

Extended Book Review

A review of *The Collapse of Complex Societies*, by Joseph A. Tainter, 1988. Cambridge, UK: Cambridge University Press, 250 pp. ISBN 052138673. \$37.99 USD. *Collapse: How Societies Choose to Fail or Succeed*, Jared Diamond, 2005. NY: Penguin, 573 pp. ISBN 014303655. \$17.00 USD.

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“World will end in 2 to 3 generations, 72 per cent of British Columbians fear”, cites the *Vancouver Sun* (2006, November 18th, Saturday). The headline refers to results from a survey timed to coincide with a meeting of world leaders in Nairobi to discuss climate change. Global warming, the Kyoto accord, and Canada’s dismal ranking in the bottom 10 of 56 countries on its performance and policies around climate change have become topics discussed by politicians and high school students alike, yet a view of the problems faced by society informed by complexity thinking can address issues larger than climate change and governmental policies.

Issues such as environmental destruction and how it can lead to societal breakdown are discussed by Joseph Tainter in *The collapse of complex societies* and in Jared Diamond’s *Collapse: How societies choose to fail or succeed*. These two books are frequently referenced works for the detailed study of past civilizations and what can be learned from their mistakes. At a graduate student interdisciplinary conference, Dr. Paul Wood, a conservation policy scholar at the University of British Columbia, delivered a presentation on the changing nature of academic thought, the role that interdisciplinarity has to play in the increasingly complex nature of research, and the problems current researchers aim to alleviate, suggesting interdisciplinarity as an “alternative to chaos” (Wood, 2006). He referred to Diamond and Tainter’s works which provided the impetus to review these two widely read books on complex societies and

to speculate on how complexity thinking could frame an interpretation of these authors' visions of the future based on what has happened in the past.

Once attuned to it, Diamond's and Tainter's books appear everywhere; they are sold as a bundle on amazon.ca, cross referenced in wikipedia, and appear in Ronald Wright's *A Short History of Progress* (2004). Many other works have addressed the mysteries of why some complex societies failed to succeed: for example, Yoffee and Cowgill (1988) in *The Collapse of Ancient States and Civilizations* and A Green History of the World: *The Environment and the Collapse of Great Civilizations* (Ponting, 1991), but few works have attained the public dissemination of Diamond's and Tainter's books. Although they are often mentioned in tandem and have much in common, there are fundamental differences between them that come to light when their arguments are considered through a complexivist lens.

Studying Collapse: Philosophical Perspectives and Methodologies

Diamond and Tainter hail from different academic backgrounds and, hence, use different methodologies and perspectives to study complex societies and collapse. To be sure, they share a common definition of "collapse." Tainter describes "collapse" as "a topic of the most widespread concern and the highest social significance" (p. 2), and Diamond believes that we have opportunities to learn from the past to identify societies at risk and measures that could best help avoid collapse. Diamond does not define societies nor does he describe them in terms of complexity. This allows him to cover a much wider range of civilizations than most works on collapse. Tainter, on the other hand, is very specific about the nature of complex societies, identifying the following characteristics: size, number and distinctiveness of its parts, the variety of specialized social roles and personalities that are incorporated, and the mechanisms for organizing complex societies into coherent functioning wholes. Depending on these elements, societies exist along a continuum of complexity. Collapse, as defined by Tainter, is a process of decline in complexity. Diamond employs a similar definition: collapse is a drastic decrease in human population and/or political/economic/social complexity over a considerable area for an extended time.

Diamond is a geography professor at UCLA and has, in the course of his career, worked in the fields of physiology, evolutionary biology, and biogeography. *Collapse* precedes his Pulitzer Prize winning book *Guns, Germs and Steel* (1997) which helped promote *Collapse* for wide public readership in spite of its density and length (525 pages). Tainter is an anthropologist and historian. He received his PhD from Northwestern, has taught at the University of New Mexico, and is currently project leader of the Cultural Heritage Research, Rocky Mountain Forest and Range Experiment Station in Albuquerque, New Mexico. His *Collapse of Complex Societies* reads more like a lengthy research report than Diamond's anecdote-filled bestseller. It begins with a thesis and engages in thorough and detailed research to support a general explanation of collapse, a response to previous work in the field described by Tainter as ad hoc. Diamond, on the other hand, employs a comparative method by comparing input

variables such as environmental fragility, relations with neighbors, and political institutions with the output variables of collapse or success. By relating output variables to input variables, Diamond aims to tease out the relationship between these variables. Both authors situate themselves in their research and are explicit about their differing epistemological stances on research.

In Search of a General Theory of Collapse: Joseph Tainter

Tainter explains that the goal of his work is to “understand collapse as a general phenomenon to gain an understanding not limited to specific cases, but applicable across time, space and type of society” (p. 43). According to Tainter past explanations of collapse have been too particularistic, a criticism he uses for the bulk of social sciences research, and argues that criticism of theories of collapse have centered on disputing facts rather than addressing the logic of the argument. In response he presents eleven prominent theories of collapse and discounts each by demonstrating failure in their logic. Tainter points out that the weakness of attributing failure to the depletion of resources is the assumption that societies can sit by and watch the last tree being felled (on Easter Island for example) without taking corrective action. He maintains that complex societies are designed (with administrative structures, etc.) to deal with problems such as resource depletion and in some cases (Hohokam phase to Civano phase of the American Southwest Soho) environmental deterioration actually led to increased complexity through the development of new technologies. In several cases Tainter discounted theories of collapse simply because contradictory evidence meant it could not be used as a general theory, for example conflict with other complex societies cannot explain the collapse of the Roman Empire and is thus rejected.

Tainter is particularly strong in his criticism of what he calls “mystical factors” that are often used to explain collapse. To him, mystical explanations represent universal theories rather than case-specific scenarios and contain “no essence to empirically knowable processes,” (p. 74) and his rejection of these theories lays bare his preference for rational, scientifically supported fact and reasoning. He cites three major problems with mystical theories—such as those presented by Spengler (1962) who wrote that each culture has “*its own ideas; its own passions; its own life, will and feeling, its own death...its own new possibilities of self-expression which arise, ripen, decay, and never return,*” (p. 16-17, *emphases original*) and Toynbee (1962) who saw civilization as a “fresh dynamic movement” (vol. IV, p. 128) that might be “full of meaning” (vol. V, p. 3). Tainter’s three major problems with mystical factors are (a) reliance on a biological growth analogy, (b) reliance on value judgments, and (c) explanation by reference to intangibles. Mystical explanations echo many elements of how complexity thinking would describe a complex society (for example as a living system) and also provide space for the possibilities of moral and ethical contributions to both the explanation and the solution to collapse. Tainter’s presentation of mystical theories focuses on the fact that living systems grow without a controlling mechanism, use up energy, develop in cycles, and eventually die. Here, Tainter has failed to see the power of viewing complex

societies or civilizations as living through the lens of complexity thinking (to be discussed later in this review). He appears to be threatened by the uncontrollable, unmeasurable, and unpredictable nature of complex (living) systems and, hence, he sees great value in economic explanations which are closely aligned with his conclusions.

The economic principle that Tainter draws upon to develop his general theory of collapse is the principle of diminishing returns; he proposes that “complexity as a strategy becomes increasingly costly and yields decreasing marginal benefits” (p. 93). He breaks this down further into the following four ideas:

- Human societies are problem solving organizations.
- Sociopolitical systems require energy for their maintenance.
- Increased complexity carries with it increased costs per capita.
- Investment in sociopolitical complexity as a problem-solving response often reaches a point of declining returns.

Tainter discusses the interplay of these four ideas within several examples of complex societies including agriculture and resource production, health care, education, and sociopolitical control. Particularly disturbing is his analysis of education showing a trend of declining marginal productivity. Tainter supports his arguments with numerous datasets from 1800-1900s, but the datasets are not sufficiently explained, thus disempowering the reader to assess claims such as overall productivity of investment in higher education for the development of specialized expertise has declined substantially since 1900. Few readers will take issue with the fact that specialized knowledge requires greater investment than generalized knowledge, but statements such as “it cannot be claimed that benefits for investment in education increase proportionate to costs” (p. 104) are not supported with a good definition of how to measure benefits or returns on investment in education.

After detailing his framework for collapse for several aspects of modern day society, Tainter proceeds to account for the collapse of three ancient societies: the western Roman Empire, the classic Maya of the southern lowlands, and the Chacoan society of the American southwest. His choice of cases is justified as representing a broad spectrum of sociopolitical complexity with differing amounts and types of evidence available for analysis. Through the study of these examples, Tainter makes the following observations and recommendations for our current society: (a) substantial increased costs occurred late, shortly before collapse and were incurred by a population already weakened by a pattern of declining marginal returns, and (b) the peoples on the periphery rose to prominence after the older (more complex) society collapsed.

Finally, Tainter discusses the applications of his theory of diminishing marginal returns and the implication that collapse is “not a fall to some primordial chaos, but a return to the normal human condition of lower complexity...an *economizing* process” (p. 198, *emphasis original*). This conclusion is painfully devoid in recognizing the human element of collapse—a fact Tainter is aware of when he agrees with Finley (1968) who observed that an economic theory of collapse is “neither a dramatic nor a romantic way to look at it....One could not make a film out of it” (p. 161). Tainter also addresses the question “Must every complex society endure this process?” (p. 199) by making two

points: 1) that societies that developed as sets of clusters, through mutual interactions of exchange and conflict, do not collapse, instead a failure of one cluster leads to the expansion of another, and 2) that collapse can only occur in a power vacuum. These concepts link Tainter's framework to the current globalized situation in which nations exist today. "There are no power vacuums left today" (p. 213) and "collapse today is neither an option nor an immediate threat" (p. 213)—two bold claims that may be true of individual nations, but not of world civilization as a whole. Tainter agrees with other writers on the subject (for example, Diamond and Wright) that world civilization will disintegrate, although he manages to put a positive spin on the increasingly competitive spiral that declining marginal returns has trapped us in, and that it may buy us enough time to find a solution to it. Tainter's recommendation is to find new energy sources and that the funds for the search must be included in the budget of every industrialized nation (and the results shared by all).

An Emerging Framework for the Environmental Explanation of Collapse: Jared Diamond

Diamond's *Collapse* reads more like a novel with a lot of scientific data, than a research report. Although his approach to the study of collapse is less hypothesis driven and more emergent than Tainter's, his background as a scientist leads him to draw primarily upon scientific data to define what is known about societies and their collapse. He describes, often repetitively and always in great detail, methods such as the study of packrat midden (fossilized rodent deposits) and dendrochronology (tree ring studies). Cognizant of his overarching role, to change how people think about themselves as individuals, within a society and situated within a globalized world (in other words as part of a nested system), Diamond begins close to home by describing current environmental issues threatening the way of life in the state of Montana. He ends the chapter with the life stories of four Montanans and pleads with the reader to try to think of the problems of other societies, although presented in mostly impersonal, scientific terms, as issues viewed by individuals whose ways of life are at stake. Thus, Diamond recognizes the limitation of using scientific data, methods, and logic to appeal to human sensibilities to be touched by or motivated by the current state of environmental crisis on a personal level.

Where Tainter was methodical in his search for a general, explanatory theory of collapse, Diamond was surprised by the emergence of his five point framework, used throughout the book to describe collapse. Admitting that he naively embarked on his endeavour and believing that the book would be about environmental damage, he finally arrived at a five point framework of contributing factors that must be considered in trying to understand environmental collapse through the study of a wide variety of societies. He found that four of the factors – environmental damage, climate change, hostile neighbours, and friendly trade partners—may or may not prove significant for a particular society, but that one factor is *always* significant - the society's responses to its environmental problems.

Marching forward to the tune that “only through the weight of evidence provided by a comparative study of many societies with different outcomes can one hope to reach convincing conclusions” (p. 19), Diamond embarks on a journey starting in Montana, visiting five past societies that collapsed and paying particular attention to Norse Greenland, three successful past societies, and four modern cases (Rwanda, Dominican Republic, China, and Australia). Diamond draws on his extensive travels to discuss practical lessons and implications for group decision making processes (often at play in governments for issues like environmental collapse), modern businesses, and how globalization makes our current situation both dire and hopeful.

Complexity Thinking, Ecological Discourses and Collapse: Looking Towards the Future

Both Diamond and Tainter employ terms and ideas from complexity thinking to characterize complex societies and the factors that contribute to their collapse, but it is in their messages and solutions for our current and future society that they diverge. Compared to Tainter, Diamond shows more promise as a complexivist when he describes the current state of affairs and recommendations for the future. For example Diamond describes our current state of globalization as “living in the same polder,” (p. 520) in part of a coherent whole or collective where “our survival depends on each other’s survival” (Ibid.). Tainter, instead, relies on the concept of a power vacuum that recognizes that complex societies are surrounded by each other and strongly linked, but discusses such links in terms of money and power exchanges with little recognition of moral, ethical, and intellectual connections. Diamond also calls us to action stating that “because we are the cause of our environmental problems, we are the ones in control of them, and we can choose or not choose to stop causing them and start solving them” (p. 521). These decisions include choosing long term planning and a willingness to reconsider core values, citing China’s bold and anticipatory decision to implement a one-child program as opposed to the Greenland Norse’s inability to reassess their identities as European Christians and adopt some of the lifesaving practices of the Inuit. This call to action and an appeal to an awareness of our values as part of the process echoes ecological discourses where ethics are understood as consciously mediated contextually appropriate behaviour (Davis 2004). A shift toward ecological worldviews can help foster “ongoing coping—a responsiveness to what is appropriate here and now” (Davis, p. 176) and could inform Diamond’s conclusion that it is how a society *responds* to imminent collapse that makes the difference. Diamond concludes his book by saying: “My remaining cause for hope is another consequence of the globalized modern world’s interconnectedness” (p. 525) and thus empowers us as a global society *to learn*. In contrast Tainter perceives the main benefit of globalization as being a means to buy time, to engage in the search for new resources where this search would be framed and informed by the same modes of thought and philosophies that created the problems in the first place.

Interestingly, Tainter's discussion of complex societies and collapse recognizes many characteristics of complex systems. For example the rapid expansion of the Roman empire was facilitated through positive feedback loops where conquering a region lead to a rapid infusion of resources and collapse was partially attributed to the development of a "coercive, omnipresent, all-powerful organization that subdued individual interests and levied all resources toward one overarching goal," (p. 141) recognizing the dangers of a top down strategy of governance. Similarly, the rise of the Mayan Chacoan society is described through a process called regional economic symbiosis where diverse production systems exist in sufficiently close proximity that resource transport is economical and where there is sufficient diversity to promote trade and neighbour interactions but when energy fluctuations (drought, disease) become synchronized and communities become closer in proximity and less diverse, the system is weakened. Thus, Tainter is complexivist in his description of the nature, rise, and fall of complex societies, but he fails to recognize how complexity and ecological discourses can contribute to his theory and thus recommendations for the future. His commitment to scientific and rational thought prevents this line of reasoning, yet complexity thinking emerged from scientific disciplines where contributions to understanding complex systems such as climate change are beginning to make an impact on policy and research.

Lessons Learned from Scientific Research

Complexity science has made significant contributions to research in climate change, in fact, the concept of complexity originally arose in concert with atmospheric processes (Lorentz, 1963). In his article on complexity and climate change in *Science's* special issue on complexity, Rind (1999) details how models based on characteristics of complexity have lead to increased understandings of the nonlinearities and feedback mechanisms in climate systems. He also hints at how complexity thinking can help climate scientists get comfortable in a space where "determinism [exists] in the midst of chaos and unpredictability [exists] in the midst of understanding" (p. 107). Complexity science is beginning to shape an emergent philosophy of climate change (Hulme, 2000). For example, Shackley, Young, Parkinson and Wynne (1998) recognize that large deterministic simulation models of climate change provide important data but also argue that there are advantages to promoting a spectrum of models which together can provide scientific input to policy makers. They recommend "the development of new public institutions and processes" that will promote "interactive learning from trial and error...[as] part of the policy and research process" and that "such openness to learn and change is what constitutes a resilient policy and scientific approach to the climate change issue" (p. 196). A questionnaire of over 100 climate scientists in the USA, Canada and Germany provided evidence that many are operating in a mode called 'post normal science' (Funtowicz & Ravetz, 1985). Schnelnhüber (1999) calls for new tools that "will allow the conscious biosphere, i.e., humanity, to embark on a more directed global environmental management course, with goals, values, and reflexivity made explicitly part of the modeling framework" (Hulme, p. 596). Finally, Wilson makes a case in

Consilience (1998) for the development of new methodologies drawn from both the natural and social sciences to create the tools that Schnellnhüber (1999) envisions for the study of climate change and which could also address calls from other disciplines studying complex global phenomena such as the spread of disease in epidemiology (Pearce & Merletti, 2006) and learning in education (Davis & Sumara, 2006)

Collapse and Complexity in Education

There are likely to be a wide variety of personal experiences that prompt an individual to want to know more about what has happened to past and modern societies and what the future holds for our globalized planet. Should one want to know more, both of the books under review are good places to begin. They each provide convincing evidence that societies represent complex phenomena and likely Tainter's economic framework will prove unsatisfying to most readers unwilling to accept an all encompassing principle of diminishing marginal returns. Diamond's five point framework and anecdotal volume applies a more humanist perspective to the problem and the role that human morals, value and choices can play in problem solving the case of collapse. Once the reader is convinced that collapse is a complex phenomenon, the reader will turn to the often asked question "What can I do?" Educators ask this question too. In response, Davis (2004) describes ecological discourses as advocating for mindful participation "in the unfolding of personal and collective identities, culture, intercultural space, and the biosphere" (p. 176) and uses these discourses to redefine teaching as *hermeneutic listening* (Davis, 1996) or teaching as conversing. Thus, Davis sees a significant contribution to be made in the reimagining of how we teach by employing complexity thinking and ecological discourses. Similarly scientists such as Wilson (1998) and Hulme (2000) believe that how we understand and research complex systems also need to be revisited in radical new ways. Therefore there is an intersection between these two discourses that can inform the problematic of how to teach or communicate issues of climate change, environmental sustainability and global citizenship. Researchers at the Center for Connected Learning work in this space as they develop computer simulations and programming software designed to help students develop an awareness of the characteristics of complex systems and how some complex systems work (Wilensky 2001). Their NetLogo (Tisue & Wilensky, 2004) software enables students to design and manipulate complex systems such as ecosystems of rabbits, weeds and grass or weather patterns in autumn. They have written about the importance and implications to familiarizing students with complex systems so that they can contribute to the ever widening gap between our understandings and working tools in the physical and social sciences and the working knowledge used and developed by policy makers, professionals and citizens on global issues (Jacobson & Wilensky, 2006). This work is just one example of how education is heeding the call to scientists, environmentalists, governments and many others about the need for a global sustainability focused outlook for the future of humanity. UNESCO has declared the current decade that of education for sustainable development and in response Canada's leading NGO for promoting

sustainability education in Canada, Learning for a Sustainable Future (LSF), has developed a national strategy that includes benchmarks for sustainability education (LSF, 2004). An extensive curriculum review is also being undertaken which aims to identify, concepts, skills and instructional methods to help meet the challenges of social, economic and environmental sustainability through education (LSF, 2006). The two books under review could be used in this new project for education as sites for students to engage with concepts of complexity and of collapse, in particular each chapter in Diamond's *Collapse* can be read independently depending on the interests of the students or what links can be made with existing curriculum.

Diamond's *Collapse* and Tainter's research are each good resources for an interested reader to engage with to stimulate thinking about the big picture and possible end result of current global problems (collapse!). Although Diamond's view is more complexivist and aware of the potential for complexity thinking to change how we act and reason our way out of what Tainter describes as the downward spiral of diminishing marginal returns, more thought and research needs to be completed in many fields including climate change, education and policy making, in order to recognize what changes we as individuals, nations and as a collective on this planet must make in order to halt the rapid approach of global collapse.

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