

Fractal Action

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Abstract

Many countries are already infected with the coronavirus: it's already a pandemic. However, most cities are still free from the deadly pathogen. Governments must add a second priority to their agenda: not only prevent the spread *to* their country, but *within* their country.

Governments must take FRACTAL ACTION: in infected countries, travel between states must be limited. In infected states, travel between cities must be limited. In infected cities, travel between neighborhoods must be limited. And in infected neighborhoods, travel between blocks. Other measures such as banning public gatherings must be deployed, perhaps **fractally**, in order to reduce the cost for the population.

Introduction

The situation is dire. More people died in a few weeks than in the full SARS epidemic, and China quarantined more citizens than those of the US or of the EU. It's not "another flu".

The virus kills more than we know. People take days to get diagnosed and weeks to die, so the number of contagions and the mortality of the virus have both been seriously underestimated.

The virus kills more healthy people than we know. So far it killed mostly old people, but this is likely to be due to lag again: young people take longer to die.

The virus will kill more, as time passes by. As China's healthcare system will get overwhelmed, expect less individual care thus more deaths – including people who die of unrelated illnesses, because they couldn't get to overcrowded hospitals.

Most countries around the world already contain carriers – whether they know it or not. A new focus should dictate the actions of local governments: preventing internal spreading.

Trade-offs

The recommendations of this paper are not considered exhaustive; probably, a stricter and more complete set of measures would be more adequate to the extreme threat faced. However, governments are hesitating as drastic measures would take a strong toll on the local population. This paper proposes a trade-off *concept* to limit internal spread of the virus.

Fractal action

The concept of fractal action rests on four principles:

Proactivity: the fact that the pathogen spreads from asymptomatic carriers means that the virus will always be one step ahead. Effective action might be two steps ahead. This means closing borders *before* contagion takes place, not afterwards.

Fractal borders: borders to be selectively closed comprise those between countries, states, cities, neighborhoods and blocks.

Progressive lock-down: to minimize social and financial costs on the affected population, borders are progressively closed down, with the following rules:

- In a neighborhood with a case, travel between blocks is restricted.
- In a city with a case, travel between neighborhoods is restricted.
- In a state with a case, travel between cities is restricted.
- In a country with a case, travel between states is restricted.

For example, were there to be a case in Capitol Hill, Denver, Colorado, US, travel in the US would be restricted on the following borders: the US border, the border within US states, the border within Colorado cities, the border within Denver neighborhoods and the border within Capitol Hill blocks.

Similarly, the degree of travel restrictions could depend on the severity of the contagion (how many cases? How many people did they come in contact with?), with fractal strictness.

The stricter the travel restrictions, the easier it becomes to allow those who need the most to travel (e.g. a parent to take for in another state) to do so (because others who need to travel less are locked down, reducing the risks of contagion). Similarly, fractal borders are judged by local authorities – those who know best how to design and execute the restrictions.

Complementarity: the proposed concept proposes a good trade-off between the benefits of travel limitations and its social and financial costs. Complementary measures should be taken, included for example: limiting public gatherings, personal hygiene and limiting unnecessary travel such as tourism.