

Seen/Unseen:**Art, science and intuition from Leonardo to the Hubble telescope.****Martin Kemp****Oxford University Press: Oxford 2006. 352 pages.**

Visualization in science, following the writings of Michael Lynch and Bruno Latour (e.g., Latour, 1990), is increasingly acknowledged as an important topic in STS. It is representation in scientific practice, in turn, that most authors address. Michael Lynch and Steve Woolgar (1990) argued, notably, for images as active agents in the construction of facts. This “ethnographic” approach is often seen as intrinsic to an STS idiom of sociologically-inclined analysis. Thinking about images in ethnographic terms, however, might be seen to be in place well before the STS efforts, some of the earliest writings on the visual in an ethnographic light being Thomas Kuhn’s writings in the 1960s. It was “historiographic” rather than “aesthetic” practice that was the object of Kuhn’s ethnography while making comparisons between art and science.

Consistently in the *Essential Tension*, Kuhn’s references to art become expressed as historiographically-mediated insights that draw, in particular, on writings by art historians such as Erwin Panofsky and Ernst Gombrich (Kuhn, 1977: 105-126). Quite contrary to this, the current STS research approaches images as historiographically transparent objects. Writings on visualization in science and art from an “art historical perspective” seem to be outside the scope and relevance of STS writing on

imagery. The lack of attention to Martin Kemp’s book *Seen/Unseen* is an example of this tendency.

Kemp’s book is divided into four parts and ten chapters grouped thematically and chronologically into discussions that range from Renaissance optical themes to problems of perception and representation by machines in modern imagery. Styles and problems of seeing shared by scientists and artists is an underlying concern for all of Kemp’s discussions. Kemp explores a wealth of materials, such as different styles of perspective and concepts of proportion, comparisons between art and science in the light of the theme of analogy, seeing patterns in the application of geometry from Leonardo to Goethe, techniques of representation and the camera before photography, the rhetoric of objectivity in anthropological photography, as well as attempts to depict the “un-seeable” such as in the case of X-Rays and other modern imagery.

Thus *Seen/Unseen* is typical of Kemp’s style of art history or “history of the visual” as he describes it, rich in comparisons between art and science in given historical and social contexts (see Kemp, 2000). By means of comparisons, he attempts to retrace and explore the practices that artists and scientists adopt in arriving at aesthetically similar results that are called as “structural intuitions”.

In *Seen/Unseen*, there are a number of such comparisons referring to Kuhn's earlier writings of the 1960s that drew, like Kemp does, on the idea of ethnographic analogy. Even though representation in Kemp's analysis expresses a historical fact, the facts of the images that he discusses are social things or objects that are mediated and constructed by practices and material technologies. Kemp's "visualization", thus, emerges as a phenomenon mediated by the agency of material practices and techniques that are socially and historically contingent. In *Seen/Unseen*, Kemp looks, for example, at the role, parallel uses and appropriation of imaging techniques, addressing a number of material technologies such as Leonardo's early modern models and machines on paper, optical and single lens microscopes starting from Hooke's lenses and ending with the Hubble telescope.

Kemp's ethnographic sensibility, a thick description of images and practices, is historiographically-mediated and similar to Kuhn's earlier approach to the visual. In the book, Kemp, for example, discusses his own approach to visualization in relation to the impact of biologist's C.H. Waddington's book *Behind Appearance* published in 1969 (p. 211). On one hand, Kemp's historiographically-mediated ethnography of the visual links his work to Kuhn's earlier endeavours. On the other hand, Kemp's referencing of Waddington's work stands as an argument for a classification of Kemp's work in a trajectory of writing concerned also with the public understanding of science. Waddington's book, in the context of its reception, may be seen to have expressed both the impact of Kuhn's "cultural history" and an emergent genre of writing described as public understanding of science. Above

all, Kemp's *Seen/Unseen* is the work of an acute observer in the business of looking at and retrieving, epistemological, social and aesthetic detail in art and science, as matters of historical fact.

Kemp defends materialism in the analysis of visualization. This becomes clear in Kemp's distinction between "cultural construction" and "cultural realization". Structural intuitions, he asserts, are the products of both "historical imperatives" and "cultural attuning". At the same time, they require, "basic mechanisms and visual potentialities" which are not, in his view, "culturally constructed" (p. 324). Here Kemp, simply states the obvious. His acknowledgment of a "biological" apparatus that hosts and becomes entangled with tacit knowledge and historical contingency is more of a materialist than a realist plea for the reading of visual evidence across art and science.

Kemp's work is an inspiring, thoughtful and comprehensive analysis of artists as ethnographers of modern science and scientists as artists in a long duration of time that has given rise to some of the most iconic moments and images of modern and early modern science from the Renaissance to the present day. Anyone who is interested in visualization in science and the ways in which images and styles of representing in science intersect with the agency of artists from a historical and ethnographic perspective should read *Seen/Unseen* that is, in itself, an experiment in historiography and interdisciplinary method as far as the study of images is concerned today.

References

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Gregory Tassej:

The Technology Imperative.

Edward Elgar: Cheltenham, UK, and Massachussets, USA, 2007. xiv + 329 pp.

Gregory Tassej's work is a critical and informed book on the importance of technology to the economic growth. The Senior Economist for the US National Institute of Standards and Technology takes a serious effort to analyze the technological change from an economic viewpoint with similarity to the work of economic historian Nathan Rosenberg.

The work has a tripartite structure—with eleven chapter—in which the main argument is developed by using a recurrent and cyclical line of argument. In the first part, Tassej depicts the “economics of decline” with a great deal of statistical data. In the second part, Tassej enlarges on R&D in the modern economy in order to explain the key characteristics of his economic model. The last three summarising chapters of the third part are dedicated to “technology-based political economy”. Tassej anchors his book to one positive thesis and four negative critics. The positive thesis that he formulates as the “technology imperative” is the following: “the high-income economy must be the high-tech economy because (i) technology drives productivity growth, which in turn, drives output and income growth, and (ii) long-term competitive advantage requires renewal of technology-based assets” (p. 3). Nevertheless, according to Tassej, this imperative is being rejected or minimized by the US analysts and policy makers,

which may lead to a loss of its world economic leadership.

According to Tassej, the changing global economic situation and its threat to the USA reside in the following four points. First, there is a “globalization of technology” due to a process of global economic convergence of emerging economies in Asia (China, Japan, India, Thailand, etc.) and in Europe. These countries are catching up to the USA. Second, the trends of US decline have been downplayed by many policy makers who are named as “apostles of denial” by Tassej. Third, even those who recognize the decrease in the US competitiveness reject to act for preventing the threat because of the dominance of traditional and out-of-date economic models. Finally, Tassej reports a lack of analytical tools for technology-based economic growth policy which would allow detecting market failures.

The above set of arguments displays a sinister image of the US economic future: “the United States is increasingly not competing. Its small and geographically-concentrated high-tech sector, its under-skilled labor force relative to current and especially future requirements and its lack of a capable STID [Science, Technology, Innovation and Diffusion of Technology] policy analysis capability are conspiring to allow global convergence to erode domestic economic

growth and the potential to increase the standard of living for its citizens” (p. 306). According to Tasse, the question is whether the USA wants “to compete or not to compete”. If the choice is to compete, the author is ready to present the keys of the required “public-private technology-based growth paradigm”. The core of book is dedicated to depict this model.

On the basis of the analysis of the book, Tasse summarizes five policy lessons. First, the high-income economy must be the high-tech economy, which requires high R&D intensity. Second, R&D funding strategies in large countries or blocks of smaller countries must diversify beyond IT and biotechnology, which necessitates portfolio management. Third, technologies evolve in cycles, which calls for dynamic policy management. Tasse contrasts his model with the so-called black-box models of technology common in economics. As a result, he depicts a multi-element and life cycle -based model of technology that is more complex than black-box models because the model reflects the multiple interrelations among the components of the technological system (e.g., among infratechnologies, generic and proprietary technologies) and takes account on issues concerning timing and requirements since basic research and generic technologies require more time and funding to develop than the market-based development of existing technologies.

The fourth policy lesson is that technology-based competitiveness is a public-private problem in essence. Therefore, it requires cooperative public-private planning, research, infrastructure investment and market development. Tasse argues that the traditional economic focus on private-industry sector

investments is outdated. The long-term competitiveness requires continuous public investments in order to make advances in basic science and generic technologies and to overcome the risk of emergence of new technologies. Moreover, there are elements of the technological system (infrastructures, standards and protocols), which are quasi-public-goods and, therefore, suffer from underinvestment in the private sector. The economic growth depends more and more on public investments that are required for supporting time-consuming and risky funding of basic research, generic technologies and infratechnologies. Fifth, technology-based growth policy must be improved, which, in consequence, requires resources and integration of STID with other economic policy areas. This requires new analytical models, data and methodological development for identification of needs, design and implementation of appropriate programs, as well as for measuring the results.

Although Tasse mainly addresses the US economic policy, his analyses could be applied to European or Asian policies as well. European and Asian countries – according to Tasse – are increasingly aware of the global changing economic situation and they are undertaking new models of economic policy (similar to the above mentioned five lessons) and catching up to the USA, while the USA resists the change due to the “installed-base” effect typical to the leader whose economy is declining.

From the point of view of STS, Tasse’s economic and policy-oriented work provokes the following reflections. Tasse’s book shows technology as the *cause* of change of global economic situation compelling countries to undertake concrete policy actions to improve com-

petitiveness. Similar to many economic studies, Tasse's conception of the relationships between technology and society is deterministic. Throughout the book, Tasse frequently repeats deterministic statements about the character of technological change. Although Tasse avoids black-boxing technology, his conception of technological change is not informed by the theoretical contributions of sociology, history and philosophy of technology. This is unfortunate, since Tasse maintains the view on technology as applied science, and his model explicitly expresses a linear dimension: basic research leads to generic technology research that is followed by applied research with the commercial prototype and, in the end, by the product develop-

ment with the market introduction. Finally, Tasse's book does not address the poorest countries or policies for helping the South where most of the humanity live in poverty and without any type of technology.

At any rate, the reading of Tasse's work is important for economists who want to know the current technological requirements for economic growth and what kind of economic policy is needed for improving competitiveness. The book is also illuminating for STS scholars due to the profusion of data and empirical analysis.

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