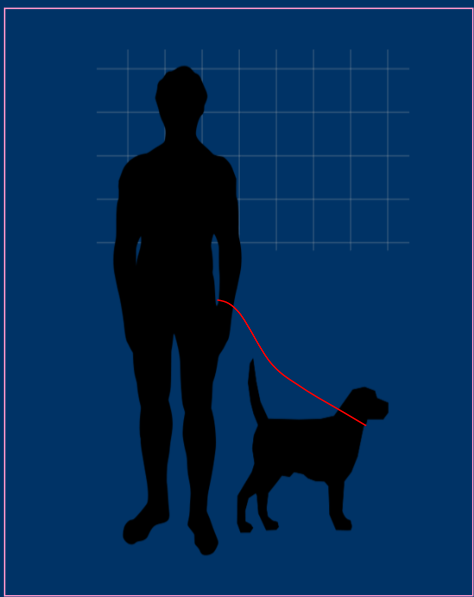
ALL ABOUT SCIENCE

PHILOSOPHY, HISTORY, SOCIOLOGY & COMMUNICATION



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Scimat (Science Matters) is the new discipline that treats all human-dependent matters as part of science, wherein, humans (the material system of *Homo sapiens*) are studied scientifically from the perspective of complex systems. That "Everything in Nature Is Part of Science" was well recognized by Aristotle and da Vinci and many others. Yet, it is only recently, with the advent of modern science and experiences gathered in the study of evolutionary and cognitive sciences, neuroscience, statistical physics, complex systems and other disciplines, that we know how the human-related disciplines can be studied scientifically. Science Matters Series covers new developments in all the topics in the humanities and social science from the scimat perspective, with emphasis on the humanities.

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Science Matters Series

ALL ABOUT SCIENCE

PHILOSOPHY, HISTORY, SOCIOLOGY & COMMUNICATION

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Scientific Research Institute Bento da Rocha Cabral, Portugal

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San Jose State University, USA

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Fig. 2.1. A metaphor for Science: Two linked animals—a *Homo sapiens* and her/his dog. The human being controls the dog and can direct it to do good things (pick up a newspaper, say) or bad things (bite the neighbor). The dog represents "natural science" while the human being, scimat (humanities, social science and medical science). [A dog leash is added to a rescaled picture of Abujoy's *Size Comparison between a Beagle and a Man* (2008), Wikimedia Commons, May 11, 2014.]

Preface

The importance of science goes without saying. Yet there is a lot of confusion and misconception concerning Science. The nature and contents of science is an unsettled problem. For example, Thales of 2,600 years ago is recognized as the father of science but the word science was introduced only in the 14^{th} century; the definition of science is often avoided in books about philosophy of science. This book aims to clear up all these confusions and present new developments in the philosophy, history, sociology and communication of science.

In fact, through a careful examination of the historical development it is not too hard to recognize that science is a subset of human activities aiming to understand how Nature—consisting of the human system and all nonhuman systems—works *without* bringing in God or any supernatural. In other words, what characterizes science is its secularity. This simple definition of Science—historically correct but missed by many people—is expounded by Lui Lam in Chapter 1. Also included there is an elaboration of the new discipline *Scimat* (Science Matters) which treats all human-dependent matters as part of science, with its immediate goal of setting up scimat centers around the world.

The nature and development of science are analyzed by the three interrelated disciplines, Philosophy of Science, History of Science and Sociology of Science while Science Communication, which depends heavily on the other three, is the discipline that connects the public to science. These four important disciplines are very young, emerged within the last century, and are part of the humanities. Chapter 2 by Lam examines the four disciplines with new insights, from the perspective of scimat, and urges the expansion of their scope to include more complex systems, humans in particular. It should be pointed out that this book is probably the first one ever which treats the four disciplines collectively together.

In China, these four disciplines are grouped under the umbrella term “scientific culture” since the 1980s. Top scholars from China were invited to present their newest works here. The lack of scientific culture in ancient China is explained by Hong-Sheng Wang (Renmin University of China) in Chapter 4. The history of its development in contemporary China is summarized by Bing Liu (Tsinghua University) and Mei-Fang Zhang (University of Science and Technology Beijing) in Chapter 13. Guo-Sheng Wu (Peking University) writes on his favorable topic, the phenomenological philosophy of science (Chapter 3) while Jin-Yang Liu (Remin University of China) discusses in detail his idea of holism (Chapter 6). New insights on science in Victorian Era, on the “mistake” of Friedrick Engel and Mitsutomo Yuasa, are provided by Dun Liu (Chinese Academy of Sciences) in Chapter 8. Moreover, in Chapter 15, a thorough description of popular-science writings in early modern China, which played a crucial role in the introduction of science from the West, is written by Lin Yin (China Research Institute for Science Popularization).

Of course, the scientific culture originated in the West and has been widely covered in numerous books and articles. Still, presented in this book are four important articles: A summary of the three waves of science studies (Chapter 11) by sociologist Harry Collins, a unique insight on what scientists really know (Chapter 5) by physicist Nigel Sanitt, a historical description of medical studies in Portugal around 1911 (Chapter 9) by historian Maria Burguete, and a history and review on science communication (Chapter 14) by the expert Peter Broks.

Two more important articles on the history and sociology of science are written by Lam. Chapter 10 is his detailed, personal account of the why and how as well as the background and crucial events in establishing the International Liquid Crystal Society, a story never told before. It is written for those working in or interested in science, liquid crystals in particular, and for science historians. Chapter 12 is his personal recollection of the six years of working in China, starting from the “Science Spring” of 1978, the year China’s reform-and-opening up *revolution* began. In this chapter, the development of soliton research and political climate in China experienced by the author is revealed for the first time.

Science consists of two parts: the scientific process and the resulting scientific knowledge. An example of these two parts in action is nicely demonstrated by Robin Warren’s description of his Nobel Prize-winning work on *Helicobacter* (Chapter 7).

Science, according to the definition in Chapter 1, consists of not just “natural science” but also the humanities and social science. We are thus very happy to be given the chance to showcase three articles in this book to illustrate this point. Kajsa Berg’s Chapter 16 describes neuroarthistory, a relatively new discipline, from Socrates to the “contextual brain”, a concept invented by the author. Ting-Ting Wang (Peking University), in Chapter 17, presents her in-depth analysis of online spy video games from the narrative and cultural perspectives, on how a game’s text is constructed and how the player’s pleasure is generated. Finally, the physicist-turned-historian Dietrich Stauffer’s Chapter 18 provides an easy-to-understand tutorial on statistical physics for humanists, with a step-to-step description of the simple but useful Ising model, finished with interesting applications in social science and a Fortran program. On top of that, a list of history titles that the author, and hopefully the reader, finds interesting is included.

The book’s 18 chapters are organized into five parts: Part I: Philosophy of Science; Part II: History of Science; Part III: Sociology of Science; Part IV: Science Communication; Part V: Other Science Matters. Hopefully, research scholars and laypeople will both find this book enlightening and useful.

Rio Maior, Portugal Maria Burguete
San Jose, California Lui Lam

A Note on Chinese Names

There is no perfect way to write Chinese names in English. The spelling and ordering conventions of a Chinese name's characters are different in different geological areas—mainland China, Hong Kong, Taiwan and United States. The conventions adopted in this book are as follows.

1. A contributor's Chinese name after the chapter's title always appears with family name *last* and the first name's characters (if more than one) connected by a hyphen. For example, Guo-Sheng Wu, a contributor in this book, corresponds to Wu Guosheng in mainland China.

2. All Chinese names in text and references are written with family name *first*, with first name's characters (if more than one) connected by a hyphen.

3. All Chinese names from mainland China are spelled out in pinyin.

4. For those who made their career in the US, whether they settled later in mainland China or not, their name's old spelling is adopted, i.e., *not* in pinyin. For example, Yang Chen-Ning in this book is Chen Ning Yang in the US (which would be Yang Zhengning if he made his career in mainland China but not in the US).

5. Lui Lam made his career in both places, outside and inside China. The name Lui Lam appears the same as a contributor and in text while his pinyin name Lin Lei appears also in text and reference list. (His family name, Lin in pinyin, is Lam in Cantonese.)

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1

About Science 1: Basics
—Knowledge, Nature, Science and Scimat

Lui Lam

There is a lot of confusion and misconception concerning Science. The nature and contents of science is an unsettled problem. For example, Thales of 2,600 years ago is recognized as the "Father of Science" but the word science was introduced only in the 14th century, and so it is obvious wrong if science is understood as modern science only, which started with Galileo about 400 years ago. If science is mainly about nonliving systems, then social science cannot be part of science. And if social science is part of science, then why the humanities, which are also about humans, are not part of science? All these confusions and dilemmas concerning science could be traced to the historical evolution of the word and concept of Science and the many misconceptions perpetuated by various philosophers and historians of science, due to the lack of an agreed-upon definition of science. This chapter aims to clear up all these confusions by retracing the historical development of science—the word, concept and practice. The nature of knowledge, Nature, religion and philosophy are covered. A simple definition of science according to scimat, the new discipline that treats all human-dependent matters as part of science, is provided. Three important lessons learned about science, including the required Reality Check (which differentiates science from other forms of knowledge) are given. Important ramifications from this definition concerning antiscience and pseudoscience in particular are discussed.

1.1 Introduction

Science is one of the three pillars that support an advanced civilization, East and West. While the other two pillars, ethics/religion and arts, have an extremely long history of at least one million years [Lam, 2011]

2

About Science 2: Philosophy, History, Sociology and Communication

Lui Lam

Within the last century, four new (sub)disciplines related to science were added to the humanities. They are Philosophy of Science, History of Science, Sociology of Science, and Science Communication. While these disciplines did contribute positively, they had also caused all sorts of problems towards people's understanding of science. What happened and why it happened? This chapter tries to answer this question with new insights gleaned from our historical and cultural heritage of thousands of years. The aim here is not to give a full review of the four disciplines but to analyze them from the perspective of scimat, coming from a humanist and physicist with experience in simple and complex systems. In particular, the mistakes of Ernest Mach, Karl Popper, Thomas Kuhn, Paul Feyerabend and David Bloor and why they occurred are analyzed from a new angle. It has to do with the time-evolving nature of the scientific process, obliviousness of the differences between simple and complex systems, failure of the educational system, and the underdevelopment of the humanities. Suggestions for the near future are provided.

2.1 Introduction

Within the last century, three new subdisciplines and a new discipline related to science were added to the humanities. The three interrelated subdisciplines that analyze the nature and development of science are Philosophy of Science (PS), History of Science (HS) and Sociology of Science (SS). The new discipline is Science Communication (Scicomm) which depends heavily on the other three. In China these four disciplines

Part I
Philosophy of Science

3

Towards a Phenomenological Philosophy of Science

Guo-Sheng Wu

Opposite to the objectivity and the readiness-made of scientific thinking, phenomenology in philosophical thinking manifests the intentionality and the constructivity. And the analysis of the constructivity of intentionality is exactly the reflection. The traditional philosophy of science is a "positive thinking." A phenomenological philosophy of science is a reflective philosophy of science which makes it possible to understand science in the broad sense, to investigate the metaphysical foundations of modern science, and to integrate questions concerning foundation of science with the broader mode of life. It also allows us to understand the trend of modern society and the reflection of modernity, and change the problem of demarcation between science and non-science into the problem of investigating the conditions of possibility that enables "non-science" to be science. With the phenomenology approach, philosophy of science transits from methodology and epistemology to ontology.

3.1 Introduction

In the Anglo-American world, philosophy of science is a mature subject belonging to traditional, analytic philosophy. The community of philosophy of science in contemporary China has largely followed the Anglo-American tradition characterized by logical analysis and empirical justification. For such a mature subject, *phenomenology* means a new "turn." By turning towards phenomenological philosophy of science, traditional philosophy of science would broaden its scope in research.

4

The Predicament of Scientific Culture in Ancient China

Hong-Sheng Wang

There were plenty of technical knowledge in ancient Chinese civilization, but no independently existing scientific-culture system. The ancient Chinese, while moving along their own tradition, had not step onto the road of modern science and technology. This is the Needham Question, which was being attributed to a cultural problem by Max Weber and then to a cultural context in Confucianism by Mou Zong-San. But more importantly, the fact is that the political power in ancient Chinese society had a function of controlling and limiting the development of scholastic culture. This phenomenon appeared not just in ancient China but also in China's modernization process since 1840.

4.1 Introduction

It was in about 1938 when Joseph Needham (1900-1995) first had the idea of writing a treatise on the history of science, scientific thoughts and technology in the Chinese culture that he regarded the essential problem as: Why modern science had not been developed in China but in Europe? [Needham, 1998]. This is the well-known Needham Question. In fact, what should also be mentioned is that he and many others had tried to answer the question for more than half a century afterwards. Their achievements are summarized in the seven volumes of *Science and Civilization in China* [Needham et al, 1954-2004].

In a wider scope, many Chinese and foreign scholars had also discussed a similar issue; some even did that before Needham (see

5

What Do Scientists Know!

Nigel Sanitt

Recently the largest refrigerator in the world—the £4.4 billion new instrument operating at CERN, Geneva—was inaugurated and running. The machine's purpose is to smash together high energy protons in order that scientists can learn about the world of matter, identify what the world is *really* made of, and discover the Higgs particle which confers mass on all the other particles. The Higgs boson was indeed found in 2012 and a Nobel Prize was awarded to the theorists the next year. My purpose in this article is not to denigrate this example of one of mankind's achievements, but to point out a number of problem areas in science which do not get much publicity, and which address the question of what scientists *know*.

5.1 Introduction

I am sure readers will be relieved to hear that in spite of the fact that my background is science and mathematics I am not going to quote any mathematical formulae, display any graphs nor describe in detail any physical theories about the Universe.

What I want to present in this chapter are a few myths and problems in science, which are currently happening and maybe are about to happen. I am going to introduce a few strands, which may, at first, appear unconnected, but which I hope to bring together. I am also going to introduce a model of scientific theories which incorporates two ideas—Integrationism and Problematology—which, I believe, can provide a basis for understanding how science works.

6

How to Deal with the Whole: Two Kinds of Holism in Methodology

Jin-Yang Liu

From the traditional viewpoint of holism, we know how to deal with a whole *only* when we do understand what the whole is. But from the perspective of methodology, "what is a whole" or "what kind is a whole" is not decided by the object itself in ontology but by "how to deal with the whole" in methodology. We thus need to make a paradigm shift from rigid ontological premise to methodological pragmatism, regarding the whole as a methodological hypothesis. And there are two kinds of holism in methodology: One is *constitutive holism* which regards an object as the constitutive whole (including entity, structure or function) and solves it through constitutive methods; the other is *generative holism* which regards an object as the generative process and deals with it through generative rules. However, neither kind has the strength of the other. It is necessary to think of a whole as a methodological concept in a strong sense, while taking it as an ontological reality in a weak sense.

6.1 Introduction

The term *holism* is not very old. It was firstly coined by Smuts in his book *Holism and Evolution* [1926] although discussion of holism can be traced back to ancient Eastern and Western philosophies. Holism is presented in a variety of forms such as *organism*, *Gestalt*, *collectivism*, *connectionism*, etc., and one may wonder whether the different forms are descriptions of a single philosophical position or there are various holisms. A common claim of different holisms is that *the whole is more than the sum of its parts*, and any theory that holds such a view can be

Part II
History of Science

7

Helicobacter: The Ease and Difficulty of a New Discovery

Robin Warren

The story of helicobacter is summarized. The story illustrates the ease and difficulty of a new discovery.

7.1 Introduction

Before the 1970s, well fixed specimens of gastric mucosa were rare. Then the flexible endoscope was introduced, enabling well-fixed small biopsies from the stomach to be made. Gastric histology and pathology were clearly demonstrated. Whitehead accurately described it in 1972.

In June 1979 I was examining a gastric biopsy showing chronic inflammation and the active change. Over the next two years I collected numerous similar cases. In 1981 I met Barry Marshal and we completed a clinico-pathological study of 100 outpatients referred for gastroscopy. There was little relation between the infection and the patients' symptoms. Peptic ulcers, particularly duodenal ulcers, were very closely related to the infection. We cultured *Helicobacter pylori*. In 1986, with Marshall et al, I studied and confirmed the effect of eradication of *H pylori* on the recurrence of duodenal ulcer. Our result overturned the over-one-hundred-years-old belief that bacteria do not grow in the stomach.

In the following, the story of these developments is elaborated.

8

Science in Victorian Era: New Observations on Two Old Theses

Dun Liu

Based on the science conditions in Victorian era (1837-1901) in England, we point out the deficiency of Friedrick Engel's thesis concerning the three great scientific discoveries in the 19th century. Moreover, we question Mitsutomo Yuasa's thesis on the rule governing the shift of the world's scientific center, which has been popular since the 1960s. Both theses were widely accepted in China.

8.1 Introduction

Due to the influence of special political and historical environments, *Dialectics of Nature* by the German philosopher and revolutionary Friedrich Engels (1820-1895), a manuscript discussing natural philosophy, was considered as a classic in directing the scientific research in China (as well the former USSR and some Eastern European countries) [Engels, 1971]. In these places, the book was also a must read among researchers in history of science or philosophy of science. Moreover, "Dialectics of Nature" has been developed into an academic discipline, enjoying a position similar to that of history of science, philosophy of science or sociology of science in the West [Gong, 2005]. In particular, Engels' thesis about "the three great scientific discoveries in the 19th century", presented in a "Reading Note", was widely accepted by the scholars in these countries. While asserting Engels' philosophical

9

Medical Studies in Portugal around 1911

Maria Burguete

This chapter describes how medical sciences at University of Coimbra evolved over the course of the 19th century, and in the process highlights the relationship between the Faculty of Medicine and Faculty of Philosophy. In the mid-19th century the two Faculties were the scene of an effort to reform their teaching methods, on the basis of relationships they established with a number of prestigious European scientific institutions. Their research concentrated on the biological, physiological and chemical foundations of life. The creation of laboratories of experimental physiology, histology, toxicology and pathological anatomy was the result of the reorganization of the medical faculty at Coimbra University from 1866-1872, according to the following paradigm replacement: the superficial look at disease was replaced by the study of the inner body and an attempt to understand the symptoms, giving rise to a new paradigm of medical practice—evidence-based medicine. In this chapter, we give an overview of this process which enhanced the European influence upon the development of medical studies in Portugal.

9.1 Introduction

The evolution of medical sciences during the 19th century in Europe can be seen as a movie where Portugal played an important role. Why? Because medical sciences could only evolved when the necessary conditions were created; this means the creation of universities with its own laboratories and scientific apparatuses as well as a scientific staff with a university practice based on research, in which the research school or institution played a crucial role.

10

The Founding of the International Liquid Crystal Society

Lui Lam

The story of the founding of the International Liquid Crystal Society in 1990 is told here for the first time. The founding process lasted three years starting 1987 and is quite different from the usual case concerning other learned societies. A personal account of the why and how as well as the background and crucial events is given. It is written for those working in or interested in science, liquid crystals in particular, and for science historians.

10.1 Introduction

Liquid crystal is a state of matter intermediate between liquid and crystals. The molecules of the organic compounds that exhibit liquid crystal phases may be rodic, discotic, or bowlic in shape [Lin, 1982; 1987]. Rodic liquid crystals are the ones used in liquid crystal display (LCD) today and were discovered in 1888 by the Austro-Hungarian botanist Frederick Reinitzer (1857-1927). Since the industrial application of liquid crystals as display was proposed in the 1960s, there has been a resurrection of intense interest in these materials [Kawamoto, 2002]. The explosive commercialization of LCD televisions since 2007,[1] a $100 billion industry, makes the study of liquid crystals as a research field more important than ever.

---

[1] In 2007, LCD TVs overtook cathode-ray-tube TVs in sales worldwide for the first time (en.wikipedia.org/wiki/LCD_television, April 10, 2013).

Part III
Sociology of Science

11

Three Waves of Science Studies

Harry Collins

There have been two waves of science studies and an attempt is being made to establish a Third Wave. The waves are described in outline. Science Matters works within the First Wave. Along the way it is argued that the human sciences are fundamentally different from the natural and biological sciences. It seems that Science Matters has failed to recognize this.

11.1 Introduction

Science Studies, or "Social Studies of Science", are the collective names for history, sociology and philosophy of science taken together. They comprise critical analysis of science from those who are not themselves scientists. In a paper written in 2002, Collins and Evans suggest that there have been two waves of science studies and propose a third wave [Collins & Evans, 2002].[1]

---

[1] The analysis presented here is not without its critics. The 2002 paper encountered fierce criticism from the science studies community and there were signs suggesting that its authors were initially being rejected from the heartland of science studies for writing it. It was the Third Wave that was the problem and the resistance of even social scientists to being seen as merely part of a movement rather than as independent thinkers. It must also be said that the 2002 paper was written from the point of view of sociologists of science and many historians and philosophers of science, who never fully engaged with the Second Wave (see below), believe the model does not describe their world. The 2002 paper, by the way, is now the second most cited paper in the 40-year history of the journal *Social Studies of Science*. Some of the flavor of the Third Wave and how it compares with the Second Wave can be obtained from a short paper in *Nature* [Collins, 2009].

12

Solitons and Revolution in China: 1978-1983

Lui Lam

Historically it is rare that one could do scientific research and political revolution at the same time. Such a chance was offered to me in China from 1978 to 1983. Throughout these six years, solitons (i.e., localized waves that travel without, or with slight, change in velocity and shape) were one of my major research topics at the Institute of Physics, Chinese Academy of Sciences. It was a hot topic in the physics community worldwide. In this chapter, the development of soliton research and political revolution in China experienced by the author is reported. The aim is not just to keep a record for those memorable years but also to convey the excitement of the so-called "Science Spring" of 1978, the year China's reform-and-opening up revolution began.

12.1 Introduction

It is rare that one can participate in history by doing scientific research and carrying out political revolution simultaneously. A famous example is the case of Condorcet (1743-1794), a French philosopher, mathematician and political scientist [Baker, 1975]. He held many liberal ideas and participated actively in the French Revolution (1789-1799). In 1794, after being branded a traitor and while hiding as a fugitive from French Revolution authorities he finished his masterwork, *Sketch for a Historical Picture of the Progress of the Human Mind* [Lukes & Urbinati, 2012]. Soon after that, he was arrested and died in prison, at age 50.

13

Scientific Culture in Contemporary China

Bing Liu and Mei-Fang Zhang

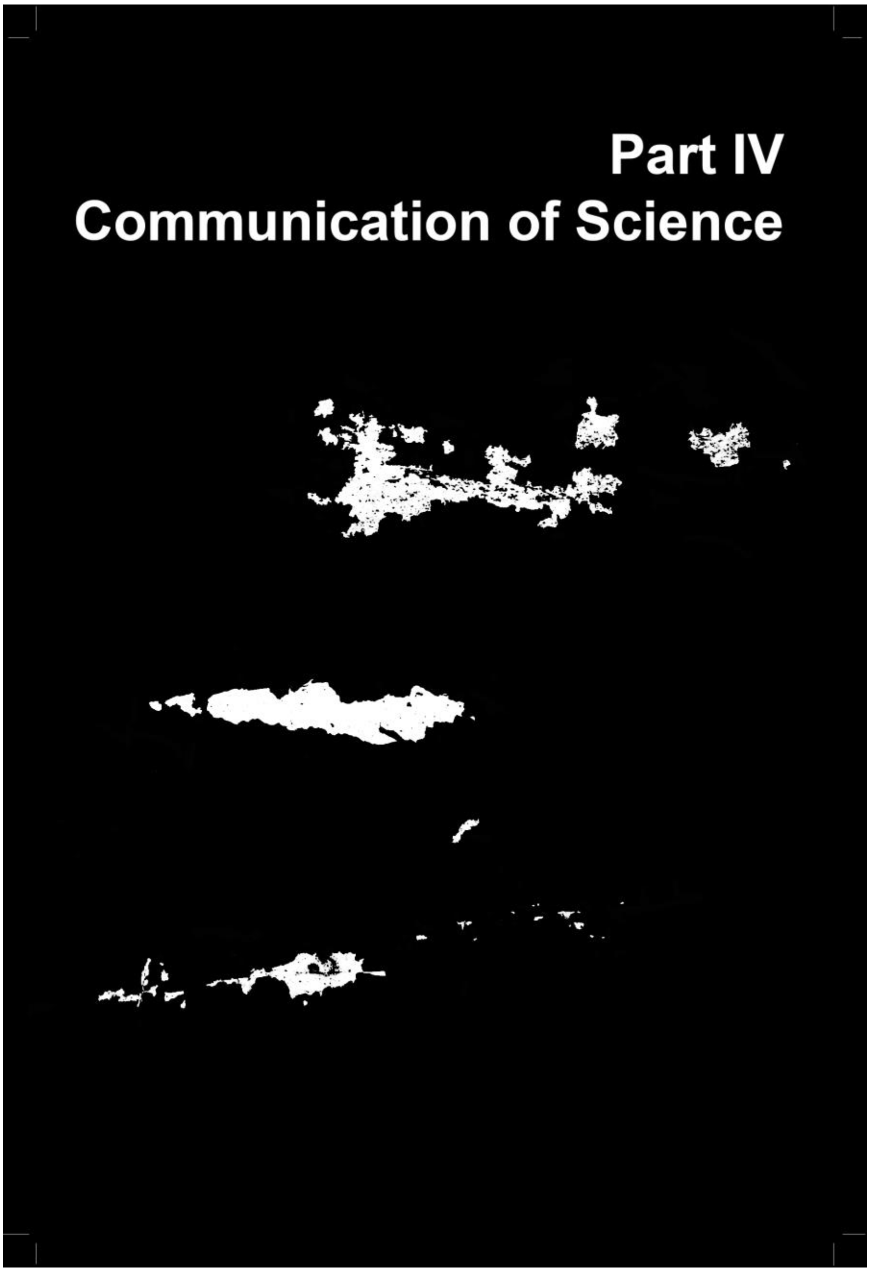
In recent years, the term "scientific culture" has been used frequently by scholars in mainland China. Although this term is very popular in many disciplines such as history, philosophy and sociology of science as well as in science policy and education studies, researchers in these fields have different study objectives, positions, approaches and styles. It is thus interesting to analyze this phenomenon, which may help readers to understand Chinese scholars' attitudes toward science. Wang Rong-Jiang has reviewed in 2011 the history of scientific culture studies in China during the past 20 years. He has systemically (though not comprehensively enough) introduced conferences, research books and articles on scientific culture, and briefly analyzed the differences between different approaches. Building on this review, scientific culture in contemporary China is presented from our own observations and perspectives here.

13.1 A Brief History

Although scientific culture hardly existed in ancient China [Wang, 2011] things changed in the early 20^{th} century.[3] At that time, Chinese intellectuals started paying serious attention to science and its values. Due to defeat in the wars and corruption in the government of the Qing Dynasty, along with a deep sense of national crisis, intellectuals began to look for helpful ideological resources to save the nation, and they

[3] Section 13.1 is based on Wang Rong-Jiang's review [2011].

Part IV
Communication of Science



14

Science Communication: A History and Review

Peter Broks

At first it looks simple. Communication is the transfer of information from A to B, from one person to another. Therefore "science communication" (scicomm) must be the transfer of scientific information from A to B. This common sense idea has been the dominant view of scicomm for many years and has helped to shape debates about "scientific literacy" and the "public understanding of science". However, it is a view that is dependent upon a specific history of science and it is an idea that has been challenged in recent years. This chapter will show: Firstly, how present day ideas about scicomm were created in the 19th century; secondly, how two historical moments from the 20th century helped shape current understanding of scicomm; and finally, how that understanding has recently been challenged. The main aim of the chapter is to argue that scicomm should not be seen simply as the transfer of information but rather that it is better understood in terms of how meanings about the natural world are created and negotiated. Material for this chapter is drawn principally from the UK and the United States. However, similar developments can be found in other countries not least because they often copied what was happening in the UK and the US.

14.1 Nineteenth-Century Origins of "Popular Science"

Much of what we now think of as "science communication" (scicomm) and "popular science" (popsci) has its origins in the 19th century. The period sees a shift from an inclusive and participatory form of popsci to one where there was a clear separation of experts from lay public. It is a separation with which we are now familiar. Equally familiar is the idea that the gap is to be bridged by scicomm.

15

Popular-Science Writings in Early Modern China

Lin Yin

Early science communication in modern China lasts from the 1840s till the beginning of the 20th century. For about 60 years, popular-science articles and books was one of the main approaches to bring scientific and technological knowledge to the public and to arm them with scientific thinking. This chapter deals with how popular-science writing has sprouted in the modern Chinese society and gives a historical introduction to the popular-science works at different stages.

15.1 Introduction

There used to be splendid cultural and scientific achievements in ancient China. Our Chinese ancestors contributed greatly to human civilization in the fields of agriculture, medical science, mathematics, astronomy, geo-science, engineering and so on. Due to the cruel reign of dictatorial system and severe restraint of feudal thinking, Chinese traditional science and its thoughts declined gradually from the middle of Ming Dynasty (1368-1644) around the beginning of the 15th century. And why modern science did not arise in China becomes quite a confusing and interesting issue for researchers in history of science and technology (S&T) [Lam, 2008, pp. 31-32]. When China was forced to face the issue of S&T later, about 300 years had passed. In fact, it was not until the late Qing Dynasty (1644-1911)—the beginning of China's modern period

Part V
Other Science Matters

16

Understanding Art through Science: From Socrates to the Contextual Brain

Kajsa Berg

Scholars from Socrates and Leonardo to Charles Le Brun, Friedrich Wölfflin and recently David Freedberg have explored how viewers empathize with art works. Together with many other thinkers, they have suggested that empathy is best understood through studying human nature. Freedberg applies neuro-scientific data on mirror neurons (brain-cells that provide the basis for empathic reactions) to examine viewer engagement with a variety of art works. His argument privileges neural processes and challenges the importance of cultural explanations of viewer engagement (for example social, political and religious). The *contextual brain* is a concept that seeks to reconcile neuroscientific arguments with context based explanations. It is based on an understanding of mirror neurons and neural plasticity (how the human brain changes as a result of experience or training) and is applied to the particular case of Caravaggio's paintings in 17th century Rome.

16.1 Introduction

Empathy and the viewers' emotional reactions were already important to Socrates and to find answers he posed a series of questions to the sculptor Cleiton [Xenophon, 1926, p. 235]. In Renaissance Italy, the viewers' emotional responses became crucial to art theorists and artists, who found inspiration in the writings of Horace, for example. This focus was intensified in the late 16th century and early 17th century. This intensification is important here as this coincides with the period when

17

Spy Video Games after 9/11: Narrative and Pleasure

Ting-Ting Wang

Role-playing games (RPG) is the most important type of video games, for both PC and online games. In the last decade or so, video games with a spy theme were pretty common and have become an important genre in games. This chapter discusses, from the narrative and cultural perspectives, the identity and pleasure of the RPG player, and analyses the text construction in the multi-narration of spy games. The discussion is divided into three parts: (1) How does a spy game tell a story? We will do a narrative analyze and find out how the narrative scheme causes pleasure in the player. (2) What stories are told by spy games? Putting these stories among the various post-9/11 texts, we can see what kind of "tacit writing" is provided by the spy games. (3) Starting from these game texts we discuss what special role is played by spy games in the video game industry, in the global political and economic system, and what effects result from it.

17.1 Introduction

Video games as a new type of cultural industry are attracting a lot of attention and are becoming a multibillion dollars enterprise [Donovan, 2010]. Role-playing games (RPG) in which the player can interact and change the development of the game, is the most important type of video games, for both PC (personal computer) and online games. Starting from the simple word games, the development of RPG has gone through many generations of changes. By including more and more elements into the game, RPG always enjoy a large number of players and is undeniably the king of video games [Barton, 2008]. (Games or video games in this

18

Statistical Physics for Humanists: A Tutorial

Dietrich Stauffer

The image of physics is connected with simple "mechanical" deterministic events: an apple always falls down; force equals mass times acceleration. Indeed, applications of such concept to social or historical problems go back two centuries (population growth and stabilization, by Malthus and by Verhulst). However, since even today's computers cannot follow the motion of all air molecules within one cubic centimeter, the probabilistic approach has become fashionable since Ludwig Boltzmann invented Statistical Physics in the 19th century. Computer simulations in Statistical Physics deal with single particles, a method called agent-based modeling in fields which adopted it later. Particularly simple are binary models where each particle has only two choices, called spin up and spin down by physicists, bit zero and bit one by computer scientists, and voters for the Republicans or for the Democrats in American politics (where one human is simulated as one particle). Neighboring particles may influence each other, and the Ising model of 1925 is the best-studied example of such models. This chapter will explain to the reader how to program the Ising model on a square lattice (in Fortran language); starting from there the readers can build their own computer programs. Some applications of Statistical Physics outside the natural sciences will be listed.

18.1 Introduction

Learning by Doing is the intention of this tutorial: Readers should learn how to construct their own models and to program them, not learn about the great works of the author [Stauffer et al, 2006] and the lesser works of his competitors [Billari et al, 2006].

Already Empedokles is reported to have 25 centuries ago compared humans to fluids: Some are easy to mix, like wine and water; and some,

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Science Matters Series

Scimat (Science Matters) is the new discipline that treats all human-dependent matters as part of science, wherein, humans (the material system of *Homo sapiens*) are studied scientifically from the perspective of complex systems. Scimat covers all the topics in the humanities and social sciences. Science is a subset of human activities aiming to understand how Nature—consisting of the human system and all nonhuman systems—works without bringing in God or any supernatural. Science thus has two parts: the scientific process and the scientific results. The scientific process is a human-dependent matter and is part of scimat.

This book All About Science focuses on the human-dependent part of science from the perspective of scimat. There is a lot of confusion and misconception concerning Science. The nature and contents of science is an unsettled problem. For example, Thales of 2,600 years ago is recognized as the father of science but the word science was introduced only in the 14th century; the definition of science is often avoided in books about philosophy of science. This book aims to clear up all these confusions and present new developments in the philosophy, history, sociology and communication of science—the four humanities disciplines related to Science. It also aims to showcase the achievement of China's top scholars in these areas. The 18 chapters, divided into five parts, are written by 16 eminent humanists and scientists including the Nobel laureate Robin Warren, sociologist Harry Collins, and physicist-turned-historian Dietrich Stauffer. The book aims at humanists, social and "natural" scientists, and laypeople who are interested in science.

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