

# CSC2720H: Systems Thinking for Global Problems


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<http://www.cs.toronto.edu/~sme/SystemsThinking>




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 University of Toronto Department of Computer Science

## How Systems Change

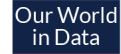
- **Coronavirus as a system**
- **Leverage Points**
- **Multi-Scale Systems**
- **Panarchy Theory**
  - ↳ **Ecological Origins**
  - ↳ **Explaining Multi-level change**

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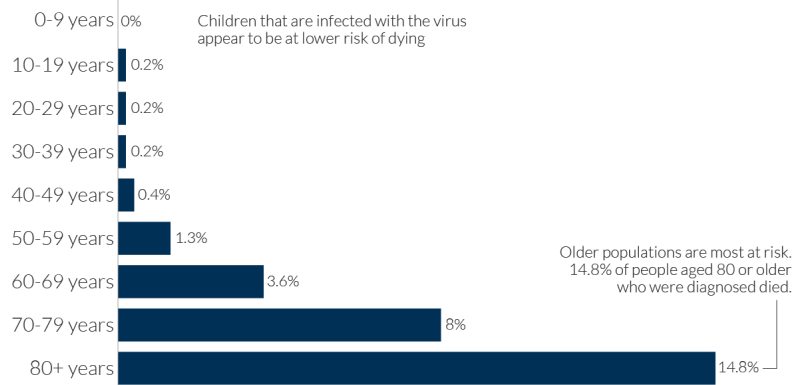
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# Coronavirus: early-stage case fatality rates by age-group in China



Case fatality rate (CFR) is calculated by dividing the total number of deaths from a disease by the number of confirmed cases. Data is based on early-stage analysis of the COVID-19 outbreak in China in the period up to February 11, 2020.



Data source: Novel Coronavirus Pneumonia Emergency Response Epidemiology Team. Vital surveillances: the epidemiological characteristics of an outbreak of 2019 novel coronavirus diseases (COVID-19)—China, 2020. China CDC Weekly. OurWorldinData.org - Research and data to make progress against the world's largest problems. Licensed under CC-BY by the authors.

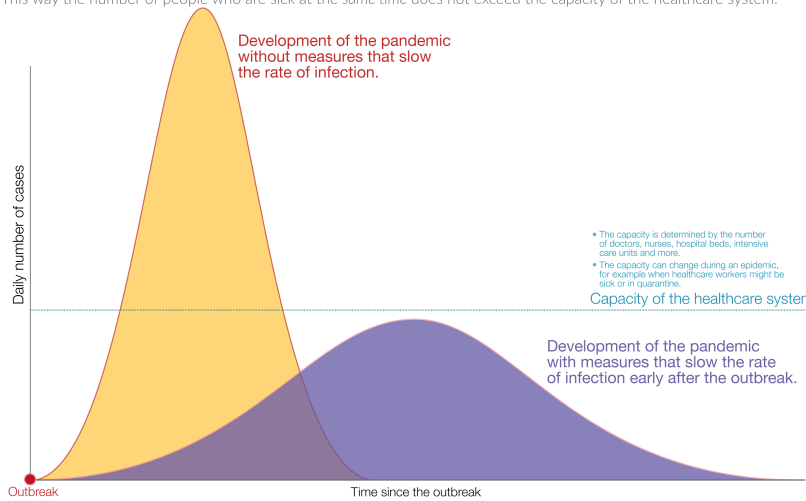
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# In the outbreak of an epidemic *early* counter measures are important

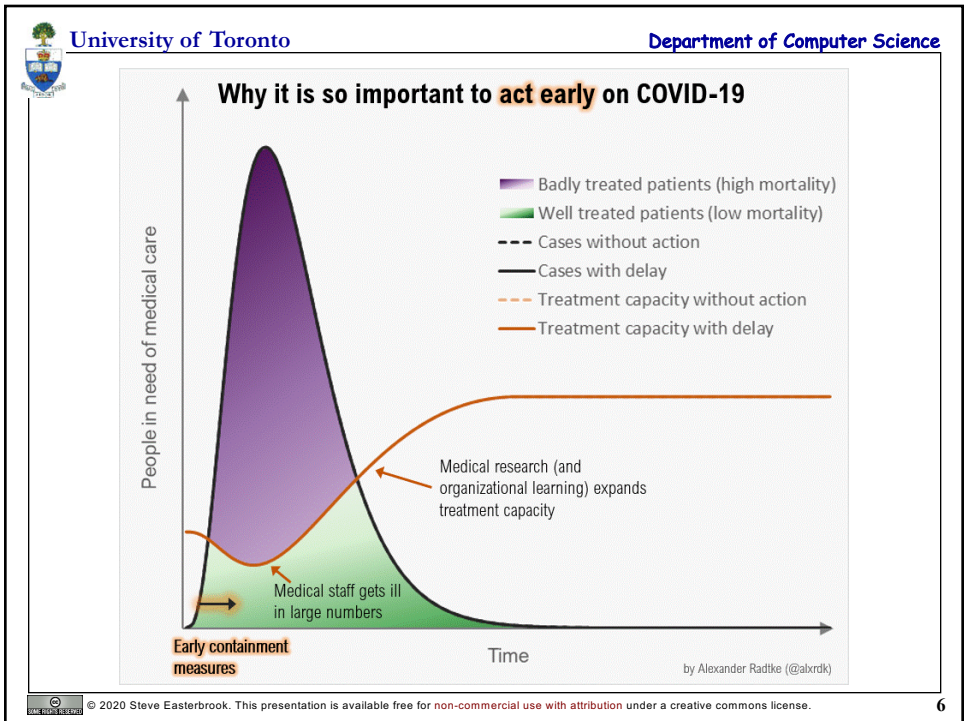


Their intention is to 'flatten the curve': to lower the rate of infection to spread out the epidemic. This way the number of people who are sick at the same time does not exceed the capacity of the healthcare system.

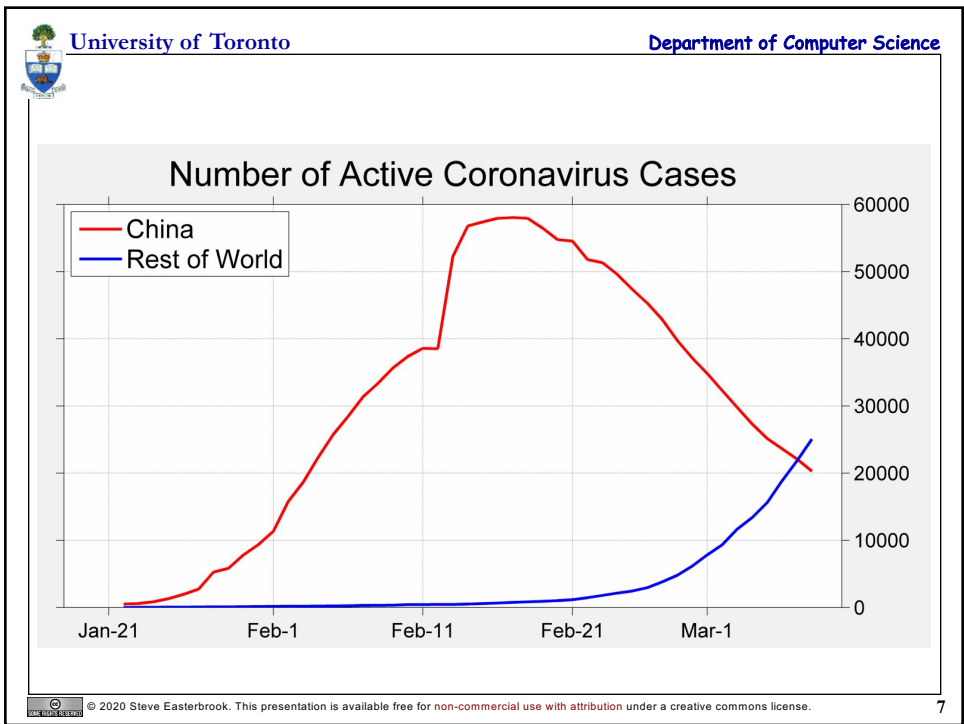


Based on the Centers for Disease Control and Prevention. OurWorldinData.org - Research and data to make progress against the world's largest problems. Licensed under CC-BY by the author Max Roser

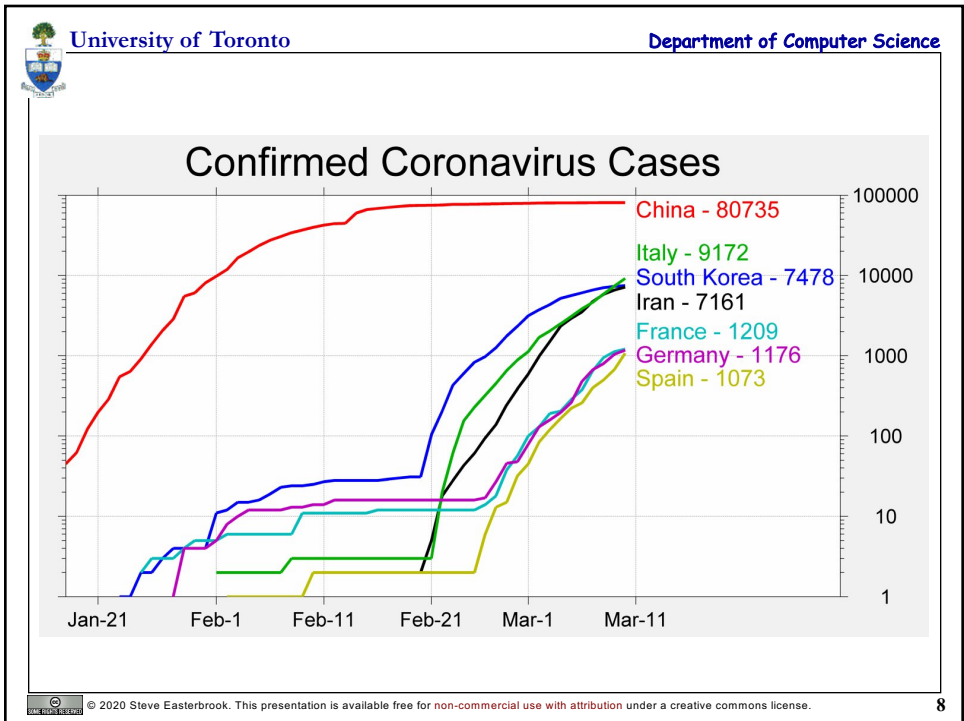
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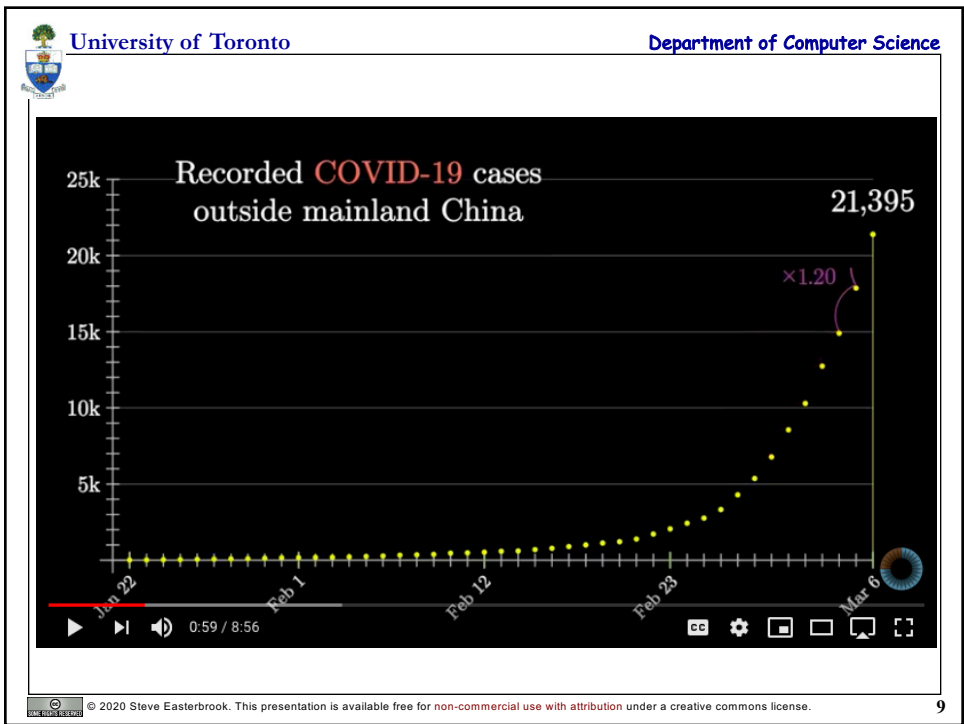
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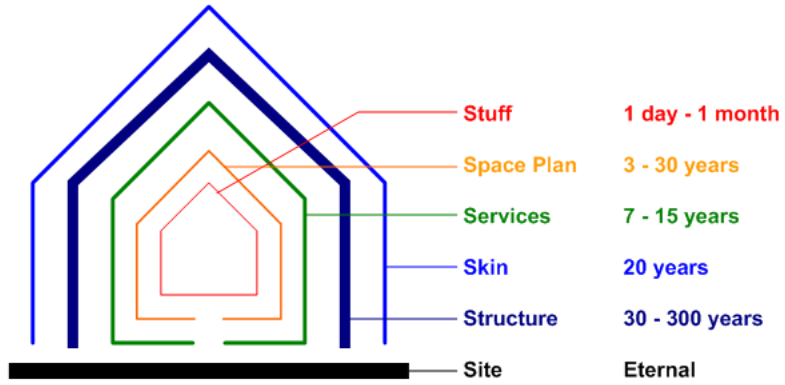
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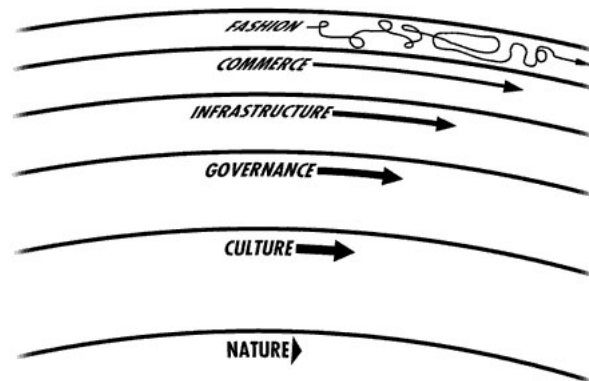


# How buildings learn



Stewart Brand's 6 S's from *How Buildings Learn*

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From: Stewart Brand – *The Clock of the Long Now*

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## The Parisian Shower

It takes time for the hot water to reach the shower head from the hot water tank, and there's enough of a delay between the taps that control the hot and cold water and the temperature response, that you're forever trying to adjust it to get a good temperature.

It's too cold, so you turn up the hot tap. The temperature barely seems to change, so you crank it up a lot. After a few minutes the water heats up so much it's scalding. So you crank up the cold tap. Again, the temperature responds slowly until you realise it's now too cold. You turn down the cold tap, and soon find it's too hot again. And so on.

How could you change this system?



<http://planet3.org/2011/10/18/the-power-to-change-systems/>



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## Leverage Points

1. **Constants, Parameters, Numbers:**  
Change the set point on the hot water thermostat
2. **Size of Stocks and Buffers (relative to the flows)**  
Get a bigger hot water tank
3. **Structure of stocks and flows**  
Replace water pipes with smaller diameter pipes
4. **Length of delays**  
Move the tank closer to the bathroom  
Wait longer before adjusting the tap
5. **Strengthen balancing feedbacks**  
Replace the taps with ones that have a finer level of control
6. **Reduce reinforcing feedbacks**  
Relax (you're too impulsive!)
7. **Restructure Information Flows**  
Put a marker at the preferred setting
8. **Change the rules (incentives, punishments, constraints)**  
Set limits on how long you can shower?
9. **Nurture the power to adapt, evolve, self-organize the system**  
Learn to tolerate hotter and colder water  
Build an automated controller
10. **Change the goal of the system**  
Take a bath instead?
11. **Change the mindset/paradigm**  
Is cleanliness over-rated?  
Accept this as part of Parisian quantness?
12. **Transcend paradigms**  
Learn systems thinking and apply it!



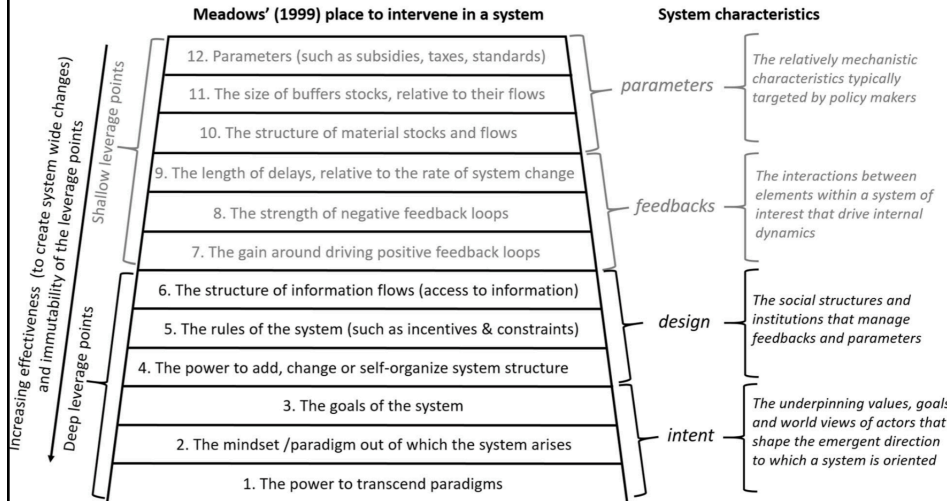
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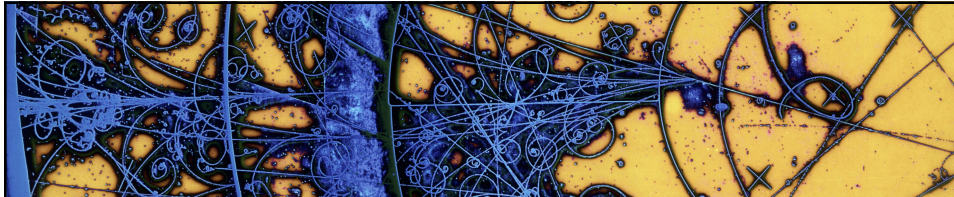
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# Leverage Points



Source: Abson et al (2017). Leverage points for sustainability transformation. *Ambio*, 46(1), 30–39.



Game

## Space for Living

