Modelling Societal Collapse Workshop Report
University of Cambridge – Centre for the Study of Existential Risk
28th February 2018

Introduction

Leo Tolstoy's *Anna Karenina* begins: "Happy families are all alike; every unhappy family is unhappy in its own way." In this workshop, rather than solely discuss a particular case-study or model of collapse, we considered the general question of whether it is possible to compare collapses and build some sort of predictive model, or whether each collapse is "unhappy in its own way".

In *Collapse*, Prof. Diamond surveys different historical examples of societal collapse involving an environmental component, and identifies five common factors. When comparing collapses, attempts such as these to 'abstract' – identify common factors or build formal models – have been criticised by those who argue for the specificity of each event.

However, abstraction also increases predictive power. If we cannot say anything in common about collapses, it is harder to predict or prevent them. As we would like to be able to help predict and prevent collapse, a sensible starting point is the question: can we model collapses?

The University of Cambridge's Centre for the Study of Existential Risk is dedicated to the study and mitigation of risks that could lead to human extinction or civilisational collapse. Ultimately, we would like to know: if collapses are predictable, what is the likelihood we will have one? Can be build a warning system? Are there recommendations to communicate to policy-makers?

The workshop was structured around short 'provocations' from four of the participants – as prompts for structured discussions and group work comparing a number of historical examples of societal collapse to consider common factors and possible models. There were presentations from:

- Dr Adrian Currie
- Dr Shahar Avin
- Asaf Tzachor
- Prof. Lewis Dartnell

This workshop report covers these presentations, pertinent elements of the discussion, and a partial list of suggested readings.

Participants:

- Jared Diamond, Professor of Geography, University of California, Los Angeles
- Bill Sutherland, Miriam Rothschild Professor of Conservation Biology, University of Cambridge
- Partha Dasgupta, Frank Ramsey Professor Emeritus of Economics, University of Cambridge
- Bhaskar Vira, Professor of Political Economy, University of Cambridge
- Aled Jones, Professor and Director of the Global Sustainability Institute, Anglia Ruskin University
- Augusta McMahon, Reader in Mesopotamian Archaeology, University of Cambridge
- Kristen MacAskill, Senior CEM Programme Manager, Engineering, University of Cambridge

- Jen Hoyal Cuthill, EON Postdoctoral Research Fellow in Palaeobiology, University of Cambridge
- Anders Sandberg, Senior Research Fellow, Future of Humanity Institute, University of Oxford
- Lewis Dartnell, Professor of Science Communication, University of Westminster
- Asaf Tzachor, Head of Strategy and Sustainability at Israel's Ministry of Environment (on leave) and Goldman PhD Scholar, UCL
- Cambridge Conservation Initiative (Samir Whitaker, Alison Johnston, Judith Schleicher, Nancy Ockendon, Gorm Shackelford)
- Centre for the Study of Existential Risk (Seán Ó hÉigeartaigh, Haydn Belfield, Shahar Avin, Lalitha Sundaram, Adrian Currie, Julius Weitzdörfer, Tatsuya Amano, Simon Beard)

Adrian Currie

Currie, A. (2018). Existential Risk, Creativity & Well-Adapted Science. *Studies in the History & Philosophy of Science.*

Adrian Currie, a philosopher of science, discussed 'wild' systems and their relevance to the study of collapses.

A 'wild' system is characterized as being (compared to competing systems) high in both 'interference' and 'noise'. **Interference** concerns the interdependence of the system's parts and their effects: it is difficult to determine the causal powers of particular components in systems of high interference. **Noise** concerns our capacity to isolate a system: it is difficult to predict the behaviour of a target system which is open to erratic shocks from without. Wild systems—those high in interference and noise—are difficult to study because we cannot isolate and examine their components separately, and their behaviour is often irregular due to exogenous effects.

Currie suggests that cultures and collapses are often 'wild' – it is difficult to isolate their components from one another, and difficult to isolate the system from exogenous effects. If that is the case then they will be difficult to model and predict.

Participants questioned which collapses have not been 'wild' and suggested that some island collapses – such as those examined by Diamond or Tzachor (see below) – may not have been.

Shahar Avin

Avin, S., Wintle. B., Weitzdörfer, J., Ó hÉigeartaigh, S. S., Sutherland, W. J., Rees, M. (2018). Classifying Global Catastrophic Risks. *Futures.*

Shahar Avin presented a framework developed by researchers at the Centre for the Study of Existential Risk to classify global catastrophic risks. The framework can help identify systematic failures and therefore go beyond just providing a list of individual risks.

This classification framework also offers a tool for analysing collapse, according to three key components: (i) a critical system (or systems) whose safety boundaries are breached, (ii) the mechanisms by which this breach might spread and affect the majority of the population, and (iii) the manner in which the population might fail to prevent or mitigate both (i) and (ii).

Participants questioned whether this framework could be applied to case-studies of collapse, such as Rapa Nui and Iceland.

Asaf Tzachor

Tzachor, A. (2018). Authors of their own calamities: What kind of science is missing in policy, and how poor governance leads to social collapse? Four natural experiments and a general theory. *Working Paper.*

Asaf Tzachor presented his PhD research on social decline and collapse.

Tzachor argued that existing explanations of decline and collapse are unsatisfactory for a range of reasons. Some focus on pre-historic civilizations, or on pre-industrialized societies, or on city-states, or are limited in scope. Some capture only some explanatory variables of societal decay, or define progress simplistically in terms of economic performance. Accordingly, most theories are unsuitable for political analysis today and cannot offer advice to governments on how to avert decline and forge a path towards sustainability.

Drawing on the Capital Theory Approach to Sustainability, and an analysis of state failure and societal decline in the 20th Century, Tzachor argues that preventing societal decline (of living standards and wellbeing) requires governance of economic, natural, human and social capital stocks.

Working definition of social decline

Social decline is synonymous in this work with "unsustainable development", it is the opposite of social progress, and is defined as a gradual failure of functions of social systems, or as a degradation in the quality-of-services and access-to-services provided by social systems: education, employment, safety and security, among others.

It could be measured as a drop in a single wellbeing dimension, such as healthy life years (i.e. death rates); as a decline in overall human development (HDI); as a decline in social progress (the "Weighted Index of Social Progress"); as a decline in GDP over time, or as some combination of the four.

Case-studies of capital stock depletion and social decline in five islands, 1960s-2010s.

- Nauru: natural, economic and human stocks
- Sri Lanka: depletion of human and social stocks
- Jamaica: human, social, economic and natural stocks
- Iceland: human and economic stocks
- Madagascar: human and economic stocks

Participants questioned whether governance could be separated from social capital, and pointed out that 'bad' governance could be 'good' for elites.

Lewis Dartnell

Dartnell, L. (2014). *The Knowledge: How to rebuild our world from scratch*. Random House.

Lewis Dartnell presented his popular science book *The Knowledge*, in which he used the conceit of 'how to recover from collapse' to explore and explain the science and engineering that underpins 21st century life. It aspires to be a 'Total Book', a single text that would enable one to rebuild the whole of contemporary society. Other texts within the 'Total Book' tradition include Diderot's *Encylopedie*, to the *Feynman Lectures* and the *Long Now Foundation Manual*, amongst other examples.

Dartnell argues that in the event of a collapse we would have to use the 'grace period' after a disaster to 'reboot' civilization. A key factor would be the availability of cheap fossil fuels. While coal may be available, oil will be more difficult. But industrial civilization without fossil fuels is possible. A Bosnian city ran on waterwheels during the civil war, and in WW2 Europe, 1m cars ran on wood not oil. Dartnell concluded that while it took 10,000 years for civilization to reach our current level, it would not take another 10,000 years to rebuild.

Some participants questioned how certain we could ever be about our chances of recovery, while another pointed out that there are some examples of Polynesian colonisation achieved with just 1 canoe and 24-100 people.

Discussion points

Discussion addressed a number of conceptual and methodological points, including how to catalogue collapses, whether it is important to distinguish between endogenous and exogenous factors, how to distinguish decentralisation from collapse, and how to draw lessons for contemporary society. Possible outputs were also discussed.

A catalogue of collapse

To develop models one would ideally develop a list of collapses, then seek to identify common factors. This list could be developed in two ways. Firstly one could list prominent examples. Possible case-studies of collapse include:

- Rapa Nui (Easter Island)
- Mangareva
- Norse Greenland
- Puebloan US Southwest
- Classic Maya Lowlands
- Late Bronze Age collapse: Egyptians, Hittites, Canaanites, Cypriots, Minoans, Mycenaeans, Assyrians and Babylonians.
- Western Roman Empire
- Mesopotamia
- Inca
- Post Columbian Americas
- Indigenous Australians
- Siberian colonisation by the Tsars
- Regions within a state e.g. Ukraine in USSR?
- If one includes examples of 'societal decline' in the 20th century then possible examples include Nauru, Sri Lanka, Jamaica, Iceland, Madagascar and Haiti.

However this raises the problem of cherry-picking. A better methodology would be to adopt some definition of collapse, analyse historical data, and see what examples meet that definition. One definition could, for example, be >75% decline in GDP in a decade or similar devastation for cases in which GDP data is unclear. One would need to decide whether to include averted collapses, with possible examples including Highland New Guinea, Tokugawa-era Japan, Tikopia, Iceland and Tonga. One would also need to decide whether to have a binary 'collapse or not?' classification or to allow gradations of collapse.

Endogenous vs exogenous

The emerging field of collapse studies tends to draw a distinction between endogenous and exogenous factors. Indeed, it can sometimes seem that it is only events that occurred primarily due to endogenous factors (like, it has been argued, deforestation on Rapa Nui) that 'count' as collapses.

Participants questioned whether this split mattered, especially if one was seeking to draw lessons for contemporary society. For example, many indigenous groups from the Americas to Siberia were fatally weakened by infectious diseases to which they had no natural immunity before they were conquered. The contemporary world does not face external invaders, but might be weakened by a pandemic just like those groups.

Decentralisation not collapse?

A key distinction identified by the participants was between state failure and societal failure. Augusta McMahon argued that over the long history of Mesopotamia power tended to vary between the countryside, cities and empire (with a slight bias towards cities, as ancient China had a slight bias to empire). When empires or cities 'collapsed' this then led to a move back to the land and a reduction in complexity. However it did not necessarily involve huge population losses. The end of the Roman Empire could fit this description. Indeed this reduction in centralisation, and/or deurbanisation, may be more typical of the majority of historical cases of collapse than the 'charismatic collapses' of e.g. Rapa Nui.

As Luke Kemp has argued however, returning to the land is not an option for the vast majority of contemporary people. This is one of several difficult questions raised in seeking to draw lessons from historical collapses.

Historical vs contemporary

Participants discussed how relevant historical examples are to the contemporary day.

For example, do collapses in the 20th and 21st centuries look different to historical examples, or are there no modern examples of collapse? Should one include civil wars in one's list of collapses? If so, one might reasonably include in a 'catalogue of collapse' the Russian Civil War, 1920s China, 2nd Congo War, the Syrian War, Somalian War, or Afghanistan War. These fit the Mesopotamian story of failed states, decentralisation and warlordism.

Another set of questions address how resilient contemporary society is compared to historical societies. Our technical capabilities to react to natural disasters have increased, but so too have our destructive powers. Has our increased interconnectedness, for example, increased or decreased vulnerability? If we ultimately want to predict and prevent contemporary collapses we will have to address this set of questions.

Possible Outputs

Several possible outputs were discussed:

- Research Agenda
- Resource sharing
- Paper, opinion-piece or technical report: What's the problem? Why is it hard? What are the methodological tools and tasks?
- Catalogue of collapses
- Ultimate output: If collapses are predictable, what is the likelihood we have one in the next thirty years? Are there recommendations to communicate to policy-makers?

Background reading:

Diamond, J. (2005). *Collapse: How societies choose to fail or succeed.* Penguin.
(TED talk on *Collapse* by the author)

Middleton, G. D. (2017). *Understanding Collapse: Ancient History and Modern Myths*. Cambridge University Press.
(Do civilisations collapse? Aeon article by the author)

Dartnell, L. (2014). *The Knowledge: How to rebuild our world from scratch*. Random House.
(TED talk by the author)

Also:

Avin, S., Wintle. B., Weitzdörfer, J., ÓhÉigeartaigh, S. S., Sutherland, W. J., Rees, M. (2018). Classifying Global Catastrophic Risks. *Futures.*

Beckstead, N. (2015). The long-term significance of reducing global catastrophic risks. GiveWell.

Currie, A. (2018). Existential Risk, Creativity & Well-Adapted Science. Studies in the History & Philosophy of Science.

Cline, E.H. (2014). *1177 B.C.: The Year Civilization Collapsed*. Princeton University Press.

Crosby, A. (1986). *Ecological Imperialism: The Biological Expansion of Europe, 900-1900*. Cambridge University Press.

Dasgupta, P., Mitra, T., & Sorger, G. (2016). Harvesting the commons. *Environmental and Resource Economics*, 1-24.

Diamond, J., & Robinson, J. A. (2010). Afterword: using comparative methods in studies of human history. *Natural Experiments of History*, 257-276.

Kareiva, P. & Carranza, V. (2018). Existential risk due to ecosystem collapse: Nature strikes back. *Futures.*

Knapp, A.B. & Manning, S.W. (2016). Crisis in Context: The End of the Late Bronze Age in the Eastern Mediterranean. *American Journal of Archaeology* Vol. 120, No. 1 (January 2016), pp. 99–149.
McAnany, P. A., & Yoffee, N. (Eds.). (2009). *Questioning collapse: human resilience, ecological vulnerability, and the aftermath of empire*. Cambridge University Press.

Liu, H-Y., Lauta, K.C., Maas, M.M. (2018). Governing Boring Apocalypses. *Futures*.

Middleton, G. D. (2017). The show must go on: Collapse, resilience, and transformation in 21st-century archaeology. *Reviews in Anthropology*.

Morrison, K.D. (2006). Failure and how to avoid it. Nature 440:752–754.

Motesharrei, S., Rivas, J., & Kalnay, E. (2014). Human and nature dynamics (HANDY): Modeling inequality and use of resources in the collapse or sustainability of societies. *Ecological Economics*, *101*, 90-102.

Tainter, J. (1988). *The collapse of complex societies*. Cambridge University Press.

Weiss, H. (2017). *Megadrought and Collapse.* Oxford University Press.

Vogelaar A.E., Hale, B.W. & Peat, A. (eds). (2018). *The Discourses of Environmental Collapse: Imagining the End.* Routledge.

Asaf Tzachor suggestions

Vico's recurring cycles of civilizations (1725);

Toynbee's non-empiric "challenge-and-(creative) response theory" (1934-1961);

Braudel's (1979) long-term economic cycles theory, where progress moves from one city-state to the next;

Korotayev, Malkovand Khaltourina (2016) *Social Macrodynamic*, focusing on pre-industrial, agrarian, political-demographic cycles;

Montesquieu's (1748), Sachs's (2001) and Diamond's (2005) "geography-ecology theory", sometimes referred to as "environmental-determinism";

Wittfogel's (1957) "oriental despotism thesis", also known as "hydraulic thesis";

Weber's (2002), Ferguson's (2003) and van Hoorn and Maseland's (2013) "cultural theory", that explains wealth with cultural, ethnic and religious determinants;

The "ignorance hypothesis", reviewed in Acemoğlu and Robinson (2012, p.63-68);

Quigley's (1961) "cultural morphology" theory and his choice of focusing on civilizations as the unit of historical-evolutionary processes, rather than on nation-states as the subject of study; Similar to Spengler's *The Decline of the West* (1918), McKneill's *The Rise of the West* (1963), and Ferguson's (2011) *Civilization: The West and the Rest*;

Acemoğlu and Robinson's (2012) "inclusive institutions theory". Such studies were judged as too narrow in the scope of their analysis or criticized for problems with empirical accuracy. Other criticisms have been that they dismiss other determinants of social progress and decline (Diamond, 2012; Sachs, 2012).

Deterministic models where development itself leads inevitably to decline, such as Wright's self-reinforcing "Progress Trap" (2004) or Tainter's (1988; 2000) path-dependent social complexity and diminishing marginal returns theory (also discusses civilizational life-cycles).

Partha Dasgupta suggestions

Brander, J.A., and M.S. Taylor (1998), 'The Simple Economics of Easter Island: A Ricardo-Malthus Model of Renewable Resource Use", American Economic Review, 88(1), 119-138.
(Authors relate their model to the fate of Rapa Nui, by noting that the species of palm in the island was especially slow-growing. The authors also explore 12 islands in Polynesia that had collapsed entirely by the time Europeans visited them.)

Dasgupta, P. (1982). Chapter 6 in The Control of Resources. Cambridge, MA: Harvard University Press.

Kintisch, E. (2016). 'The Lost Norse", Science, 354(6313), 696-701.

PNAS (2012), 'Special Feature: Critical Perspectives on Historical Collapse", Proceedings of the National Academy of Science, 109(10), 3632-3681.

Butzer, K.W. (2012), 'Collapse: Environment, and Society", Proceedings of the National Academy of Sciences, 109(10), 3632-3639.
(Reports the ways a number of societies in 14th-18th centuries Western Europe displayed resilience by coping with environmental stresses through innovation and agricultural intensification.)

Turner, B.L., and A.M.S. Ali (1996), 'Induced Intensification: Agricultural Change in Bangladesh with Implications for Malthus and Boserup", Proceedings of the National Academy of Science, 93(25), 14984-14991.
(Shows that in the face of rising population and a deteriorating resource base, small farmers in Bangladesh have expanded production by intensifying agriculture practices.)

Downey, S.S., W. Randall Haas Jr., and S.J. Shennan (2016), 'European Neolithic Societies Showed Early Warning of Population Collapse", Proceedings of the National Academy of Science, 113(35), 9751-9756.
(Found that the introduction of agriculture in European Neolithic societies spurred population growth, but that societies in many cases experienced demographic instability and, ultimately, collapse.)

Scheffer, M. (2016), "Anticipating Societal Collapse: Hints From the Stone Age", Proceedings of the National Academy of Science, 113(35).
(Notes that there were early warning signs, in the form of reduced resilience to small disturbances, preceding the great drought in the late 1270s that destroyed the people who had built the iconic alcove sites of Mesa Verde.)

Jansson, M.A., T.A. Kohler, and M. Scheffer (2003), 'Sunk-Cost Effects and Vulnerability to Collapse in Ancient Societies", Current Anthropology, 44(5), 722-728.
(Points to the role of irreversibility in the establishment of new management practices (the authors call the irreversibility "sunk-costs") played in making ancient societies vulnerable to collapse.)