

Methodology

Comprehending China (or other countries) computationally

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Abstract: This article argues for connected computers to be deployed in scientific and collaborative China/country studies in the age of globalization and ‘convergence of knowledge’. The hope is that it will appeal not only to researchers in artificial intelligence, machine learning, data mining, human–computer interaction, conceptual modelling, knowledge organization (KO), knowledge management (KM), library and information science (LIS), big data analytics, soft – and cognitive – computing and semantic web technology but also to China/country scholars and social and human scientists, on whose assumed expertise foreign policies are usually based. Rethinking country (China) – or area studies in a global context, the author – educated at Leiden University and believing he is breaking new ground in a troubled field of academic education and research – attempts to redesign, renew and uplift these studies by stressing the need for cross-disciplinary (as distinct but not separated from international) research and pleading for the use of the latest insights of computer scientists.

Keywords: machine learning, data mining, human computer interaction, digital library

The School of Oriental and African Studies (SOAS) in London and the German Institute of Global and Area Studies (GIGA) in Hamburg are two of the institutions solely devoted to area/country studies, the study of China being one of them. In 2016, the three-year research project ‘Rethinking Asian Studies in a Global Context’, funded by the Andrew W. Mellon Foundation, in New York, and co-ordinated by the International Institute for Asian Studies (IIAS) in Leiden, was ‘successfully’ completed, but there had been no *fundamental* rethinking. In this paper, we try to do just that: breaking new ground in a troubled field of academic education and research, where social scientists are increasingly rubbing shoulders

with human scientists, but notably failing to find a common ground, a scientific view they could share.

‘Area study’ refers to a field of scholarship pertaining to a particular geographical, national or cultural region. In fact, the term is a general description of a great variety of research fields. It tends to be sorely overlooked or conveniently glossed over, but ‘area experts’ such as Africanists, Americanists, Arabists, Hispanists, Indologists, Iranologists, Islamologists, Japanologists, Koreanists, Mongolists, Sinologists, Slavists, Tibetologists, Turkologists and Vaticanists have the bad habit of trespassing on fields of study belonging to social or other kinds of scientists. Typically, area/country study programmes in non-American countries cover a bit of geography, demography, history, language, literature, art, religion, politics, economics, sociology, anthropology, archaeology, psychology, education, science and technology and philosophy, inasmuch as the subjects involved are related to the region. Such programmes lead to the graduate being a jack of all trades but a master of none, for the courses are targeted at the student who is unwilling to be disciplined in a specific scientific domain and seeks to be knowledgeable about almost everything concerning the area or country of his/her predilection, i.e. the student who doesn’t want to become an expert in anything whatsoever and yet – after graduation – likes to be considered a country connoisseur or, worse still, an area expert. The statement made by an emeritus professor of Chinese philosophy, ‘To be a sinologist is to seek to comprehend and to make comprehensible the multiple facets of the society and culture of China’, is thus at best a sign of naivety and at worst an attempt to obfuscate.

In the USA – where higher education authorities (aware of the harmful consequences of the blurring of academic boundaries and appreciating the wider significance of labour division) are strongly critical of the policies pursued by their foreign counterparts – students who have an interest in a particular country are required to narrow down their interest and to make a choice of discipline. However, having graduated in – say – economics and publicly asked about their opinion on the country, they are generally quick to leave their home turf (in the present case, economics tested on or applied to the country’s economy) and trespass on somebody else’s property, without penalty. Doing so, the expert becomes a dabbler, the professional an amateur.

Area studies have been strongly influenced by, but should not be confused with, cultural studies (Barker & Jane, 2016), a very broad, extremely varied and highly contested field of research recently tied up with global studies and – their omnivorous practitioners taking the whole shebang as their remit, not caring about the virtues of being disciplined (Goethe!) – global history.

Whereas ‘area’ is a vague concept, referring to a region of a country (e.g. Dutch Bible Belt, Northeast China) or of the world (e.g. Sub-Saharan Africa, Middle East) (Hobbs, 2016) or to a domain of interest (e.g. constitutional law, American football), ‘country’ (as distinct from ‘countryside’) stands for a nation–state, to which passport holders belong and which may be one’s mother- or fatherland. A country is a bordered stretch of land with politically organized people. Studies of

international relations (not to be confounded with global studies!) are studies not pertaining to countries but to the *relations between them*, though these relations can have direct bearings on a country's internal affairs and vice versa. Countries – like their inhabitants – can be classified by dozens of criteria.

Often relying on the advice given or the information provided by 'area/country experts', heads of state or government discuss with one another (mostly behind closed doors and seldom in their native language) burning issues and sign important documents, thereby determining the fate of tens or hundreds of millions of people. Looking at group photos taken on the occasion of international meetings like the ASEM, G20 and G8 (today G7 owing to Russia's suspension), however, one wonders whether each broadly smiling figure in the picture comprehends his/her colleagues' countries. When the American and Russian or Chinese presidents sit down and talk face to face with each other (via interpreters!), do they only exchange views, each thinking s/he is right? Or do they engage in a real dialogue, in a genuine conversation, each opening his mind to the argument(s) of and actively listening to the other?

A country is a complexity of complexities delineated by its boundaries (frontiers) and surrounded by its environment (foreign countries). It is not an aggregate (*Gesamtheit*) but an intricate, structured, history-molded, culture-soaked, goal-directed whole (*Ganzheit*), a set or *ensemble* consisting of a multitude of interdependent elements, which in turn are sets. Differently structured and distinctively patterned, its population is bonded together, has a sense of belonging, is proud of its way of life, and is – perhaps vaguely but still fundamentally – aware of the other, the *outside* world. With emergent properties, that are somehow irreducible to the properties of its constituent components (Humphreys, 2016),¹ each country – being a multi-faceted, poly-dimensional, multi-level and embedded whole – is characterized by top-down and bottom-up forces. At the same time, it exerts, and is affected by, various influences. Like living organism, it is surprisingly adaptive and constantly changing. In its innermost core, a country is held together by information, allegedly a form of energy.

A country is a unit or entity to be investigated interdisciplinarily, at different though linked levels. It is a dynamic system of dynamic systems (political, legal, economic, financial, social, educational, cultural etc.) that may be systematically compared with other dynamic systems/countries (Kuijper, 2016), all of them constituting the suprasystem euphemistically called 'Family of Nations' (UN). If the ambition is to comprehend a country, i.e. to (be able to) present an adequate summary, a *Zusammenfassung* of different accounts or visions of it, we need scientists with profound knowledge in a particular discipline and proficiency in communicating with neighboring 'T-shaped' experts, for no country student can be master of all pertinent sciences. Each and every country is an *individuum*, something

¹ In addition, visit <https://plato.stanford.edu/entries/properties-emergent>. Emergence was the topic discussed at the University of Colorado's 31st Boulder Conference on the History and Philosophy of Science, in October 2015.

that cannot be divided without losing its identity. Like the elaborate pattern of a carpet that cannot be seen by the ant, the convoluted pattern of a country cannot be perceived by the political, military, legal, or literary scientist, the linguist, economist, sociologist, ecologist, or other scientist working – alone or with equally cloistered colleagues – at a stovepipe faculty, school or department. A joint and concerted, well-managed scientific collaboration is needed. The accumulating insights gained in the burgeoning science of complex adaptive systems (Miller & Page, 2007; Youngman & Hadzikadic, 2014)² and the new science of networks (Barabási, 2016) will turn out to be useful throughout the exercise.

With the relatively new fields of artificial intelligence, data mining, machine learning, human-computer interaction, conceptual modeling,³ knowledge organization (KO), knowledge management (KM),⁴ soft computing,⁵ meta-analysis,⁶ and library and information science (LIS),⁷ expanding at an accelerating pace, and – thanks to tireless efforts of Sir Tim Berners-Lee – semantic web technologies increasingly enabling people to create data stores on the Web, build vocabularies and write rules for handling linked data, the important question arises whether computers could be more helpful in understanding the situation in and development of a country. The need for this is self-evident in the age of globalization and ‘convergence of knowledge’. The answer to this obvious question should be, resoundingly: ‘much more helpful’. For it is clear that considerable improvements on the work of Paul Otlet, the celebrated pioneer of library science (UDC), are now possible.

- Myriad books and journals on small, medium-sized or large countries currently in libraries are being digitized.⁸ These libraries could be searched computationally.
- Double/multiple counting having been avoided, books and journals on a particular country could be arranged by year/month of publication, or publisher.
- Indexes could be integrated; entries could be systematically cataloged by (sub)discipline or topic, and listed in order of frequency; technical terms or expressions could be clarified by relating/organizing them; contents could be synoptically outlined (schemes of concepts or keywords).

² See also the journal *Complex Adaptive Systems Modeling* (2013ff).

³ For conceptual modeling, which might improve scientific collaboration, visit <http://conceptualmodeling.org>.

⁴ For KM, see Bolisani & Handzic (2015); for KO, see Szostak et al (2016).

⁵ Soft computing (aka computational intelligence) differs from conventional (hard) computing in its tolerance of imprecision, uncertainty, partial truth, and approximation. Fuzzy logic, machine learning, evolutionary computation, chaos theory, and probabilistic reasoning are its main components.

⁶ Matsuoka *et al.* (2014) and Wilhelm & Kestler (2016) are recommended readings.

⁷ Rubin (2015) is probably the best book on this topic.

⁸ Visit https://en.wikipedia.org/wiki/list_of_digital_library_projects. The website of the Alliance of Digital Humanities Organizations (<http://adho.org>) should also be visited.

- Quantitative data could be collected and subjected to statistical analysis.
- The desirability and feasibility of conducting meta-analyses could be explored.
- National and personal (*curriculum vitae*, university education) data on authors, contributors or translators could be sifted out and mapped in an orderly way.
- A master bibliography could be alphabetically or thematically compiled and kept updated.
- IT connections could be made with existing databases somehow related to the country.
- Computationally visualized patterns (networks) or trends could suggest further research. This point is to be particularly emphasized, because many scientists and scholars are unfamiliar with, or inclined to underestimate, the possibilities of information visualization (Ware, 2013; Spence, 2014).⁹
- The cooperation between scholars and scientists from different countries or disciplines could be stimulated, and the coherence and integration of their work could be enhanced. In other words, by computationally collating data from different sources the potential for cross-disciplinary and cross-cultural exchanges to provide novel insights into how a country works and develops could be highlighted.

Computers are, and could be more, *helpful* in understanding countries, but on their own they will probably never be capable of such understanding. This may always remain the preserve of critical, creative, culture-bound and culture-building, history-making and history-moulded humans interacting with the machines. The reason for this still inherent deficiency of computers is a fundamental one. The real or potential space of discourse, the universal set including but not limited to the subsets we are accustomed to thinking in and speaking about is unknown. There is no meta-classification, no commonly agreed general theory of classification or clustering (Parrochia & Neuville, 2014), no master algorithm (Domingos, 2015). For the time being, the hyped ‘theory of everything’ (ToE), taken literally, is pie in the sky. At the current state of ontology,¹⁰ nobody knows how to sort or logically sequence (big) data without creating leftovers. No one knows the dimensions of cognition, how to organize or classify classifications, how to Rummikub them, how to fit all of them in a scheme, system or model, at least not yet, but the quest for the ultimate learning machine (the holy grail of computer scientists) goes on unabated.

The vexed ontological problem has to do with the – since the glorious years of the Vienna Circle (1918–1938)¹¹ somewhat neglected – question how the

⁹ In addition, explore <http://ieevis.org>.

¹⁰ Visit <http://ontologforum.org/index.php/OntologySummit2016>.

¹¹ Visit <http://www.univie.ac.at/ivc>.

sciences (usually divided into natural, social, human and formal sciences) hang together; a question hard to resolve, because there is a fault line, a perhaps unbridgeable chasm between (the sciences of) matter/nature and (the sciences of) mind/culture. Contrary to what Julien de la Mettrie, Patricia Churchland, Margaret Boden, Dick Swaab and many other scientists want(ed) us to believe, man is more than a machine. Being, according to Pindar (c.522–c.443 BC), but ‘a dream of a shadow’, man is, mysteriously, a part of and apart from nature. His actions (for example scolding and sacrificing) are not events like sneezing and stumbling (O’Connor & Sandis, 2010).¹² Francis Crick’s ‘astonishing hypothesis’ (1994), that consciousness is a property of matter, looks inescapable, but the particular mechanism of it remains, to say the least, obscure (Wilczek, 2015, p. 402, n. 320; Seager, 2016). Perhaps one day biochemists, molecular biologists, geneticists and neuroscientists will come out, having finally unravelled the great mystery, that is to say, having proved that there is no kingdom outside or beyond the realms of atoms and genes.¹³ Until then, however,¹⁴ we allow ourselves to remain doubtful if human beings can ever design and make a machine or robot able to be conscious, to ‘have a dream’, to philosophize, to theorize, to feel guilty, to love, to suffer, to revolt, to feel compassion or to create a work of art (Brockman, 2015; Grove, 2016).¹⁵ Although the differences between people are considerable (equality, particularly its relationship with liberty, having been a hotly debated issue), each individual is a duality, a coin with two sides. We have, like the Roman god Janus, two faces. Mind (*Geist*) and body (*Körper*), though inseparable from each other, cannot be identified with or reduced to each other (Medicus, 2013). We are not only embodied; we are also embedded, socially (*Mitwelt*) as well as environmentally (*Umwelt*). We are profoundly connected. ‘No man is an island entire of itself’, John Donne (1573–1631) aptly said.

Scientific collaboration (teamwork) will be greatly facilitated by e-science, the ‘fourth paradigm’, the shift in scientific research that unites theory, experimentation, and computation. E-science combines:

¹² In addition, visit <https://plato.stanford.edu/entries/action>.

¹³ Mukherjee (2016) tells a highly interesting story, but leaves the question we raise unanswered.

¹⁴ Last October, at their joint meeting in Oslo, the members of the International Council for Science and the International Social Science Council decided to pursue a merger between the two organizations. Unfortunately, the International Council for Philosophy and Human Sciences was conspicuous by its absence. To complete the magic *quartet*, representatives of the formal sciences (encompassing logic, mathematics, statistics, computer science, and systems science) should also have been invited. Prominent scientists from *all* disciplines should join the conversation. Having tuned up their instruments, *different* musicians, skilled professionals in their own right, play together as *one* ensemble, performing a symphony — under the *bâton* of a conductor.

¹⁵ In addition, visit <https://en.wikipedia.org/wiki/Robotics>, <http://journal.frontiersin.org/journal/robotics-and-ai>, www.ifr.org and <https://aeon.co/essays/how-ai-is-revolutionising-the-role-of-the-literary-critic>.

- vast quantities of digitized data (digital libraries),
- supercomputers running sophisticated software and capable of mapping the dynamics of science and technology,
- high-tech computer connectivity (cyber-infrastructure, cloud computing, semantic web).

IBM Watson is disrupting industries with cognitive computing (Russell, 2016). In collaboration with prestigious universities and research institutes, it is building machines to extend the power of human beings using them. Going beyond artificial intelligence, Watson is working with businesses, scientists, researchers, and governments to ‘outthink our biggest challenges’. All those involved in the ambitious project have high expectations. ‘Deep learning’, the felicitous concept introduced by Rina Dechter in 1986, is making giant strides. ‘Deep learning libraries’ such as Caffe, CNTK, ConvNet, DeepNet, EBLearn, Gnumpy, Keras, MxNet and Torch have come on the scene. At its peak, the world’s most powerful computer (residing in — China) can perform more than 125 quadrillion floating-point operations per second (Dongarra, 2016). There is currently serious talk of hypercomputation (Syroploulos, 2008) and qualitative computing (Chatelein, 2012, ch. 1), and quantum computing (predicted to dwarf conventional computing!) is said to be seen on the horizon.¹⁶

Be that as it may, ‘technological singularity’ (the point at which robots transcend human intelligence), the subject Raymond Kurzweil has been famously speaking about on several occasions (Shanahan, 2015), only *seems* to be near. While the problems of mankind are mounting dramatically, the struggle for political power is taking place on a global scale and whole civilizations are clashing, the *really* big challenge is: comprehending countries by means of computers, that is, harnessing the power of ever more advanced computers, not only to gather and process country-related information but also to organize and manage the growing corpus of country *knowledge* mainly available in university libraries.

People interested in the state of affairs in, or the developments of, countries such as China, Egypt, India, Iran, Israel, Japan, Korea, Mexico, Russia, South Africa, Turkey and the USA¹⁷ are overloaded with information from various sources that they struggle to filter down to what is essential or relevant, setting aside what is, for the time being, of minor, secondary importance. Indeed, it would be no exaggeration to say that the modern country scholar faces ‘*une mer à boire*’ – a virtual ocean available for drinking. To use another metaphor, s/he threatens to

¹⁶ Station Q is a worldwide consortium, led by Microsoft Research, for research into the mathematics and physics of topological quantum computation. Visit <http://news.microsoft.com/stories/stationq> and <https://stationq.microsoft.com>.

¹⁷ Europe is not, but – taken as a distinct set of historically interconnected nation states – can be considered to be, a country. Careful comparison with China (born out of the “Warring States”) and the United States of America (a federal republic composed of 50 states) will be revealing. In our view, Europe is essentially a *discors concordia*, rooted in *reason* (Greece), *faith* (Christianity) and *law* (Roman Empire).

be stuck in a quicksand of information. We firmly believe that he can be rescued by the application of fast developing systems-science (Nakamori, 2014) and the creation and intelligent use of digital libraries (Witten et al., 2016).

Cross-pollination, mutual fertilization among different disciplines is a requirement, indeed a sine qua non for the blooming of a hundred academic flowers. More specifically, in the study of countries, the best and brightest minds, using the smartest algorithms, should come together or be put together, physically or virtually, but under firm leadership anyway. This would be a science project, for which it may not be easy to find funding. Foundations such as the Alfred P. Sloan, Andrew W. Mellon, Bill & Melinda Gates, Calouste Gulbenkian, Carnegie, Ford, Kellogg, Li Ka Shing, Rockefeller and Volkswagen may be requested to make a grant. If they do, governments may follow their lead. We are thinking of the National Science Foundation (NSF) in America, and the European Research Council (ERC).

First and foremost, however, a ‘blue-ribbon commission’ on the state and future of area/country studies should be set up.¹⁸ This is, admittedly, a tall order, because the jobs of quite a few tenured professors would then be on the line, not to speak of the prestige of area/country pundits regularly appearing in the media (talk shows). The commission members may draw on the report of the renowned Gulbenkian Commission (chaired by Immanuel Wallerstein) that addressed the inadequacies of the social sciences and indicated the direction they should take in the next 50 years. The report, entitled *Open the Social Sciences* and published in 1996 by Stanford University Press, has stimulated debate around the world. The commission may be further inspired by reading the triennial *World Social Science Report*, flagship publication of the International Social Science Council (see above, footnote 14). These reports, written in consultation with UNESCO, ‘address important social science challenges, take stock of social science capacities and contributions, and make recommendations for future research, practice and policy.’¹⁹

The trick of the trade we advocate is to see similarities *and* dissimilarities, the same *and* the other, the universal *and* the particular, the whole *and* its parts, the one *and* the many.¹⁹ ‘**Connect the dots!**’ is the battle cry (to computer scientists and ‘country connoisseurs’) that permeates and summarizes this article. The connections can be direct or indirect, linear or nonlinear. Combining – in the spirit of the *Annales* School (Burguière, 2006) – the values of scientific disciplinarity and the virtues of total history, we are trying to break new ground in a troubled field of academic education and research, where social scientists are increasingly rubbing shoulders with human scientists but notably fail to find common ground, a scien-

¹⁸ In the USA, a blue-ribbon commission is a group of experts appointed, often by the government, to investigate a given question or a matter of controversy and give advice.

¹⁹ Explore http://www.informationphilosopher.com/problems/one_or_many. To drive our point home, both the proponents of nationalism and the champions of a supranational union of Europe fail to see the whole *and* its parts. Consequently, the ‘dialogue of the deaf’ continues.

tific view they could share. Rethinking area or country (China) studies in a global context, we attempt to redesign, renew and uplift them by stressing the need for cross-disciplinary (as distinct but not separated from international) research and pleading for the use of the latest insights of computer scientists (Hey & Pápay, 2015; Merritt, 2016; Copeland et al., 2017). The garment of the studies, which have a long pedigree,²⁰ is old-fashioned and worn-out. Patching and darning will not be sufficient anymore. A complete renewal is urgently needed.

Area/country studies should be planned and executed on a project basis. To this end, advice may be gained from the International Centre for Complex Project Management (ICCPM), a non-profit organization that seeks to translate research into the effective management of complex dynamic, poly-dimensional, multi-tiered and embedded systems into practical solutions in different domains.²¹ The road ahead may be long, bumpy and slippery, but the panorama will be breathtaking. Surely there is a way, if and when there is a will, if and when scientists stop striving to become all-purpose researchers, stick to what they are really good at (mindful of the proverbial cobbler) and wholeheartedly and without reservation endorse our proposal to collaborate and team up with one another,²² i.e. to embark on a cooperative joint venture (CJV), to play joyfully together like a musical ensemble.²³ The stakes are high, higher than many people may care to think!

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²⁰ Area/country studies started to grow in the age or era of discoveries/explorations that, as tends to be conveniently forgotten, has led to the age of globalization, the object of some protest.

²¹ Megaprojects, characterized by vast complexity (especially in organizational terms), large investment commitment and long-lasting impacts, are always *managed*. For an impressive list of megaprojects, visit https://en.wikipedia.org/wiki/List_of_megaprojects.

²² For interdisciplinarity, see the special issue of *Nature*, 7569, September 17, 2015. For the closely related subject matter of unity of science, visit <https://plato.stanford.edu/entries/scientific-unity> and see the Springer book series, edited by Shahid Rahman and John Symons, *Logic, Epistemology, and the Unity of Science* (2004ff). Let us not forget: philosophy was once thought to stand for KO, for the systematic unity of the sciences.

²³ Musical ensembles vary in their number of participants.

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