

# THE FRONTIERS COLLECTION

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# THE FRONTIERS COLLECTION

## *Series Editors*

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The books in this collection are devoted to challenging and open problems at the forefront of modern science, including related philosophical debates. In contrast to typical research monographs, however, they strive to present their topics in a manner accessible also to scientifically literate non-specialists wishing to gain insight into the deeper implications and fascinating questions involved. Taken as a whole, the series reflects the need for a fundamental and interdisciplinary approach to modern science. Furthermore, it is intended to encourage active scientists in all areas to ponder over important and perhaps controversial issues beyond their own speciality. Extending from quantum physics and relativity to entropy, consciousness and complex systems—the Frontiers Collection will inspire readers to push back the frontiers of their own knowledge.

Ugo Bardi

# THE SENECA EFFECT

Why Growth is Slow but Collapse is Rapid

 Springer

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*This book is dedicated to my daughter,  
Donata, who hopes that the models will turn  
out to be wrong.*

# A Report to the Club of Rome

Formed in 1968, the Club of Rome comprises around 100 notable scientists, economists, businessmen, high-level civil servants, and former heads of state from around the world. Its mission is to promote understanding of the long-term challenges facing humanity and to propose holistic solutions through scientific analysis, communication, and advocacy. Part of the Club's work involves the accreditation of a limited number of peer-reviewed reports, the most famous of which is *The Limits to Growth*, which was published in 1972. To be considered as a Report to the Club of Rome, a publication must be innovative, present new approaches, and provide intellectual progress, as compared to other publications on the same topic. It must be based on sound scientific analysis and have a theme that fits the priorities of the Club. *The Seneca Effect* by Ugo Bardi is the latest such report.

## Advance Praise for *The Seneca Effect*

“Why do human societies collapse? With today’s environmental, social, and political challenges it is a question that is more than academic. What can we learn from history? How can we avoid the pitfalls? In this fascinating book Ugo Bardi provides many of the answers. Packed full of insights and ideas which will leave the reader satisfied, curious, and stimulated, we are delighted that this book is an official *Report to the Club of Rome*.”

Graeme Maxton, Secretary General of the Club of Rome

“Stock markets take a long time to rise, then crash quickly. Poker players go ‘on tilt,’ after being conservative for hours. Economies and ecosystems enter phase shifts where declines occur much faster than growth. Polymath writer and scientist Ugo Bardi expertly describes this widespread ‘Seneca’ phenomenon and its relevance to our socioeconomic system in coming decades.”

Nate Hagens, Professor of “Reality 101” at the University of Minnesota, Co-founder Bottleneck Foundation

“*The Seneca Effect* is probably the most important contribution to our understanding of societal collapse since Joseph Tainter’s 1988 masterpiece, *The Collapse of Complex Societies*. Since we live in a society that is just in the process of rounding the curve from growth to decline, this is information that should be of keen interest to every intelligent person.”

Richard Heinberg, Senior Fellow, Post Carbon Institute, Author, *The End of Growth*

“In this book, Bardi explains the intricate mechanisms of collapse with the captivating eloquence of a seasoned storyteller, the pluralism of a polymath, and the incisive precision of a scientist. Despite its ubiquity, collapse is not an inevitable law of nature. Bardi offers a call to policy makers, scientists, and citizens of the world to reinstate the dormant resilience mechanisms in our societies.”

Sgouris Sgouridis, Masdar Institute of Science and Technology, University in Abu Dhabi, United Arab Emirates



## Foreword

In the volume you are about to read, Professor Ugo Bardi takes us cheerfully into a dark cave of the science and engineering behind collapse. Like a miner turning on his headlamp and descending into the pit, Bardi has conquered whatever misgivings might come with peering at a highly risky task, and he makes the best of a grim situation. Bardi reminds us early and often that collapse is not a failure, it is a feature.

We are on a discovery of catastrophe, but the journey is neither gloomy nor hopeless—quite the opposite. As I pondered my own reaction to the “Seneca effect,” it came to me that the teachings of Zen and of European existentialism might be helpful. The existential moment of enlightenment, *satori* to the Zen Buddhists, arrives when we awaken to our own true nature. This awakening comes when we confront our own mortality and accept our impermanence as beings on earth. Each of us exists with some circumstances of birth, for example, our socioeconomic status and our childhood—what existential thinkers refer to as our “thrownness” in the world. *Satori* means that we accept these conditions but, crucially, that we realize that the meaning of life on earth comes through the choices we are able to make. We have the ability to choose how we deal with our circumstances, and we have the responsibility that comes with the consequences of these choices. We come to see that as sentient beings, we can choose to be miserable or to be happy, within this knowledge of our impermanence.

Armed with the strength and peace of *Satori*, we can understand how each of us forms part of a complex ecosystem. Native Americans and most other indigenous peoples understood the circular nature of life in a natural system that is in a state of homeostasis. We make choices every day about our use of natural resources, about how we treat others—how we act in the world during our time on it. Ugo Bardi, with a chemist’s pragmatism, informs us that our way of life, perhaps even humanity itself, is rushing toward the edge of a cliff. How are we to react to this grim news? Some of us consider ourselves sovereign in our lifetimes and take the divine right of kings as our creed. This would hold that it is our birthright to make the most of what we have while we are on this earth. As for future generations, they will have their turn, and they will find ways to enjoy their lives as best they can and manage the

world as they find it. The fruits of our discoveries are for us to enjoy. Our children, so this approach goes, will figure out their own solutions to the problems they face.

Others may believe in intergenerational equity, that we have an obligation to preserve the planet and our society at least in its current level of resources. This humanistic approach holds that we are visitors on this planet, that we have a moral obligation to future generations to leave the world in a condition that enables them to live as happy a life as is possible.

Most of us, I suspect, don't think much about either option and just do what we can to make ends meet and raise our children. Whatever the case may be, Bardi reminds us that we are hurtling through space on a planet that responds, as a complex system, to the laws of nature. Death, collapse, decay, entropy, decline, and scarcity—these are gloomy realms to roam. Like Kierkegaard's unflinching journey through existential despair, Ugo confronts these startling facts of life on earth as a complex system and challenges us to incorporate them more actively into our narrative about being alive. Collapse is a feature of the universe; he repeats often: we have to learn not only how to live with it but also how to exploit it for a better way of traveling on the vehicle we call earth.

As I write this, our world faces a resurgence of nationalism, anti-globalization, xenophobia, and populism not seen in nearly a century. The "Seneca effect" that Bardi describes here may be taking place now with the post-World War II order. While this chapter of history remains to be written, we can take heart from Ugo Bardi quoting the statement that "nothing is impossible if it is inevitable." The invitation Bardi extends is one that we must ponder deeply. Have we reached a tipping point, whereby the fruits of globalism have become, as in the tragedy of the commons, so familiar as to become an object of contempt? The downsides of globalization—migration and economic dislocations as capital and employment seek the highest returns and sluggish, consensus-based decision-making—are now in high relief. Investors, who are paid to make good decisions about allocating capital, should pay attention to Bardi's themes. The societal shocks that Bardi describes—events such as the sack of Rome, the arrival of the Conquistadores in the Americas, the use of the atomic bomb in Hiroshima and Nagasaki, and the terrorist attack of 9/11—are profoundly damaging and can cause lasting reorganizations in complex systems. In light of current political trends, we must ask how a more tribalistic, fragmented world deals with pollution, natural resource depletion, disease, and ethnic tension? What are we as individuals to make of this? How does the existential dialectic between impermanence and choice inform our paths?

Bardi takes the scientist's rational, objective, and nonjudgmental tools and applies them to an emotive subject: the almost assured collapse of our way of life as it has been the norm during the past decades. This seems appropriate: we place our own and our children's lives in the hands of designers of automobiles, airplanes, and roller coasters that we trust will not catastrophically fail. When it comes to meta-systems such as this vehicle we call Earth, why not conceptualize its safety through a similar lens? Thanks to scientists, we have an understanding of the what and why behind global warming. We have much less clarity around the systemic risk that exists and is building in our political and economic ecosystems. Bardi introduces us

to concepts from materials engineering, game theory, chaos theory, and complexity theory that should serve as a wake-up call to the consequences of choices that we, as free people, get to make every day.

John Rogers is an investment professional, former CEO and president of the CFA Institute and global CEO of INVESCO's institutional business unit. Board director of 'Preventable Surprises.' He is based in Charlottesville, Virginia area, personally and professionally interested in promoting sustainability and investing.

Charlottesville, VA, USA  
December, 2016

John Rogers

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