# KNOWLEDGE, ORGANIZATION, & MANAGEMENT
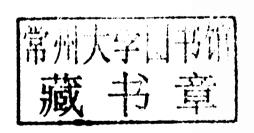
*Building on the Work of Max Boisot*

Edited by
**JOHN CHILD
& MARTIN IHRIG**

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OXFORD
UNIVERSITY PRESS

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"Max Boisot's key message has lost none of its topicality and importance: the form and communication of knowledge lie at the heart of human social organization. This book provides an excellent discussion of the challenges and opportunities involved—be they the cultural and institutional differences of systems or the complexity of today's (organizational) world."

Gilbert Probst, Managing Director, World Economic Forum, and Professor for Organizational Behavior and Management, University of Geneva, Switzerland

"For those of us who had the pleasure of knowing Max Boisot, he was one of the most creative and original of people. He had an extraordinary ability to understand how things were actually working and to create an image of how they could be changed. He not only had a powerful imagination, but also was deeply grounded in pragmatism. This book is a splendid tribute to a remarkable man. A real visionary."

Nicholas Stern, IG Patel Professor of Economics & Government at the London School of Economics, President of the British Academy, and ex-Chief Economist of the World Bank

"Max Boisot was a deep thinker whose interest in knowledge enabled him to make important contributions to many areas. In this volume, Child and Ihrig bring together Boisot's pathbreaking articles, and combine them with thoughtful appreciations by those who knew him best. The result is a worthy tribute to Boisot's legacy, and a wonderful way to introduce his thinking to a new generation of scholars."

Henry Chesbrough, Faculty Director, Garwood Center for Corporate Innovation, Haas School of Business, UC Berkeley, and Esade Business School, Ramon Llul University

"Boisot's deep insights are brilliantly unpacked and situated, both socially and epistemologically, in this superb collection. Given that nearly every economy is now being disrupted, his I-Space adds timely insights to how to move beyond simplistic analyses to ones that honor the embedded nature of the tacit."

John Seely Brown, Former Chief Scientist of Xerox Corp and Director of Xerox PARC

"Max Boisot's lucid explanations of the workings of the knowledge economy profoundly changed my perspective on strategy. He was years ahead of most of us in explaining why periods of maximum value are so fragile and why we need an entirely new logic for business—one that emphasizes sharing and speed—if our organizations are to be successful. In the knowledge economy, hoping to hide behind entry barriers is futile. As this excellent book demonstrates, Max showed us all an alternative."

Rita Gunther McGrath, Associate Professor, Columbia Business School

Max Boisot, Montpelier, 2010. Photograph by Dorota Boisot.

To all those like Max Boisot who willingly share knowledge rather than hoard it.

# Foreword

## Glimpsing an Unknowable Future

*Stuart Kauffman*

In a wonderful, mere ten days, I met Max and fell in love with his humanity and mind. As it happened, I was at CERN conspiring with Markus Nordberg to link efforts in studying the origin of life, an old passion, with CERN, focused on physics. I again, thank Markus.

Max, in a blizzard of wisdom and intuition, and I in a blizzard of confusion, explored new territory that lay between us. This territory is the subject of this Foreword. I believe Max would approve of what I write below, for he, more rapidly than any I have met, listened to my own thoughts and built upon them in ways that, we both felt, might expand his life work.

At root, as this book amply demonstrates, Max was profoundly interested in knowledge and its effective sharing. Perhaps the latest full formulation of his ideas are in his *I-Space*, augmented with real life and knowledge options, as discussed in the book co-authored by Markus Nordberg and Max. It is a superb book. I ventured, in the small blurb I felt honored to write for that book, that Markus and Max spoke not just of big science, but of a starting pattern of thinking about how a world civilization of our 30 civilizations might weave together fruitfully, leaving the ancient, hence near-sacred, roots of each intact, but allowing us to jointly co-create what we will become. The ways CERN is finding to co-discover in its efforts to explore an unknown, is deeply like what we face in the twenty-first century. We too face Mystery, a major theme Max and I discussed in our few, fine, days together.

I miss him.

### The world seen as a statable complex combinatorial optimization problem

As Max and I probed this issue, we realized that we usually begin with a mistaken belief. We begin with the presumption that we know all the relevant

variables bearing upon some problem. Moreover, we know either the single "success criterion" or the figure of merit, or in a more complex but well understood case, we have multiple success criteria, but do not know their relative importance.

Consider a single figure of merit. Then over a discrete or continuous space of behaviors, strategies, actions, we can think of the success of each of these, shown by the figure of merit, as a height. This yields a payoff, or fitness landscape over the strategy space. If it is fixed in time, this fitness landscape may be flat, may have a single, Fujiyama-like peak which is also therefore the global optimum, or may have many peaks of different heights. In fact, the number of peaks can be exponential in the dimensionality of the space, that is in the number of different strategies. In the latter case, finding the global optimum is exponentially hard: Pretty much the entire space must be searched to find the global optimum.

A large literature, growing out of "spin glasses" in physics, with their complex Potential Landscapes, where low energy is "good", and their cousin, NK fitness landscapes, exists. Search on these more or less rugged landscapes is quite well understood now by a variety of search techniques including simulated annealing, the genetic algorithm, and others. The "No Free Lunch" theorem asserts that, averaged over all possible fitness landscapes, no search procedure outperforms, on average, any other. In short, we need to know something about the landscape itself to search it wisely. This raises the new, still only partially explored issue of learning the landscape's structure as we search it.

In the more complex case of multiple incommensurate success criteria, the solution concept that is widely accepted is Global Pareto Optimality. A Pareto optimal point on a, say, continuous strategy space, is one in which no move can improve one fitness criterion without making another worse. Global Pareto optimal points are those that are both Pareto Optimal and maximize all the different success criteria simultaneously. Again a large literature exists on this topic.

## Options

In Max Boisot's *I-Space* and the Boisot-Nordberg book about big science, the concept of options plays a major role. Small, competing yet collaborating work groups, in face of an overall goal, but, critically, facing unknown physics, seek to find good pathways. In this effort, options for future actions and search pathways plays a major role. This is very wise. But it is deeply hampered by an essential feature. Consider options on the stock market. Given the famous ITO equation, one can price options, which has driven us to complex financial instruments. But pricing options demands that we know the probability

distribution of future events, as in the ITO calculus. In turn, this demands that we know the SAMPLE SPACE OF THE PROCESS.

Sometimes we do know the sample space of the process so can "sensibly" calculate the value of options, financial and real life.

But as Taleb and others point out, sometimes we do not know the sample space, or cannot learn it. For example, if the true sample space is given by a power law distribution with a slope less than minus 1, that distribution has neither a mean nor a variance. So no sampling will tell us the "real" sample process.

## Can we always prestate the relevant variables?

I now come to one of the major points Max and I discussed with a mixture of awe and awareness for its potential implications: In the evolution of science, for example, CERN's work, and in the evolution of the biosphere, the econosphere and culture, we cannot, I urged upon Max, always prestate the variables that will BECOME relevant.

I give a simple example from economic evolution. When Turing invented the Turing machine, its invention enabled von Neuman to invent the digital mainframe computer. Thomas Watson Sr. of IBM thought there would be a market for three of these, invented to calculate shell trajectories in naval battles in WWII, in the Eniac. Watson was wrong. Now the wide sale of mainframe computers created a market that did not CAUSE but did ENABLE, i.e. make possible, the invention by Jobs and others of the personal computer. The wide sale of the personal computer created the market that did not cause, but enabled, the invention by many including Microsoft, of word processing. The wide sale of word processing enabled sharing of files. The sharing of files enabled CERN scientist to invent the beginnings of the World Wide Web. The Web, once in place, did not cause, but enabled, selling things on the Web, and Amazon and eBay emerged. The emergence of content on the Web enabled a market for web browsers and Yahoo and Google grew. With them, came Facebook and LinkedIn.

We have all lived much of this IT revolution. Do any of us think Turing could have foreseen Facebook or Google? No. More, these newly relevant features of contemporary economic and social life arose with no one's INTENT.

In short, in the evolution of the econosphere, we CANNOT PRESTATE THE VARIABLES WHICH WILL BECOME RELEVANT. This has very large implications that Max and I glimpsed. First, we do not know the sample space. Knowing the sample space of a process means that we know what CAN happen but do not know what WILL happen, like flipping a coin 10,000 times. We know all possible outcomes, but do not know if we will get 5460

heads. Knowing the sample space and using the binomial theorem, we can calculate the probabilities of 5460 heads.

But if we do not know the sample space, not only do we not know what WILL happen, we do not even know what CAN happen. Then REASON, the highest human virtue of the ancient Greeks and our beloved Enlightenment, cannot be a sufficient guide to living our lives forward, for we must act without knowing what CAN happen.

In turn, this means we cannot "price options", as Max would wish us to do in the case of CERN strategies for learning in the face of unknown physics Mystery. Who could calculate Einstein's probability of success inventing General Relativity?

The problem above is deep and even deeper. Since losing Max, my colleagues, Giuseppe Longo and Mael Montevil, French mathematicians at the Ecole Polytechnique, Paris, and I, have published, "No entailing laws, but enablement in the evolution of the biopsphere," online posted Physics ArXhiv Jan 11, 2012, and in press, GECCO conference, (1,2). We think we have shown that this is the end of the reductionist world view at the watershed of evolving life. No law, we claim, and you can read the above article should you wish, entails in a Newton-like or even Schrodinger-like way, the evolution of the biopshere or, a fortiori, the economy or culture. We arise beyond entailing law, and beyond knowing what CAN happen.

More, with no selection, the evolving biosphere creates its own possibilities for becoming. In parallel, the evolving econosphere, Turing to Facebook, creates, often with no intent or foresight, its own opportunities for evolving further.

But if this is so, then the knowledge CREATION and management and dissemination that was the life work of Max Boisot, needs unknown extension. Again, Max and I glimpsed all this in our magical ten days together, with croissant and cafe au lait at CERN. How I wish he were still with us.

For this means, for science, and for humanity evolving, that we co-create without the capacity to prestate in many cases, the opportunities, the Adjacent Possibles, into which we become. We must live "Well Discovered Lives," not knowing ahead of time what we will co-create with one another.

If the above is true, as I think it is, CERN is a "small" but critical example of how we live with and find our way in the face of Mystery, here is unknown physics where we cannot calculate the value of the options of which Max wrote.

But this is real life. We do live, all the time, not knowing what we will co-create. This suggests something like "wise enablement," perhaps indeed along the lines of *I-Space* and CERN as an early and now studied example, of how to do this well. So, too, the evolution of English Common Law, inventing its way around a framework of ancient precedent which serves as its skeleton for variations that allow it to evolve as the world invents itself ever anew.

Max loved the glimpses. The above is at most a glimpse. His life was dedicated to open exploration of how we may do all this well. Bless you Max Boisot.

## Acknowledgements

# Acknowledgements

The process which led to the production of this book originated a few days after Max Boisot's untimely death in September 2011. The shock of Max's death gave rise to an outpouring of sorrow and appreciation of the man and his work, as witnessed by many communications both on-line and off-line. As Max's close colleagues and friends, both of us were stunned and shared this sense of deep loss. So when Chris Mabey sent us an email suggesting that "we might collect together some record of Max's achievements, memories of his life and personality," we quickly took up the idea of editing a collection of Max's papers accompanied by commentaries on his life and work.

The book would not have been possible without its various contributors who all responded to the opportunity to join it with an enthusiasm that itself is a tribute to the regard in which they held Max Boisot as a scholar, colleague, and friend. The writers of commentaries and reflections are acknowledged in the relevant headings, but we should like to thank them all here as well. Others also contributed to this book through the interviews they generously gave—Derong Chen, Barry Dornfeld, Yuan Lu, Chris Mabey, and Ian MacMillan. We also appreciate Stuart Kauffman's deeply insightful Foreword which he provided at a difficult time.

We have benefitted from the valuable advice and input offered by Liliana Petrella of EFMD, Anne Tsui, past-President of the Academy of Management, Graham Leicester of the International Futures Forum, and the anonymous reviewers of our book proposal. We were touched and inspired by the moving obituary that David Snowden wrote for Max in the Cognitive Edge Network blog.

David Musson of Oxford University Press has given unfailing support to the concept and then the materialization of this book from start to finish. Having published many of Max's books, David has a deep appreciation of his work as well as being one of Max's many personal friends. Emma Booth at OUP ensured the smooth passage of the book into production and made our lives much easier.

Special thanks also go to Wolfgang Güttel who co-organized two memorable and well-attended sessions on "Remembering Max Boisot" and "Building on the Work of Max Boisot" at the 2012 Colloquium of EGOS (The European

Group for Organizational Studies). These sessions brought together some of the contributors to this book, as well as other colleagues and friends of Max, and they helped to inform many points of relevance.

Following these two sessions, the EGOS board decided to establish an annual "EGOS Award in Honour of Max Boisot." This award is supported from the royalties accruing from this book. Max was a regular participant in EGOS Colloquia, and EGOS is therefore the ideal home for it. The award is intended to be both a memorial to Max Boisot's work and a means of encouraging further contributions to his field of scholarship. The topic for the award is the knowledge-based study of complex organizations and systems. Contributions in any of the main areas in which Max forged new understanding through a knowledge perspective are eligible for the award. Further information on the award is available on the EGOS website (www.egosnet.org). We are grateful for the considerable advice and support that members of the EGOS Board gave in the creation of the award.

As well as being compiled for Max, and for the readers who cannot fail to benefit from a greater appreciation of the man and his work, this book is also for Max's family, in particular Dorota Boisot. Despite facing the many burdens of grief and rebuilding a life, Dorota has in so many ways supported our efforts with encouragement and insights that have made all the difference.

John Child                                                                          Martin Ihrig
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# Permission Acknowledgements

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