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Technology and Global Change

The Illusion of Control

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This is an introduction for the special collection on "Illusion of Control".

At any time, a society is a collection of individuals including people that have ages between zero and "eighty plus." Through stories told by their parents and grandparents, some of the "eighty plus" people may have "emotionally loaded" memories that go back as far as a hundred years. In traditional societies where stories are passed on from generation to generation, that memory span may be much longer. Yet there is a difference between the memory (and wisdom) embedded in a story and the active memory about events and control that is passed on from grandparent to parent to child. And of course, memory, like knowledge, is a strange thing. It builds up as one grows in age and experience, it mixes what happened recently with what happened a long time ago, it tends to deteriorate as we grow older and it disappears when we die, or rather, most of it disappears while some of it is reshaped and transferred to those who survive us (e.g., in narratives). It illustrates that people and the societies they form are complex adaptive systems. What can the notion of control in such systems be, other than an illusion?

INTRODUCTION

Societies are built on illusions.[1] Simple illusions like "it" will last,[2] "it" being conditions of stability, or well-being, or, ironically, health; and complex illusions like the invisible hand (Smith 1776),[3] or progress, or that we, as individuals, organizations, or governments, are in control.[4]

The illusion of control points to a pattern of thought that entices us to believe that we can control the emergence of our future. COVID-19 punctured that illusion. The uncertainty that resulted from the pandemic enables us to think about our future *as a context* over the emergence of which we cannot have control. In that context, narratives are important. They express the cultural, institutional, social, and environmental embeddedness of our human decision-making (van der Leeuw, Forthcoming) and, as such, play an important part both in generating illusions of control and in extending their "lives."

EVOLUTION AND STABILITY

The past, as well as the context for our future, evolved and evolves over time, partly because of natural evolution and partly in response to changing societal needs. Meeting these needs requires a certain amount of stability.

Evolution "equipped" beavers with the capability to create a stable environment (Odling-Smee 1988).[5] They can build a dam that creates a pond in which they can build a lodge, find food, be protected against predators, and reproduce. Of course, the stability of this environment is limited

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1 Loosely defined as "Something that is not really what it *seems* to be." *Cambridge English Dictionary* (Cambridge: Cambridge University Press).

2 Or, as Madame de Pompadour said in 1757, with a French twist: "Après nous le deluge."

3 The invisible hand metaphor points to the ideas that voluntary trades in a free market produce unintentional and widespread benefits, and that these benefits are greater than those of a regulated, planned economy.

4 Over time the control illusion has established thinking patterns in which equilibrium is seen as the inevitable outcome of a process, rather than a frozen moment in its continuously changing dynamics.

5 This process is sometimes referred to as niche construction.

by external events, like floods, over which they have no control.

Humans have the illusion that they can create such stability with knowledge. And for limited amounts of time, they can indeed create a sense of stability. That sense triggers us to believe that we are in control.

A command to control

Genesis 1:28: "….. Be fruitful and increase in number; fill the earth and subdue it. Rule over the fish in the sea and the birds in the sky and over every living creature that moves on the ground." Aristotle laid a basis for understanding nature so that we could control it. And then Descartes introduced reductionism and the rationality by which we could ignore complexity and develop mechanisms to control. Control of nature, social organizations, governments, industry, and the way we think about our brain.

SIMPLIFICATION

For many individuals, the illusion that they are in control is a lifelong reality. We do not realize that what we control is a simplified world, a small part of an infinitely larger and complex world. Controlling that simplified world interferes with its complex reality.

Complexity and evolution

From the point in time that the big bang occurred, the laws of physics and complexity have been features of the evolving universe. The **laws of physics** allow us to expose the history of the universe all the way to the big bang (reductionism allows us to look beyond the innumerable properties and features that emerged in the ever more diverse and complex universe). The characteristics of **complexity** such as emergence, adaptation, and self-organization prevent us from knowing the future (we cannot know what new properties and features will emerge as the universe and all that is part of it continues to evolve).

Because of the limited predictability inherent in complex systems, this interference will cause system responses that are unpredictable, in terms of both when they will happen and how they will happen. We cannot control these responses. The reason is that the world, which we spend a relatively short time in, is too big and complex. We cannot trace (even a minuscule part of) all the cause-and-effect relationships that evolved in the universe to form that world. We need to simplify it because we cannot know all the causes and effects, let alone influence them.

So, what did humans do? They did different things in different cultures.

In Western cultures,[6] they simplified the world by reducing it to abstractions, universal laws, and general truths. They focused on linear cause-and-effect relationships, through which they could hope to understand the world around them and exercise the control by which they "… fill the earth and subdue it." Plato was a leading philosopher, monotheism was a key mover, and science added the illusion of objectivity and truth. During the last four hundred years, reductionism has dominated Western thinking.

In other cultures (Henrich 2021)—for example, the Chinese—they used patterns to simplify the world. Patterns constitute complex combinations of many cause-and-effect relationships. Such patterns in the Chinese culture have crystallized over millennia. Inspired by Lao Tze and Confucius, maybe, but without a single, creating deity or a reductionist science looking for general truths. Identifying (with) complex patterns has always been part of Chinese thinking.

CERTAINTY AND UNCERTAINTY

Both simplifications are based on an illusion—namely, a sense of certainty that the simplified world represents reality. Humans need that sense of *certainty*. And, when changes are slow compared to the average age of humans, the future seems predictable, even *certain*. But simplifications also create new illusions—namely, the ones that follow from the uncertainty that is inherent in the differences between the continuously changing reality and that sense of certainty. It seems to be in the "nature" of humanity at large to ignore that *uncertainty*, essentially due to the fact that the human mind can deal only with a very limited number of dynamic sources of information, compared to the almost (?) infinite number actually interacting in the real world. As a result, most of the dynamics humans are part of remain unobserved and ignored by them (e.g., Taleb 2006 on "black swans"—sudden, dramatic events emerging completely unexpectedly in dynamics that humans consider "under control").

Nowadays, we cannot say any longer that changes are slow. In fact, human societies and the ecosystems they de-

6 The West roughly defined as Western Europe and, in the last 150 years, the United States and Canada.

pend on are going through momentous and "explosive" changes,[7] mostly generated by human activities themselves. How to understand these and meet the challenges they pose have become existential questions for humanity. In trying to find answers to these questions, we must deal with two fundamental aspects of life: the *certainty of change* and the *uncertainty about how and when change will take place*.

CONTROL AND CHANGE

Whether through patterns or through reductionism or in other ways, control has always been an existential part of human life. We cannot live without it. Whether we are hunter-gatherers or city dwellers, we need to exert some element of control over our surroundings to ensure we have food, water, and shelter as well as a mate with whom we can procreate. In that sense, humankind does not differ from other living beings on our planet, such as beavers. Where we do differ is that we *strive to control the natural evolution* of our surroundings, both our direct surroundings and those beyond our direct reach.

Doing that, humanity accumulated a lot of experience and knowledge on how to effect change. It also created the illusion that it can control change. Control, rather than adaptation, became a leading reaction to change.

By taking control, humanity started to adapt the environment to its needs.[8] Prior to that, natural evolution took place—on a timescale of millions of years—as a continuous interplay between changing environments and adapting needs of living systems. Once humanity took control, it started to adapt the environment on a timescale of (tens to hundreds of) years. These adaptations were not the result of a continuous interplay with natural evolution, but a result of linear interference in it.[9]

NATURAL EVOLUTION, HUMAN CONTROL, AND ILLUSIONS

Natural evolution takes place in a complex adaptive system in which interactions between and adaptations of innumerable agents determine how the system will evolve and how new properties will emerge. There is neither predictability nor any predetermined direction.

In the Western way of thinking, human control by "imposing change" or by "reacting to change" is a linear interference in such a system with the purpose of moving natural evolution in a desired direction with a predictable outcome. To measure the results of its interference, humanity needed to make values[10] explicit that are implicit in complex adaptive systems. Paradoxically, that created the need for more control, and the basis for illusions.

The fundamental reason for this is that, as humans try to control a complex adaptive system, that system reacts in unforeseeable ways. The only way humans have to control these reactions is to add more controls. Controlling nonlinear systems with linear means is bound to fail. That leaves only the illusion of control, until humans find a way to counteract nonlinear behavior with adequate nonlinear reactions.

SIMPLIFICATION AND OVERSIMPLIFICATION

As argued before, societies are built on illusions that are the inevitable consequence of the simplifications that humans need to make sense of their world.

The statement "Everything must be made as simple as possible. But not simpler" is attributed to Albert Einstein, and Murray Gell-Mann introduced the concept of a "Crude Look at the Whole." Both, statement and concept, deal with simplification.

Both warn against oversimplification, but how do we know that we are oversimplifying?

A crude look at the whole

"In considering any very complex system, we naturally tend to break this system up into more manageable subsystems or aspects and to study those separately. However, one of the most important characteristics of complex nonlinear systems is that they cannot be successfully analyzed by determining in advance a set of properties or aspects that are studied separately and then combining those partial approaches in an attempt to form a picture of the whole. Instead, it is necessary to look at the whole system, even if that means taking a crude look, and then allow possible simplifications to emerge from the work."
—Murray Gell-Mann at the Para Limes 2015 conference: "A Crude Look at the Whole"

7 Think about the concurrent and interdependent "explosions" of the world population, of scientific knowledge, of technology, of urbanization, of mobility and connectedness, and the consequences thereof for the stability of natural and human-made systems on which our societies depend.

8 Of course, the change from adaptation to control was a gradual one, and while control became more important over time, adaptation still plays an important role.

9 One might call this an evolutionary bifurcation point. There is a growing body of evidence that points to the beginning of organized agriculture as the "moment" when natural evolution and humanity parted ways, some ten to twelve thousand years ago.

10 Metaphorically speaking, values are pointers that tell how systems in a changing environment should behave to stay vital and adaptive.

Murray Gell-Mann answers this implicitly.

"Take a crude look at the whole and allow possible simplifications to emerge from the work." Obviously, that is the opposite of the reductionist approach in which you take the complex system apart, study the subsystems separately, and let the whole emerge from the subsystems."

Christoph Adami, in his review of John Holland's book *Signals and Boundaries*, is a little more explicit. "*If taken apart complex systems lose precisely the character that makes them complex. The essence of these systems then, seems to lie not in the nature of their components but in how the components interact—across different hierarchies, in synergistic and antagonistic manners*" (Adami 2012).

In other words, if a system falls apart after simplification, we have oversimplified.

SIMPLIFICATION, HARMONY, AND THE SPEED OF CHANGE

If we want to briefly paraphrase the above, one might say: illusions are the inevitable result of simplifications. We cannot control our world without simplifications because the number of interrelated cause-and-effect relationships in the real world is way beyond the comprehension of humans. So, in simplifying that world in order to control it, we create illusions of control. That is and has always been part of human life.

Humanity has lived "in harmony" with such illusions for practically all of its existence (Agosta and Brooks 2020).[11]

"Harmony" in this case refers to the phenomenon that, as the ecosystem that humans lived in changed (over a period of many generations), the simplifications changed with them, and so did the illusions that they were in control.

Until about a hundred years ago, changes in human ecosystems took place over many generations. By the beginning of the twentieth century, such changes happened within only a few generations. In the last hundred years, enormous changes in the human ecosystem began to happen within a generation.

One may argue that the harmony between humans and the illusion that they can control their world started to become disturbed around the time when science introduced abstractions, universal laws, and general truths as a means to simplify the world.[12] Universal laws and general truths do not change with changing environments, and as a result the illusions of control started to become disconnected from the changes in the human ecosystems.[13] At the same time, the increase in scientific knowledge became a major driving force behind those changes.

Speed of change, complexity, and our brain

World population

In the period between 1900 and 2020 (roughly six generations), the world population grew by a factor 5 (from 1.6 billion to 8.0 billion people). It took from AD 1100 to AD 1900 (roughly forty generations) for the world population to grow by the same factor (from 320 million to 1.6 billion).

Connectivity

In the last one hundred years, the mode of transportation changed from horses to cars to jet planes, and the mode of communication changed from letters to telephone to internet. That all happened within a period of less than a hundred years. As a result of such changes, the world became a lot more complex and that increase in complexity happened faster and faster.

Our brain

Our sole tool to simplify that increasing complexity (our brains) did not change and, as a result, the capability of humans to simplify their world in harmony with their ecology started to run out of sync with the accelerating rate of change in that ecosystem.

SCIENCE, TECHNOLOGY, A SCIENCE-INDUCED BIFURCATION POINT, AND RUNAWAY ILLUSIONS

In the early days of the scientific revolution, science aimed at understanding nature, with the purpose to control it (Bacon 1620). The day-to-day practical world presented the problems that science aimed to understand. Practical problems were leading in the development of scientific theories. Theory followed practice. That was the case until deep into the nineteenth century. But by the end of that century, theory began to run ahead of practical problems, and the relationship between science and practice increasingly became dominated by scientific disciplines and specializations. Practical questions no longer gave direction and content

11 During most of their existence, humans lived "with nature," in small groups or communities. When their environment, or nature, changed, they changed their way of life, and when the environment became too harsh, they moved.

12 Somewhere in the sixteenth century, at the beginning of the scientific revolution.

13 For society, this means that whereas we think that our understanding of nature and our laws to behave accordingly led to the development of our ecosystems in controllable and predictable ways, the practice is that these ecosystems behave as the unpredictable complex adaptive systems that they are. The more we introduce absolute truths and rules to abide by them into the system, the more we will find that our illusion that we can control the system is not in line with reality. This manifests itself—e.g., in human-induced climate change or the growth of inequality in the world.

to the development of scientific knowledge, but scientific disciplines started to give direction to practical applications—that is, the development of technologies.[14]

The change from science following practice to practical applications following scientific knowledge[15] marked the creation of a context in which the speed at which new technologies are developed is no longer determined by the task or the wish to solve practical problems,[16] but by the creativity with which engineers and product developers can use scientific knowledge to satisfy their fantasies—and their greed.

The fantasies propel ideas that individuals can be in full control of the world around them, satisfying any need they may have (material, convenience, information, health, or wealth). That is all an illusion, of course. Out of greed, those fantasies often focus on needs that can most easily be exploited. Together, science-induced fantasies and greed provide bases for runaway illusions, easily controlled by ruthless advertising practices and agencies.

WHAT MAY THIS ADD UP TO?

Humanity cannot live without illusions of control. For thousands of years, we have managed to control those illusions by making them part of our ecosystems, through narratives that *express the cultural, institutional, social, and environmental embeddedness of our human decision-making*, or otherwise. One way in which this embeddedness expresses itself is trust.[17]

Trust

Confucius once remarked that rulers need three resources: weapons, food, and trust. The ruler who cannot have all three should give up weapons first, then food, but should hold on to trust at all costs: "without trust we cannot stand."
The Analects, book 12

But now it seems we are losing control. Human ecosystems are changing too fast, narratives that created and preserved stability in our societies are changing in ways that make it more difficult to govern (Lewis 2021), and organizational monopolization of data (data-opolies) manipulate narratives and create runaway illusions that serve their business interests at the expense of societal stability (Stucke 2018).

On top of that, we now have technologies like ChatGPT (Wikipedia contributors 2023) that create artificial illusions that are based on the almost infinite power of modern computers to combine data into stories, mimic human conversations, compose music and fairy tales, generate business ideas, and play games. Based on the ultimate level of reductionism (the whole world reduced to zeros and ones), it interferes with the complex adaptive systems that make up our societies and our world. We know that such interference leads to overall unpredictable consequences. These may lead to good and bad effects for individuals, but it leaves societies without ways to serve the general well-being of all their citizens.

One direct victim of the developments sketched above is trust. Trust in institutions, governments, financial systems, big companies, science, narratives, and illusions that we can control.

WHAT CAN BE DONE? A WAY AND A WARNING

It is much easier to analyze what possible causes may lead to an observed effect than to create a desired effect from multiple possible causes. This is true for particle physics, and it is even more true for real life.[18] Real life can be seen as an aggregation of interacting complex adaptive systems. In reducing these systems to the sum total of their agents, we take away the "magic" capability of these systems to let new properties emerge, to adapt, to self-organize, or to create diversity. The "magic" results from the interactions between the individual agents and the capability of the agents to learn, adapt, develop mechanisms, and form hierarchies (Holland 1995).

Trust emerges from such interactions. If we take away the interactions, trust disappears. Narratives are essential mechanisms in developing trust. To rebuild trust where it is

14 An early development in that direction was initiated by Sir Benjamin Thompson, Count Rumford, who established the Royal Institution of Great Britain (1799). Subsequently a strong push in that direction was given with the establishment of universities in England by local industries, who needed more advanced technologies to drive their innovations. Examples are the Universities of Manchester (1851), Newcastle upon Tyne (1852), Birmingham (1900), Liverpool (1903), and Leeds (1904). See also Terence Kealey, *The Economic Laws of Scientific Research* (New York: St Martin's Press, 1996).

15 One might call this a bifurcation point in the way this concept is used in the sciences.

16 Or, as Francis Bacon might phrase it: "To subject nature to its God given laws."

17 *Trust* as in the *Oxford Dictionary*: "Firm belief in the reliability, truth, or ability of someone or something."

18 In his iconic article "More Is Different," P. W. Anderson (1972) states: "The ability to reduce everything to simple fundamental laws does not imply the ability to start from those laws and reconstruct the universe. In fact, the more the elementary particle physicists tell us about the nature of fundamental laws, the less relevance they seem to have to the very real problems of the rest of science, much less to those of society."

lost, existing narratives must be changed, or new ones developed (van der Leeuw and Folke 2021).

In order to do that, we must deal with obstacles that prevent us from realizing the desired changes. Obstacles manifest themselves when humans want to make change happen, especially when they want it to happen faster than the natural evolution of the systems that are affected by the changes (Vasbinder and Sim 2021). Introducing new technologies that affect established patterns of thought or behavior can generate such obstacles. These may manifest themselves as runaway illusions of control that hamper the harmonious coexistence between humanity and the illusions over which it has control.

How to regain control of these illusions, or the narratives that support them and the trust "without which we cannot stand"?

There is a way and a warning. The *warning* is that evolution is relentless. It conserves nothing. Living systems, among which are human societies that do not adapt to changing conditions, will go extinct (Agosta and Brooks 2020).

The *way* is to find natural routes around the obstacles. In looking for such routes, humanity may focus on the natural harmony with nature that exists in small communities and that seems to have gotten lost in cities. Such small communities can adapt quickly and harmoniously to change, or at least they can have the illusion that they do.

The next paper (van der Leeuw and Dirks) sets the stage, arguing for a generalized perspective on the emergence of the illusion of control. The other papers in this special collection highlight how the illusion of control plays out in different domains—from the fishing industry (van Santen) to the emergence of corruption in ex-colonial territories (Feikema), from politics (Cleary) to business (Obolensky) and finance (Sheng). They highlight the individual perspectives of the authors of the papers, which range from the humanities (Nowotny) via biology and epidemiology (Brooks and Agosta) to the cognitive sciences (Iriki and Tanaka).

In organizing this special collection, we have deliberately kept the papers in the same order as at the conference. The purpose of the latter was to elicit questions and comments by presenting the contributions in a way that stimulated cross-fertilization. The results of that attempt can be found in the discussions at the end of each presentation, and in the general conclusion, on the website of Para Limes (https://www.paralimes.org/past-events/conference-illusion-of-control/).

COMPETING INTERESTS

The authors have no competing interests to declare.

AUTHOR BIOGRAPHIES

Jan Wouter Vasbinder did his BSc in shipbuilding engineering and his MSc in nuclear physics. He started his professional career as a researcher in a Dutch nuclear laboratory. In 1981 he was appointed Attaché for Science and Technology in Washington and Ottawa. In 1985 he returned to the Netherlands, to head an organization responsible for developing large and long-term cooperative-industry-university research programs. Subsequently he became member of the management team of the Dutch organization responsible for executing government innovation policies. In 1995 he cofounded Prisma & Partners, a firm dedicated to finding, strengthening, and mobilizing the innovative capacity of companies, government (related) organizations, and regions.

His career took a drastic turn in 2004 when he initiated Institute Para Limes (IPL) in Europe. IPL was founded in 2005 by twenty-five founding fathers among whom were six Nobel laureates. IPL set out to be the European version of the Santa Fe Institute in New Mexico. Its founding manifesto stated four needs it would address:

- to ask the unconventional questions.
- to stimulate encounters across disciplinary boundaries.
- to challenge the established ways of thinking.
- to open unexplored, yet promising, avenues for research.

The 2009 financial crisis brought that ambition to an abrupt end. However, in 2011 the activities of IPL were continued at the Nanyang Technological University (NTU) in Singapore under the name Para Limes. Initially Para Limes focused on developing the first institute in Southeast Asia dedicated to research of complex systems. The Complexity Institute was spun off on 1 April 2014, and Para Limes refocused its activities on organizing high-level conferences, workshops, and projects, getting together world-class scientists, philosophers, artists, and people of practice to identify essential questions in society and explore ways to address them. In 2019 Para Limes resumed those activities in Europe.

During his stay at NTU, Jan W. Vasbinder initiated, organized, and chaired more than twenty high-level conferences and workshops, involving world-class scientists and thinkers from six continents. He initiated and organized a series of lectures by (the late) Sydney Brenner and W. Brian Arthur and a workshop on Grand Challenges in Science in the 21st Century. He was also responsible for the organization of the series of lectures initiated by Sydney Brenner, resulting in the book *10 – on - 10, the Chronicles of Evolution*.

Jan W. Vasbinder has written and edited more than ten books, most of them in the series *Exploring Complexity*, published by World Scientific Publishers (WSP).

The joy in his work comes from exploring new, potentially powerful, combinations of knowledge, arts, philosophy, and practice and from developing projects and programs to make such combinations useful.

His motto is "the value of knowledge is in its use."

He is married and has four children.

Sander van der Leeuw. An archaeologist and a historian, Sander van der Leeuw pioneered the application of the

Complex Adaptive Systems approach to socio-environmental challenges, technology, and innovation. He coordinated the ARCHAEOMEDES research program (1991–2000) using the CAS perspective on sustainability challenges in S. Europe—the first of its kind worldwide. He held teaching positions in Amsterdam, Leyden, Cambridge, and Paris (Sorbonne) and was founding director of Arizona State University's School of Human Evolution and Social Change and dean of its School of Sustainability. He is Fellow of the AAAS, Honorary Fellow of RIHN (Kyoto, Japan), External Faculty Fellow of the Santa Fe Institute, and Corresponding Member of the Royal Dutch Academy of Arts and Sciences. He held a Chair at the Institut Universitaire de France. In 2012, he was awarded the title "Champion of the Earth for Science and Innovation" by UNEP, and in 2023 the lifetime research award of the Shanghai Archaeological Forum of the PRC.

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Victor Galaz is Associate Professor in political science at the Stockholm Resilience Centre (Stockholm University), and programme director of the Beijer Institute's Governance, Technology and Complexity programme. His research explores the political and governance challenges created by rapid global change, including globally networked risks, governance dimensions of "planetary boundaries," the interplay between financial systems and Earth system dynamics, and the sustainability implications of novel technologies such as artificial intelligence. Among his publications are articles in journals including the *Lancet*; *Technology in Society*; *Nature Sustainability*; *Global Environmental Change*; *Lancet Planetary Health*; *Public Administration*; *Governance*; *Complexity, Governance and Networks*; *Nature Climate Change*; *Science*; and others. Galaz is also the author of the book *Global Environmental Governance, Technology and Politics: The Anthropocene Gap* (Edward Elgar, UK/US, 2014), and editor of *Global Challenges, Governance, and Complexity Applications and Frontiers* (Edward Elgar, UK/US, 2019).

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