstraction enabling higher-order forms of societal organization in which coordinative functions of institutions are partly taken over by new forms of external representation. For example, in modern society, certain aspects of the coordination of societal interactions are governed by an abstract time represented by clocks. This process of cultural abstraction contributes to the opacity of institutions from the perspective of individuals because it decouples actions with the representations from the concrete interactions at lower levels of societal reflexivity. Regulating one's actions with the help of a clock thus becomes an efficient substitute for the direct coordination of actions among the members of a complex society.

Both in the case of knowledge and in that of social order, external representations may themselves become the objects and means of actions, giving rise to rich symbolic worlds of social and epistemic meaning with feedback on the underlying social and material practices.

16.2 Abstraction, Reflection and Normative Thinking

Let me again explain the crucial process of generating abstractions: Reflective abstractions in science, such as those giving rise to the abstract mathematical concept of number, ultimately depend on the material actions from which they originate, such as the concrete actions of counting material objects with the help of number words or number signs. This will be illustrated later with a historical example. Reflective abstraction is a constructive process in which novel cognitive structures are built up by reflecting on operations with specific external representations such as language, tallies or mathematical symbols. These external representations may in turn embody previously constructed mental structures so that a potentially infinite chain of abstractions is created.

Here I must warn against a common misunderstanding: It may appear as if this chain of abstractions gives rise to a teleologically predetermined hierarchy of steps leading from actions with concrete objects to ever higher-order mental operations. This is simply not the case. The historical development of reflective abstractions is in fact highly path-dependent, contingent as it is on a series of concrete historical experiences. The same holds more generally for cultural abstractions, including legal principles and moral norms. But societal reflexivity is somewhat different from epistemic reflexivity in that it is even more difficult to debunk its abstractions and identify the actual historical experiences that shaped them.

Normative thinking is actually often considered to be fundamentally different from scientific thinking, just as norms and facts are taken to belong to different categories. Science is assumed, at least at its core, to be value-free, while ethical

norms supposedly cannot be grounded on facts. Yet, we encounter normativity in scientific thinking, even in basic principles such as in the moral value of truth or in demands for good scientific practice. And we encounter fact-dependence in ethical norms, as when new insights into the nature of human reproduction or new medical practices make it necessary to rethink ethical principles about the protection of life. The theoretical framework presented here suggests that ultimately moral and epistemic norms have the same origin, that they both result from a reflection on collective and individual human actions and experiences.

The possibilities for reflection on human actions and experiences evidently depend on the knowledge economy of a society. This knowledge economy comprises societal institutions in which knowledge is transmitted and generated. Similar to the knowledge economy, there is also a moral economy of a society. The functions of the epistemic and the moral economies are different. The knowledge economy serves to maintain, transmit and develop the cooperative action potential of a society by means of epistemic practices. The moral economy, on the other hand, serves to maintain, transmit and develop social cohesion and the possibilities for cooperation within a given set of institutions and by means of normative practices. Clearly, these functions are closely intertwined: maintaining social cohesion requires problem solving and hence knowledge, while collective problem solving presupposes cooperation and hence moral norms and practices. The knowledge-dependence of norms and the normative dimensions of knowledge are both mediated by the historical evolution of cultural abstractions. These cultural abstractions are neither universal nor merely conventions, but are ultimately based on human experience and its concrete historical representations.

At least in the history of science it has turned out to be extremely useful to analyze the precise way in which experience enters fundamental abstractions such as space and time. It has also turned out useful to analyze contradictions in systems of knowledge as a driving force of this development. For example, in 1905 Albert Einstein confronted seemingly insurmountable contradictions within classical physics. But then he realized that the classical concepts of space and time were neither given a priori, that is, prior to experience, as had been claimed by Kant, nor merely conventions, as had been claimed by Poincaré. Einstein recognized instead that these abstract concepts were actually conceptual constructs based on a limited domain of experience, as suggested by Hume. The realization that the much larger experimental horizon of the new physics of his time transcended this domain eventually helped him to formulate the relativity theory with its fundamentally new concepts of space and time (Renn 2006).

From such instances, an epistemic history of science has inspired a reconstruction of the experiences underlying the fundamental concepts and practices of science. Similarly, one might conceive of an epistemic history of normativity by studying the experiences that have shaped the fundamental precepts of normative thinking and practices.

16.3 A Brief History of Knowledge

This leads to the third part of this essay, which deals with the globalization of knowledge in history and some of its consequences. It may be possible to recognize some of the basic mechanisms of the global exchange of knowledge and its interdependence with other processes of transfer and transformation even in the earliest phases of human development. All of these processes are layered in the sense that the introduction of a new process does not lead to the eclipse of earlier processes. This historical superposition of experiences in itself necessitates a global perspective.

Typically, the outcome of a knowledge production process becomes the precondition for the stability of the level of development attained. This may be illustrated with a historical example. In the fourth millennium BCE, we see the beginning of large-scale settlements in Mesopotamia. At this time we also see, not coincidentally, the development of writing (Nissen et al. 1993; Damerow 2012; Renn 2014). The invention of writing was originally a consequence of state administration. Not only did it change the conditions of the geographical transfer and historical transmission of knowledge, but also extended the human cognitive facilities by stimulating reflection processes and the creation and articulation of previously unknown cultural abstractions. Eventually, writing was converted from a consequence into a precondition, not only for a particular model of state organization but also for a level of socioeconomic development, from literature and law to science, that depended on these novel cultural abstractions. The example of the invention of writing thus nicely illustrates how more or less contingent consequences of historical processes may turn into the necessary precondition for the stability of the current situation as well as for its further development.

It has often been claimed that since its inception writing has been used as a means of representing language. But in fact it emerged, independently of spoken language, as a technology for the administration of centralized politico-economic systems of the ancient Mesopotamian city-states where its communicative function was restricted to the administrative context. Thus, the first writing did not represent the meaning of words or sentences, nor did it reflect grammatical structures of language, but rather meanings related to specific mental models of societal practices such as accounting. Since it was not used as a universal means of communication, it could only transport a very precise meaning in a very precise context. It was on this basis that a long-term and stable Babylonian administrative economy developed, which in turn served as a precondition for further development, in particular, for the second invention of writing, this time as a universal means of codifying language. This second invention of writing would have been impossible without the spread and manifold use of the earlier proto-writing.

As the historian of science Peter Damerow pointed out, a similar development precedes the emergence of mathematics, which also emerged from context-dependent Babylonian administrative proto-writing, originally invented to solve specific local administrative problems (Damerow 2012). This example illustrates

the process of reflective abstraction introduced earlier. For many years, not even historians of mathematics imagined that there were numbers whose meaning depended entirely on the context of what they were supposed to count. In other words, the meaning of the respective symbols depended on whether they were counting people, length, field measurements or pints of beer, the latter being an important application of Babylonian mathematics. And yet our present day mathematics, which claims universal validity, emerged from a system of symbols that were originally invented exclusively to solve specific administrative problems and characterized by this very context dependency.

Contrary to what philosophers have long believed, the universality of mathematical knowledge is thus not the characteristic feature of a specific type of knowledge. It was rather the outcome of a specific historical trajectory of globalization. Since the third millennium BCE, the idea of writing probably spread from Mesopotamia throughout the world, although it cannot be excluded that there may have been independent inventions of writing as well. But it does appear that writing spread almost immediately to Iran and Syria, then a thousand years later to the Indus civilization, and another thousand years later to China. This spread led to an enormous increase in the possibilities for transmitting knowledge and also for the emergence of science.

The initial emergence of science in a form familiar to us took place in different parts of the ancient world: Greek and Chinese science developed independently of each other around the middle of the first millennium BCE. The onset of Greek science is to be found in the Middle East, not far from the cultural centers of Mesopotamia. The point that I want to emphasize here is the emergence of cultural abstractions by cultural transfer. As a consequence of the transfer of Babylonian knowledge on medicine, astronomy and mathematics to a different cultural area, that knowledge itself took on another form. In particular, the justification for the validity of a claim was made explicit in the Greek context, while in the Babylonian context it remained part of implicit knowledge. Babylonian science does not comprise explicit scientific proofs so that its knowledge appears to us as an unfounded collection of instructions (Schiefsky 2012).

This knowledge was in fact not unfounded. It was just that the normative control of knowledge operated in a different way. Since knowledge was embedded in the age-old institutional and practical contexts of Babylonian culture, there was simply no motivation to make the reasoning behind certain claims explicit. This changed as soon as another culture appropriated such knowledge, especially when that culture, as is the case for Greek culture, was geared to a public discussion of political decisions and their justification. While the justification of Babylonian or Egyptian scientific knowledge was largely inherent in the institutional and representational structures in which it was generated, it became the subject of explicit normative reasoning in the Greek context.

The process just described was a process of cultural interaction in which knowledge accumulated over thousands of years in the cultures of the Middle East eventually changed its form as a consequence of being transferred to a new context. This is a striking example of the important role of cultural breaks and

intercultural appropriation for innovations due to the recontextualization they engender. In contrast to the transition from Babylonian to Greek science, in China there was, at that time, no comparable transmission across a cultural break connected with a complete recontextualization of knowledge. In Chinese as well as in Babylonian traditions, the structures of scientific reasoning therefore remained, at least from our perspective, largely implicit. Thus ancient Chinese mathematics has also seemed to some of its Western interpreters to represent a mere collection of instructions, devoid of explicit scientific reasoning.

Processes of cultural abstraction by recontextualization are not just characteristic of science but have also shaped the traditions of normative thinking, as can be inferred from the history of religion. For instance, the Babylonian exile of the Jews in the sixth century BCE and their later encounters with Persian and Hellenistic traditions not only led to an integration of new cultural resources into the Jewish tradition, but also to a transformation of this tradition towards greater inclusiveness and universality (Geller 2014). This can be illustrated by the biblical account of the prophet Jonah charged by God to preach in the Assyrian city Niniveh, announcing its imminent destruction. Jonah tries to escape the divine mission but is ultimately confronted with the fact that the God of Israel embraces ignorant enemies in His grace. Jonah ends the Book abruptly with God's rhetorical question:

> And should not I spare Nineveh, that great city, wherein are more than six-score thousand persons that cannot discern between their right hand and their left hand; and also much cattle? (Jonah 4:11)

Similarly, the emergence of Buddhism at about the same time in India occurred in the context of a reaction to the contemporary Brahmanical religion and led to a highly reflective textual tradition (Braarvig 2012). Buddhism carried with it packages of knowledge comprising texts, artisanal and artistic practices, but also forms of social organization such as monastic communities that travelled across Eurasia.

Religions such as Judaism, Buddhism and later Christianity and Islam provided to be efficient networks for spreading both knowledge and normative thinking. These world religions embodied much of the structures of authority and the mechanisms for knowledge production and dissemination of the state. But whereas knowledge in the state was limited by its geographic boundaries, the packages of knowledge associated with world religions traveled more or less freely across state boundaries. Religion offered a new social order greater than that of the state, but modeled on the state; thus, for instance, the concept of the Umma in Islam and the City of God in Christianity (Damerow and Renn 2010).

While authority was merely asserted by the state (and grounded in physical force), the world religions needed to justify their authority. Thus they developed sophisticated schemes of justification and produced extensive bodies of knowledge through complex processes of dialectics. Some of these schemes and processes had their origins in earlier systems of thought that had arisen under specific local conditions, such as Hellenistic philosophy. But whereas such schemes and processes had been local, the world religions embedded them in institutions of potentially global extent. It is against the background of these complex schemes of

argument, processes of justification and elaborate bodies of knowledge—and in dialogue with them—that modern science was born, as will now be discussed.

The capacity of religion to challenge the authority of the state in terms of its own internal logic ultimately increased the potential of science to challenge religious authority. This is especially true for a religious tradition like medieval and early modern Christianity that systematically committed itself to the augmentation of knowledge, positioning itself within a comprehensive worldview.

In the context of the late medieval and early modern development of extensive commercial networks, of new military technologies, of large-scale engineering endeavors such as the Arsenal of Venice, and of large building projects like the cathedral of Florence, a new class of scientist-engineers such as Brunelleschi, Leonardo and Galileo faced important technological challenges. Addressing these challenges, they relied on theoretical knowledge from antiquity, the Islamicate world and from medieval scholastics, which they combined with contemporary practical knowledge, thus creating a new form of science in which theoretical knowledge was systematically related to experience.

In response to the encompassing religious worldview, the new knowledge accumulated by these scientist-engineers began to assume the character of an equally all-embracing interpretation of the world, as can be found in the great philosophical concepts of the early-modern period, for instance, in the works of Giordano Bruno or René Descartes. Science eventually became a kind of counter ideology by which the emerging bourgeoisie could defend its claims to power, not according to a transcendent, religious order, but according to immanent laws of nature and society. The new knowledge thus also assumed a normative dimension.

This situation helps to explain why, in the sixteenth century, the reform of astronomy by Copernicus, placing the Sun rather than the Earth at the center of the universe, could have had such far-reaching ideological consequences: it occurred within a context of a socially dominant system of knowledge that claimed to be universal and exclusive (Omodeo 2014). The geocentric worldview, placing the Earth at the center of the universe, was deeply anchored within this system of knowledge. Questioning this claim, even with good scientific reasons and without any intent of heretic provocation, still amounted to unhinging the whole system and thus causing an ideological revolution by means of an astronomical, and at the outset purely scientific innovation. In contrast, there was no comparable revolution in seventeenth-century China when Jesuit missionaries introduced Copernican theory, or even Galileo's telescope, which made the new view of the heavens so intuitively plausible. In Ming China, there was simply no combined religious and philosophical worldview that this new discovery could potentially provoke (Schemmel 2012).

In the early modern period, all the patterns of the globalization of science had essentially already formed within the European network of scientific knowledge. It was crucially shaped by Europe's dense but culturally diverse urban landscape. The successful expansion of science within Europe could therefore create a model essentially followed by all later globalization processes of science, including the replication of institutional settings and canons of knowledge. The thus emerging

network of scientific knowledge exhibited self-organizing behavior, as is evident in the fact that there was no central control of scientific practice, and yet scientific knowledge accumulated at an astonishing rate and traveled quickly across the emerging scientific community. Positive network externalities fostered the inherent dynamics of spreading science so that the more people engaged in it, the more useful it became. Science developed into a self-organizing network that inherently scales globally (Renn 2012, Chap. 24).

The globalization of knowledge today is a consequence of two processes: the intrinsic globalization of science just described and the fundamental role that knowledge, particularly scientific knowledge, has assumed in other, economic, political and cultural globalization processes. One important result of the interaction between intrinsic and extrinsic processes of the globalization of knowledge is the emergence of global objects of science, in particular global human challenges such as climate change, scarcity of water, global food provision, reliable energy supply, sustainable demographic development and nuclear proliferation.

The production of scientific knowledge in large-scale technological ventures, in global infrastructures and regulations, or in worldwide operating enterprises has given rise to socio-epistemic complexes involving new epistemic communities. These socio-epistemic complexes such as the global energy or traffic systems cause changes on a global scale that cannot be easily undone. Governance of such socio-epistemic complexes requires the production of more and more scientific knowledge which becomes ever more inseparable from the development of policies relying on social and economic knowledge and its normative reflection. Such socio-epistemic complexes may even endanger their ecological and social substrata—unless new scientific knowledge continually becomes available. In consequence, they sharpen the dilemma of human freedom, enhancing humanity's potential to act but making the world increasingly dependent on the appropriate use of this potential.

It thus becomes clear that the much-discussed globalization processes of the present involve knowledge not just as a mere presupposition or consequence of economic or political processes. It is in fact the globalization of knowledge as a historical process with its own dynamics that orchestrates the interaction of all the underlying layers of globalization. The globalization of knowledge and its normative reflection profoundly influence all other globalization processes—including the formation of markets—by shaping the identity of its actors as well as of its critics.

It is important, however, not only to investigate the globalization of knowledge and its normative dimensions, but also to pay due attention to its counterpart, the localization of knowledge and norms in local processes of appropriation, as Kostas Gavroglu and his colleagues have emphasized, in particular in their research initiative on "Science and Technology at the European Periphery (STEP)". Referring such an analysis to the present we may perhaps regain autonomy with regard to the economic dimension dominating our current perception of these processes. An investigation of this kind may explain the sense in which the globalization of knowledge and its encounters with local knowledge has become a critical dimension of today's globalization processes on which their future development depends.

From this perspective, they may turn either in the direction of further subjecting the economy of knowledge to the control of other globalization processes, or in the direction of strengthening the autonomy of knowledge and its normative reflection, and thus also our potential for steering such processes.

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