**Remarks on Complexity Theory**
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# Complexity Theory: The Theory of the Ultimate Void.

The so-called Complexity Theory is almost like the Visa card commercial: everywhere, but maybe not always where you want to be.
All "serious books", magazines, just about anything listed under the 'non-fiction' label somehow needs to mention or allude to some elusive 'complex systems'. Complex Systems, Complexity Theory: today's mantra... In order to sound scientifically versed or simply show rational credentials, one must never omit mentioning complex systems, either as an explanation, an aside, a consideration, or a problem that will need to be fixed at some ulterior time. Complex systems are here to stay. Words or notions that invariably follow the mere mention of complexity are – this is a mere sample: *networks*, *interrelations, interconnections*, *chaos*, *irreducibility*, *relationships*, *global (global anything will do quite well)*, *randomness*, *probability*, *incompleteness*, *interactions*, *loops, negative* or *positive feedbacks* and so on. The only correlation these terms share is their meaninglessness.
It matters not that Complexity Theory has no definition – or as many as there are books written about it - there is a specific gravitational grammar around it. The sudden discovery of our post modern mindset suggests that we have finally arrived at the conclusion that things are not always as simple they seem.
This revolutionary conceptual new frontier is now officially open to all, so that a 'new' pseudo-scientific babble can expend endlessly.
Three main categories of 'complexity' seem to fit the mold of a complex system:

1) **The extreme or near impossibility to solve a specific or a set of similar problem.** <u>(Mostly found in Human Sciences or esoteric mathematics)</u> In this type of complexity, time is the primary factor creating complexity. Complex issues in this category would take anywhere from a lifetime to infinity to solve. It is important to note here the elements that make up this type of complex system are fully described, understood, and known. It is their relationships or interconnectivity – computational factor – that creates complexity. NP complete problems or Omega – type numbers are typical examples of application / version of complexity in mathematics. Nature and its wonder – such as why a mound of sand collapses after x amount of sand is dripped unto it, is a human science version of the same idea (hint: stability, it seems, sits at the very edge of chaos, i.e. just before the sand pile collapses under its own weight) .
2) **The lack of data to explain or predict situations or outcomes** <u>(Generic Version and Sociological Studies)</u> is another version of Complexity Theory. This is usually used as an explanation as to why we have gross scientific deficiencies. Such science professes to predict the future using advanced modeling techniques and uses the complexity as an

explanation for their constant failure to explain or predict anything. Think economy or weather forecasting. Error is built-in and an existential part of these systems. Even physics has joined the fray – complaining that our current backward state in technology is to blame for the lack of adequate concrete experimental data, hence the impossibility to find solutions to most questions bouncing around the quantum field. Most sciences fall in this category these days. It is interesting to note that, whatever the complaints may be, the technology is there but the interpretation is not. Discoveries are made but no one seems to be able to make heads or tails about it. Complexity Theory: bits of data without glue.

3) **World issues, Global economy, Global warming, etc. (**The rest of the unexplained because unexplainable….The impossibility to conceive an explanation for lack of any data whatsoever save for the effect of too many unknown unknowns) constitutes the third version. This one is close to 'chaos theory' as it usually bundles together all fields of human activities in particular and in general, predicting universal fireworks of a infinite magnitude. The principle goes like this: the author illustrates how should one of these human activity - may it be farming, stock trading or industrial processing - go wrong, the damage of this single event would go from singular to global, from one to many, multiplying before collapsing – as in the domino effect – on all the cards that mankind built. The universe as we know it would ultimately implode. In this scenario, we are apparently doomed if we do or if we don't. Since complexity arises from nowhere in particular or somewhere/nowhere under unknown conditions and conjunctions with horrendous repercussions everywhere and to everything, civilization is bound to collapse pretty soon. Global this or global that are the usual suspects here.

The overall logic of complexity theory always starts out by explaining our lack of understanding, hence solutions. It then proceeds to propose solutions to our lack of understanding… The argumentation stops when the author(s) 'stumble' unto some core complex system that cannot be further explained in simple terms. That complex is deemed irreducible: all the parts of the system are intermingled so badly that they promptly declare the apparent cluster the foundation of their personal complex system.
This is the premise of all the Complexity Theorist. Based on this phenomenal discovery, we are subjected to a long explanation as to the meaning of this irreducibility and its formidable significance. The conclusion typically exposes a loose method for the befuddled reader to play with the system so that he too, can be part of the 'Secret'.
In short, the Complexity Theorists explain how complexity can be simplified by some external explanation - a meta-complex solution.

Complexity theory is basically a single name for a totally separate and distinct set of issues conveniently buried under pseudo scientific jargon. Since it impossible for technocrats and specialists alike NOT to have a ready made answer to everything, the lack of answer becomes the answer itself. As such Complexity theory might just as well be renamed Theory of the Void, Theory of Nothing, Theory of The I don't Know and should include all things and unknown phenomena, including but not limited to dark matter (the old Ether thing) ghost, flying saucers and alien abductions.
Complexity Theory: Who needs it?

Ref:

There are many definitions of complexity, therefore many natural, artificial and abstract objects or networks can be considered to be **complex systems**, and their study complexity science is highly interdisciplinary. Examples of complex systems include ant-hills, ants themselves, human economies, climate, nervous systems, cells and living things, including human beings, as well as modern energy or telecommunication infrastructures.Complexity has always been a part of our environment, and therefore many scientific fields have dealt with complex systems and phenomena. Indeed, some would say that only what is somehow complex – what displays variation without being random – is worthy of interest.The use of the term complex is often confused with the term complicated. In today's systems, this is the difference between a myriad of connecting "stovepipes" and effective "integrated" solutions. (Lissack and Roos, 2000) This means that complex is the opposite of independent, while complicated is the opposite of simple.

**Harnessing Complexity**
**Robert Axelrod and Michael D. Cohen**
**The free Press, 1999**
**This is a small book about a large question: In a world where many players are all adapting to each other and where the emerging future is extremely hard to predict, what actions should you take?**
We call such worlds Complex Adaptive Systems. In Complex Adaptive Systems there are often many participants often many kinds of participants. *They interact in intricate ways that continually reshape their collective future*.
New ways of doing things, even new kinds of participants-may arise, and old ways or old participants - may vanish. Such systems challenge understanding as well as well as prediction.
These difficulties are familiar to anyone to has small changes unleash major consequences. Managers and policy makers hear about complexity research, they often ask, "How can I control complexity?" What they usually mean is, "How can I eliminate it?" But complexity stems from fundamental causes that cannot always be eliminated.
We show how the very complexity that makes the world hard to understand provides opportunities and resources for improvement over time.
We are often asked how "complexity" differs from "chaos." The simple answer is that Chaos deals with situations such as turbulence (Gleick, 1987) that rapidly become highly disordered and unmanageable. On the other hand, complexity deals with systems composed of many interactive agents: **While complexity may be hard to predict, they may also have a good deal of structure and permit improvement by thoughtful intervention.**
Our approach is not just an extended "evolutionary metaphor," nor is it part of Social Darwinism (Hofstadter, 1955) or sociobiology (Wilson, 1975). We view processes of biological change as wonderful examples in the larger set of Complex Adaptive Systems. However, they have special kinds of agents, particular sorts of strategies, distinctive patterns of interaction, and their own special processes of selection. The patterns one sees in biology are not always found in other Complex Adaptive Systems. Copying a strategy for stock trading (such as a computer algorithm) involves only digital information and so is nearly costless compared with producing a new organism that contains a copied gene. Evaluating a business strategy (say, the introduction of a new product) can be enormously expensive compared with making a random variation of a fruit fly. Variation, interaction, and selection are at work in a population of business strategies, but the detailed mechanisms are often distinctly unbiological. To harness complexity effectively, many kinds of Complex Adaptive Systems must be considered. We have paid special attention to the role of information in Complex Adaptive Systems. The continuing fall in the costs of copy-Preface
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Dixon on Complexity … The Drama:
The temperature is rising, and it's going to get much hotter yet. We
can now make a plausible case that we're on the cusp of a planetary emergency. Humankind is facing an increasing risk of a synchronous failure, arising from multiple stresses acting powerfully at multiple levels of our social, economic, and biophysical systems. At the moment, these stresses are acting in the background, quietly eroding the resilience of these systems. The danger is that several will reach a crisis point simultaneously. For instance, a sharp shift in climate that cripples food production and Destabilizes regimes across Asia could occur at the same time as another International financial crisis and a string of major terrorist attacks on several Western capitals. Such a combination could overwhelm the adaptive capacity and resilience of even rich and powerful societies. A breakdown of institutional and social order might then happen very suddenly essentially "out of the blue." We aren't thinking in these terms, because we tend to
treat our problems in isolation and not see the links between them. So we aren't at all prepared for the challenge barreling down the road toward us.

==== *Oded Goldreich (2005***Absolute Results (a.k.a. Lower-Bounds).** As stated up-front, absolute results are not known for many of the ``big questions'' of complexity theory (most notably the P-versus-NP Question). However, several highly non-trivial absolute results have been proved. For example, it was shown that using negation can speed-up the computation of monotone functions (which do not require negation for their mere computation). In addition, many promising techniques were introduced and employed with the aim of providing a low-level analysis of the progress of computation. However, the focus of this course is elsewhere.

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