Humanities x “Science”

→ Innovation

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Science and “Science”
• The first philosopher and father of science

• Started trying to understand everything in the world without referring to the Greek gods—the beginning of philosophy (love of wisdom)

• But he did allow the existence of souls (even for a piece of rock)
Birth of Disciplines & of Science

**Philosophy** (600 BC, “love of wisdom”; Pythagoras; 13c, English)

- ‘Philosophy’ (humans)
- **Theology** (including Natural Theology) (God)
- **Natural Philosophy** (14c, nonhumans)
  - no God
  - God invoked
    - Science (14c)
      - (“pursuit of knowledge”, firm theories)
      - **“Natural Science”** (14c)
        - Scientist (1834)
        - Scientific Method (1854)

- **Humanities** (14c)
  - “Philosophy”
  - History
  - Religion
  - Economics
  - Sociology

- **Social Science** (1772)
  - “Science” (1867)

- **Scimat** (2008)

- **Science** (2008)

Scimat website: www.sjsu.edu/people/lui.lam/scimat

Medical science does not fit into ‘Philosophy’ or “Natural Science”; it is part of Scimat (Science Matters, 人科) which includes all human matters.
Terminology

Science  =  Natural science

=  Science of nonhuman systems  +  Science of humans

="Natural science"  +  Social science + Humanities + Medical science

="Science"  +  Scimat

NB: Humanities are not part of “science” but are part of science
What happened

• **Science** in the modern sense is a **new word** created in 1867, meaning to **understand nature without invoking supernatural/God**—a **new concept**, too

• After that, we retroactively look back in history and identify which parts of human activities belong to science

• And find, e.g., **Thales** (ancient Greek philosopher) was the first one who did that when he proclaimed “everything is made of water” so we call him the **father of Science**, and exclude his talks of soul from science

• Similarly, we identify part of the natural philosopher **Newton’s work on mechanics/gravity as science** and call him a scientist while excluding his writings on God at end of **Principia** from science

• Thus, Thales and Newton are **half scientists** (Galileo is 100% scientist), irrespective of their other beliefs (soul or God)
By recognizing humanities as part of science

• It will help to raise the scientific level of the humanities (and make a better world)

• And thus increase the enrollment of humanities in universities

• Will help humanities students to find good, exciting jobs
Sixth International Science Matters Conference

10th Anniversary

Bettering Humanity
Historic Secular Movements

October 25-27, 2017
Cascais, Portugal

In the long history of humans' development, various efforts to better humanity have been proposed. This conference aims to review the secular movements which are historically significant, to understand how and why they mostly failed and in what ways they succeeded so that we can learn from them and do better with the Scimat approach. Examples of these movements in modern area include the Enlightenment, the Vienna Circle and the Humanism movement. In this conference, reviews are presented by experts on the main theme of bettering humanity. But like previous Scimat conferences, papers on all other science matters are welcome. It is also the occasion to celebrate the tenth anniversary of the scimat conference series and the Scimat Program.

Invited Speakers

- Investment banking (Bank of HIC, Deutche Bank, Lloyds Bank) Germany: FLORENTIN BOUZE
- Erasmus Professor of Faculty of History, University of Oxford: JOHN R. R. CHWETE
- Professor University Parks, 7 Scholars: CLAUDE CONEN
- President of EASL, EAPMC: JEAN-PATRICK COMBRANDE
- General Secretary of United Nations (Portugal) ANTONIO ESPOSITO
- Journalist & PhD in Communication (Spain): CRISTINA JIMENEZ
- Commissar: President of British Humanist Association UK: SHARON KNORRINZ
- Arch Iowa State University professor: JESUS CHEN, US
- Swiss Institute of History (Switzerland): JANOS MOLnar, MTRA
- University School of Arts Professor (Portugal): MIGUEL MIRAG A
- Editor: oxon Publishing (Japan): NAGI OHISHI
- Max Planck Institute Berlin (Germany): ANNETTE VOGT
- To be confirmed.

This conference is under the auspices of the International Science Matters Committee: Manuel Abich (Portugal), Peter Braka (UK), Maria Burgos (Portugal), João Carra (Portugal), Paul Caro (France), Patrick Heggy (USA), Brightside Hooper (Germany), Liu Xiao (China), Bing Liu (China), Dusan Lu (China), John Orin (UK), David Pajanje (UK), Nigel Santer (UK), Ivo Schneider (Germany), Michael Shorten (USA), and Robin Warren (Australia).

further information: www.scimat-2015.com
Humanities x "Science" → Innovation
Arithmetic

\[ 5 + 3 = 8 \]

\[ 5 \times 3 = 15 \]

Multiplication > Addition
Science Is Not Enough

Politicians trying to dump humanities education will hobble our economy

By the Editors

Kentucky governor Matt Bevin wants students majoring in electrical engineering to receive state subsidies for their education but doesn't want to support those who study subjects such as French literature. Bevin is not alone in trying to nudge higher education toward coursework that promotes better future job prospects. Senator Marco Rubio of Florida, a former presidential candidate, put it bluntly last year by calling for more welders and fewer philosophers.

Promoting science and technology education to the exclusion of the humanities may seem like a good idea, but it is deeply misguided. *Scientific American* has always been an ardent supporter of teaching STEM: science, technology, engineering and mathematics. But studying the interaction of genes or engaging in a graduate-level project to develop software for self-driving cars should not edge majoring in the classics or art history.

The need to teach both music theory and string theory is a necessity for the U.S. economy to continue as the preeminent leader in technological innovation. The unparalleled dynamism of Silicon Valley and Hollywood requires intimate ties that unite what scientist and novelist C. P. Snow called the "two cultures" of the arts and sciences.

Steve Jobs, who resigned for decades as a tech hero, was neither a coder nor a hardware engineer. He stood out among the tech elite because he brought an artistic sensibility to the redesign of clunky mobile phones and desktop computers. Jobs once declared: "It's in Apple's DNA that technology alone is not enough—that it's technology married with liberal arts, married with the humanities, that yields us the result that makes our hearts sing."

A seeming link between innovation and the liberal arts now intrigues countries where broad-based education is less prevalent. In most of the world, university curricula still emphasize learning skills oriented toward a specific profession or trade. The ebullience of the U.S. economy, which boasted in 2014 the highest percentage of high-tech output among all its public companies—has spurred countries such as Singapore to create schools fashioned after the U.S. liberal arts model.

If Bevin and other advocates of a STEM-only curriculum look more closely, they will find that the student who graduates after four years of pursuing physics plus poetry may, in fact, be just the kind of job candidate sought out by employers. In 2013 the Association of American Colleges & Universities issued the results of a survey of 318 employers with 25 or more employees showing that nearly all of them thought that the ability to "think critically, communicate clearly, and solve complex problems"—the precise objectives of any liberal arts education—was more important than a job candidate's specific major.

"Those same skills, moreover, are precisely the ones required for marrying artistic design with the engineering refinements needed to differentiate high-end cars, clothes or cell phones from legions of marketplace competitors—the type of expertise, in fact, that is least likely to be threatened by computers, robots and other job usurpers. "Consider America's vast entertainment industry, built around stories, songs, design and creativity," wrote commentator Fareed Zakaria, author of the book *In Defense of a Liberal Education,* in a *Washington Post* column. "All of this requires skills far beyond the offerings of a narrow STEM curriculum."

The undergraduate able to cobble together a course schedule integrating STEM and the humanities may be able to reap rich rewards. Facebook co-founder Mark Zuckerberg became an avid student of Greek and Latin when he was only in high school, in addition to setting about learning programming languages. And the same government officials who call for a shift in educational priorities should know better than to trash the liberal arts. Take Bevin's call to eschew French literature: Bevin is someone with his own debt to the humanities. He graduated from college with a bachelor's degree in East Asian studies.

The way to encourage high-tech industry to move to Kentucky—or any other state—is not to disparage Voltaire and Camus. Rather the goal should be to build a topflight state educational system and ease the way financially for students from even the most humble backgrounds to attend. The jobs will follow—whether they be in state government or in social media start-ups.

JOIN THE CONVERSATION ONLINE
Visit *Scientific American* on Facebook and Twitter or send a letter to the editor: EDITORS@SCIAM.COM
Mark Cuban

Born 1958, American businessman, investor, author, television personality, philanthropist, Dallas Mavericks owner; net worth 3.4 billion USD

**Time interview: The No.1 Job Skill in 10 Years**

- Millions of jobs will become automated in coming years (AI/robots)
- Even people with in-demand skills like computer coding could soon be displaced
- Nature of work is changing — we're going to have a lot of displaced workers
- Creative thinking — a new skill becoming more in-demand than it ever has been
- Liberal arts majors — greater demand in 10 years, more than for programming or engineering majors
- Experts in philosophy or foreign languages will ultimately command the most interest from employers in the next decade (too complex for AI)

• 2012-2016, 101 million jobs created in USA; only 5% are related to computers (10% if internet jobs are included), the rest are liberal arts related, i.e., skills involving interaction with humans

• Someone with Chinese language degree from Stanford hired immediately by Google upon graduation

• An anthropology major, good at listening to people with different cultural backgrounds, thrived in own company in computer-human interface

• Examples of Humanities x “Science”:
  ▪ Curiosity + big data = marketing
  ▪ Empathy + DNA sequencing = DNA consultation
  ▪ Literary curiosity = managing social networks

Liberal arts provide skills in solving complex problems involving humans—an education in critical thinking

Liberal arts degree with technical knowledge or engineering degree with liberal arts education is mostly wanted in today’s and tomorrow’s job market
Innovation from Humanities x “Science”

Kaeru B Back

Frog Be Back

《旅かえる》
《青蛙回家》

- A role-playing game (RPG), red hot in China in Jan. 2018
- Frog lives at home, leaving and coming back at will, which players can’t control (like a rebellious, teenage son or a lousy husband)
- Players just wait or send postcards but can encourage him to come home by putting food on table, etc.
Creator  上村真裕子

- Invented by a Japanese woman 上村真裕子
- Producer, team of 4, Hit-Point Workshop (26 people)
- It took 10 months from concept to distribution
- In Apple app store, 95% download from China; only 1% from Japan
- In two months, 22 million downloads (including unauthorized Chinese-language copies, called Traveling Frog 旅行青蛙)

Success reason: resonant with people’s feelings — a humanities skill
Why Innovations Are Hard to Come By in China
1. The Chinese Culture

A. Challenging authorities was never in the Chinese tradition

• Harmony is supreme!

• It comes from the Chinese culture of “the middle road” (中庸之道)

  which is good in stabilizing the society

  but bad for innovation

B. Seeking truth was never the priority in China’s long history

• *Weiwen* (维稳 maintaining stability) is top priority!

• Seeking truth (the basic tenet of innovation) could inconvenient weiwen
2. Only Two Persons in China Had Done Great Innovations

**Yang Zhenning (C. N. Yang)**
Born 1922
In China since 2003
Nobel Prize in physics 1957
Aged 96

**Tu Yaoyao**
Born 1930
In China since 1930
Nobel Prize in physiology or medicine 2015
Aged 88

3. And there are the 3 obstructive “mountains”
The 333 on China’s Road to Innovation in Basic Science
3 Obstructive “Mountains”
China’s physics leaders before 1986

Yan Jici
1901-1996
PhD France

Shi Ruwei
1901-1983
PhD USA

Guan Weiyian
1928-2003
PhD USSR
Physics Dept., Nanjing University
started counting papers

The originator

Gong Changde (1932 - )
1953 BS (equivalent)
Fudan University
1986 Chair, Phys. Dept.,
Counting Papers and Innovation

- Soothing
  Reasonable number of papers

- Alcoholic
  Too many papers

- Drunk with poison wine
  Fraudulent papers

- Can innovate
- Paper & Wine
- Can’t innovate

- Boat higher, water lower
- Nothing to do with innovation

Paper & Wine

Soothing
Reasonable number of papers

Alcoholic
Too many papers

Drunk with poison wine
Fraudulent papers

Can innovate

Paper & Wine

Soothing
Reasonable number of papers

Alcoholic
Too many papers

Drunk with poison wine
Fraudulent papers

Can’t innovate

Paper & Wine

Soothing
Reasonable number of papers

Alcoholic
Too many papers

Drunk with poison wine
Fraudulent papers
2. Never Ending Assessment of Scientists

• In the 1980s, after the Cultural Revolution (1966-1976), China abolished the tenured system (“iron bowl”)

• And run the academic institutes and universities like an IBM company (no guaranteed employment, review everybody yearly)

• While assessment data are used as reference for decision makers in other countries, China’s administrators use them directly in deciding salary increases and promotions

• Also, income for researchers comes from three sources: basic salary, administrative salary, and grant money. (The basic salary is only about 1/3 of income which can hardly support living.)
### 3. Outdated Graduate School Schemes

#### Graduate schools

<table>
<thead>
<tr>
<th>China</th>
<th>United States</th>
</tr>
</thead>
<tbody>
<tr>
<td>Master degree <strong>before</strong> PhD (exceptions rare and need approval)</td>
<td>Common to go directly to PhD without going through master degree</td>
</tr>
<tr>
<td>For both master and PhD programs, the applicant has to <strong>pick a mentor first</strong></td>
<td>Commonly, no master degree thesis; PhD first year take courses; pick mentor by mutual agreement after passing matriculation exam at end of 1&lt;sup&gt;st&lt;/sup&gt; year</td>
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<tr>
<td>A graduate school mentor could <strong>supervise 30 or more students</strong> at same time (since sudden expansion in 1999)</td>
<td>A few graduate students at most at the same time (e.g., at Harvard, Zhuang Xiaowei’s large group has <strong>12 graduate students</strong>, all for PhD, but <strong>13 postdocs</strong>)</td>
</tr>
</tbody>
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**Problems:**
- Mentors’ have too much power over students’ fates (leading to tragedies)
- Too many students, not enough time to innovate
3 Historical Approaches in Innovation
1. The Ancient Greek Approach

- Ask questions, any question
- Keep on asking why (Socratic method)
- Do it for curiosity, for fun
- Maximal freedom in enquiry
- Maximal exchange of information

Possible only in a “free” society!

- Advantage: Innovations flourish
- Adopted in Western countries
- Unsuitable for countries where Google Scholar is inaccessible

Yang Zhenning

Socrates

c. 470 – 399 BC
2. The Chinese Approach

- 1967, amid the Cultural Revolution, Chair Mao Zedong authorized a crash program (a secret military project) to tackle malaria, upon the request from the Vietnamese.

- 1971 Tu Yaoyao, then 41, inspired by traditional Chinese medicine literature, succeeded in discovering artemisinin (Qing-hao-su in Chinese).

- It's a drug that has significantly reduced the mortality rate for malaria patients.

- The discovery and its use in treating malaria are regarded as a significant breakthrough in tropical medicine in the 20th century.

- 2015 Tu won the Nobel Prize in physiology or medicine.

Problems:

- It happened only once in history.
- The goal was preset.
- It involves a lot of women/men power and huge resources (like fighting a war).
3. The Vatican Approach

Galileo: father of modern science

- End of Renaissance period in Italy
- The Vatican controlled everything: ideology (Catholicism), society, universities

Education/Employment

- 1580, U. of Pisa, study medicine, switch to math and natural philosophy
- 1585, dropout from U of Pisa; work as tutor
- 1588, instructor, Accademica delle Arti del Disegno (Florence), teaching perspective and chiaroscuro; applied for math chair at U of Bologna but failed.
- 1589-1592 (3 yr), math chair, U of Pisa
- 1592-1610 (9 yr), math prof., U. of Padua, teach geometry, mechanics, astronomy
- 1610 (aged 46), tenure, U of Padua, math position

Why successful

- Galileo was free to choose research topics
- Tenured after 12 years (in 2 universities)
- No one counted his papers
- Intense debates (got into trouble when opponents were also powerful political figures)
3 Solutions
Constitution of the People’s Republic of China, Article 36 contains this:

The defining feature of socialism with Chinese characteristics is the leadership of the Communist Party of China.
1. Remove the Mountains

• The 3 obstructive “mountains” were self-created \(\text{(for historical reasons)}\) and thus could be removed by self-actions

• Change the educational system \(\text{(need action of Ministry of Education only)}\)

• Easier said than done \(\text{(no one dares to initiate it)}\)
2. Go Around the Mountains

How nature does it

How humans do it

Build new private universities

2016 Westlake Institute for Advanced Study

2018 Westlake University
3. Tunneling Through the Mountains

One university, two systems

- Scientific innovations won’t challenge the social system; humanities/social science innovations could

- Thus, School of Science (nonhuman systems) and School of Humanities/Social Science (humans) in a university should be governed with different rules

- For School of Science, adopt the Vatican approach and give science faculties tenures, don’t count papers, no yearly assessments, etc.

NB: “1 x, 2 systems” is very common in China. Why not in universities?
Consequences

• **Won’t** guarantee success in innovation

• **Just cutting the ropes that bind scientists’ “feet”** (so they can run and compete freely and equally in innovation)

• **Successful innovations need something more** (picking research topics, guidance, role models...)
General education should be mandatory and strengthened in universities (to avoid the danger of breaking science ethics, e.g.)

Blending humanities and science will promote/lead to innovations

Adopting the Vatican approach in scientific innovation in China should be considered (meaning “one university, two systems”)

Otherwise, invent the 4th approach in innovation

Revise the graduate school schemes (students pick departments, not specific mentors, upon applying)
Take Home Message
Humanities x “Science” → Innovation

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The title is first explained. It involves the correct definition of Science, why there are quotation marks, and the proper relationships between the humanities and science. And why and how when the two are synthesized or merged it will promote and even lead to innovation—something China recognizes she needs urgently. We then explain why innovations are so hard to come by in present China. To overcome that, “The 333 on China’s road to innovation” is presented, viz., three kinds of successful approach in innovation in science history, three obstructive “mountains”, and three solutions.

Lui LAM, humanist and physicist, is professor at San Jose State University, California, and guest professor at Chinese Academy of Sciences and China Association for Science and Technology. Education: BS (First Class Honors), University of Hong Kong; MS, University of British Columbia; PhD, Columbia University. Worked in USA, Europe (Belgium, West Germany), China (Inst. of Physics, CAS, Beijing, 1978-1983). Invented Bowlics (1982), Active Walks (1992) and two new disciplines: Histophysics (2002) and Scimat (Science Matters, 2007/2008). Published over 180 papers and 16 books, including Arts (2011) and All About Science (2014). Founder of International Liquid Crystal Society (1990); founder and editor of two book series: Science Matters (World Scientific) and Partially Ordered Systems (Springer). Current research: philosophy and complex systems. Website: www.sjsu.edu/people/lui.lam/scimat. Email: lui2002lam@yahoo.com.
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