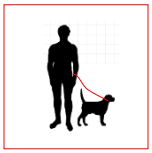
Humanities, Science, Scimat

A Trans-Disciplinary and Cross-Cultural Introduction

Lui Lam

Science Matters Series

Lui Lam
Founder and Editor



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.

Published

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

2. *Arts: A Science Matter*
   M. Burguete & L. Lam, editors

3. *All About Science: Philosophy, History, Sociology & Communication*
   M. Burguete & L. Lam, editors

4. *Humanities, Science, Scimat: A Trans-Disciplinary and Cross-Cultural Introduction*
   L. Lam

Science Matters Series | No.4

Humanities, Science, Scimat

A Trans-Disciplinary and Cross-Cultural Introduction

Lui Lam

San Jose State University, USA

World Scientific

NEW JERSEY · LONDON · SINGAPORE · BEIJING · SHANGHAI · HONG KONG · TAIPEI · CHENNAI

Contents

Prolog

The year was 1990. When NASA's *Voyager 1* space probe was leaving the Solar System, it turned its camera around and took one last picture of Earth. In this rare picture, our dear Earth appears as a pale blue dot. The blue is reflection from the seas while the white comes from the clouds and ice. It is this pale blue dot we share every day. It is on this pale blue dot our joy and sorrow come and go. We are curious about the real world happening on this pale blue dot and beyond. We are curious about the trees, ants, sunset and the stars up in the sky. We are curious about the fate of us humans—past, present and future. And we keep on wondering whether there is a God out there.

These questions were raised systematically about 2,600 years ago by the Greeks in the West and the Chinese in the East. The complete answer did not come, not even today. However, in the past 400 years since Galileo, modern science has prospered and we know much more. We even have the answer to some of the big questions raised by our ancestors.

Our understanding of this pale blue dot and its inhabitants, we humans among them, comes from all branches of science, but especially from the study of complex systems in the last three decades as well as the century-long development of evolutionary science and neuroscience. To understand where we came from, why we humans behave the way we do, and how we can make the world better tomorrow, we have to look back 13.7 billion years in the past. A long look back in time, just like the *Voyager 1*'s long look back in space. In this book, some of these understandings are presented, spanning from science to arts and human history, and to the God question.

1

Introduction

No matter what you study and do in the future, this book contains some fundamental or common-sense knowledge that you should possess. They are essential in helping you to understand properly yourself and the real world out there, and could change your life or career planning. They are prerequisites for a fruitful and happy life, in the university and beyond.

1.1 Learning

This book is a textbook for a general-education course. Its nature is trans-disciplinary and cross-cultural. Its emphasis is not on the detailed knowledge but on the basic concepts and their connections. The materials presented are profound and deep, but never complicated. For details, there are the special courses, and you can easily find them in Wikipedia and Google Scholar.

Part I: Basic forms the core of this course; everyone should read. The rest you read when you feel like it. But you may want to know that those are extremely interesting topics which are not available elsewhere. That is why you buy this book. Every chapter ends with a Summary and Further Reading, which are mostly popular-science books or articles. The Summary is to make your life easy; I am on your side.

As a student, you should read before you enter the classroom and take advantage of it. You pay for them already, anyway. To get the maximum return for your money, use the classroom to engage people, the instructor and fellow students, in discussion and debate—the Socrates Method of gaining knowledge. The second advantage of attending class is that the

instructor has prepared a large number of beautiful, colored power-point slides to entertain you, to keep you awake and save you time in collecting them yourself. Ask the instructor for copy of the slides.

The examinations should be easy. No formulas and no calculations. But you can make it as technical as you want, in doing your term paper, assuming there will be a term paper. It is up to you. Aim high. But the important point is to have fun. And make a lot of interesting friends there. After all, it is just a general-education course.

1.2 Teaching

Every university instructor is qualified and *can* teach this general-education course. You may not know everything in this book since the topics span from the humanities to "natural science". But nothing there is technical. You can understand them easily. The tricks are:

- In the first lecture, you admit to the students that you are not the expert in every topic in the course. And tell them you will learn it together with them. Tell them that is the way research is done. That is true. No shame, no guilt.
- Ask volunteers in the class to do an Internet search for any question that you cannot answer. And give the volunteer "extra credit" after the student does a one to three minutes presentation in the next class. Students love extra credits, at least for those in the United States. Tell them this is to train them to do presentations. That is true, too.

Now, no matter what you do, make sure you cover Part I: Basic before the course ends. You can expand any part of it according to your personal expertise or interest. That can be done easily with Internet search, use of the library, and reading some of the materials suggested in the Further Reading section at the end of each chapter.

The book can be used for a short course, or a one to two units course. (In America, one unit is a 50-minute class per week, for about 14 weeks that include examination sessions.) There are enough materials in the book to cover that. The course is suitable for undergraduate or graduate students of any major. Here are two ways of conducting the class.

1.2.1 *Closed Teaching*

Closed teaching means the traditional way of teaching, suitable for a large class—any class with more than 15 to 20 students, say. The instructor lectures, with power-point presentations. For a full-term course, the examinations could consist of two mid-terms and a final. Each mid-term exam could be multiple choice and worth 25 points, with questions to test whether the students actually read the book and grasp the important points. The final exam could be a term paper and worth 50 points, written individually with 1,500-2,000 words, say.

Closed teaching is boring, for both the instructor and the students, but is still the practical way to go for a large class. However, you can make the class more interesting and enlightening by leaving a lot of time for class discussion.

1.2.2 *Open Teaching*

Open teaching is very educational, for both the instructor and students. It is the preferred mode of teaching for a small class; the optimal class size is 15 students. A particular mode I tried before in my course *The Real World* is recommended here (Fig. 1.1). It is actually two intertwined courses: a research-training course and a regular course on scimat. (See Section 4.5.1 for a quick introduction to scimat.)

The course is made up of lectures and seminars, student projects, and oral presentation and writing trainings. For a full-term course, the grading could be: presentation (25%), mid-term exam (25%), term project and report (40%), participation (10%). The course consists of three parallel components:

1. The instructor will introduce the proper relationships between humanities and "natural science"—from the perspective of scimat—and new developments (especially those using the bottom-up approach) in history, arts and philosophy. Outside speakers could be used.
2. Students will form teams of 1-3 persons each. Each team will work on a (research) project of their choice which is approved by the instructor, to investigate what has been done scientifically on that topic, with the help from the web, library and experts around the world. Students will present progress report in class. Make sure every team member will deliver at least one presentation. The team will hand in a joint written report at end of course. And organize a half-day or one-day workshop for them to

present them to the public. Mix it with prominent speakers invited from your university or outside. That will make the students and your department happy.

3. The teams will be treated and guided like research teams. Pretend that they are your research groups for a funded project called "Understanding the World". The teams do not compete with each other, but compete with other research groups outside of your university. Have a group picnic; that will raise everybody's spirit (you or your department pays for it, of course). The students will learn how to do good research, do oral presentation and write research papers in English. (The good papers could be published in international research journals.)

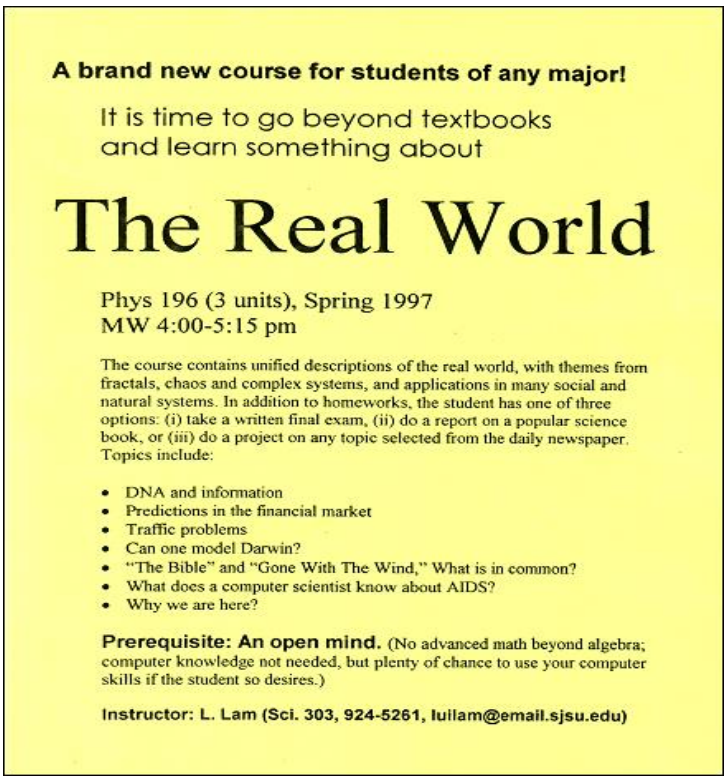


Fig. 1.1. The upper-division course *The Real World* offered by Lui Lam in Spring 1997 at San Jose State University. In Fall 2002, a general-education course of the same name was taught by Lam as one of the 100 incoming-freshmen MUSE courses. (MUSE means Metropolitan University Scholar's Experience.)

The scimat lectures are presented to fill in the gaps between student presentations, which are plenty in the beginning but less so near the end.

1.3 The Book

The book, in the form of a textbook, is designed also for self-study. It is suitable for everybody to read. As a textbook, only a few references are given. But the reader can find the relevant references from the author's articles listed in the Bibliography. The literature listed in Further Reading can be consulted, too. Note that the references listed in Further Reading are all by other authors and serve as background materials only.

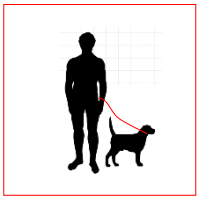
There are a few Chinese names in this book; the conventions are:

1. All Chinese names in text are written with family name *first*, with first name's characters (if more than one) connected by a hyphen.
2. All Chinese names from mainland China are spelled out in pinyin.
3. 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).
4. Lui Lam made his career in both places, outside and inside China. The name Lui Lam is the only exception of the three rules above. Lam is the family name.

1.3 Further Reading

- Gary Miller's *The Meaning of General Education* (1988) is the only book that discusses the history, concept and impact of general education, which started in the 1920s and 1930s as a curriculum movement in the United States.

Epilog



In the last 400 years or so since Galileo, the study of nonhuman systems under the name of "natural science" or modern science did enlighten deeply our understanding of Nature (e.g., Big Bang), make our lives easier (cell phone) and help to prolong our lives (for good or bad). But that is not enough as the future of humanity is concerned, as the so-called "revolt against science" tried very hard to remind everybody. *It is the humanities that determine our quality of life* (e.g., to pollute or not to pollute) *and bring us genuine happiness* (human relationships, arts). While the study in "natural science" should be continued, it is time for us to return to the Aristotle tradition of treating the human system and nonhuman systems as equally important in our search for knowledge. This tradition was interrupted by the phenomenal success of modern science.

Deepening humanities' research and taking it to the next level do not require large increase of the research budget. No smashing machines needed to be built. What is needed is a change of our concept of science and our perception of priority. For example, for the four science-related humanities disciplines covered in Part II, shifting the focus from simple systems to complex systems, from nonhuman systems to the human system, can be started immediately. The humanities were the frontier for the early Greeks and ancient Chinese, which are again the new frontier for the rest of us.

For students majoring in "science" or engineering, it is imperative that you take a few humanities courses; for those in humanities, take some "science" courses and make sure you know how to use Excel, for example. Because the world out there is fast changing and not entirely predictable; we don't know where the new growth points are in the future. Except that we know for sure, the world is in desperate need of talents who are equally fluent in the humanities and "science".

About the Author

Lui Lam, humanist and physicist, obtained his BS (First Class Honors) from University of Hong Kong, MS from University of British Columbia, and PhD from Columbia University. He is a physics professor at San Jose State University, California, and adjunct professor at 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 two new disciplines: Histophysics (2002) and Scimat (2007/2008). He has published 16 books and over 180 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 (World Scientific) and Partially Ordered Systems (Springer). His current research is in scimat and complex systems. *Email: lui2002lam@yahoo.com*

Science Matters Series | No.4

Since the ancient times humans are curious about the real world out there. We are curious about the trees, ants, sunset and the stars up in the sky, and the fate of us humans—past, present and future. And we keep on wondering whether there is a God out there. These questions were raised systematically about 2,600 years ago by the Greeks in the West and the Chinese in the East. The complete answer did not come, not even today. However, in the past 400 years since Galileo, modern science has prospered and we know much more. We even have the answer to some of the big questions raised by our ancestors.

In *Humanities, Science, Scimat*, some of these understandings are presented, from the scimat perspective that treats all human-depending matters as part of science. To understand where we came from, why we humans behave the way we do, and how we can make the world better tomorrow, we have to look back 13.7 billion years since the Big Bang. The book spans from science to human history, from arts to philosophy, and to the God question. It is a trans-disciplinary and cross-cultural introduction to some fundamental knowledge that everyone should possess today. The book is written as a textbook for a new, twenty-first-century general-education course for students of all majors, and for self-study by everybody else.

Lui Lam, humanist and physicist, is a professor at San Jose State University, California. He invented Bowlic Liquid Crystals (1982), Active Walks (1992), Histophysics (2002) and Scimat (2007/2008). He is the founder of the International Liquid Crystal Society; founder and editor of two book series, *Science Matters* and *Partially Ordered Systems*; editor of *Introduction to Nonlinear Physics* and *Nonlinear Physics for Beginners*; and author of *This Pale Blue Dot*.