The Committee of Sleep: Dreams and Creative Problem Solving

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Each night before retiring, the French Surrealist poet, St. Paul Roux, hung a sign on his bedroom door which read: "Poet at work." John Steinbeck wrote: "It is a common experience that a problem difficult at night is resolved in the morning after the committee of sleep has worked on it." We echo this sentiment each time we advise a friend to: "Sleep on it!"

These quotes don’t name the dream as spokesperson for the Committee of Sleep. However, most stories of nocturnal problem solving involve either dreams or “hypnagogic imagery”—the pictures that go through our minds as we fall asleep or slowly awaken.

Dreams have produced art, music, novels, films, mathematical proofs, designs for architecture, telescopes, and computers. Dreaming is essentially our brain thinking in another neurophysiologic state— and therefore it’s likely to solve some problems on which our waking minds have become stuck. Harvard psychologist Deirdre Barrett’s research has explored the role of dreaming in everyday problems and creative projects, the brain processes behind this, and how dream incubation can increase problem solving dreams. This talk will take inspiration from great historical dreams and modern lab research in presenting techniques to increase the likelihood that people will have breakthrough dreams—and recall and act on them.


Deirdre Barrett, Ph.D. is a psychologist on the faculty of Harvard Medical School’s Behavioral Medicine Program. She is Past President of both the International Association for the Study of Dreams and The Society for Psychological Hypnosis. Dr. Barrett has written four books including The Committee of Sleep (Crown, 2001), and edited four others including Trauma and Dreams (Harvard University Press, 2001). Dr. Barrett has published dozens of academic articles and chapters on health, hypnosis, and dreams.
The main focus of the ongoing debate over the meaning of interdisciplinarity concerns integration. Integration is a process by which ideas, concepts, theories, methods, tools and information from two or more disciplines are connected or blended. Interdisciplinarity is fast becoming as important outside academia as within. Therefore, the emergence of disciplines can be seen as a good case study to understand interdisciplinarity concepts. What is Interdisciplinarity? Let us consider three approaches:


3. Oxford Handbook of Interdisciplinarity Robert Frodeman; Julie Thompson Klein; Carl Mitcham (2012): General public, academics, & policy makers, seek approaches to help organize and integrate the vast amounts of knowledge being produced, both within research and at all levels of education.

The emergence of disciplines in the modern sense took place around 1800. This implied the shift from occasions arisen externally to science for the collection of experiences and data to a research problem: molecular biology is a good example - the study of biological phenomena on the molecular level.


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Maria Burguete received her Ph.D. in History of Science (contemporary chemistry) from Ludwig Maximilians University at Munich, Germany (2000). She graduated from the Faculty of Sciences in Lisbon (1982), after completing a Bachelor Degree in Chemical Engineering (1979). She is a scientist with and research experience in a wide variety of scientific fields. This diversity enhanced the development of both her interdisciplinarity and a transdisciplinarity. She is now a scientist at Bento da Rocha Cabral in Portugal. She has published seven scientific books and seven poetry books, and over 25 scientific papers mostly in history and philosophy of science. Since 2010 she is a fellow of the European Academy of Sciences, Arts & Letters, founded in Paris in 1980.
Why Science and Poetry advance together

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Although science is universally regarded as a pillar of human culture, it is often treated by media and even by erudite commentators as separate or different from other human endeavours. Much of the perceived difference between science and other fields stems from Popperian arguments that all scientific statements must be falsifiable through confrontation with nature to distinguish true from false, thus providing scientists with an absolute advantage over other forms of knowledge. More recently, this view has also been reinforced in a negative way by a revival of the Faustian myth, according to which the scientist can wreck everything by dabbling too far with the forces of nature. The combination of these opposite but complementary opinions brands science as a ‘different’ branch of culture for so-called ‘lay’ persons, whose knowledge is supposedly less factual and more humane.

One may doubt whether such a naïve view can really spread, but the argument must be countered. The public has enough sense to realize that ‘anti-science’ would be as perverse as ‘anti-poetry’. Nonetheless, it is important to revisit and refute these prejudices. First, we should remind ourselves that no scientific theory can be absolutely and completely certified as ‘the Truth’. We cannot even explain the nature of time. While some scientific statements are simple enough to be very accurately verifiable, others are closer to the realm of conjecture, but all can coexist within the bounds of the so-called ‘exact’ sciences. Indeed, that is what makes the sciences so interesting. A number of open questions call for passionate debate, which is the real task of researchers wishing to advance their subjects. Poetry, on the other hand, is regarded, by the same, either with tolerant favour or sometimes with contempt as the precise opposite of science. No poetry, it is argued, is founded in fact. To be poetic, a theme must be legendary, and if it is legendary, it is almost an advantage for it not to be true, or at least to be totally unverifiable. So, poetry and vagueness are often taken as synonymous. While truth is essential to the scientist, it should become quite irrelevant and perhaps even damaging in the eyes of the poet. We thus have two activities, both very highly rated as branches of human culture, which are taken to oppose each other in every conceivable way. So, it comes as a surprise to many (indeed even to some scientists and poets) that there are hidden and fundamental connections between these two branches of culture. Far from being separate, when pursued by creative minds, they have progressed hand in hand. In order to give substance to this view, I take examples from the continued series of meetings between scientists and poets which have been organized over the past ten years in EuroScience Open Fora (ESOF) – currently the most important pan-European gathering of researchers – which have taken place, so far, in Munich, Barcelona, Turin, Dublin and Copenhagen. From these encounters, it emerges very clearly that there is a dialogue between active scientists and creative poets. The outcome, apart from better mutual understanding, is the realization that each one of these activities has never been completely separate from the other and, that they must advance together to contribute fruitfully to culture in the modern world.

The present communication proposes a reflection on the content of contemporary science as revealed in the course catalogs of the most important universities in the world. These catalogs of courses can be considered the tree of science of our time. (It will be taken as a reference of this analysis the Shanghai ranking of universities.) The set of courses from each university will be envisaged from the point of view of three content categories: courses that are dedicated to studying human affairs (category A); courses that are dedicated to study what there is out there waiting to be studied, if anything (category B); and the courses that someone would have difficulty inserting one of the above categories (category C). There are undoubtedly other ways to categorize the university courses and the predominant scientific areas of our time, as there are various definitions of science. This categorization does not antagonize any of these ways of categorizing. In contrast, seeks to identify the real interest of contemporary science. The usual answers to the question about what matters to science (e.g. increased knowledge, preference for scientific methodology in relation to other methods of acquiring knowledge) are unsatisfactory. A quantitative research about the content of the tree of contemporary science can show that the dominant content is the subject of science himself. To put it another way, science is interested mainly by humans and their interests. This dominant content reveals the real interest of scientific inquiry. As it turns out, this communication seeks to identify the significance of scientific activity. Unambiguously, it can be proved that the category A dominates the tree of contemporary science, and that the contents of the categories B and C are discovered in accordance with procedures of category A. (Marginally, it is possible to strengthen the results obtained with parallel exercises that could be done with the contents of other fields of activity: TV content, movies, advertising, history of book publishing, etc. As is evident, the results of a possible quantitative analysis of these different areas are not discordant with the results of the quantitative analysis of the contents of scientific activity in different scientific fields. For example, what is the statistics of the content of all television programs ever produced and broadcasted? Or, what is the statistics of internet content? It would also be fascinating to get an accurate statistics of the content of all books published in Europe since Gutenberg. This communication suggests the conjecture that these different statistics have structural similarities.) It is possible to consider that the exercise proposed in this communication has two important results: we see more easily what unites the various sciences; one realizes in a better way that what is gained in understanding the contents of the three categories has a high price, a result that can inspire someone to seek other ways of knowing the contents of category B.

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Manuel Curado is professor at the University of Minho, Braga, Portugal. He is the author of several books, namely the recent The Viriádas of Doctor Samuda (Coimbra, Coimbra University Press, 2014), and A Portuguese Genius: Edmundo Curvelo (Coimbra, Coimbra University Press, 2013). He edited also several books, namely The Complete Works of Edmund Curvelo (Lisbon, Calouste Gulbenkian Foundation, 2013).
Interdisciplinary Skills for Complex Global Environments: a must for Competitive Engineering Education

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Engineers increasingly engage in international projects, including service on multinational teams at different points around the globe, collaborating on a common project through real-time, electronic communication [1]. Effective collaboration requires not only the ability of participants to communicate in a common language, but also the assurance of a common level of technical understanding. Such issues are not trivial, given the global diversity of systems for educating engineers, for different goals in skills, for quality control of their education, and for regulating their professional practice [2]. From the engineering education perspective, the accreditation and assessment of academic programmes is vital in order to maintain the quality and the status of engineering graduates, and hence the technical workforce. Results of a survey of the relevant literature and observations indicate that various accreditation models have been developed regionally, as well as internationally but most of these models seem to be non-uniform, too complex, non-transparent and, moreover, difficult in their application. This leads to confusion and growing concerns about the mutual recognition and global mobility of the engineering profession. As a result, there is an urgent need for a systematic and shared global model of engineering accreditation that can be used to assess global professional skills and attributes of engineering graduates. The aim of the current paper is double. While on the one hand it presents the added value of the EUR-ACE accreditation system, on the other one it presents a survey on the graduates’ opinion on the level of training in the different technical and non-technical areas, comparing the teaching profile with the actual needs of the professional working environments. It also underlines that there is a rise of interest in increasing interdisciplinary studies in order to enhance the readiness and the competitiveness of engineering graduates. The survey was carried out in August 2012 by the International Relations Office of the School of Engineering (University of Florence) as preliminary activity to the EUR-ACE accreditation of two curricula.


Elisa Guberti studied languages and graduated in 2000 at the Università di Bologna. She also owns a post graduate degree from the Università Cattolica of Milano on “International Higher Education Systems”. During the past 15 years she acted as Project Manager within several EU supported projects in the field of Engineering Education within the School of Engineering of the University of Firenze, Italy. She is author and co-author of several scientific papers dealing with engineering education and she is passionate about exchange of best practices of engineering education and profession so as to benefit engineering colleges and engineering graduates worldwide in the context of building sustainable economies and resilient societies.
Is science part of literature? Could we define scientific papers as the expression of a literary genre? After all, some people use the expression « scientific literature » to designate the whole body of publications that constitute human knowledge at a given point in time. But does that include the literary production in the many different languages of the world?

Common sense has it that literature and science are two different fields of human activity. We do not read a scientific paper the same way as we might read one of the Shakespeare’s tragedies or a novel by Simenon. What are we looking for in each of these two « genres »?

The process of writing is also very different when we want to publish a scientific paper from when we expect some kind of literary success out of the writing of a novel. The writing of a scientific paper is based on the anticipation of its reception by a highly specialised audience, whereas the writing of a literary piece — a novel, for example — involves some risk: the risk of misunderstanding. In science, understanding must be precise and complete. In literature, misunderstanding is the rule. We shall develop these ideas in order to improve our perception of the differences between science and literature.

Baudouin Jurdant is Professor emeritus from the University Paris Diderot (Paris 7) and Associate Researcher in the Centre for the Philosophy of Science of the University of Lisbon (CFCUL). He started his career as a journalist in a daily newspaper in Strasbourg. In 1973, he submitted his doctoral dissertation on the theoretical problems of the popularisation of science which has been published in 2009. In 1984, he submitted his thesis for the Doctorat d’Etat : Ecriture, monnaie et connaissance. In 1997, he joined the University Paris Diderot where he became responsible for the Master in Scientific Journalism. He is now retired and lives in Lisbon.
General-education (GE) courses are offered in (almost) all American universities as a means to bridge the gap between the humanities and “science”, to prepare students to face the world once they graduate. Since being fluent in both areas will enable the student to be a better citizen and enjoy higher chance of being employed in the ever-changing market.

Unfortunately, most the available GE courses are too narrow in their scope and are confined either to the humanities or “science”. The GE course, “Humanities, Science, Scimat” (HuSS) created by Lam, offers something completely new. It is an interdisciplinary and cross-cultural introduction to the humanities and “science” from the unified perspective of scimat.

Scimat (Science Matters) is a new multidiscipline introduced by Lam in 2007/2008. Conceptually, scimat represents the four tenets that (1) Science is humans’ effort to understand Nature without bringing in God or any supernatural; (2) Science covers everything in Nature; (3) Nature includes humans and all nonhuman systems; (4) all research on human matters, humanities in particular, are part of science. Disciplinarily, scimat represents the collection of research disciplines that deal with humans; thus, scimat is the sum of the humanities, social science and medical science.

In this talk, I will present my experience of teaching this HuSS course in the International Summer School of 2015 at the Renmin University of China, Beijing. It has 32 sessions, each 45 minutes long, and consists of three parallel components: (1) The instructor introduced the proper relationships between humanities and (natural) science, from the perspective of scimat and with new developments in history, arts and philosophy. (2) The 27 students were divided into 5 research teams and worked on a research topic of their choice. Students presented progress report in class; each team handed in a formal paper at end of course. (3) The teams were treated and guided like research teams.

At the end, the students learned (1) the proper definition of science, (2) the proper relationships between humanities and science, (3) the proper understanding of history, arts and philosophy, (4) the new multidiscipline called Scimat, (5) using Excel to program, calculate and plot results of some stochastic systems (such as Random Walk and Active Walk), (6) how real research is done, (7) team work, (8) communicating efficiently and do professional presentations in MS PowerPoint, and (9) writing papers in publishable form, all in English.

Version 0.3 of a HuSS textbook is available. This course can be taught by any professor in any university.

Lui Lam obtained his BS (First Class Honors) from University of Hong Kong, MS from University of British Columbia, and PhD from Columbia University. He 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). Lam published 16 books, including All About Science (2014), and over 180 papers. He is the founder of the International Liquid Crystal Society (1990), the founder and editor of the two book series: Science Matters (World Scientific) and Partially Ordered Systems (Springer). His current research is in scimat and complex systems.
An interesting History of Biology

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Biology is generally considered the science of the XXIth century; however it has a very long history which goes back at least to Aristotle, considered the “father” of Biology, and a strong humanistic side. The fascination for Life and its mysteries has always enchanted thinkers and philosophers of all times. Herein I propose a quick trip through a few historical moments, selecting eight examples of people who have made significant contributions to the Life Sciences. Naturally, a personal selection. 1. How did it all begin? – Aristotle and the primordia of Biology; 2. Pedro Hispano, arguably Portugal’s first scientist – a brief tale about the only Portuguese to become Pope (John XXI) in the XIII century; 3. The first globalists – The fantastic saga of the Portuguese Discoveries, the exchange and the description of new plants and animals; 4. Peeking into de microcosmos, ca. 1650 – The men who discovered the microcosmos; 5. What if Darwin and Mendel met? – Hypothetical rendez-vous in London, circa 1860; 6. A beautiful mind – The times and Life of Mathilde Bensaúde, world female pioneer plant pathologist; 7. The double helix – Rosalind Franklin and “buddies” Watson & Crick; 8. Tomorrow’s people – the new generation of biologists

Manuel M. Mota is a biologist (University of Lisbon, 1982), completed a PhD (as a Fulbright scholar) in Virginia Tech (USA) in 1992, in Plant Pathology (Phytonematology), and has since worked mainly with plant parasitic nematodes, with a strong emphasis on the recent biological invasion known as “pine wilt disease”. He has published over 100 papers and book chapters in major international journals such as Molecular Plant Pathology, Trends in Parasitology, PLoS, Planta, Forest Pathology, Nematology, New Phytologist, Mol. Phylogenetics and Evolution, Ann. Appl. Biology, etc… is editor of 2 books (in Brill and Springer, two major scientific publishers). His is a regular referee for 15 major scientific journals. He teaches several courses of Biology at the University of Évora (UE), and ULHT (Lisbon), and has taught at other universities (Kyoto, Prague, Nottingham, Va. Tech, UENF/Darcy Ribeiro, Brasil, etc..). His scientific activity has attracted significant funding (over € 1 million) to the UE, mainly through national and international research projects. Besides strict biological courses, he also maintains interest in History and Epistemology of Biology, and has taught Bioethics and History of Biology.
Interdisciplinarity in Education

José Carlos Quadrado

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Interdisciplinarity is fundamental in a society where integration is a major source of education development. However several approaches to interdisciplinarity are conceptually wrong. Interdisciplinarity is not present where the educators involved are all experts on everything, or when the educators are from different expertise fields just sent to the same place hoping that interdisciplinary stuff happens.

Interdisciplinarity is the establishment of communications that enable idea-filtering, thus creating information that is useful, and consequently being transformed into knowledge and consequently into a source of wealth.

A university interested in exploring the major advantages of interdisciplinarity should focus in degrees based on topics rather than fields, e.g. a degree on automobile construction rather than a course on mechanical engineering that can be applied to a lot of things but cannot make anything directly with it. In a topic based degree the cultural aspects are fundamental, e.g. it should have language classes integrated within the degrees based on what are the countries with the most job offerings for that degree. Interdisciplinarity is in education the prime response to building the degree based on what the employers are saying that they are needing right now while forecasting what they will need for the future.

The reason for the correctness of an interdisciplinary approach is directly related to its capacity to address the major difficulty of interdisciplinarity, the impossibility of being up-to-date in all the disciplines. It is hard enough keeping up-to-date in one discipline, keeping up-to-date with all the disciplines that interact in an interdisciplinary way is virtually impossible. That has always been the drawback of interdisciplinary approaches in education, no matter how well prepared a student is by the university, without the permanent professor-induced and colleague-induced pressure to perform, the student loses contact with the relevant literature in a short amount of time. If that is key for standard degrees, it is even more so for interdisciplinary degrees. The proposed solution is to focus the interdisciplinary degree in production topics, meaning that the student has an interdisciplinary education focused around the generation of a certain type of product, i.e. change the focus from the knowledge area, to the production area.


José Carlos Quadrado has a BSc in Energy and Power Systems, a diploma degree in Electrical Engineering, Automation and Industrial Electronics from ISEL, an MSc and a Doctor degree in Electrical Engineering and Computers from Lisbon Technical University. He also holds the Habilitation degree (Aggregation) in Electrical Engineering from Beira Interior University.

He holds over 100 international publications (including journals and chapters of books), several patents and some international technical prizes and scholarships, and also holds the position of editor and editor-in-chief in some journals. Up to now he has also developed several international engineering education and engineering projects in the fields of renewable energy, fuel cells, electrical vehicles and intelligent control.
Are University textbooks still relevant in the digital world?

Nigel Sanitt

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Textbooks have always played a pivotal role in undergraduate teaching at University. With the advent of digital publishing, textbooks are freely available online and on various electronic platforms. Will this result in textbooks evolving into both electronic and printed formats? Or is their a revolution in progress which will see textbooks going the way of the dinosaurs?

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Nigel Sanitt obtained his B.Sc. from Imperial College, London University, Part III of the Mathematical Tripos and Ph.D. from Cambridge University, UK. His early academic work was in the field of Gravitational Lenses. He is currently CEO of Pantaneto Press.
Science in education - the role history of science, technology, and medicine and gender studies could play

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History of science has its own history as well as history of technology and history of medicine (history of STM). When we start with the first journal *ISIS*, founded in 1912 by George Sarton (1884-1956), then we are looking back more than 100 years. From the beginning there was always included an educational and didactical aspect to investigate the history of STM.

The same is true when we are examining the latter history of gender studies, which we can start with 1949 when in Paris the first edition of the book *Le Deuxième Sex* (The Second Sex) by Simone de Beauvoir (1908-1986) came out. Her dictum became famous "One is not born as a woman, one becomes one", although this view is not held by all gender theorists.

To answer the question which role history of STM and gender studies could play in the relationship between science and education, we want regard this relationship by studying the long history of history of science as well as the latter history of gender studies.

First, in this talk I’ll give a short overview on the history of STM as well as on the history of gender studies. The main topics, principles, and perspectives will be described with regard to the question which role history of STM and gender studies could play in the relationship between science and education.

Second, I’ll outline the special connection between history of education, i. e. pedagogy, didactics as principles of teaching, and the educational and didactical aspects of history of STM and gender studies. When and why history of STM, and gender studies respectively, was used in the classroom? Under which circumstances this happened? And what were the aims?

Third, in my talk I’m using examples from history of mathematics and science. On the one side, history of mathematics is one of the sub-disciplines of history of STM which was practiced very often by teachers of mathematics. This links to our question on the role of pedagogy immediately. On the other side, mathematics was (and is still) considered - by teachers and professionals as well as in mass media - as a "male discipline" by definition. This links to the question on the role gender studies could play.

Finally, some questions will be discussed how the connection between science and education could be linked stronger. How could we use more research results on history of STM and gender studies? How can we include colleagues from different perspectives and from various disciplines? How could we use these resources better and more effective?

Annette B. Vogt obtained her diploma in mathematics and her PhD in history of mathematics, both from the University of Leipzig. Prof. Vogt is a research scholar at the Max Planck Institute for the History of Science in Berlin. She published several books and more than 150 scientific papers. Since 2013 she is serving as assistant secretary general of the Council of the DHST/IUHPST; from 2005 to 2013 she was President of the Women’s Commission in the DHST. She is Corresponding Member of the International Academy for History of Science. In her current research project she investigates the history of statistics between mathematics and economy with a special focus on the development in Germany.
KEY WORDS: dreaming; problem solving; creativity; dream incubation. The French Surrealist poet, St. Paul Boux, would hang a sign on his bedroom door before retiring which read: "Poet at work." (Gumpertz, 1976, p. 161). None of these quotes designate the dream as spokesperson for the committee of sleep. However most accounts of solving problems or producing creative products during sleep are of REM-like dreams or hypnagogic imagery. In the most famous and controversial example, the chemist Kekulé reported that his Nobel-prize winning realization of the structure of the benzene molecule as hexagonal rather than straight came after dreaming of a snake grasping its tail in its mouth (Ramsay and Rocke, 1984). In The Committee of Sleep, Barrett reveals how dreams can also tell us about our future potential—and how to reach it. Read this book, sleep on it, and see what transpires! Discover the world's research. Creative problem-solving dreams virtually always occur only after the dreamer has done extensive work on the issue awake. Most typically, a person is stuck at one particular step of a multiple phase process and the dream solves that step. The dream of Dmitri Mendeleev about The Periodic Table of the Elements is no exception. All accounts of this event agree that he'd worked for years on the Table, produced other drafts, but that he attributed the version he was most satisfied with to a dream.