

THE - VISIONS - OF THE MIND.

Bruno Latour.

This article reviews the most important works that have tried to account for scientific method in terms of the material visualisation of objects. The article avoids both an epistemological model and a perceptual one ; rather it develops the notion of - immutable mobile -. It also serves as an introduction to the other articles in the issue.

THE RATIONALISATION OF SIGHT.

Williams M. Ivins.

This in an introduction William Ivins wrote to several treatises on perspective written by famous Renaissance artists. In this introduction, Ivins summarises his essential thesis concerning - the matter of the images -. His argument is that the audio-visual revolution dates back to the Renaissance when the printing press and aqua forte were invented simultaneously. Perspective enabled this new medium to reproduce without deformation any point in space or time.

DESTRUCTION OF VISUAL CONCEPTS.

Jocelyn de Noblet.

The author sets out to show that in all areas of knowledge, every time revolutionary ideas emerge, there are conceptual difficulties because of people's desire to cling on to old visual concepts.

The article examines the period 1895-1927 and makes a comparative analysis of formalistic changes in theoretical physics and in applied arts.

THE QUALITY OF QUANTITY.

Jean Lave.

How do we calculate in daily life ? How do we get by when we shop in supermarkets, having to calculate and compare discounts ? How do we manage our budget without ever using the rules of accounting ? These are some of the questions raised in this article which summarises the results of two different studies : the first describes arithmetic practices among Liberian tailors ; the second studies daily arithmetic practices among Californian grocery shoppers and weight watchers. The author studies these practices and compares the ability people seem to have in managing their own mathematical problems with their aptitude in answering standard maths tests at school. The article envisions several new ways of approaching the study of daily arithmetic practices.

ON TEXTS AND THEIR ALLIES.

John Law.

This paper discusses the way in which a set of pharmacological experiments was undertaken in

order to generate results in the form of inscriptions. It is suggested that the experimentalist acted like an entrepreneur, combining a variety of potentially unruly resources with the aim of simplifying these and, in the end, reducing them to docile figures on a sheet of paper. The difficulty of this process and the way in which these resources were tamed by a process of juxtaposition is underlined. Three particular classes of potential resources are selected for especial attention : natural objects or devices, people and inscriptions. It is argued that these have certain properties that render them relatively durable and transportable and hence convenient for the purpose of long distance social control. Reductionistic explanatory strategies that allocate ultimate power to either the text or the human actor are thus rejected.

CIRCUMSTANTIAL EVIDENCE.

Steven Shapin.

Robert Boyle's experimental programme had as its end-product the generation of indisputable matters of fact. In this paper the author analyzes the resources used to produce these matters of fact, paying particular attention to linguistic practices. Experimental reports rich in circumstantial detail were designed to enable readers of the text to create a mental image of an experimental scene they did not directly witness. This process is called - virtual witnessing -, and its importance was as a means of enlarging the witnessing public. The notion of a - public - for experimental science is essential to our understanding of how facts are generated and validated. In these episodes, circumstantial reporting was a technique for creating a public and for constituting authentic knowledge.

OBSERVATION OF NATURE OR INSTRUMENTS ?

Trevor Pinch.

In this paper a new schema for the analysis of scientific observation is proposed. The concepts of externality and evidential context of observational reports are introduced. These new concepts suggest that observational reporting is dependent on theory. The analysis is illustrated by reference to the detection of solar neutrinos and measurements of solar oblateness. Detailed studies of these cases reveal how the externality and evidential context shifts during the course of observational disputes. Some of the consequences of the new schema for the analysis of scientific language, access to experimental data, and black-box instrumentation are developed.

THE - EXTERNALIZED - RETINA.

Michael Lynch.

Graphs, diagrams, micrographs, and other representations are mundane *renderings* which scien-

tists compose and handle in their day to day research. Such pictures give tangible form to scientific perception ; they - externalize - processes of visual discrimination and objectification by accomplishing these processes - on paper - rather than in the mind of the beholder.

In this paper a few published illustrations from diverse sources in the life sciences are analyzed for the purpose of explicating and criticizing two familiar themes on scientific perception : selection and mathematization. Selection refers to the pragmatists' account of perception through simplification of a primordially chaotic - reality -. Mathematization refers to the historical process through which the natural manifold is progressively defined in terms of mathematical universals. As a result of this convergence of preparatory practices and literary formats, laboratory specimens become - hybrid objects -, simultaneously identified with material and mathematical space.

ANTS INSIDE THE PANOPTICON.

Dominique Lestel.

A photo essay reconstitutes the different stages by which Mexican ants are transformed into articles and statistics.

THE ILLUSTRATION OF SCIENTIFIC TEXTS.

Françoise Bastide.

Twenty illustrations taken from biological - literature - are presented in this article. They are not intended to form a catalogue (which would be impossible) but simply to show the (increasing) degree of intervention by illustrators in the different illustrative processes : photographs, tables, graphs, drawings. Increasing intervention on the part of illustrators coincides with an increasing degree of complexity in the information contained in the illustrations : a complexity determined by semiotic characteristics. In general, the illustrations take their meaning from the text which explains how they should be read ; conversely, the illustrations serve as a foundation for the arguments presented in the texts. The purpose of all illustrative material, including photographs, is to provide a demonstration of what is stated in the text, and as such it acts as both a reminder and a guarantee.

THE POPULARISATION OF VISUAL CONCEPTS IN THE POPULARISATION OF SCIENCE.

Daniel Jacobi.

Instead of studying the visualisation processes used in scientific articles like other contributors to this issue, the author examines the ways in which images are transformed as they move from first-hand technical literature to more and more popularised versions of the same texts.

MEDICINE, ART, AND ANATOMY.

Samuel Y. Edgerton, Jr.

There is no better example of how the early sixteenth-century book publishers merchandised their new printed product than the illustrated anatomy treatise. By tracing the history of this specialized *genre*, we may learn not only something about the practices of nascent entrepreneurial capitalism but also how printing really did become an agent of intellectual change in Western Civilization. This paper intends to survey the evolution of the most famous and influential anatomy treatise ever published, Andreas Vesalius's *De humanis corporis fabrica* of 1543.

So engaging were the illustrations of Vesalius and Valverde that they set the standard and served as models for almost every other printed anatomical diagram thereafter.

THE PAPER FOUNDATIONS OF MODERN MACHINES.

Eugene Ferguson.

Today, our mass-production industries can design on paper a complex machine, such as an automobile engine, then build a million identical examples of it. Our ability to do this results from bringing together in the 20th century tools, techniques, and understandings that have been developed over nearly two thousand years.

The thesis of this paper is that after the advent of printing no particular step in the development of 20th-century capabilities was in itself revolutionary. Instead, the remarkable end result can be explained by a series of mundane, incremental changes in the way knowledge was clarified and transmitted on paper. In the 18th and 19th centuries, a growing repertoire of - generic - ideas for machines, promulgated in books and models, was complemented by methods of analysis that promoted an understanding of possibilities inherent in the machines. - Proprietary - drawings, specifying exactly how a particular machine must be constructed, made possible the central control of manufacturing processes. Mastery of the essential complexity of mass production rested upon gradual empirical adjustment of shop procedures, a process that was mediated through drawings and words on paper.

SEEING POWER.

Shandra Mukerji.

This article reviews the different shapes of world maps in the course of early modern history. The author's contention is that power over the world is power to *see* the world.

THE IMAGES OF WAR OR VIDI VICI.

Philippe Quéau.

Electronic and computerised images play a crucial role in the pursuit of contemporary warfare. Six

main functions may be listed : observation, display, artificial vision, production of images to deceive the enemy, enhanced visualisation and simulation. Electronic imagery is thus used for its ability to objectify and synoptically concentrate information, and for its ability to treat and synthesize data. They give access to elaborate forms of control, modelisation and simulation. Several consequences are noteworthy : first, images do not need a human eye, they are analysed through algorithms ; second, the proliferation of linkages allows for a sophisticated interaction between the body (voice, gestures) and the images – interaction that may entail a derealisation of sensual and motor functions. Lastly, the images are the end-product of (formal) languages ; they do not show what is or what could be, but are useful visualisations of pure abstractions of language. In effect, images have shifted from *show* to *simulation*.

THE PRINCE'S EYE GLASSES.

Claude Riveline.

Four figures seem sufficient for most governments when assessing the health of the national economy : inflation, trade balance, industrial production, number of unemployed. These figures, however, are ill defined and loaded with gross miscalculations. In spite of this, governments seem bound to retain them because, on the one hand, the public is used to them and, on the other, they are easy to calculate and are required by law and/or tradition. Such a situation can only change as a result of exceptional upheavals or through a slow and painstaking process of reflection on the part of those who govern and those who are governed.

DIAGRAMS, MODELS AND PERCEPTION.

Judith Epstein.

This article traces the genealogy of contemporary research into visual perception in order to distinguish between, on the one hand, positivistic methods (from Gestalt theory to cognitive psychology and artificial intelligence) and, on the other hand, non-positivistic analysis of the relations between language, perception and knowledge as developed by Wittgenstein, the philosopher.