The Scimat Program: A China–Portugal Project

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ABSTRACT: The key to success can be seen as adaptability because, nowadays, individuals will face challenges that require skills to adapt to new situations through innovation and change. Therefore, a deeper understanding of different cultural perspectives through training and education in several fields of knowledge can be achieved through Science Matters (Scimat) courses. Science Matters courses are a cooperation project between Portugal and China. The Scimat Project started in 2007 with a series of International Science Matters Conferences. This is a new multidiscipline approach and a new paradigm, providing a unified perspective for the connection among disciplines in arts and humanities, social and medical sciences.

KEYWORDS: Interdisciplinarity; Transdisciplinarity; Knowledge; Science Matters.

INTRODUCTION

For more than two centuries, universities throughout the world have relied on academic disciplines as platforms for generating new knowledge. Indeed, this situation led to the emergence of fantastic new fields of knowledge such as biochemistry, which resulted from the fusion of biology and chemistry; neurochemistry, which emerged from the fusion of neurology and chemistry; neuroarthistory which resulted from the fusion of neurology, arts and history; artificial life which resulted from the synthesis and simulation of living systems or in another two words, complex systems. The closer we get to the future, the more disciplines we will have in a complete symbiosis pointing to interdisciplinarity and transdisciplinarity.

All honest humans' quests for knowledge are efforts to understand nature, which includes both human and non-human systems, the objects of study in science. Thus, broadly speaking, all these quests are in the scientific domain, though the methods and tools used may be different. For example, literary people mainly use their bodily sensors and brain as information processors, while natural scientists may use measuring instruments and computers. Yet, all these activities could be viewed from a unified perspective: they are scientific developments at varying stages of maturity and have a lot to learn from each other.

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That 'everything in nature is part of science' was well recognised by Leonardo da Vinci, Aristotle and many others. Yet, only recently, with the advent of modern science and experiences gathered in the study of complex systems and other disciplines, that we know how human-related disciplines can be studied scientifically.

Science Matters (Scimat) is a new discipline that treats all human-related matters as part of science. Scimat is about all human-dependent knowledge, wherein humans (the material system of *Homo Sapiens*) are studied scientifically from the perspective of complex systems. Therefore, the emergence of new fields of multidisciplinary knowledge such as Science Matters, a new multidiscipline that provides a unified perspective for all disciplines in the humanities (including arts), social and medical sciences, will supply the content for one of the most interesting and important disciplines in the 21st century.

In this article, the very nature of science will be revealed, followed by an analysis of the 'two cultures' raised by C. P. Snow. Moreover, it will present the demarcation of everything in nature according to human and non-human systems with a brief introduction of complex systems, one of which is the human system. The motivation and concept of Scimat, as well as the three major implications of Scimat will also be introduced.

1. DEVELOPMENT OF KNOWLEDGE

The fragmentation of knowledge into different disciplines is a relatively recent phenomenon which started only a few hundred years ago. As knowledge knows no separation boundaries, the highest degree conferred by universities is still called 'Doctor of Philosophy', but not 'Doctor of Chemistry' (for example), wherein philosophy means 'wisdom' — all kinds of wisdom. This means that there is a material basis underlying the unified intrinsic nature of knowledge.

Knowledge about our universe could be divided into two groups: those unrelated and those related to humans. For instance, Newton's laws of mechanics are *human-independent*. Sooner or later, they would be discovered by any other civilisations; examples of *human-dependent* knowledge are literature and dance: an extraterrestrial intelligence might not dance like us, because it could have three, not two legs.

Human-independent knowledge is commonly called 'natural sciences' while *human-dependent* knowledge is called humanities and social sciences. However, this classification is inappropriate. On one hand, humans are a material system consisting of atoms — the atoms that constitute the system are studied in natural sciences. Consequently, all *human-dependent* knowledge is part of natural sciences, since the objects studied in natural sciences are all material systems.

On the other hand, science is about the study of nature and a mean to understand it in a unified way. Nature consists of everything in the universe — all material systems, humans and non-humans. Therefore, science and natural sciences are thus identical to each other. From this we can conclude: physical sciences include not just physics, but chemistry, biology, and so on. In other words: everything in nature is part of science.

2. THE NATURE OF THE TWO CULTURES

In May 1959, Charles Percy Snow gave the lecture The Two Cultures and the Scientific Revolution at the Senate House in Cambridge. Forty years later, this lecture was republished by Cambridge University Press in 1998 under the title *The Two Cultures*. The lecture essentially contains three themes:

1. The distinction and non-communication between the scientific culture and the literary culture in the West;
2. The importance of the scientific revolution;
3. The urgency for rich countries to help poor countries.

This lecture generated tremendous interest and discussion around the world. It was the 'two cultures' theme that caused the most controversies and debates. Consequently, for example, how things fall under the influence of gravity can be predicted and measured with high accuracy. This branch of study is now called natural sciences, which involve mostly non-living systems, even though living systems (such as humans and other simpler biological bodies) are not excluded. However, the so-called 'natural sciences' are actually sciences of simple systems while all *human-dependent* studies, such as the humanities or social sciences are about complex systems since, in fact, human being is the most complex system in the universe. As study deepened, specialisation became essential, and we were left with two distinct groups: the writers in the literature profession and what Snow called 'scientists' for those working in 'natural sciences'. Finally, we end up with 'two cultures' — with a gap in between.

3. THE SCIENCE MATTERS COURSES

As an attempt to fill the gap in between, a non-profit association with the four founding partners: Maria Burguete, João Miguel Pais, José Amaral and Raúl Sardinha, and members from a diverse background of interdisciplinarity, started the Science Matters courses for the first time in 2015 at the Institute Bento da Rocha Cabral under the following programmes — 'Introduction', 'Knowledge, Nature, Science and Scimat', 'Science and Scimat, again', 'History', 'Arts', 'Philosophy' and 'How to do good research and to write a scientific article in English'.

The Science Matters courses, covering all topics across humanities, social sciences and medical sciences, aim to help individuals to develop skills that will open new opportunities. This is a great opportunity for university students, students who are about to enter universities as well as the general public, as they are given for free, and they will question situations and statements which we take it for granted, but actually need to be replaced by other approaches that will take us to the 'real' world.

Science Matters courses can be viewed as a rally point to raise the scientific level of humanities and thus to make the world most likely a better and more peaceful place. It is the foundation that lies behind the synthesis of humanities and science. A successful example is Christopher Langton, author of *Artificial Life V: Proceedings of the Fifth International Workshop on the Synthesis and Simulation of Living Systems*. Langton, born in 1948, is an American computer scientist and one of the founders of the field of artificial life. He made numerous contributions to the field and developed several key concepts and suggested that artificial life must not simply become a one-way bridge, borrowing biological principles to enhance our engineering efforts in the construction of life-as-it-could-be. *Artificial Life V* includes retrospective and prospective looks at both artificial and natural lives with the aim of refining the methods and approaches previously discovered into viable, practical tools for the pursuit of science and engineering goals.

4. SCIMAT'S AIM AND VECTORS

Nowadays, we are dealing with a society of knowledge and Science Matters is exactly a representation of a society of knowledge, as we can look at the composition of the International Science Matters Committee with broadest representation possible that contains members from different fields from science to literature, arts and medical sciences.

A Luso–Chinese project inspired by the idea of Science Matters and developed by Maria Burguete (Portugal) and Lui Lam (China) established the philosophy of Science Matters through four vectors:

1. International Conferences of Science Matters (2007 to 2019);
2. The establishment of International Science Matters Committee to advocate the Scimat concept;
3. Science Matters courses since 2015;

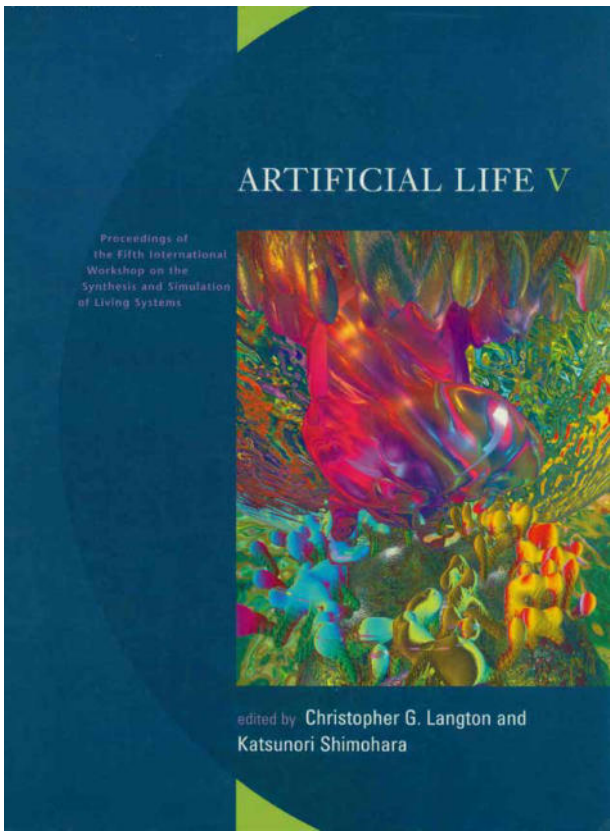

Fig. 1: Book cover of *Artificial Life V: Proceedings of the Fifth International Workshop on the Synthesis and Simulation of Living Systems*, edited by Christopher G. Langton and Katsunori Shimohara, 1997.

4. Editorial projects whose final aim is the publication of a trilingual collection of *Science Matters* series.

There is no doubt that via the four vectors mentioned above, we can see the study of human condition in its various aspects — biological, physical, cultural, social and psychological — can make mankind better prepared to face the real world, a world where change is permanent. Science Matters's perspective is related to the European approach supported by Edgar Morin where the education of the future is based on seven branches of knowledge, namely mistake and illusion, useful knowledge, human condition, earth identity, facing uncertainty, teaching comprehension and the ethics of mankind.

Looking at this approach, we can realise that the European approach of Edgar Morin is much more concerned with ethics and human condition than the American view, mostly supported by bioscience, humanities and communication.

Scientists and scholars will need not only the skills to understand biological systems, but also the skills for using information effectively for the benefit of mankind. Therefore, computational skills are becoming increasingly critical. Above all, interdisciplinary skills are fundamental. Expanded interactions will be required among different branches of science (e.g., biology, computer sciences, physics, mathematics, statistics, chemistry and engineering), between basic and clinical sciences, and among life sciences, social sciences and humanities. Such interactions will be needed at three levels: at the individual level — scientist and scholars will need to be able to bring issues, concerns and capabilities of different disciplines to their specific research; at the collaborative level — researchers will need to be able to participate effectively in interdisciplinary collaborations; and at the disciplinary level — new disciplines like Science Matters will need to emerge at the interfaces between traditional disciplines.

5. DEVELOPMENT OF INTERDISCIPLINARITY

In a recent article published in 2015 by John Hopkins University Press, Harvey Graff addressed that historical case studies offered insights into the future of interdisciplinary scholarship. Curiously, this theme is more often invoked than examined. Therefore, *Undisciplining Knowledge* written by Graff can be considered as a good contribution to the limited existing titles on this topic. Graff's approach adopts an integrated historical, social and contextual framework, which explores in chronological order the development of six pairs of interdisciplines, which are genetic biology and sociology, humanities and communication, social relations and operations research, cognitive science and new histories (emphasising social and cultural factors),

materials science and cultural studies, and bioscience and literacy studies, respectively. In short, Harvey Graff provides a new conceptual framework for considering interdisciplinarity, knowledge production and institutionalisation.

Fifty years ago, novelist C. P. Snow brought up a similar question of the two cultures, but researchers took little notice at the time as he mainly laid the blame on artists and writers for their ignorance of science.[1] In 2014, professor Anne Glover also made a statement to stress the importance of science:

> ***I would also like to convey that science is a fundamental part of our culture in Europe, it's exciting, it's full of opportunity and also fun…We can remind ourselves that Europe, through science, engineering, technology and philosophy, invented the modern world and it's also in our power to invent the future.***[2]

Today, the digital age pervades the artistic culture of our times. Its technologies are used everywhere, from music to graphic arts, and even in literature. In fact, the internet and personal computers have liberated the creative spirit of many modern artists. The only problem is that these advances are not attributed to scientific research, their origin.

Basically, researchers respond to public indifference or hostility by arguing that science is relevant to European citizens in terms of 'value added', where 'value' is the financial return which should, in the future, fund our knowledge society's expensive welfare. If one follows this line, science must be skilful because it is good for the economy. That may be true, but it is far from enough. How can we be sure that the future is better than the past?

Economics, quite rightly, will not colour its judgements about culture. In fact, culture is based on values. Does science fit within this intellectual framework? Since the 1950s, the European and global systems of higher education have been facing structural changes. Until the 1990s, major issues regarding the finance and steering of higher education institutions did not rank high on the political agenda of nearly all Western industrial nations. However, for the past 20 years, we could observe considerable pressure to change them with regards to governance regimes. The driving forces were the rapid massification of higher education, the academisation with changes in the occupational structure, the chronic shortage of public funding as well as the growing pressure on institutions to fulfil better the demands of knowledge-based economies.[3] Reform efforts, as mentioned by Alan Scott in 2010, paradoxically introduced in the name of autonomy, and better reading of academic degrees, were aiming to increase efficiency and guarantee improvements in the quality and quantity of the core tasks of research and teaching. Perceptions underwent continuous revisions with regard to the driving forces affecting the patterns of higher education systems, reflecting the absence of a deep discussion about the true meaning of universities and their social functions.

In 1998, the Organisation for Economic Co-operation and Development (OECD) became an ardent advocate for the substitution of the term of 'higher education' by 'tertiary education' in the international higher education policy arena where the name 'university' was almost vanished. It also stresses several stages of learning. After 12 years of schooling, students may enrol in a third stage of education prior to embarking on regular employment. I think that 'Bologna' is a significant case study. From the political anguish of the then French minister of education, Claude Allegre, an agreement for internal use was signed with three other ministers of education — the ministers of education of Italy, Germany and the United Kingdom — at the celebration of the 800th anniversary of the Sorbonne in 1998. Later, followed by the bureaucratic intervention of the European Union, that agreement became a fire that crossed its own borders and spread throughout

Europe. Political institutions, not universities (although they gave their acquiescence), took the lead in what was known by the 'Bologna Process'.

The current transformations of the role of universities are, above all, determined by the decline of the national cultural mission that has so far provided its *raison d'etre*. Moreover, the process of economic globalisation brought with it the relative decline of the nation state as the principal instance of the reproduction of capital and knowledge around the world. In turn, and because of this, universities are either becoming transnational bureaucratic enterprises, or linked to transnational government bodies such as the European Union or operated independently by analogy with a transnational enterprise.

It is now part of the common perception that the world is changing rapidly and unpredictably as a result of globalisation. The rapid interdependence of political forces, the interpenetration of cultures and mass populations of education are sources for questioning today's institutions. The diverse and heterogeneous society of the new Millennium, characterised by internal social crises, prolonged democratic crises, environmental crises, unsustainable practices, as well as the threats to institutions by globalisation, poses questions on what role universities should play in today's society.

The place that universities occupy in the society is no longer clear, as well as the exact nature of the society. Intellectuals cannot afford to ignore the change taking place in the universities' institutional structures. As a result, one may ask whether prevalent university managerial models are still justified. We must not forget that European universities gave birth to the humanism of the Renaissance, drove the Reformation, led the raise of the empirical science, promoted the emergence of critical history and contributed to the birth of one of the most important institutional models of the modern world — the research-based university — as a pillar of the creation of new knowledge.

CONCLUSION

The conclusion is that a new humanism will be required in the 21st century to avoid regressive forces emerging under various disguises, ranging from economic to political and religious pressures. The 'open society' is our inheritance, but we must fight to preserve it, or its advantages could all too easily disappear.

The expansion of universities goes beyond their old cores as elite institutions is embodied in a continuously growing number of students which can be seen as a manifestation of knowledge extension claims. Such demand permeated in societies is fueled by knowledge-based economies and job markets. Universities have become accessible to people from multiple social backgrounds, providing the opportunity for social groups which were previously excluded from university education. We may also list in the positive side the increase of access to diversity, pluralism and other complex elements embedded in culture. From this perspective, the enlarged access can be interpreted as the democratisation of universities.

An institution remains functional only if it vitally embodies its inherent idea. Should its spirit evaporate, an institution will be petrified into something merely mechanical like a soulless organism reduced to dead matter. And universities cannot even continue to form whole once the unifying bonds of their corporate consciousness dissolve. The functions a university fulfils for society must preserve an inner connection with the goals, motives and actions of its members.

Finally, a quote from Newman's transcript in discourse five of his book, titled *The Idea of a University Defined and Illustrated*, where he expressed the following belief:

> ***It is a great point then to enlarge the range of studies which a University professes, even for the sake of the students; and, though they cannot pursue every subject which is open***

> ***to them, they will be the gainers by living among those and under those who represent the whole circle. This I conceive to be the advantage of a seat of universal learning… An assemblage of learned men, zealous for their own sciences, and rivals of each other, are brought, by familiar intercourse and for the sake of intellectual peace, to adjust together the claims and relations of their respective subjects of investigation. They learn to respect, to consult, to aid each other.***[4]

In a world where material acquisition and consumption are becoming the dominant ethos, there is an urgent need to bring spirituality to the core of humans' endeavour. We are at verge of a change in the model of civilisation, which can hardly be built from the old paradigm of a system that has reached its limits.[5] In this respect, universities will have a central role in leading the creation and promotion of a new thinking susceptible to support the creation of new knowledge more effective in its social uses. To achieve this goal, universities must become more consciously and intentionally active in anticipating, shaping, intervening and guiding these changes towards a better world. RC

NOTES

1 C. P. Snow and Stefan Collini, *The Two Cultures*, rev. ed. (Cambridge: The Syndics of the Cambridge University Press, 1959; Cambridge: Cambridge University Press, 2012), 1–21. Citations refer to the Cambridge University Press edition.

2 "Chief Scientific Adviser," European Comission, archived November 1, 2014, https://ec.europa.eu/archives/commission_2010-2014/president/chief-scientific-adviser/.

3 Peter Maassen, "System Diversity in European Higher Education," in *Higher Education Research and Policy*, ed. Marek Kwiek and Andrzej Kurkiewicz (Frankfurt am Main: Peter Lang, 2012), 1:79–97.

4 John Henry Newman, *The Idea of a University Defined and Illustrated* (Gutenberg ebook, 2008), 101, https://www.gutenberg.org/files/24526/24526-pdf.pdf.

5 Global University Network for Innovation (GUNi), *Higher Education in the World 3: Higher Education: New Challenges and Emerging Roles for Human and Social Development*, 3rd ed. (Basingstoke: Palgrave Macmillan, 2008), xvi–xvii.

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