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Science Matters Series

Lui Lam

Founder and Editor

Science Matters (SciMat) 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 humanities and social sciences from the SciMat perspective, with emphasis on the humanities.

Books in Series

1. *Science Matters: Humanities as Complex Systems*
M. Burguete & L. Lam, editors
2. *Arts: A Science Matter*
M. Burguete & L. Lam, editors

Preface

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 (SciMat) covers all the topics in humanities and social sciences, arts in particular. Arts here include visual arts, literature, film, music, architecture, performance arts, new media arts and so on.

This book treats arts as part of science, from the unified perspective of SciMat. It is probably the first and only book to which academic professionals and practicing artists contribute, as equals, on the common theme of creating and understanding arts. It contains 17 chapters, with 18 contributors who are prominent humanists, professional artists or scientists. It consists of three parts: Part I: Philosophy and History of Arts; Part II: Arts in Action; Part III: Understanding Arts. The book is aimed at both research scholars and laypeople. While the discussions presented in the chapters of this book are very general and definitely applicable to all kinds of arts, for practical reasons, specific examples are mostly confined to visual arts, literature and film. We hope to cover other parts of arts in the future.

Two other features of this book should be mentioned. First, arts studies, like in any other discipline, can be and are carried out with three different approaches: empirical, phenomenological and bottom-up. (For the humanities, with arts as a particular case, the bottom-up approach could be starting from the neuro or the genetic level.) All these three approached in arts studies are represented in this book. Second, the general nature and the origin of arts, an unsettled problem for 2,400 years since Plato's time, are addressed in four chapters in this book. In particular, a plausible answer to this important problem is presented for the first time (Chapter 1).

It is our wish that this book will help to start a new trend in arts studies; that is, arts scholars and practicing artists work together, treating arts as part of science.

Rio Maior, Portugal
San Jose, California

Maria Burguete
Lui Lam

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1

Arts: A Science Matter

Lui Lam

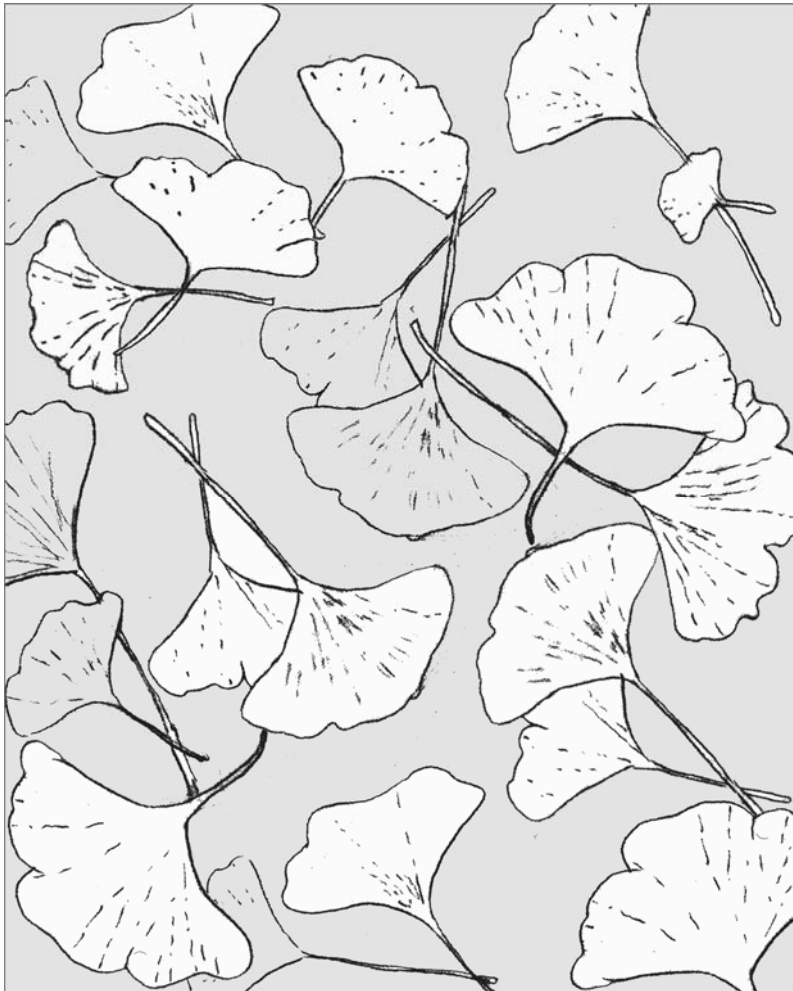
The nature and origin of arts, and its relationship to “science” have been under much debate since Plato about 2,400 years ago. Here, a new perspective on these issues is presented. Science is to understand how nature works, while nature consists of (human and nonhuman) living systems and nonliving systems. Consequently all human-dependent matters are part of science—the premise underlying the new discipline called *Science Matters* (SciMat), which covers all topics in humanities and social sciences, arts in particular. (Arts here refer to visual arts, literature, film, performance arts, music, architecture, new media arts and so on.) In fact, arts are a subset of humans’ creative activities that aim to excite the receiver’s neurons in a certain manner, through that person’s senses, with or without significant consequences. The usual kind of “science” is to understand mostly inanimate, simple systems and how the world/universe works; it is part of science in general. Arts as a science matter is to find out everything about arts, including arts’ origin and nature, and how and why arts work at both ends of the creator and the receiver. Like physics and any other discipline, arts can be classified into two types—*pure arts* and *applied arts*. Some arts, such as drawing and performance art, could start a million years ago. All arts evolved over time and space, and the contents kept on changing as humans invented language and writing and as they migrated out of Africa and spread over the world; arts contain both global universal elements and local features. Here, all these issues as well as how arts as a science matter could be studied are elaborated, after a brief introduction to SciMat and humans’ development history and inheritance mechanism (genes and epigenes) is given.

1.1 Introduction

Arts in this chapter refer to visual arts, literature, film, performance arts, music, architecture, new media arts and so on. The origin and nature of

PART I

Philosophy and History of Arts



2

The Latin “*Artes*” and the Origin of Modern “Arts”

Brigitte Hoppe

This chapter will analyze the range of attitudes held by scientists and artists observing and presenting natural phenomena at various periods of time. It will explain the meaning and significance of the principal fields of education called the “liberal arts” and the “mechanical arts” since the Late Antiquity. Both areas comprised no less than seven disciplines including sciences, mathematics, artistic and technical skills. In the European civilization, these were the essential elements of education and learning until the 18th century. Certain interrelations between sciences and arts can be better understood by examining particular early collections of artifacts produced in Early Modern Times (16th–17th centuries). Sciences and arts began to deviate from one another in the course of growing specialization and changing societies in the modern world. In Antiquity (4th BC–5th centuries AD) and from the Late Middle Ages (15th century) on, artists and scientists became eminent observers of natural objects such as plants, animals, minerals, the stars in the sky, and the topography of special regions, e.g., the Netherlands coastal areas with its sailing ships, and the tropical forests of Brazil. Portraits of scientists often include typical objects such as a skull representing the field of anatomy, or an armillary sphere for astronomy. Since the 17th century we find critical discussions of scientific life, work, and the impact they made: the focused concentration of an alchemist and the social impact of scientific innovations. The discussion of the relationship between technical inventions, e.g., the steam engine, cars on a highway, multi-storey buildings in a small city street, and the bare necessities of human life furthered the development of a critical worldview in fine arts. In abstract sculptures and paintings, in particular in the style of “concrete art”, geometric figures and spectral colors recur, but their meaning in an individual composition is different from a direct representation; artists of our time are able to present a unique interpretation of the world around them in their works of individual imagination.

3

Science and Art: A Philosophical Perspective

Guo-Sheng Wu

The original source of modern science is Greek liberal humanities. Modern art is something called fine art which is the heritage and development of ancient ideal of free arts. Freedom is the common essence of both science and art. As soon as their Greek mind emerged, the two immediately recognized each other as brothers who were separated from and lose touch with each other for a long time. This is why science and art know each other very well while they are two different departments of human culture.

3.1 Introduction

The distinction between science and art is clear. However, there are also many famous scientists, artists and humanists who emphasize the similarities between science and art and their internal intrinsic association. Science and art have great differences, since the creation of aesthetic object is the aim of Art but the object of science is not created by Science. Yet, many scientists emphasize much on the role of aesthetics in scientific research. Thus it raises a question: What kind of interrelationship it is that is between science and art?

3.2 Origin of “Science”

Here, the origin of the word “science” is discussed. To modern people, the main difference between science and art appears to be that the two

4

Neuroarthistory: Reuniting Ancient Traditions in a New Scientific Approach to the Understanding of Art

John Onians

There is a long tradition of using neuroscience to understand art. From Aristotle to Baxandall scholars who we might think of as humanists have turned to science for help. This, however, became unfashionable at the end of the twentieth century and the practice is only now being revived, reuniting ancient traditions. This chapter presents some of the latest knowledge of the brain that is revolutionizing the field and illustrates its application. It also argues that the issue of whether humanistic and scientific traditions can be reunited is crucial to the future of intellectual enquiry.

4.1 Introduction

Art as part of science has a long tradition, dating back at least to Aristotle, one which unfortunately was broken after the Roman Empire. However, today the importance of the link between the fields is recognized by more and more humanists.

4.1.1 A Long Tradition

Two and a half thousand years ago in ancient Greece Lui Lam's vision of the arts as an aspect of science [Lam, 2011] would have been normal. This was especially true in the school of Aristotle, who was happy, unlike Plato, to consider humans as just another type of animal, and who wrote studies of politics and drama, for example the *Politics*, which are in many ways as scientific as his studies of biology, such as the *Parts of*

5

Science and Art in China

Bing Liu

Although the idea of Science and Art (S&A) has been suggested for quite a long time, the real concern for this topic in China was raised only in the last 15 years or so. Since then, many research papers and dissertations have been published in this field. In this chapter, the brief history and status quo of the studies on S&A in China are reviewed, including, e.g., the important events, conferences, exhibitions, and publications. Works on S&A from China are classified into four categories with different depth levels. Existing problems in the development of S&A in China are summarized and discussed.

5.1 Introduction

Science and Art (S&A for short; or, as referred by others, Art and Science) is a rather vague and ill-defined area. It includes many contents and research works that are directly or indirectly related to S&A. It also covers some relevant activities of art creation and scientific research, and even some social activities on this theme. Here, the word science can be broadly understood to include technology.

This chapter provides a brief overview of the development of S&A in mainland China (early period in Section 5.2; later period since 1987 in Sections 5.3 and 5.4). In particular, Section 5.3 covers important conferences and exhibitions, while publications—books, journals, and research papers—on S&A are summarized in Section 5.4, wherein, research works are classified into four categories. Existing problems in

6

The Development of Science Theater

Ivo Schneider

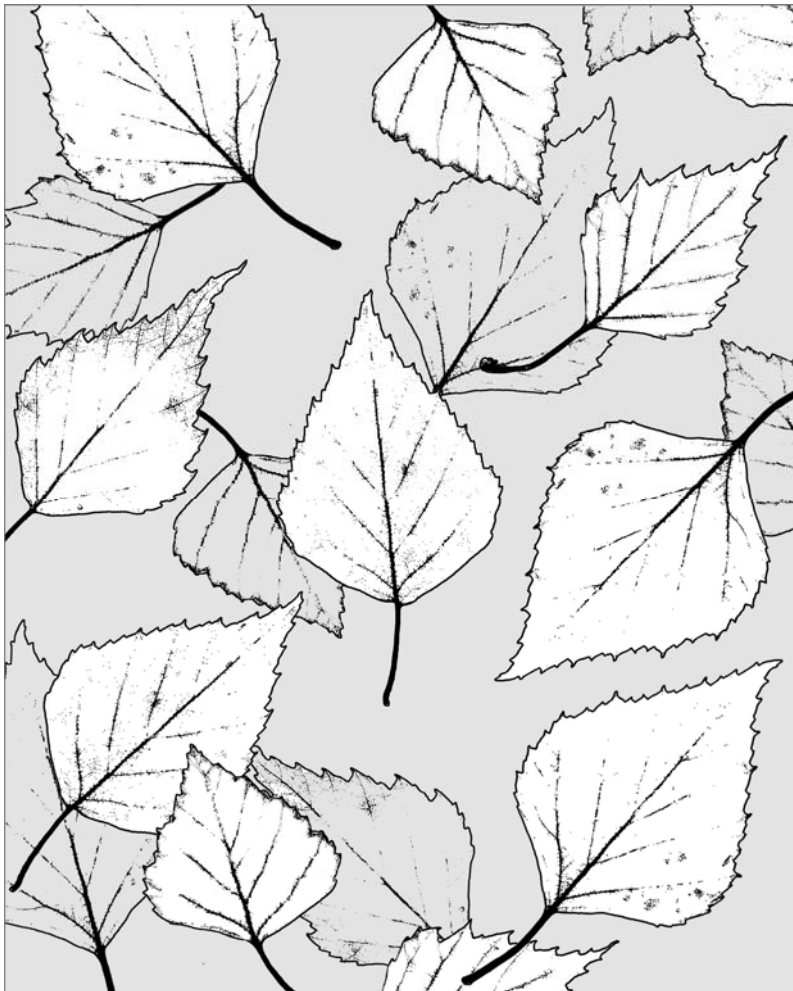
This chapter on science theater deals with those plays on stage in which science plays an important role. Science theater connects scientific activity and scientific results with the emotional and social realm of human life. Its roots can be seen in the dialogues of Galilei, de Fontenelle or Algarotti in the 17th and 18th century, albeit these dialogues could well have but never did enter the stage. Since the beginning of the 17th century, the spectrum of science theater has ranged from unreserved approval combined with the conviction that an improvement of social and economical conditions can only be achieved by scientific progress to fear and refusal of science. Different from other countries science theater in Germany could never claim any status except for a short period, during which it pointed mainly to the negative aspects of scientific activity. The reason behind this unique phenomenon is explored and explained as due to the persistence of the Bildungsbürgertum mentality in Germany. Presented also in this chapter is a long discussion of the science theaters staged around 2000 in New York and London, those in German speaking countries (*Life of Galileo*, *The Physicists*, and *In the Matter of J. Robert Oppenheimer*), the two most successful science theaters of recent years (*Copenhagen* and *Infinities*) as well as science theaters authored by scientists (e.g., Carl Djerassi) and historians of science (e.g., Marc Friedman). France is discussed as an example for a nearly continuous development of science theater from the 17th century.

6.1 What Is Science Theater?

Science theater has different connotations. In today's science centers some of them claim a science theater. This holds for the *Phaeno* in Wolfsburg or the new science center in Hamburg, which will be finished

PART II

Arts in Action



7

Silence in Arts

Cristina Leiria

In silence many things I have been finding and most of them are subjective, therefore resulting from my own experience. On those bases through the development of work started as an architect I have reached the sculpture world where I was given the opportunity to share an immensity of feelings related not only with the silence but also with light and peace. Through several stages of creativity we can be transported to new worlds.

7.1 Introduction

I, Cristina Rocha Leiria, architect specialized in Development Planning, has been working in sculpture and ceramics since 1993. My work is a form of art open to love and beauty, or at least it is my spirituality that enables me to conceive and produce this kind of art.

In this chapter, we can learn more about my experience as an artist through the presentation of my work, so we can realize the meaning of this message—*Silence in Art*.

Starting my professional life as an architect, I am now an architect with a sculptural approach and in recent years I have been devoting my work mostly to monument building and public art, trying to achieve my main purpose: the re-harmonization of the human spaces, both public and private.

8

Linsen's Art

Linsen H. Ngai

Linsen Hsia Ngai was a professional chemical physicist before becoming a self-taught watercolor painter about 25 years ago. Her selected artworks are presented here, in a chronological order.

8.1 My Background

I obtained a B.S. degree in Chemistry from the University of California, Berkeley, and my M.S. and Ph.D. degrees from University of Chicago majoring in Chemical Physics. After retiring from scientific research I became a watercolorist. I am a self-taught artist. I started out doing black and white paintings on Chinese paper and using Chinese ink. As I evolved as an artist, I began to use more color and less ink and eventually not using Chinese ink at all. I am still doing watercolor paintings on Chinese paper. My subject matter includes birds, animals, flowers, plants, landscapes, and figures and portraits. I want to show through my paintings the beauty of nature and to pass it on to future generations to enjoy.

8.2 Early Period

As a beginner in art my very first attempt was learning how to paint bamboo by using various shades of Chinese black ink and doing different

9

From Curiosity to Creation: The Art of Holly Lane

Holly Lane

For the last several centuries specialization has caused science and art to diverge so as to seemly have little in common. However, a basis of commonality between art and science is the trait of curiosity, and both disciplines teach us to look attentively. The benefits science has bestowed upon the arts and humanity are acknowledged, and in turn the benefits the arts offer are cited. Reflections on the various definitions of art and speculations on the origin of art are offered from the perspective of an exhibiting artist. Some of the ways artists think about and approach, diverse kinds of art and the creative process will be discussed. Concluding, the artist's own work will be presented and prefaced by some of the concepts that shape the artwork.

9.1 Introduction

In the beginning, of human life, there was curiosity. In the beginning of each individual human life there is curiosity. Children are not embarrassed to ask questions, all kinds of questions. Even pre-articulate babies are curious; curious about balls of lint, noses, and the activity of the family dog. As individuals we are fortunate if, as we mature, curiosity is not squelched by fear, peer pressure, and inhibitions. If humankind was not curious we would probably not have science, art, philosophy, myths, poetry, books, electricity, medical cures, space exploration, zippers, and cheesecake, to name just a handful. Since there is so much to be curious about, to explore, individuals generally pick one category in college (or equivalent) that ideally, in alignment with

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Making Movies and Making Physics

Hark Tsui and Lui Lam

The characteristics and experiences of making movies and making physics are discussed, respectively, by a movie director/producer and a physicist. Similarities and differences between the making of movies and the making of physics are presented. Discussions on the nature of movies and physics, on creativity and innovation as well as on the joy of making movies and making physics are provided.

10.1 Introduction

Making movies is a creative process that involves several operational stages: (1) conception of the project, (2) lining up the funding, (3) finding coworkers, (4) shooting the movie, (5) post-shooting work, and (6) marketing and distributing the movie.

Making physics means creating new physics—doing physics, or physics research, at its best. It is also a creative process and, like making movies, involves the same six stages in its operation, from the beginning to finish. The exception is that when doing pure theory or simple experiments, stages (2) and (3) may be absent.

Hark Tsui has been directing and producing movies since 1979 [Ho & Ho, 2002; Morton, 2001] and Lui Lam published his first physics paper in 1968 [McMillan et al, 1968]. Presently, Tsui has directed/ produced over 70 movies and Lam has published over 170 research papers and 12 books. The two knew each other since 1975 when both were doing community work in the New York Chinatown, in lower Manhattan.

11

A Journey along the Borderland: A Critical Approach to Artificial Intelligence-Based Art and Literary Practices

Jichen Zhu and D. Fox Harrell

Digital media open up opportunities for new integrations of art and science. However, the close contact between the multiple cultures in either tradition also unveils fundamental value differences that impose considerable difficulties in performing interdisciplinary work. In this chapter, we identify a new form of this cultural divide in the context of computer art and digital media practices. Next, we identify a growing number of practices that engage the capacity of the computer to abstractly represent data and to process it algorithmically in order to serve expressive, critical, and generalizable purposes. In particular, we explore artificial intelligence-based art and literary practices that actively negotiate the hidden assumptions and push the disciplinary boundaries of both art and science. Finally, we present our AI-based interactive narrative work *Memory, Reverie Machine*, which engages literature, cognitive science, and AI. It illustrates our perspective and strategy of combining art and science practices synergistically, as part of a growing community for which the exploring of the borderland between art and science can transform not only particular technologies or how they are perceived, but also end goals and values.

11.1 Introduction

Half a century ago, British scientist and novelist C. P. Snow [1964] delivered a now notorious talk on the increasing gap between the two cultures of the sciences and the humanities [Lam, 2008]. Reflecting on

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ChemArt and BioArt: Art-Science Interactions

Maria Burguete

The development of science is a time evolving process; so is Art. However Art began earlier and so far they still do not have a methodology the same way science has. Why does this happen? For a scientist truth results from the scientific methodology; for an artist truth comes from revelation plus inspiration. The structural unity of art can be seen as an expression, in the sense of an iconographic translation of the cosmic universe. Art deals with symbolism based on a platform that can move frontiers by overcoming the limits of common perception. Art is a place where new worlds are invented, and also where art itself is continuously being created. *ChemArt* refers to those artworks that use images or concepts from chemistry as the central theme, and occasionally, chemicals as a medium; similarly for *BioArt*, except that chemicals are replaced by biological materials. Considering ChemArt as the interaction between Chemistry and Art, we can say that flexibility of nature enhanced the emergence of both chemistry and art: Chemistry allows us to understand diversity and beauty of nature at the molecular level, and awakens our curiosity about its “modus operandi”; Art, through the interaction of human beings with the environment, induces an expressive reaction by contemporary artists. ChemArt naturally leads us to BioArt, the same way that yesterday’s chemistry leads us to the modern chemistry of living organisms or biochemistry. BioArt is the new challenge the contemporary world is facing now: a crossroad between artistic culture and scientific culture. A major question dealing with science and art is concerned with the incorporation of biological and biomedical tools in the performance of artistic works, and the use of living tissues as an *art medium*. This new approach strongly appeals to a straight cooperation and collaboration among artistic production and scientific practices. The ultimate aim of science is to look for a single unifying “theory of everything.” Art does the same from an iconographic point of view, and includes spirituality.

PART III

Understanding Arts



13

On the Origin of Literary Narrative and Its Relation to Adaptation

Patrick Colm Hogan

This chapter takes up the relation of literary narrative to adaptation. Due to the species-wide nature of most biological adaptations, this involves a particular focus on the universal features of narratives. The first section defines several senses in which we may say that a complex practice, such as literary narrative, is “adaptive.” Subsequent sections have two goals. The first is negative. Literary narrative does not appear to be an adaptation in the strict sense, though there is some, very limited evidence that it may have “ancillary” adaptive value. The second, positive goal is to indicate how we may, in part, understand the origin of literary narrative—or, more precisely, the sources of many universal properties of literary narrative—as a complex result of the interaction of various evolved systems and processes. Both arguments suggest that the term “by-product” might best be reserved for a particular type of biological phenomenon such that literary narrative is more appropriately categorized as (in part) “adaptation-derived” rather than as a by-product. The final section considers what consequences this analysis has for assessing the value of literature and the arts. This arises as an issue since many advocates of the arts and humanities seem to view claims of adaptive advantage as crucial for establishing the worth of art. This section concludes with an argument that seeking the value of art in adaptation is misguided.

13.1 On Literature and Adaptation

In the last decade or so, there has been a good deal of debate over the origin of the arts, particularly the degree to which the arts may

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Emotion, Cognition and Aesthetic Form in Vishal Bhardwaj's *Omkara* and Shakespeare's *Othello*

Lalita P. Hogan

Discussion in this chapter uses insights drawn from cognitive theories of emotion to illuminate aspects of Shakespeare's *Othello* in relation to its 2006 Hindi film adaptation, *Omkara*, by Vishal Bhardwaj. The first section draws attention to the common motif of sexual jealousy and domestic violence, contextualizing it broadly, by drawing attention to how readers read stories in relation to their own private "stories," and Martha Nussbaum's notion that literary sensibility cultivates compassionate imagination. This context is central to considering the role of emotion in literature and film. The second section provides a brief introduction to the Appraisal Theory of emotion, explaining how emotions are elicited in relation to various types of cognitive evaluation of events and environmental factors, as to their desirability and undesirability, emphasizing the central role played by imagination. It is in this way that representational reality can have real emotional impact, even though the people and the situations are unreal. The third section provides details about plotlines of *Othello* and *Omkara*, highlighting main characters, events and relationship configurations. The fourth section takes up a discussion of the *law of situational meaning*, comparing the film and the play, with focus on the central conceptual metaphor of stealing and thievery used in connection with socially prohibited marriage. The fifth section focuses on the role played by visualization of the object, the gift of love, the loss and recovery of which aligns aesthetic form to the *law of apparent reality*. The sixth and final section, appropriately, shows how the emotion *law of closure* organizes stage, screen and story time, leading inexorably to the tragic *denouement* in the play and the film.

15

***Tanbi* Novels and *Fujoshi*: A New Romance for Young Chinese Women**

Ting-Ting Wang

In the 1960s, *tanbi* comics and novels which focused on boy's love came into being in Japan and was popular among young women. They, both readers and writers of *tanbi*, were women and called themselves *fujoshi*. At the late 1980s, Japanese *tanbi* comics but not novels became available in China. It was not until the end of the 1990s that *tanbi* novels with Chinese authors appeared in novel websites in China. Between 2005 and 2006, it became a main style of net novels in China. In this chapter, we first introduce the history of *tanbi* subculture in Japan, the two main types of *tanbi* texts, and the writing and publishing of *tanbi* novels in China. We then address the questions on why *tanbi* subculture is well accepted in China, what desires of young women are reflected in it, and how it challenges the mainstream culture.

15.1 Introduction

In the 1960s, *tanbi* comic came into being in Japan, the subject of which is boy's love. Handsome young men and boys, beautiful love and hot sex are universal elements in *tanbi* comics and novels. Most of the readers and writers of *tanbi* are young women with ages from 15 to 30; they call themselves *fujoshi*. After the introduction of *tanbi* comics to China in the late 1980s, *tanbi* novels written by Chinese started to appear in novel websites in China at the end of the 1990s. In the subsequent several years, they have only a small

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Objects in Art and Science

Nigel Sanitt

Up to the nineteenth century western art was dominated by the idea that art (paintings in particular) represented objects. This view termed *mimesis* assumed that (1) the world exists before and independent of the work of art; (2) the medium is a neutral means of representing objects. Mimesis today is only a small part of art theory, with representation of the world in art being seen as culturally and historically variable. The mimetic view of science (if I can refer to it as such) is that there is a world independent of the scientist and that science is neutral and objective. This is the dominant view of science today. In spite of enormous technological and theoretical progress in science during the last hundred years, it seems to me quite surprising that this mimetic view of science still holds sway and that in the sense I have described it, scientists do not seem to have caught up with the art theorists.

16.1 Introduction

This chapter is not about art theory (and I apologize to art theorists who think that I have inaccurately simplified their subject). My aim is to look at objects in science and use images (paintings and photographs) as a metaphor to highlight problems in interpreting scientific theories and the objects they claim to create.

As an alternative to the conventional view of scientific thinking, I describe a scheme which has as its starting point the idea that questioning is at the root of science (Problematology) and rejects an object-oriented mimetic view of science.

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Su Dong-Po's Bamboo and Paul Cézanne's Apple

Lui Lam and Li-Meng Qiu

Su Dong-Po (1037-1101) of the Song Dynasty is arguably the most well-known poet and writer in China. He is also a distinguished painter; he liked to paint bamboos and rocks. Unlike his contemporaries and painters before him, the leaves in Su's bamboo painting are not necessarily attached to the stem. Paul Cézanne (1839-1906), a French post-impressionist, is recognized by Picasso, Matisse and many others as the father of modern art. He went beyond impressionism and painted many things including apples. Both these two artists tried to go beyond the appearance and show the *essence* of the objects they painted, in their own new ways. It was not by accident that these two painters—one from the East and the other from the West, separated from each other by about 800 years—had the same idea about painting. There must be something basic behind this. As shown in this chapter, the mechanism behind their techniques is based on how we see things, the cognitive science of vision in the human brain. The fact that Su's style was not adopted as mainstream, unlike that of Cézanne, is discussed; it is related to the unique nature of China's ultra-stable feudal system in the past, in which science and technology are implicitly or explicitly discouraged. Finally, the possible origin of Dong-Po Pork, for which Su is also famous for, is presented in an appendix.

17.1 Introduction

Su Dong-Po (1037-1101) from China and Paul Cézanne (1839-1906) from France (Fig. 17.1) lived about 800 years apart from each other, in two different continents. Both are pioneering painters. While Su is primarily a poet and writer, Cézanne is shy in writing [Cézanne, 1995, p. 9].

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Contributors

Maria Burguete received her Ph.D. in History of Science (contemporary chemistry) from Ludwig Maximilians University at Munich, Germany (2000). She was the very first biochemist to graduate from the Faculty of Sciences in Lisbon (1982), after completing a Bachelor's Degree in Chemical Engineering (1979) at the Lisbon Higher Institute of Engineering (ISEL). She is a scientist and a university lecturer with teaching and research experience in a wide variety of scientific fields. Burguete is now a scientific researcher at Scientific Research Institute Bento da Rocha Cabral in Lisbon, Portugal, and a Correspondent Member of European Academy of Sciences, Arts and Letters. She has published five books in the scientific field (and eight books of poetry) and over 30 scientific papers. *Email: mariaburguete@gmail.com.*

D. Fox Harrell is a researcher exploring the relationship between imaginative cognition and computation. He is an Assistant Professor of Digital Media at the Georgia Institute of Technology. He directs the Imagination, Computation, and Expression [ICE] Lab/Studio (icelab.lcc.gatech.edu) in developing new forms of computational narrative, gaming, social networking, and related technical-cultural media based in computer science, cognitive science, and digital media arts. The National Science Foundation has recognized Harrell with an NSF CAREER Award for his project "Computing for Advanced Identity Representation." Harrell holds a Ph.D. in Computer Science and Cognitive Science from the University of California, San Diego. He also earned a B.F.A. in Art, a B.S. in Logic and Computation, and minor in Computer Science at Carnegie Mellon University, each with highest

honors. He has worked as an interactive television producer and as a game designer. *Email: fox.harrell@lcc.gatech.edu.*

Lalita Pandit Hogan received her M.A. and Ph.D. in English from the State University of New York at Buffalo, New York. She is a professor of English at the University of Wisconsin-La Crosse, where she teaches Shakespeare, Critical Theory and World Literature. She has published articles and book chapters on Shakespeare, Tagore, Goethe, Comparative Aesthetics and Indian Cinema. She is co-editor of three books and three special issues, which include *Rabindranath Tagore: Universality and Tradition* (2003); *Cognitive Shakespeare: Criticism and Theory in the Age of Neuroscience* (Winter 2006) and *Hindi Cinema*, special issue of *Projections: Journal of Movies and the Mind* (Winter 2009). *Email: hogan.lali@uwlax.edu.*

Patrick Colm Hogan received his B.A. in Philosophy from the University of Santa Clara, his M.A. in Philosophy from the University of Chicago, and his Ph.D. in English from the State University of New York at Buffalo. He is a professor in the Department of English as well as the Program in Comparative Literature and Cultural Studies and the Program in Cognitive Science at the University of Connecticut. He is the author of 12 books—including *The Mind and Its Stories: Narrative Universals and Human Emotion* and *Cognitive Science, Literature, and the Arts: A Guide for Humanists*—and over 100 professional articles. He is currently completing work as editor of *The Cambridge Encyclopedia of the Language Sciences*. *Email: Patrick.Hogan@uconn.edu.*

Brigitte Hoppe obtained her state diploma in pharmaceutical sciences from the University of Freiburg (Breisgau, Germany); she earned a Ph.D. in the History of Science from the University of Frankfurt (Main) in 1964. Her research on epistemological changes in life sciences during Early Modern Times was the basis of the post-doctoral thesis (habilitation) at the University of Munich in 1972, where she became Associate Professor in 1980. She pursued research (partially sponsored by research foundations) in national and international archives and is a member of national and international learned societies. Hoppe has

published 7 books and over 200 papers in the field of the history of the sciences. Her current research deals the history of life sciences from the 16th to the 20th centuries. *Email: B.Hoppe@lrz.uni-muenchen.de*

Lui Lam obtained his B.Sc. (with First Class Honors) from the University of Hong Kong, M.Sc. from University of British Columbia, and Ph.D. from Columbia University. He is Professor of Physics at San Jose State University, California and Adjunct Professor at both the Chinese Academy of Sciences and the China Association for Science and Technology. Lam invented bowlics (1982), one of three existing types of liquid crystals in the world; active walks (1992), a new paradigm in complex systems; and a new discipline called histophysics (2002). He published 12 books and over 170 scientific papers. He is the founder of the International Liquid Crystal Society (1990); cofounder of the Chinese Liquid Crystal Society (1980); founder and editor of two book series, *Science Matters* and *Partially Ordered Systems*. His current research is in science matters, histophysics and complex systems. *Email: lui2002lam@yahoo.com.*

Holly Lane earned her B.F.A. in Art, with Great Distinction (1986) and her M.F.A. in Art—Pictorial Art (1988) from San Jose State University. Painter and sculptor, Lane has had 18 solo exhibitions at galleries and museums, and been included in 86 group exhibitions including an influential exhibition at the Whitney Museum of American Art at Champion. Her work is in 80 private collections and 10 public collections. Over 40 reviews and articles on her work have been published by magazines and newspapers: *The New York Times*, *The New Yorker*, *Art News and Art* in America, to name a few. The art history textbook by Terence Grieder, *Artist and Audience* (1996), highlights her work. Lane is currently preparing for her tenth solo show in New York City. *Email: hlane42@comcast.net.*

Cristina Leiria studied at the Graduate School of Fine Arts, Lisbon and Development Planning Unit, University College London. She was an architect in United Kingdom, Mozambique, Zimbabwe, South Africa, Portugal and Macao. From a young age she has spontaneously

sculptured, and in 1992-1994, aside from architecture, started to develop this ability finding in the world of silence a new dimension of life. After 1999, trying to infuse urban life with hope and peace through the joining of spiritual, social and architectonic domains, her work focuses on Public Art such as the Kun Iam Ecumenical Center (1999), 22 m bronze statue at Lotus Flower Building, Macau, China; *Kun Iam and Lotus Flower* (2002), 2.7 m bronze, Lisbon; *Loving Birth* (2003), 3 m white-sea stone, Cascais; *Sailing the Wind* (2003), 12 m, Tavira; *Sailing* (2007), 3 m bronze, Cascais. *Email: crisrochlei@gmail.com.*

Bing Liu obtained his B.Sc. from Peking University (physics department) and M.Sc. from Graduate School of Chinese Academy of Sciences. He is now a professor of history of science at Tsinghua University, vice director of the Center for Science Communication and Popularization of CAST and Tsinghua University, and Guest Professor at several universities in China including Shanghai Jiaotong University. He published 17 books (also translated 7 books and edited more than 30 books) and over 200 academic papers. Liu's research fields currently include history of physics, historiography of science, philosophy of science, and science communication. His Blog: <http://blog.sina.com.cn/liubing1958>. *Email: liubing@tsinghua.edu.cn.*

Linsen Hsia Ngai was born in China and grew up in the United States. She earned her B.S. in Chemistry from the University of California, Berkeley, and her M.S. and Ph.D. from University of Chicago majoring in Chemical Physics. She was a postdoctoral researcher at Northwestern University and Boston University before doing laser research experiments at Naval Research Laboratory. After retiring from scientific research she became a watercolorist. Her subject matters include animals, birds, wild lives, flowers and plants, landscapes, human figures and portraits. She is a member of the Mclean Art Society, Vienna Art Society, Potomac Valley Watercolorist, and the McLean Project for the Arts. Her arts are in display in many local shows and juried shows. Some of her arts were honored with awards and recognitions. Her artworks could be viewed at website: www.LStudios.org. *Email: sauhaar@yahoo.com.*

John Onians obtained his B.A. from Cambridge University and his Ph.D. from London University. From 1971 to 2007 he taught at the University of East Anglia, where he is now Emeritus Professor. He has also taught at several universities in the United States, at the Universities of Amsterdam and Leiden in the Netherlands and elsewhere. He has held fellowships at the Warburg Institute, London; the Centre for Advanced Research in the Visual Arts, Washington DC; the Getty Research Institute, Los Angeles; the Clark Art Institute, Williamstown and the Wissenschaftskolleg, Berlin. His books include *Art and Thought in the Hellenistic Age* (1979), *Bearers of Meaning* (1988) and *Neuroarthistory* (2007). He was founder editor of the journal *Art History* and edited the first *Atlas of World Art* (2004). He is now writing a neuroarthistory of Europe. *Email: j.onians@uea.ac.uk.*

Li-Meng Qiu obtained her B.A., M.A. and Ph.D. from Renmin University of China. She is assistant professor of Chinese Language at Zhejiang University, China. Qiu published 3 papers on simplified Chinese characters and traditional characters, prepositions of ancient Chinese language and excavated texts research. She taught Chinese Culture in the Confucius Institute at the University of Rhode Island (2009). Her current research is in teaching Chinese as a foreign language, ancient Chinese grammar and Chinese culture. *Email: qiulimeng202@yahoo.com.cn.*

Nigel Sanitt obtained his B.Sc. in Physics from Imperial College, London and Part III of the Mathematics Tripos and Ph.D. from Cambridge University, where he trained as an astrophysicist at the Institute of Astronomy. He is founder and editor of *The Pantaneto Forum*, a journal which aims to promote debate on how scientists communicate, with particular emphasis on how such communication and research skills can be improved through a better philosophical understanding of science. His book *Science as a Questioning Process* was published in 1996, and he has edited a collection of articles from the first five years of *The Pantaneto Forum* under the title: *Motivating Science*. *Email: nigel@pantaneto.co.uk.*

Ivo Schneider is Professor emeritus for the history of science of the Universität der Bundeswehr München. He was professor and visiting professor at the universities of Munich, Princeton, Bielefeld, the university of Minnesota in Minneapolis and the technical university of Budapest, from which he got the degree of a Doctor honoris causa in 2004. Special research interests concern the history of classical probability theory, mathematical practitioners and reckoningmasters, scientific instruments in the 17th and 18th centuries, biographies of scientists, science theater and the origins of Bavarian optical industry. His books comprise a source book of the history of probability theory and biographies of Archimedes, Johannes Faulhaber and Isaac Newton. He is a member of different national and international societies for the history of science and ever since 1995 membre effectif of the Académie Internationale d'Histoire des Sciences. *Email: ivo.schneider@unibw.de.*

Hark Tsui was born in China, grew up in Vietnam and received secondary education in Hong Kong. He studied film at University of Texas, Austin, and earned a B.A. degree; then went to live and work in New York Chinatown from 1975-1977. Subsequently, he went back to Hong Kong and directed his first feature film *The Butterfly Murders* in 1979, ushering in the New Wave. Tsui has directed and produced over 70 movies, including *A Better Tomorrow* (1986), *A Chinese Ghost Story* (1987), *Swordsman* (1990), *Once Upon a Time in China* (1991), *A Chinese Ghost Story: The Tsui Hark Animation* (1997), *Seven Swords* (2005) and *All about Women* (2008). He was honored with, among others, the Golden Horse Award (1981), Hong Kong Film Award (1987, 1992) and the Outstanding Contribution to Asian Cinema Award (2009). Website: filmworkshop.net. *Email: fws@netvigator.com.*

Ting-Ting Wang obtained both her B.A. and M.A. in Chinese Literature from Renmin University of China. She has published research papers in journals, translated books and wrote novels. Her current interest is in film and mass culture studies. *Email: wtingting_fish@yahoo.com.cn.*

Guo-Sheng Wu obtained his B.Sc. and M.Sc. from Peking University, and Ph.D. from Graduate School of Chinese Academy of Social

Sciences. He is Professor of History and Philosophy of Science, and director of Center for Social Study of Sciences at Peking University. He published more than 20 books and over 100 scientific papers. His current research is in phenomenological philosophy of science and technology, early modern history of mathematical physical sciences, and science communication. *Email: wugshpku@gmail.com.*

Jichen Zhu is an assistant professor of Digital Media in School of Visual Arts and Design at University of Central Florida, where she is the director of the Procedural Expression Lab. Her work focuses on developing humanistic and interpretive theoretical framework of computational technology, particularly artificial intelligence (AI), and constructing AI-based cultural artifacts. Her current research areas include digital humanities, software studies, computational narrative, and serious games. Zhu received a Ph.D. in Digital Media and a M.S. in Computer Science from Georgia Institution of Technology. She also holds a Master of Entertainment Technology from Carnegie Mellon University and a B.S. in Architecture from McGill University in Montreal, Canada. *Email: jzh@mail.ucf.edu.*

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