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To act or not to act. Predictability of intervention and non-intervention in health and environment

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A cautionary tale from recent events

Days after COVID-19 was officially declared by the WHO as a pandemic, on March 17th 2020, the world-renowned Stanford epidemiologist John P.A. Ioannidis published an article titled "A fiasco in the making? As the coronavirus pandemic takes hold, ***we are making decisions without reliable data***". In this article, after trying to make an estimation of the infection fatality rate of SARS-CoV-2 projecting the data acquired from the case of the spread of the epidemic on board the Diamond Princess cruise ship, he argued that:

"...reasonable estimates for the case fatality ratio in the general U.S. population vary from 0.05% to 1%. That huge range markedly affects how severe the pandemic is and what should be done. A population-wide case fatality rate of 0.05% is lower than seasonal influenza. If that is the true rate, locking down the world with potentially tremendous social and financial consequences may be totally irrational. ***It's like an elephant being attacked by a house cat. Frustrated and trying to avoid the cat, the elephant accidentally jumps off a cliff and dies****." [1]*

Subsequently, two years after the first imposition of strict lockdowns in most of the western world, we are beginning to realize not only that such interventions had ***severe negative impacts*** on almost every aspect of life, but, most importantly, ***they seem to have had no significant long-term effect on the burden of disease***, hospitalization and death. [2][3][4]

Policy making : is it an unidisciplinary technocratic issue?

- In his farewell address, famous for the warning against a "military industrial complex", US President Dwight D. Eisenhower, among other things, had this to say:
  "Partly because of the huge costs involved, a government contract becomes virtually a substitute for intellectual curiosity. (...) The prospect of domination of the nation's scholars by Federal employment, project allocations, and the power of money is ever present and is gravely to be regarded. Yet, in holding scientific research and discovery in respect, as we should, we must also be alert to the equal and opposite danger that public policy could itself become the captive of a scientific-technological elite. ***It is the task of statesmanship to mold, to balance, and to integrate these and other forces****, new and old, within the principles of our democratic system-ever aiming toward the supreme goals of our free society." [5]*

The need for an immediate response

- In an emergency situation, there is no time for proper deliberation. When faced with a threat like a pandemic which has the potential to get worse if measures are not put in place early enough, in other words when timing seems to be an essential part of the equation, **one can argue that we need to intervene in the strongest possible way, assuming the worst-case scenario.** This is characteristically applied in the subject of climate change where the call is to "act now" assuming the worst-case scenario.
- The actions taken themselves have a level of unpredictability, and both their known and predictable negative effects as well as the potential for yet unknown negative effects should be factored in.
- The critique on lockdown policies, in this sense, is not targeted towards their initial imposition, but more on the **failure to adjust the policies when new data were available**, for example when it became evident that the specific pathogen (SARS-CoV-2) could not be eliminated. Lockdowns also were not supported by previous guidelines. [6]

Simple answers for complex problems

- One core issue may also be that, as a culture, **we like simple answers**. When a decision on policy is concerned, people tend to be friendlier towards **politicians that provide them with simple answers**, and thus politicians tend to prefer **scientists that provide them with simple narratives**. The complexity of dealing with nonlinear systems may be difficult for a culture that strongly believes in the ability of man to control his environment.
- **Systems like climate and public health are complex**, nonlinear, and, most importantly, open. These kinds of systems are approached using stochastics and complexity theory, yet policy makers tend to assume simple linear and deterministic relations :
- **Climate** tends to be publicly understood and discussed in two variables: **global average temperature anomaly** and **CO2 concentrations**. Maybe also "extreme weather events" has entered the conversation, and that is because it provokes fear and invites attention.
- **Public health** during the last two years seems to be understood only in terms of **one disease** and measured also by two variables: **mobility/human contact** and **cases**.
- Such **linear dipoles are gross oversimplifications** and the myopic focus on such dipoles is a corruption of both scientific discourse and public policy-making.

The Hurst-Kolmogorov (HK) behavior

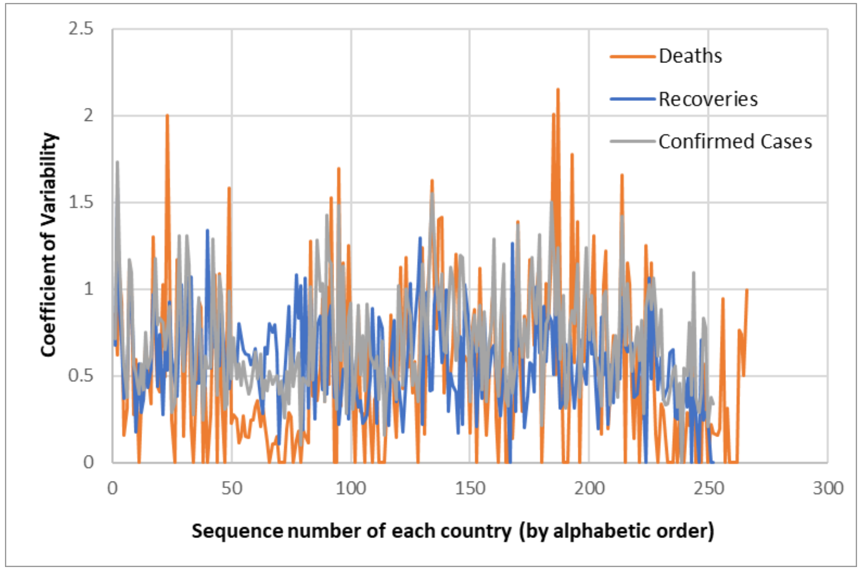
- The Hurst-Kolmogorov (HK) behavior, is also known as Long Term Persistence (LTP). It seems that in natural systems, randomness and predictability are intrinsic and can be deterministic and random at the same time, depending on the prediction horizon and the time scale[7]. Particularly, all these processes are characterized by high unpredictability due to clustering of events.

- Although, in HK dynamics the marginal distribution of the process maybe arbitrary, the most commonly used distribution is the Gaussian one, which results in the well-known fractional-Gaussian-noise, described by Mandelbrot and van Ness [8], i.e. the power-law decay of variance as a function of scale γ(k), is defined for a process [9]. The HK behavior is quantified by the Hurst parameter($0<H<1$). In the simplest case, the variance γ(k) of the process at timescale k, known as climacogram, is given by:

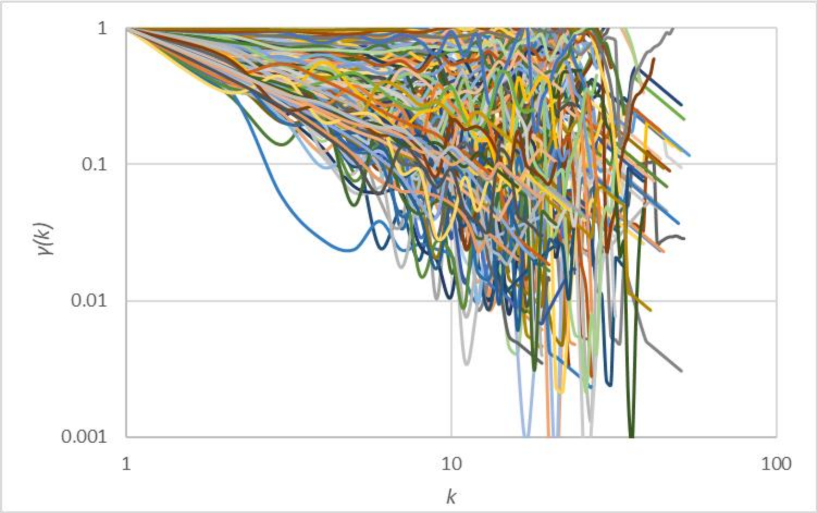
$$\gamma(k) = \frac{\lambda}{(k/\Delta)^{2(1-H)}}$$

Where Δ, is a characteristic timescale and λ is the variance for this time scale. For $0<H<0.5$, the HK process exhibits an anti-persistent behavior, $H=0.5$ corresponds to the white noise process, and for $0.5<H<1$ the process exhibits LTP(clustering).

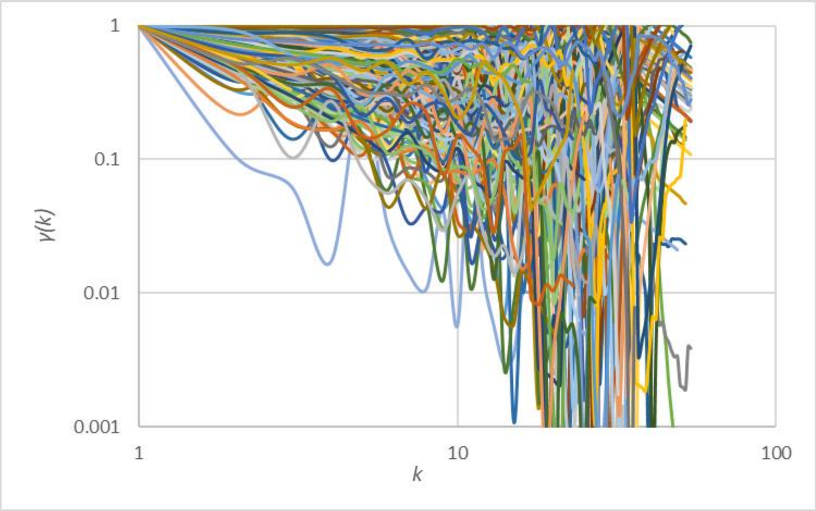
The stochastic ambiguities in the COVID-19 outbreak



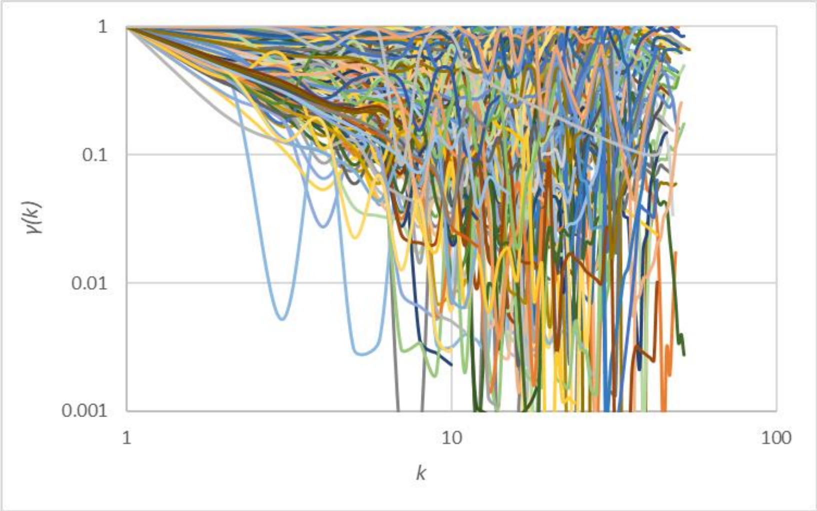
Standardized climacogram of differential Deaths



Standardized climacogram of differential Confirmed Cases



Standardized climacogram of differential Recoveries



Source of raw data: http://humdata.org/

Conclusions

- Models are just ways of thinking about a system and should be open to new data and new insights. To think we have a final answer, and that the answer is so simple (linear dipoles), invites error.
- Complex systems cannot be controlled, all we can do is try to **manage them by making small adjustments one-by-one**, periodically revisiting our assumptions.
- We should not insist on simple narratives. If we are not prepared to change our ways of thinking again and again, and rely on so-called "settled science", we should be prepared to make grave mistakes with public policy.

Proposals

- We should do a better job finding objective ways to give technocratic advice to governments and policy makers.
- We should consider not only easily measurable outcomes and figures, but instead acknowledge the interdisciplinary nature of the problems in question.
- We should acknowledge the real level of **uncertainty in natural phenomena and proposed interventions**.

The need for a methodology

- A methodology is needed to be developed that could give policy makers an **indication of when radical action is warranted**. A metric that can be calculated before action is taken.
- When assessment of the results is possible, the metric can be **revisited and informed**, and used for comparative purposes for future action. The utilization of a well-defined index is needed, that will be able to **assess uncertainties**, and a kind of feedback loop that can **inform the understanding** after the fact.

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