Making a Difference

Coronavirus (COVID-19): Complex modelling and the case for open systems

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The Problem

With the emergence of a new and dangerous disease, governments do not have time to wait until clear data about the disease is available and cannot rely that this disease will be similar to others in the past – they have to take immediate action if they are to limit the death toll. The data coming in about COVID-19 is complex: composed of different sources that collect the data in different ways. So where can the Government turn for informed advice?

The Response

The UK government turned to complex computational models to make sense of the data and give them some idea as to what was happening and what was to come. A team of epidemiologists at Imperial College adapted a model that had been developed over 13 years ago to model flu pandemics against the new virus. It was their model results along with an evaluation of the data coming from Italy that alerted the Government to the coming problems. This modelling was critical in getting the Government to change their policies and introduce social distancing and lockdown measures aimed at slowing the infection rate down so its spread happens over a much longer time period.

However there are lots of difficulties with such complex models. They are very hard to check completely, since many of the parts can interact in surprising and unpredictable ways. They also, inevitably, encode assumptions about the disease and how people are spreading it, because the facts are unknown. These difficulties are fundamental to this kind of modelling and are not the fault of the Imperial team – they are rapidly reacting to the situation and doing the best they can.

Their results are not uncontested – there are many teams racing to model this, all using slightly different assumptions and levels of sophistication in their models – and they do not all agree on the implications.

As we become more interconnected and our collective life more complicated, we are going to have to increasingly rely on complex modelling of this type. As it says in a recent overview of such modelling published by the Government Office for Science "Just as physical tools and machines extend our physical abilities, models extend our mental abilities, enabling us to understand and control systems beyond our direct intellectual reach".

Recommendations

We are going to have to improve the practice of modelling, but also the interface between modellers and policy actors and between modellers and the public. Four such suggestions include:

- Modellers will have to get used to making their models openly available to others to check and play with at an early stage – that way it is not just a single team or model that is relied upon but the efforts of a whole community of researchers (in a similar manner to how the software that runs the internet was built).

- It should be standard government policy that any model that significantly influences important decisions should be made open, so that others can see the assumptions that these models are based upon and critique them. In other words, move towards democratically accountable modelling.

- Policy actors and the public should develop some basic knowledge about such modelling so they know when it can be relied upon and for what kinds of purpose. For example, it is rare that these kinds of model predict the future well, but they can be very useful in understanding what is happening and what might go wrong as a result of interventions. There is a good introduction to this and some guidelines in a recent government report.

- Ways of making detailed, individual data available to researchers in responsible ways in crisis situations needs to be worked out and routinely implemented. Producing a stream of good quality data takes time, so this needs to be in place before a crisis occurs.

Further information

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Government Office for Science (2018) *Computational Modelling: Technological Futures*. **www.gov.uk/government/publications/ computational-modelling-blackett-review**

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