

Sharing Our Heritage to Shape Our Future

How Effective Are Multi-User Sharing Platforms in Supporting Collaborative Visioning for the Future, and Why is Heritage Centre-Stage?

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Abstract—This is a position paper about heritage and futures that the authors present for discussion to set the stage for a subsequent analysis of the topic supported by statistics and formal proofs. In social eco-informatics, a significant, challenging, not yet solved problem comes from the fact that the global Internet community is entering the age of collaborative and generative design: not of a central object, but of complex systems. People are looking around them, spotting patterns of connection, extrapolating as trends converge, questioning the implications, and coming together in groups to reimagine the future. The recognition that we need to come together to shape our common futures does not just coincide with the rise of social media: it is thanks to social media that this consciousness has reached such scale. Now, social networking sites are being created with the intention to help people across the world talk about the future they want and co-design it. In this process, heritage, seen as the treasure trove of human experience, is found to be centre-stage. We do not know what the next generation will value and like, but we can display and discuss what humans valued and liked and why, using the results to make better decisions. The practice of sharing heritage can become the context and the method for collaborative design. This paper inquires how effective these new platforms are in shaping visions for the future, and what difference an emphasis on sharing heritage makes to their success. And, in conclusion, the paper underlines how comprehensive and systematic use of heritage (seen as the treasure of human experiences) becomes the key science for sustainable and dynamic innovation in the coming anthropogenic era, during which human activity is becoming the dominant influence – not only in climate and the environment, but also in the human genetic and epigenetic heritages evolutionary processes.

Keywords—multi-user sharing platforms; collaborative visioning for the future; heritage science

I. INTRODUCTION

We have entered the age of collaborative design, not of a central object, but of complex systems. People are looking around them, spotting patterns of connection, extrapolating as trends converge, questioning the implications, and coming together in groups to reimagine the whole, 'a crude look at the whole', as Murray Gell-Mann would say [1].

There is an on-going shift in consciousness beyond an individualist mindset towards greater awareness of the collective, connected nature of our lives in our global

Internet community. The understanding that “no man is an island” (John Donne, Meditation XVII) [2] is expressed in the ancient philosophy of the Tao – where human life is seen as “an integral feature of the world process, and not as something alien or opposed to it” [3]. But with the rise of liberalism, recognition of our interdependence became more an abstract theory than a lived experience: you might have known you were in tune with high-street trends, for instance, but believed it was a matter of personal choice, intoxicated with the idea of self-determination [4].

Today, things are different: we are confronted with the influence of wider forces shaping our lives on a minute-to-minute basis, thanks to the omnipresence of accessible and useful data, targeted advertising, and social media. Targeted communications and advertising run on the irony that people can be made to feel intimately known, *precisely because* their behaviours and interests can be mapped to wider trends and thereby anticipated. Behavioural researchers are asking “how modern collective behaviour may be changing in the digital age, including whether behaviour is becoming more individualistic, as people seek out exactly what they want, or more social, as people become more inextricably linked, even “herd like,” in their decision making” [5].

Some find the shift in our collective consciousness unnerving, as Cameron Tonkinwise, Director of Design Studies at Carnegie Mellon University, explains [6]:

I think everyone feels the disjuncture between what big data is telling us – “I discover that I am part of a data set through the ads in my buzz feed and the way they have been tailored to me” or literally an article saying “You are a Gen Xer and you have no healthcare” – and our phenomenological experience of the world.

In response to this rising awareness of the forces at play, communities are coming together to shape their future. It might be interpreted as a reassertion of collective agency [7]. They are going beyond the traditional work of consumer-focused design, which focuses on the relation of subject to object. Their focus is how communities relate to commonalities [8].

Similarly, designers—from brand strategists to web programmers—are putting user experience at the heart of their processes. They recognise that we cannot recreate systems—such as cities, food cycles, and community energy schemes—without the volition and participation of their

future users. The same goes for pensions, health plans, transport, and schools [9].

To reiterate, the recognition that we need to come together to shape our common futures does not just coincide with the rise of social media: it is thanks to social media that this consciousness has reached such scale. And so it is no coincidence that social sites are enabling people across the world to co-design their future spaces. The transition began with innovative companies recognising the opportunities in social media for co-creation [10]. But increasingly, communities of interest are collaborating on social platforms to take the design of their own futures in hand.

Take Visionmaker [11]: a New York-based platform that allows communities to rethink precise urban areas, projecting into the future. Individuals can select an area of the metropolis and a timeframe (for instance, Manhattan in 2050), and specify factors such as land use (from vegetable garden to street trees to retail complex), energy sources (e.g., waste-to-energy power plant), water source, storage and usage, and transport types. They can also select various 'precipitation events'—such as drought, or showers—and observe how their system fares. Crucially, designs can be shared and discussed with other visionaries or contributors.

Only some urban planners are thinking about what might social design sites, such as this, actually change. For an analogy, take the design of an energy efficient building. An architect can optimise natural light and ventilation all they like, but if the inhabitants choose to live with the curtains drawn for privacy and the lights on, the features are wasted. Similarly, our future will depend only in part on our external conditions: we must also design our future lifestyles.

This is something the creators of Visionmaker have worked into the fabric of their site: "Beyond changing the ecosystems of an area of interest, users are able to change the Lifestyle and Climate scenarios that inform their visions." A lifestyle scenario—the site explains—will affect the consumption and waste generation patterns of the people living in the area, as well as factors such as take-up of various modes of transportation, and subsequent energy use.

Communities are also establishing themselves around social platforms to design global systems, beyond the bounds of single geographies or industries. We might even paraphrase the Latin author Cicero in his famous quote—dated June 46 BCE—"if you have a garden and a library too, you are not missing anything" (*Si hortum in bibliotheca habes, deerit nihil*), saying "if you have a garden and a 'connection to the internet' too, you are not missing anything" [12].

One example of such a social platform, where humanity's garden meets its vital knowledge-sharing infrastructure, is 'The Future of Protein'. This online sharing site is at the heart of The Protein Challenge 2040: a consortium convened by Forum for the Future and involving the World Wildlife Fund, the Global Alliance for Improved Nutrition, Firmenich, Hersheys, Quorn, Target, Volac and Waitrose.

This is the first international innovation partnership to explore how we balance supply and demand of protein for a growing population, in a way that is affordable, healthy and good for the environment. The stakeholders are now sharing

their perceptions of change and their long-term implications via Forum's public trends-monitoring platform, the Futures Centre, in a topic hub called 'The Future of Protein' [13]. Users spot 'signals of change', from 'Nutrient shakes replace meal breaks in Silicon Valley' to 'Industry stakeholders call for debate on insects as food and feed'. They're also raising questions, such as 'What will it take to meet China's growing demand for pork?'

These questions converge around the theme of intangible cultural heritage. Can Westerners overcome their aversion to eating grubs? Will the attraction of meat continue to rise among Asia's growing middle class? Why are social mealtimes losing their value among tech entrepreneurs? Our assumptions about the world we want to create—its founding myths—are shaped by our cultures. In designing the future, we are always choosing the elements of our current culture that we want to carry forward with us. In this conscious or subconscious selection process, we are also designing what might be inherited by the future generations in terms of both active cultural politics and digitally archived latent legacy factors.

The paper is structured in nine sections (including this introductory one and the conclusion) followed by an acknowledgment of an epiphany and bibliographical references. Section 2 presents heritage as the treasure of human experience, which can pioneer a new science in the social media era. Then—after having introduced Singapore as a privileged view point in Section 3—some exemplary less privileged case studies are presented in the three following sections (Greece in Section 4, Syria in Section 5, and Rwanda in Section 6) to open the stage for Section 7 and Section 8 that propose a complex-network approach to heritage data analysis as the core methodology, with which heritage science can support multi-user sharing platforms in developing effective and sustainable collaborative visioning for the future. In the paper, it has been chosen to avoid a systematic review of online social media and platforms that could relate to the topic, because other conference papers are focusing on them in detail both in CENTRIC 2015 - The Eighth International Conference on Advances in Human-oriented and Personalized Mechanisms, Technologies, and Services and SOTICS 2015 - The Fifth International Conference on Social Media Technologies, Communication, and Informatics (Barcelona, Spain, November 15-20, 2015) [14].

II. HERITAGE: TREASURE AND FOUNDATION OF HUMAN EXPERIENCE

For the first time ever, our society has the technological capacity to organize and retrieve myriad records of human experience at any time and from any digitally connected place, and apply these elements of this treasure trove to any kind of future design process. We are able to select from the past and apply to the future in full consciousness that responsibility belongs only to those present, in their shaping of the past, and is heavily interdependent of the news flow. [15].

"Heritage poses the challenge of innovation in a new way: how does the new integrate with the old?" This was the

key question raised by Helga Nowotny (co-founder and former president of the European Research Council) in her keynote address at the 1st Singapore Heritage Science Conference on *Heritage science as a complex system: The embarrassment of complexity: A phase of transition?*. The conference was organized and chaired by Andrea Nanetti and Siew Ann Cheong at Nanyang Technological University Singapore for the Complexity Program and the School of Art, Design and Media (6-7 January 2014), to pioneer a new science of heritage, as a state-of-the-art multidisciplinary domain able to investigate and discover integrated action plans and solutions in response to, and in anticipation of, the challenges arising from cultural heritage issues in society. In this way, heritage is closely linked to the history and identity of communities [16].

This new science of heritage focuses on accessing, interpreting, conserving and managing cultural heritage. It takes into account knowledge and values acquired in all relevant disciplines, from arts and humanities (philosophy, ethics, (art-)history, economics, sociology and anthropology) to fundamental sciences (chemistry, physics, mathematics and biology), as well as computer sciences and engineering, and media studies. In fact, the 2nd Singapore Heritage Conference “Heritage and the Creative Industry”, held on 15-16 January 2015, wrestled with the tensions between age-old practices and our modern digital lifestyles. In particular, there was a sense that we might be losing our humanity, as our lives become more and more digital. In hearing experts—like Harold Thwaites in his keynote—talk about their past experiences, and draw from them creative inspirations for the future, one could realize that human qualities like ethics, empathy, identity, and spirituality are connective qualities that serve to bind people together. In short, to be human is to be connected to other humans, to our environments, and for some, to cosmic significance [17]. On that same note, significantly, Steve Dixon—in his talk given for the online international symposium *Art of the Networked Practice* chaired by Vibeke Sorensen and Randall Packer at the Nanyang Technological University Singapore for the School of Art, Design and Media on April 1, 2015—used the metaphor of existentialism to speak about commitment and engagement in contemporary networked practices [18].

The ethics of reporting current affairs has received much attention, but the emphasis has been on the present-day implications and the need to assume responsibility for past events: a stance shaped by notions of justice rather than an acknowledgement of any design agency in the practice of reporting itself. More attention is now due to the ethics of shaping the future, and the politics of heritage-selection as part of this. In this way, the social media experience is entering that same field of 'intangible cultural heritage' that UNESCO (and with it 153 countries) defines as [19]:

... the practices, representations, expressions, knowledge, and skills—as well as the instruments, objects, artifacts and cultural spaces associated therewith—that communities, groups and, in some cases, individuals recognize as part of their cultural heritage. This intangible cultural heritage, transmitted from generation to generation, is constantly recreated by communities and groups in response to their environment, their

interaction with nature and their history, and provides them with a sense of identity and continuity, thus promoting respect for cultural diversity and human creativity.

Thus, according to the UNESCO charter, the preservation of intangible cultural heritage requires the active collaboration of the people or community within which the heritage resides. This in turn requires protection of the processes that allow traditions and shared knowledge to be passed on to future generations, along with arts, science, problem solving and invention.

The 4th Singapore Heritage Science Conference (25-26 January 2016) will approach the interpretation of the nature of changes in intangible cultural heritage through the lens of complexity science: despite the fact that the roles of innovation and creativity in shaping the intangible cultural heritage of complex societies are not yet described in the literature, we believe that, in essence, these changes are voluntary human expressions of ingenuity. To build up a complexity science toolkit for incorporating innovation and creativity into the core processes of a living heritage, the role of multi-user sharing platforms will be crucial: these will both enable and build awareness of collaborative visioning for the future [20].

III. SINGAPORE AS A PRIVILEGED VIEW POINT

In Singapore this year (2015), the decision process for its future direction is very much a conscious one. Singapore was ‘born’ as a nation state 50 years ago, and has advanced largely (although not exclusively) to the plans of its first Prime Minister, the late Lee Kuan Yew. Because of the cultural dimension of urban planning—as addressed by Liu Thai Ker, former director in Singapore of the Urban Redevelopment Authority and now Chairman of the Centre for Liveable Cities in his lecture given on September 18, 2015, in the Chinese Heritage Centre at Nanyang Technological University Singapore—in a careful and attentive design, Singapore's urban development story offers not only a unique view point for an integrated engineered use of the built heritage but also an advantaged perspective for intangible cultural heritage appreciation [21]. In fact, many are now taking the opportunity to look another 50 years into the future. One sharing platform, Imagine2065, invites communities to redesign key social spaces. Among three spaces showcased, two are to be found on the map: Telok Ayer community centre and the youth centre *Scape. The third—the ‘mothership’—invites designs for online shared spaces, with various aims: to channel funding for social projects, to offer a safe space for pre-formed thoughts, to raise difficult questions, such as ‘Should new college graduates immediately get corporate jobs?’

Visions for both community centres illustrate the active process of heritage-design. Members of the Telok Ayer community call for “a living museum that reflects the organic and dynamic stories of the community” and “a gallery where community groups can showcase themselves”, while the youth centre is imagined as “a blank canvas for youths to express themselves”.

Imagine 2065 is the creation of The Thought Collective, a group of social enterprises with the shared aim to “build up

Singapore’s social and emotional capital” – beginning with young people. Founder Tong Yee explains [22]:

We truly believe that in any form of solution, if you do not understand the context, you are not going very far. If you look at a young person, you have to ask, ‘How do I give you the context that will allow you to be a much more strategic thinker and partner in the future?’

The need for young people to be at the heart of future developments has been powerfully advocated by one of Singapore’s most respected strategists, the former Foreign Minister, George Yeo, an early blogger and Facebook user. At the launch of his newly published collection of essays and public talks, Yeo observed a “much healthier” level of civic participation in Singapore today, and put it down to two factors: the Government “letting go” to some extent, and new technology like social media “allowing sunlight to break through”. He was referring to a speech he made in 1991, in which, as the Straits Times reports [23]:

He used the analogy of the state as a banyan tree, calling for it to be pruned to let the sun through so that the undergrowth - or civic society - will not be stultified.

George Yeo, in his new book, writes [24]:

As hierarchies give way to networks, it is younger members of society who adapt the most readily ... If we fail to engage and involve the young, the transition from a hierarchical to a network society will be a troubled one.

The ‘motive force’ for this transition, Yeo claims, is the digital revolution:

The new technologies unleashed by [it] enable better and higher forms of human organisation to emerge but not before old ones are brought down. The search for new pathways to that future is the story of today.

Heritage is at the heart of his understanding of that search. It was Yeo that persuaded the Chinese Chamber of Commerce to restore the Sun Yat Sen Villa, transforming it into a museum commemorating the founding father of the Republic of China, who visited Singapore nine times between 1900 and 1911 [25]. The restoration was not only a tribute to Singapore’s Chinese heritage, but a statement of Yeo’s intent to maintain strong economic ties with China in future. Yeo was also one of the founders of a project to revive Nalanda University, Bihar’s ancient seat of learning, and is now its new Chancellor, taking over from the Indian-American economist Amartya Sen, a fellow advocate of the power of debate and author of ‘The Argumentative Indian’ [26].

IV. GREECE: A CASE OF HERITAGE IN ACTION

Since 2008, after Wall Street imploded, Greece became the epicentre of Europe’s debt crisis. An article published by Suzanne Daley and Anemona Hartocollis in *The New York Times* in response to the Greek referendum of 5 July 2015 made the interesting claim that the ‘No’ was influenced by a “history of defiance”, founded in Greek history as illustrated here below in Figure 1.

The authors cite Nick Malkoutzis, the editor of *Macropolis. Greece in Perspective*, a political analysis

website [27], in saying: “It is true that deep in the Greek psyche is the idea of glorious resistance against all odds. Moments of defiance, he added, are “written into the conscience of every Greek”. Instances used to justify this understanding of the Greek psyche are handpicked from both history and mythology, from legends of women throwing themselves off cliffs to escape slavery, to the iconic figure of the Spartan king Leonidas remembered for his death at the Thermopylae, to Greek fighters blowing themselves to avoid being captured by the Ottomans in the 1800s [28].



Figure 1. Greek “No” to the Troika and king Leonidas’ legacy [29].

If Figure 1 shows a clear example of (ab)use of heritage to (emotionally) convey political statements, otherwise based on assumptions, Figure 2 shows the retired Greeks waiting to receive partial pension payments outside of a bank in Athens, who can hardly get relief by that “history of defiance” founded in Greek history, as described by Nick Malkoutzis. Our vision is that multi-user sharing platform can start to make the difference today in a strong collaboration between computer science, humanities, and news broadcasting tools (e.g., Apple News as firstly realised with iOS 9 in September 2015 [30], and Facebook Instant Articles [31]).



Figure 2. Photograph by Eirini Vourloumis for The New York Times.

The comparison between Figure 1 and Figure 2 provides a first example for what has been claimed here above in Section 3. Even if it is not a formal proof, yet, it shows the way towards its accomplishment: a comprehensive and systematic analysis and use of historical information would become here a key tool for sustainable and dynamic innovation in news broadcasting and appreciation. Let us think about a platform, which could automatically access the historical evidence and the many sub-sequential (politically and culturally informed/biased) interpretations related to the Spartan king Leonidas and visually match them with the key elements of Nick Malkoutzis' narrative and with the economic scenarios envisaged by the so called troika (European Commission, European Central Bank, and International Monetary Fund) using the methodology mentioned here below in Section 7.

The process of defining what is, and what has been, influences both our present day, our collective sense of the past, and our aspirations to the future. Our aspirations are formative, and therefore in shaping them, we also have a part in shaping the world to come.

The better we understand what's changing today, the greater chance we have of shaping the future we want. Futures practitioners (including the team at Forum for the Future) monitor the 'megatrends' shaping our lives—such as population growth, climate change and hyper connectivity—and collect signals of change: unprecedented instances of behaviours, technologies, designs and applications that could open new directions for current systems. These stories of ongoing and sudden change are used to create potential scenarios of different futures, so that organisations, sectors, industries or nations can make better decisions today.

Decisions are based on how we judge – both rationally and emotionally – various scenarios, and these judgements are based on assumptions of what is desirable and valuable. The stories we tell shape these assumptions. Today, some of the most influential storytellers—Disney, for instance [32]—condition young children to value riches over rags and conformity over difference: its happy endings are defined by wealth, marriage and conventional beauty.

Thus, if nations are founded upon narrative myths, and intergenerational repetition perpetuates the assumptions and values they contain, as demonstrated in 2011 by Caspar Hirschi [33], heritage can be understood as the system through which we—as communities, organisations and states—can choose these myths and share them.

Now we have the technology to implement a heritage-based better understanding of the future implications (on social, economic and environmental fronts) of the selections and (re)shaping of our mythical foundations. In the case of Greece, one of the most important outcomes of this approach—paraphrasing 90-year-old Jimmy Carter's interview with National Geographic—would be filling vacuums and things that governments do not do [34].

The vision is also to increase the participatory responsibility of citizens in the democratic processes of decision-making. The theoretical point has always been made both in philosophy and political science.

One could recall Plato's *Socrates' Apology*:

The unexamined life is not worth living (Ο δε ανεξέταστος βίος οὐ βιωτὸς ἀνθρώπῳ, 38a).

Life is not worth living without *ἐλεγχος/elenchus*, i. e., without examination, argument of disproof or refutation, dialogue; cross-examining, testing, scrutiny especially for purposes of refutation. Such is the Socratic elenchus, often referred to also as *exetasis* or scrutiny and as *basanismus* or assay [35].

One could recall August Wilson, who signed both the Declaration of Independence and the Constitution, preached startlingly democratic theories - more democratic than the ideas of any other delegate to the Constitutional Convention. In his oration at Philadelphia on July 4, 1788, celebrating the adoption of the Constitution of the United States, he said [36]:

You are responsible for the world that you live in. It is not the government's responsibility. It is not your school's or your social club's or your church's or your neighbour's or your fellow citizen's. It is yours, utterly and singularly yours.

One could recall the Greek composer Yorgos Tsangaris (1948-2008) [37]:

There is no time for yourself if you want to become a Man (Δεν υπάρχει χρόνος για τον εαυτό σου αν θέλεις να γίνεις Άνθρωπος).

But, it seems that only today we are having a new great opportunity: using heritage-based multi-user sharing platforms we could support collaborative visioning for the future and—as Marten Sheffer would say—"create safe operating space to avoid the loss of resilience that prepare the advent of crisis" [38].

V. SYRIA: FROM NEWS FEEDS TO MULTI-USER SHARING PLATFORMS

A key question today is about the support that technology and crowd-sourcing can offer to help us undertake the process of selecting and sharing our heritage collectively, as part of futures design.

One approach comes from News Deeply, an online media platform that aims to offer readers the cultural, political and historical context to current affairs, revalorising a systemic understanding of events – as opposed to the exclamatory hype of the tabloid press. It began with a news site focused exclusively on Syria [39], which features a timeline, conflict map and detailed sections covering 'the basics' since the March 2011 uprising, the regime, an understanding of the Islamic State of Iraq and the Levant/ash-Sham/Syria (better known as ISIS), a summary of key global players, and a reading room of leading thinkers.

Two elements, arguably, are missing: one is a section elaborating the heritage of Syria. This would enable the reader to conceptualise the scale of loss – both in terms of deepened empathy for the people and in imagining the damage to societal cohesion, as well as the loss of sites of cultural significance. The other missing element is the opportunity for users to contribute their own observations.

They can currently comment on shared stories, but not share their own.

Were these two desirable functions to be combined—creating a section in which users could contribute their understanding of Syria’s pasts (Greek-Roman-Byzantine, Arab, Crusader, Ottoman, French, Independent) as well as the current civil war started in 2011—it would create a rich opportunity for discussion as to ways forward. Could the careful use of taxonomy in tagging the stories shared even allow users to study patterns of values, as represented in the heritage, and relate these to desired social outcomes? Our solution is proposed here in Section 7 and Section 8.

VI. RWANDA: A SHARED APPROACH TO NARRATIVE INTERPRETATION

Heritage as a means for collaborative design demands a shift away and a reorganization of traditional disciplines (history, anthropology, archaeology, etc.) towards a new awareness of collective sharing and interpretation.

An example of what this new awareness might draw upon in its development is offered by Dave Snowden, Founder and chief scientific officer of Cognitive Edge, with SenseMaker® [40], which allows people to act as their own ethnographers for complex analysis of their lived experiences.

Of course, anthropologists have always collected stories from the studied group; the difference in Snowden’s approach is that the people not only share their experiences but also index them. His system means that each individual does not only have a voice but also the means of interpretation.

It is essentially a software tool that allows users to contribute a narrative and then asks them a set of questions to analyse what they have shared. This data is used to map their interpretation of their story against other users’ interpretations of their own stories. The framework for this map might be a simple triangulation, or a grid. The SenseMaker® site explains:

The output of SenseMaker is statistical data backed up by explanatory narrative. This means that advocacy is an integral part of the system. Numbers on their own appear objective but are not persuasive; anecdotes on their own may be persuasive but are not objective. [...] “Instead of asking, “How do we create a culture of X?” we ask “How do we create more stories like this and fewer stories like that?”

Crucially, in sensitive contexts and for difficult subject matter, the interpretation can be made public and mapped, without individual’s story being revealed. The system also allows people to share their experience in their own language and yet offer data that can be used widely, without costly translation. This enables the system to operate at significant scale – potentially even national or global.

To give an example, GirlHub—a Nike Foundation project—ran a pilot project with SenseMaker® to study the impact of its 12+ Young Empowerment Programme in Rwanda [41]. In Figure 4, the SenseMaker® matrix maps the descriptions caregivers gave of the intentions and actions of girls in the stories they shared. Caregivers were asked to

share a true story about an experience in a girl’s life. They were then asked whether, in their story, the girl wanted to do something, did not want to do something [mapped across the horizontal axis] did something, or did not do something [mapped on the vertical axis]. The researchers then focused their interest upon those stories where ‘wanted to do something’ met ‘did something’, to discern patterns that could lead to recommendations for future empowerment. For instance, they noted that, “The areas where girls and parents were viewed as having the most decision-making ability were education and health”.



Figure 3. Pilot study conducted in 2015 in Rwanda by GirlHub.

A shared approach to narrative interpretation calls for the application of such a system for personal histories to develop a new collective heritage mapping as a foundation for possible sustainable futures as presented in the two following Sections 7 and 8.

VII. A COMPLEX-NETWORK APPROACH TO HERITAGE DATA ANALYSIS

In the words of John H. Holland [42] and William Brian Arthur [43], complex systems are characterized by their dependence on contingencies; for example, event B happens because event A happened in the past, but not event C. These contingencies, also called path dependences, make the study of global histories highly bewildering, because of the concatenation of conditional probabilities [44].

Seeing history not as a linear progression of events, but as a complex, nonlinear network of contingencies gives us the correct frame of mind to respond to the issues raised by William A. Green in his article on world history periodization [45]:

Periodization is rooted in historical theory. It reflects our priorities, our values, and our understanding of the forces of continuity and change. Yet periodization is also subject to practical constraints. For pedagogical reasons, world historians must seek reasonable symmetry between major historical eras despite huge discrepancies in the availability of historical data for separate time periods and for different areas of the world.

It also addresses to the issues raised by microhistory [46], which studies well-defined single historical units/events to ask—as defined by Charles Joyner—“large questions in small places” in contrast with large-scale structural views [47]. The most famous example being Carlo Ginzburg’s *Il*

formaggio e i vermi first published in Italian in 1976 [48]. In the book, which is considered to have initiated this research field in historical studies, the author wrote:

The historians have long since learned that history is the history of men, not of the "great," and the closer you get up to everyday reality the better you decipher the past, and then grasp the sense of immediacy with the problems, the connections with today's present, i.e., history.

The solution proposed by Andrea Nanetti and Siew Ann Cheong to delimit time periods is to move away from focusing on main individual events, but to look instead at intensity in the flow of events in societies' natural nonlinear perception of time.

Figure 3 (left) shows the six W's of a narrative, and how they relate to the key actors, key events, key periods, key locations, key factors, and key actions in historical analysis. In Figure 3 (right) different link types (blue, green, and red, and possibly others as well) of socio-political relations (trade, diplomacy, conflicts, etc.) connect historical actors (a, b, c, d, e, f, g, h, i, j) in a complex network, from which, among other higher-level information, we can extract the power blocs shown here below as the clusters A and B.

Concerted effort and funding are now needed to enable such projects to proliferate.

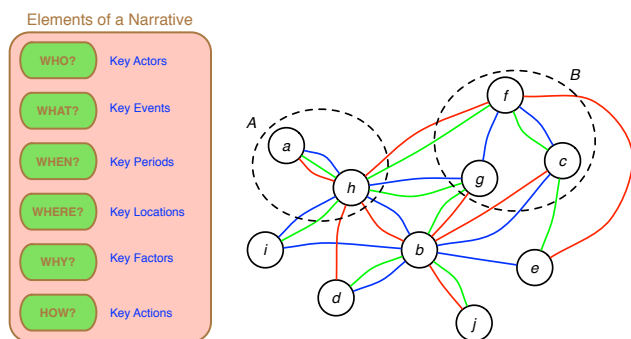


Figure 4. The 6 W's of a narrative as a complex network

Marten Scheffer's research team recently used eco-systems as a showcase to point out that complex systems theory associates regime shifts as critical transitions with higher intensities of events [49]. Building on his insights, Siew Ann Cheong and Andrea Nanetti decided to mine the complex network of intercontinental trade, diplomacy, conflicts and other interactions among cities, nations and continents during Late Middle Age and Early Renaissance (1205-1533 CE) to identify time and geography of such transitions. This time-resolved complex-network approach to historical analysis allows to automatically identifying the *key actors* driving a specific key event. At present, expert historians painstakingly piece together the key events, and thereafter examine the main actors in such events. With that method, this identification can be automated and different definitions of key actors adopted [50].

This methodological approach can easily move from the historical landscape to the social media historical memory, as

intangible cultural heritage of humanity (see the UNESCO definition in Section 2).

VIII. ENGINEERING SOCIAL MEDIA HISTORICAL MEMORY AS INTANGIBLE CULTURAL HERITAGE OF HUMANITY

Engineering Historical Memory [51] is an experimental methodology and an on going research project for the organization of historical data in the digital age, that Andrea Nanetti theorized when he was Visiting Scholar at Princeton University in 2007, and further developed it when he was Visiting Full Professor at the University of Venice Ca' Foscari in 2012. Since 2013 he is carrying on the research at Nanyang Technological University Singapore at the intersections of humanities and data science/visualisation. The project was awarded best conference paper at 2013 Culture and Computing (Kyoto, Japan), and has been funded by Microsoft Research and Microsoft Azure (2014-2016).

Engineering Historical Memory is helping to develop heritage studies as a science in response to, and in anticipation of, the exponential growth of knowledge—encoded/embody in complex interactions of written, pictorial, sculptural, and architectural records, oral memories, practices, and performed rituals—in our *glocal* society (i.e., reflecting or characterized by both local and global considerations). What sets it apart from other approaches is a focus on developing and applying computationally intensive techniques (e.g., pattern recognition, data mining, machine learning algorithms derived from other disciplines, and visualization solutions) to achieve this goal. It entails the creation and advancement of databases (relational, graph, and hybrid), algorithms, computational, statistical, and complexity techniques and theories to solve formal and practical problems arising from the study, interpretation, conservation, and management of cultural heritage data in the context already presented in Section 2.

The basic problem has been clearly framed by Larry Page in his TED's talk *Where's Google going next?* given on 21 March 2014 [52]:

Google mission is to *organise* world's information and make it universally *accessible* and *useful*. People keep on asking: "Is it what you guys are still doing?" I think at it on myself and I am not quite sure about what to answer. Actually, when I think about *search*, it is such a deep thing for all of us: to really understand what you want, to understand the world's information... And we are still very much in the early stages of that. And it is totally crazy! We have been out for 15 years already, but it is not at all done.

In September 2015, Apple welcomed to its News App using the following advertisement [53].

The best stories from sources you love, selected just for you.
The more you read, the more personalised your News becomes.

To start the application the user is required to select a list of preferred sources. But there is no tool to cross the information and validate the single news.

On 23 September 2015, Wired published an article by Julia Greenberg referring to Facebook 360 videos in News Feed [54].

"Over time the types of stories that people want to tell each other and the types of content they want to share with each other will get richer and more immersive" Facebook's VP of product Will Cathcart says. "So just as we have seen an evolution from text to photos, we are seeing a pretty big jump to video in the last couple of years. We think that's only going to continue.

From a media perspective, the challenge is to have a system that works on a visual base to be tested in two parallel experiences: one with the scholars (historians and art historians interested in data mapping and visualization) to investigate as deeper as possible at a global cultural scale the concepts of 'provenance' and 'validation' of the sources and their interpretations; and another in the social media to approach the actual shift from texts, to photographs, videos, and 360 immersive spaces in the community sharing processes.

IX. CONCLUSION AND FUTURE WORK

It is true, for the first time in history all peoples on earth have a common present: no event of any importance in the history of one country can remain a marginal accident in the history of any other. Every country has become the almost immediate neighbour of every other country, and every man feels the shock of events, which take place at the other side of the globe. But this common factual present is not based on a common past and does not in the least guarantee a common future. Technology, having provided the unity of the world, can just as easily destroy it and the means of global communication were designed side by side with means of possible global destruction

(Johanna Arendt 1906-1975, *Man in Dark Times*, 1955/1968, p. 83)

As observed in Sections 3 to 6, the potential to share, select and index our heritage, and to use this as a tool in designing our future, has reached unprecedented scale. Heritage is considered as the *thesaurus* of human experiences (i.e., the comprehensive storage system of human knowledge and values) embedded in human artefacts and in nature as interactively experienced by different cultural communities, and biologically perceived by the human brain. In this way, heritage issues become the key-factor for innovation in the Anthropocene, the incoming era, during which human activity is becoming the dominant influence not only in climate and the environment but also in the human genetic and epigenetic heritages evolution.

In Section 7—following the solution proposed by Andrea Nanetti and Siew Ann Cheong in 2013—, has been proposed to use a complex-network approach to heritage data analysis as the core methodology, with which heritage science can support multi-user sharing platforms in developing effective and sustainable collaborative visioning for the future. We do not know what the next generation will need, value, and like, but we can display and discuss what humans needed, valued, and liked—and the reasons why they did it—using the results to make better decisions. The following Section 8 demonstrated how social media could become the repository of possible solutions, whether organized, treated, and investigated through the lens of a new upgrade of the methodologies developed by the century-old scholarly tradition of historical sciences.

In that way, this contribution can be used for theory and/or practice to develop ICT tools able to aggregate

heritage data into news and social media platforms in order to increase the awareness of existing connections and possible future scenarios in a more scientific way.

All in all, heritage is not about the past but about a shared future: we believe that sharing and discussing our heritage via multi-user sharing platforms can support collaborative visioning for the future and towards a new art and science of living together on Earth.

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REFERENCES

- [1] Available from <http://www.bu.edu/pardee/9-27-05/> [accessed on 12 October 2015]. See: J. H. Miller, *A Crude Look at the Whole: The Science of Complex Systems in Business, Life, and Society*. New York: Basic Books, 2016.
- [2] J. Donne, "Meditation XVII". [Online]. Available from: <http://www.online-literature.com/donne/409/> [accessed on 12 July 2015].
- [3] See the Introduction in A. Watts, *Tao: The Watercourse Way*. New York: Random House, 1975.
- [4] J. Christman, "Liberalism and individual positive freedom," *Ethics*, vol. 101, no. 2, January 1991, pp. 343–359.
- [5] R. A. Bentley, J. M. O'Brien, and A. W. Brock, "Mapping collective behavior in the big-data era." *Behavioral and Brain Sciences*, vol. 37, issue 1, February 2014, pp 63–76.
- [6] Anna Simpson, Interview with C. Tonkinwise [conducted on 15 April 2015," unpublished.
- [7] H. Haugh, "Community-led social venture creation," *Entrepreneurship Theory and Practice*, vol. 31, issue 2, March 2007, pp. 161–182, doi:10.1111/j.1540-6520.2007.00168.
- [8] K. Alexiou, G. Alevizou, T. Zamenopoulos, S. de Sousa, and L. Dredge, "Learning from the use of media in community-led design projects," *Cultural Science*, vol. 8/1, Jan. 2015, pp. 30–40.
- [9] G. Voss and N. Carolan, "User-led design in the urban domestic environment," *Journal of Urban Technology*, vol. 19, no. 2, 2012, pp. 69–87. Available from: <http://www.unialliance.ac.uk/blog/2015/02/12/changing-healthcare-for-the-better-through-user-led-design-research> [accessed on 12 July 2015].
- [10] From Social Media to Social Product Development: The Impact of Social Media on Co-Creation of Innovation. [Online]. Available from: http://papers.ssrn.com/sol3/Papers.cfm?abstract_id=1975523 [accessed on 12 July 2015].
- [11] Available from: <https://visionmaker.us/nyc> [accessed on 12 July 2015].
- [12] M. Tulli Ciceronis, *Epistularum ad Familiares, Liber IX, Ep. IV*.
- [13] Available from: <http://www.thefuturescentre.org/topic-hubs/protein> [accessed on 12 July 2015].

- [14] Available from: <http://www.iaria.org/conferences2015/ProgramCENTRIC15.html> and <http://www.iaria.org/conferences2015/SOTICS15.html> [accessed on 26 July 2015].
- [15] A. Nanetti, S. A. Cheong, and M. Filippov, "Interactive Global Histories. For a new information environment to increase the understanding of historical processes," in *Proceedings of the International Conference on Culture and Computing 2013* (Kyoto, Ritsumeikan University, Sept. 16-18, 2013). Los Alamitos, CA: IEEE Computer Society, 2013, pp. 104–110, doi:10.1109/CultureComputing.2013.26.
- [16] The complete videorecorded conference is available from: <http://www.paralimes.ntu.edu.sg/Pages/Home.aspx>.
- [17] The complete videorecorded conference is available from: <http://www.paralimes.ntu.edu.sg/NewsnEvents/HeritageandtheCreativeIndustry/Pages/Video%20Gallery.aspx>.
- [18] The complete videorecorded symposium is available from: <http://oss.adm.ntu.edu.sg/symposium2015>.
- [19] UNESCO Charter for the Safeguarding of Intangible Cultural Heritage, 2003, Art. 2.
- [20] A. Nanetti and S. A. Cheong, "Complexity Science and Man-Heritage-Landscape Systems. A Heritage Impact Factor Theory", in *Proceedings of the 3rd International Conference on documentation, conservation and restoration of the architectural heritage and landscape protection, ReUSO 2015*, organized by the School of Engineering Building at the Polytechnic University of Valencia, in association with the School of Architecture at the Polytechnic University of Madrid, the Architectural Department in the University of Florence, the Department of Civil Engineering and Architecture of University of Pavia, Forum Unesco-Universidad y Patrimonio, and the Instituto Universitario de Restauración del Patrimonio (Valencia, October 22-24, 2015), unpublished.
- [21] T. C. Khoo, Chief Editor, *Built by Singapore: from Slums to a Sustainable Built Environment*. Singapore: Centre for Liveable Cities, 2015 (Singapore Urban Systems Studies Series).
- [22] Available from: <http://www.thefuturescentre.org/signals-of-change/2951/crowd-sourcing-singapore-s-future-spaces> [accessed on 12 July 2015].
- [23] Available from: <http://www.straitstimes.com/politics/singaporeans-more-vocal-today-bringing-new-tensions-and-possibilities-george-yeo> [accessed on 12 July 2015]. Yeo calls himself a Taoist, referring to "the larger currents at play ... to which we are subject" (citation in George Yeo on Bonsai, Banyan and the Tao, A. I. Latif and H. L. Lee, Eds., Singapore: World Scientific, p. 3, 2015).
- [24] A. I. Latif and H. L. Lee, Eds., *George Yeo on Bonsai, Banyan and the Tao*. Singapore: World Scientific, 2015, p. 5.
- [25] Available from: https://en.wikipedia.org/wiki/Sun_Yat_Sen_Nanyang_Memorial_Hall [accessed on 12 July 2015].
- [26] Available from: http://lkyspp.nus.edu.sg/wp-content/uploads/2013/04/pa_tk_ST_George-Yeo-A-Man-for-All-Seasons_090511.pdf [accessed on 12 July 2015].
- [27] S. Daley and A. Hartocollis, "Greek 'No' May Have Its Roots in Heroic Myths and Real Resistance," *New York Times*, 6 July 2015, p. 45.
- [28] Available from: <http://www.macropolis.gr>.
- [29] Available from: https://www.flickr.com/photos/helmet_13/19441895492 [accessed on 20 September 2015].
- [30] Available from: <http://www.apple.com/ios/?cid=wwa-us-kgw-features>.
- [31] Available from: <https://instantarticles.fb.com>.
- [32] A. Simpson, *The Brand Strategist's Guide to Desire*. London: Palgrave Macmillan, 2015, pp. 55–56.
- [33] C. Hirschi, *The Origins of Nationalism: An Alternative History from Ancient Rome to Early Modern Germany*. Cambridge: Cambridge University Press, 2011.
- [34] "My Work Since the White House and My Legacy [Interview with Jimmy Carter]," *National Geographic*, vol. 228, no. 4, October 2015, p. 11.
- [35] G. Vlastos, "The Socratic Elenchus," *Oxford Studies in Ancient Philosophy*, vol. 1, 1983, pp. 27–58.
- [36] Available from <http://www.nccs.net/the-responsibility-of-citizens.php> [accessed on 25 September 2015].
- [37] Available from: http://www.antiwarsongs.org/do_search.php?idartista=12288&lang=it&stesso=1 [accessed on 25 September 2015].
- [38] M. Sheffer et al., "Early-warning signals for critical transitions," *Nature*, vol. 461, 3 September 2009, pp. 53–59, doi:10.1038/nature08227.
- [39] Available from: <http://www.syriadeeply.org>.
- [40] Available from: <http://cognitive-edge.com/sensemaker> [accessed on 12 July 2015].
- [41] Available from: <http://old.cognitive-edge.com/wp-content/uploads/2015/04/GH-SenseMaker-brief.pdf> [accessed on 12 July 2015].
- [42] J. H. Holland, *Emergence: From Chaos to Order*. Oxford: Oxford University Press, 2000.
- [43] W. Brian Arthur, *Increasing Returns and Path Dependence in the Economy*. Ann Arbor: University of Michigan Press, 1994.
- [44] P. Bak and M. Paczuski, "Complexity, contingency, criticality," *Proceedings of the National Academy of Sciences of the United States of America*, vol. 92, 1995, pp. 6689–6696.
- [45] W. A. Green, "Periodizing World History," *History and Theory*, vol. 34, issue 2, May 1995, pp. 99–111 (p. 99, for the quotation). See also the larger work by the same W. A. Green, "Periodization in European and World History," *Journal of World History*, vol. 3, 1992, pp. 13–53, and the paper by J. H. Bentley, "Cross-Cultural Interaction and Periodization in World History," *The American Historical Review*, vol. 101, no. 3, June 1996, pp. 749–770.
- [46] C. Ginzburg, "Microhistory, two or three things that I know about it," in *Idem, Threads and Traces*. Berkeley: University of California Press, 2012, pp. 193–214.
- [47] C. W. Jovner, *Shared Traditions: Southern History and Folk Culture*. Urbana: University of Illinois, 1999, p. 1.
- [48] C. Ginzburg, *Il formaggio e i vermi. Il cosmo di un mugnaio del '500*. Einaudi: Torino, 1976. In English: *The Cheese and the worms: the cosmos of a 16th-century miller*. Transl. by J. Tedeschi and A. Tedeschi. Baltimore: Johns Hopkins University Press, 1980.
- [49] M. Scheffer et al., "Early-warning signals for critical transitions," *Nature*, vol. 461, no. 7260, 2009, pp. 53–59.
- [50] A. Nanetti, A. Cattaneo, S. A. Cheong, and C.-Y. Lin, "Maps as Knowledge Aggregators: from Renaissance Italy Fra Mauro to Web Search Engines," *The Cartographic Journal*, vol. 52, issue 3, August 2015, pp. 1–10.
- [51] Available from: <http://ehmazure.cloudapp.net>.
- [52] Available from: https://www.ted.com/talks/larry_page_where_s_google_going_next?language=en.
- [53] Available from: <http://www.apple.com/news>.
- [54] Available from: <http://www.wired.com/2015/09/facebook-launches-360-video-immersive-star-wars-clip>