

CSC2720H: Systems Thinking for Global Problems

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Dept of Computer Science
<http://www.cs.toronto.edu/~sme/SystemsThinking>

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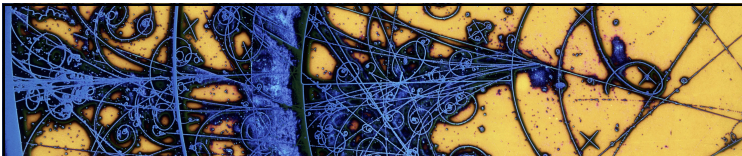
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Week 5: Delay and its impacts

- Warmup Exercise: Warped Juggle
- Debrief from Beer Game
 - ↳ Effect of information delays
 - ↳ Oscillating equilibria
- Effects of Delay
 - ↳ Fixes that Fail (system archetype)
- Delays in other systems
 - ↳ Inertia in the human-climate system
- Game: Harvest


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2



Warmup exercise:

Warped Juggle

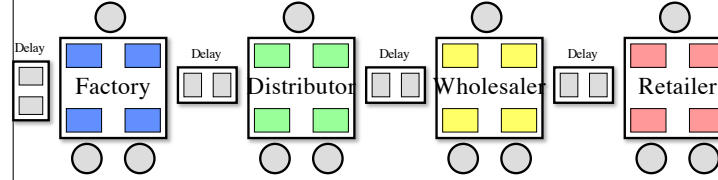


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The Beer Game!



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Experiencing System Dynamics

- Did you feel yourself controlled by forces in the system from time to time? Or did you feel in control?
- Did you find yourself "blaming" the groups next to you for your problems?
- Did you feel desperation at any time?

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Analysis: The Aditya Line

Orders by week – Aditya Line 2020

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The Aditya Line Inventory

Out of stock = Serious lack of service level!

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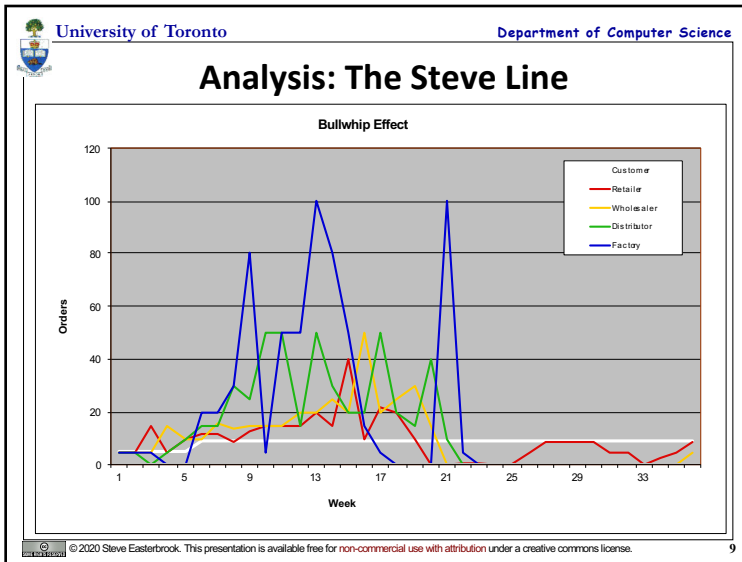
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The Aditya Line – Cumulative Cost

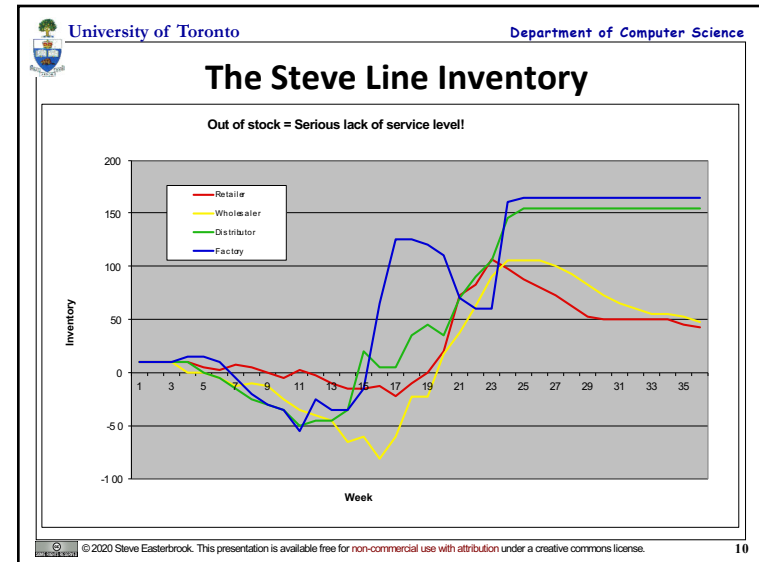
Total Cost

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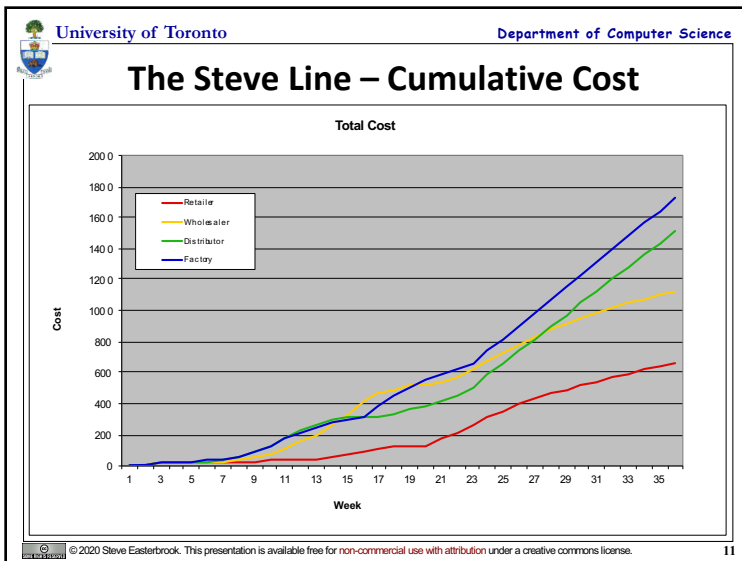
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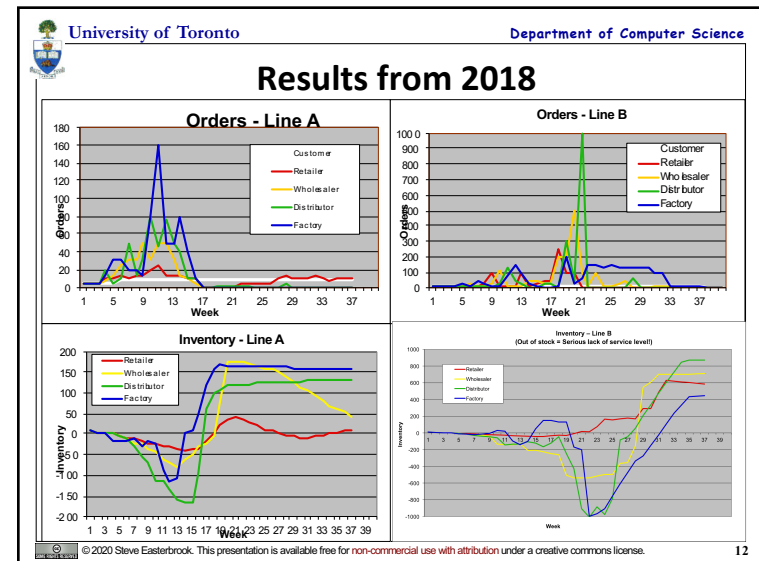
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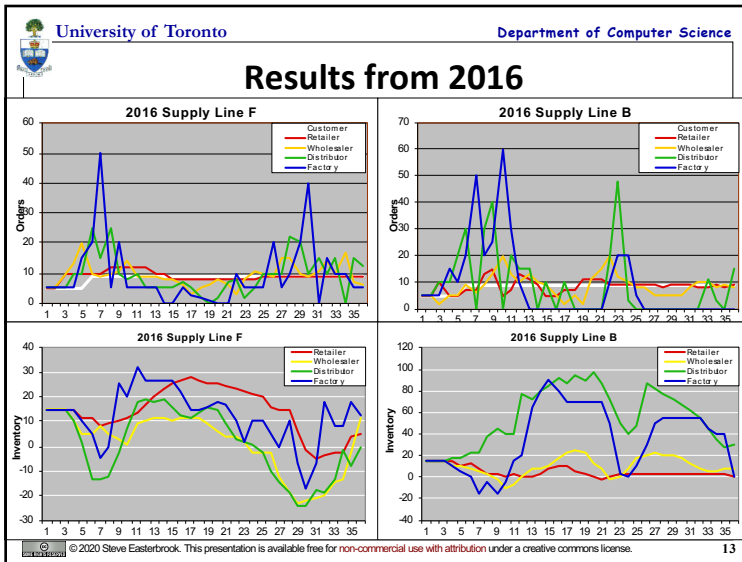
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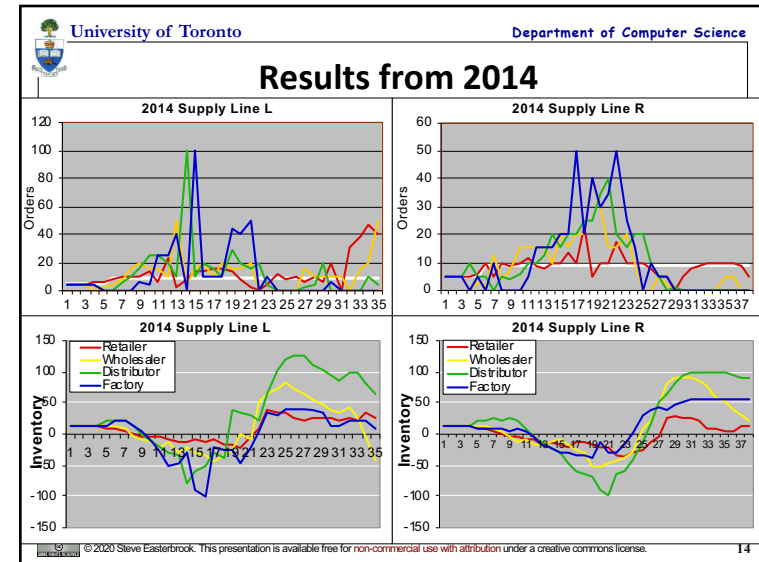
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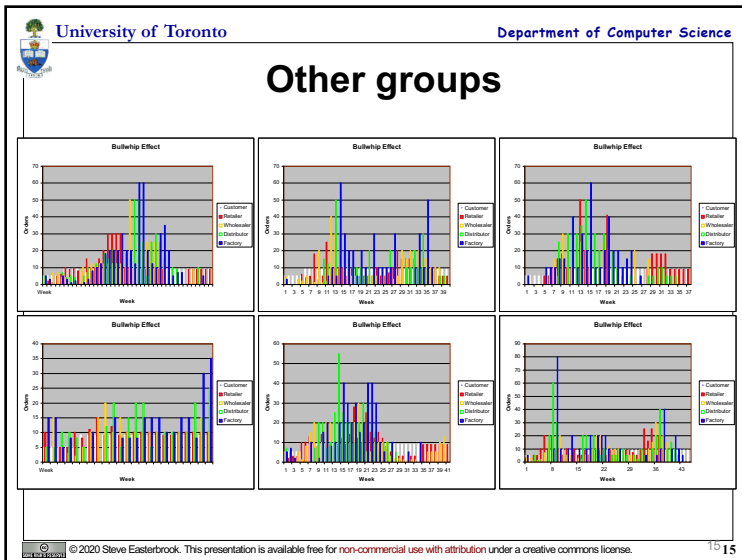
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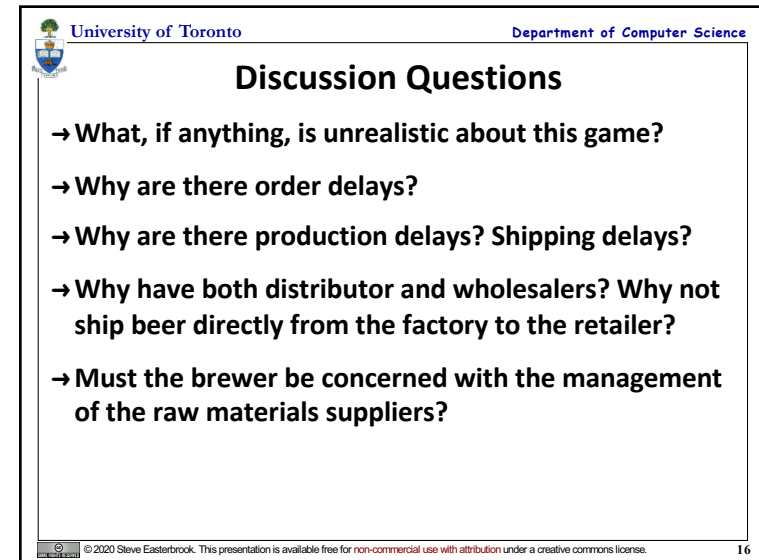
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14



15



16

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Real World Reactions

- A typical organizational response is to blame the “person responsible”
 - ↳ E.g find whoever placed the orders (or the inventory manager) and blame them.
- But the game clearly demonstrates how inappropriate this response is
 - ↳ different people following different decision rules for ordering create similar oscillations.
- We have to change the structural setup!

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Pilot-Induced Oscillation

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Other Effects of Delay

- Fixes that Fail (a common pattern)

See: <https://ourworld.unu.edu/en/systems-thinking-and-the-cobra-effect>

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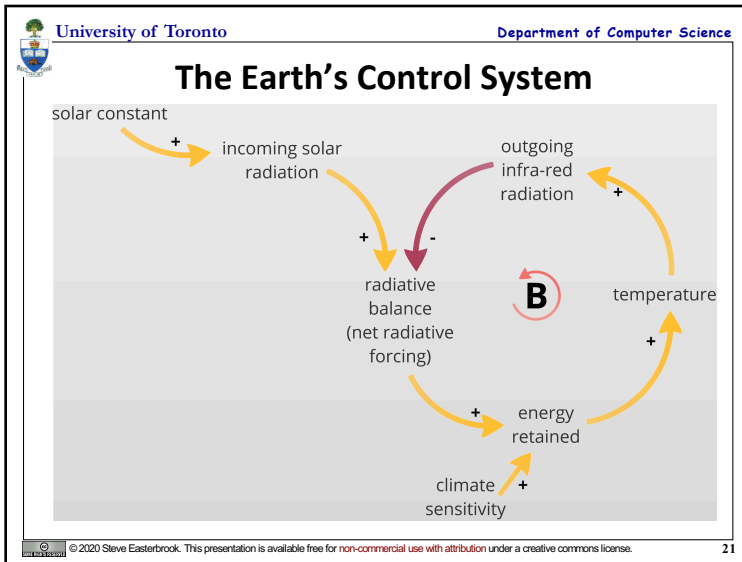
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Case Study

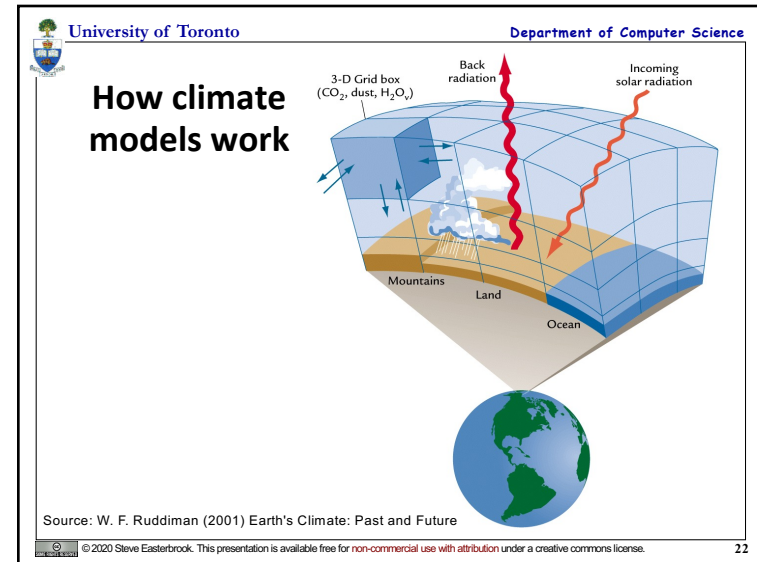
Delay in the Climate System

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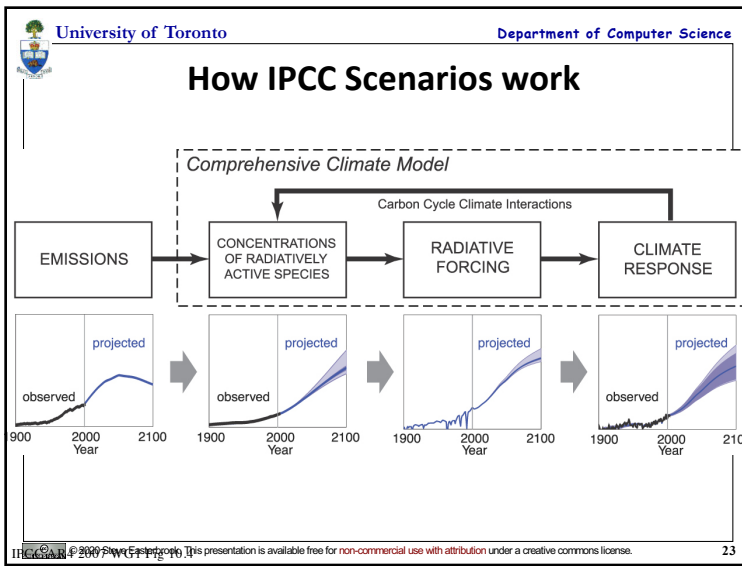
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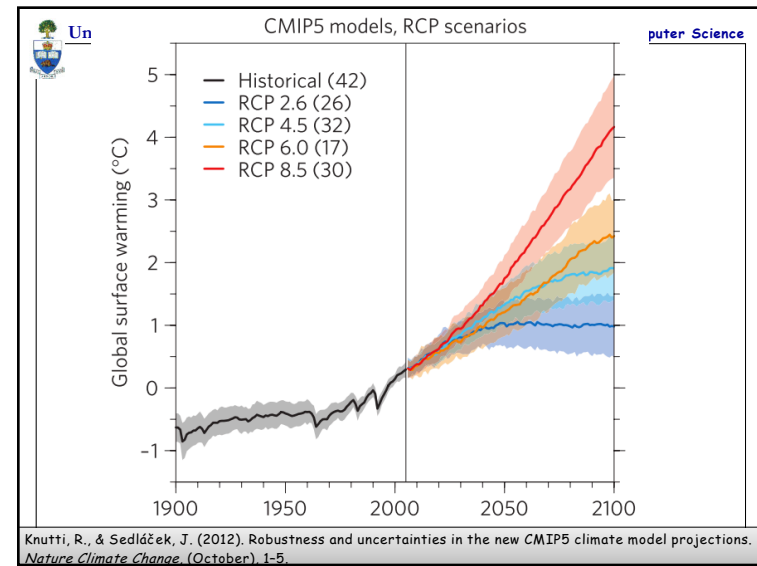
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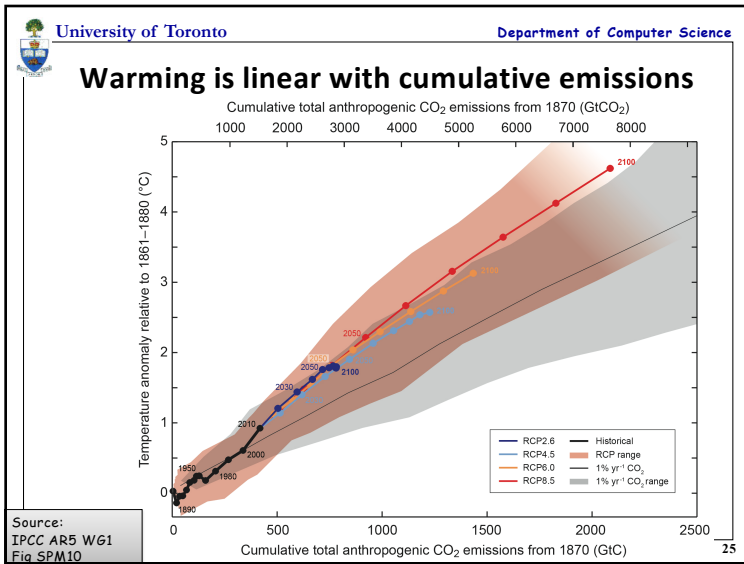
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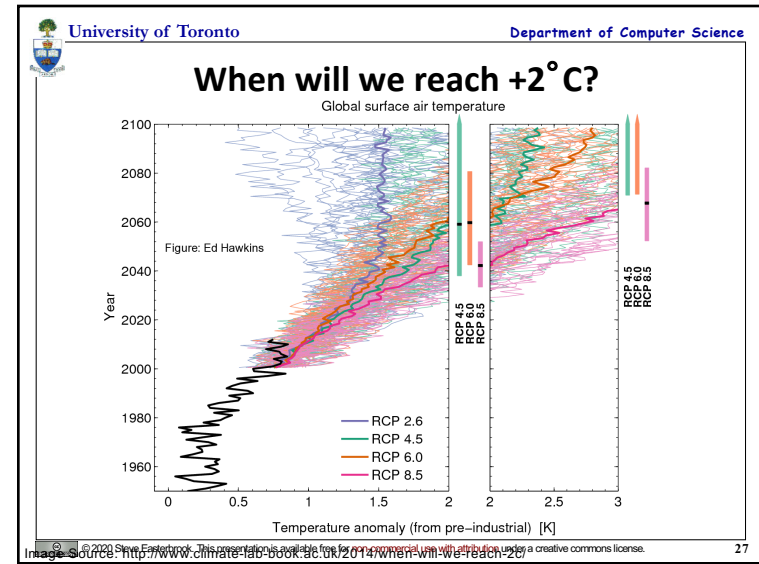
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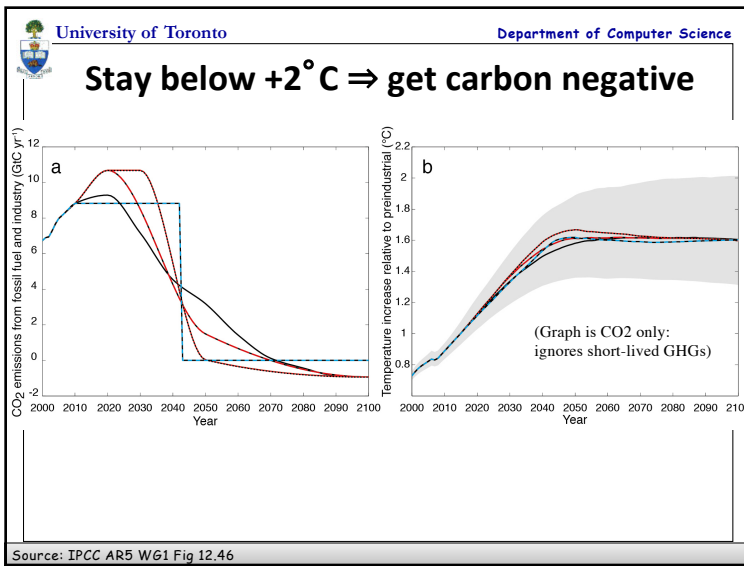
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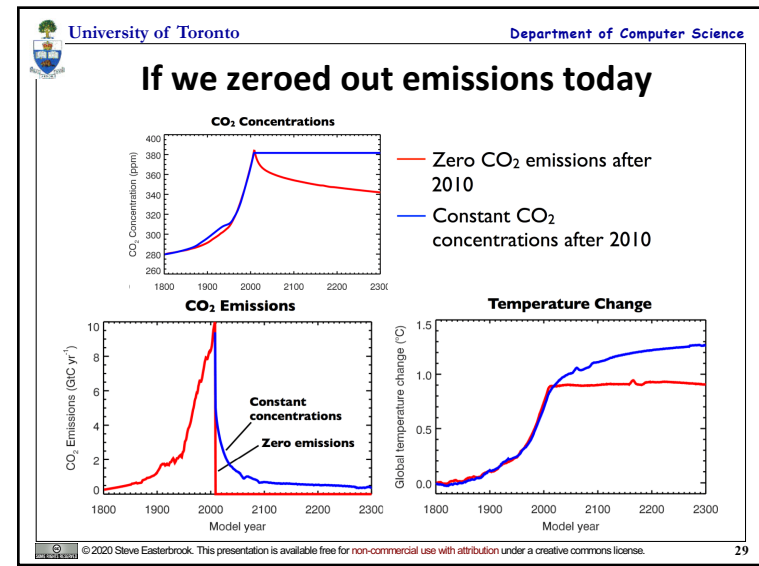
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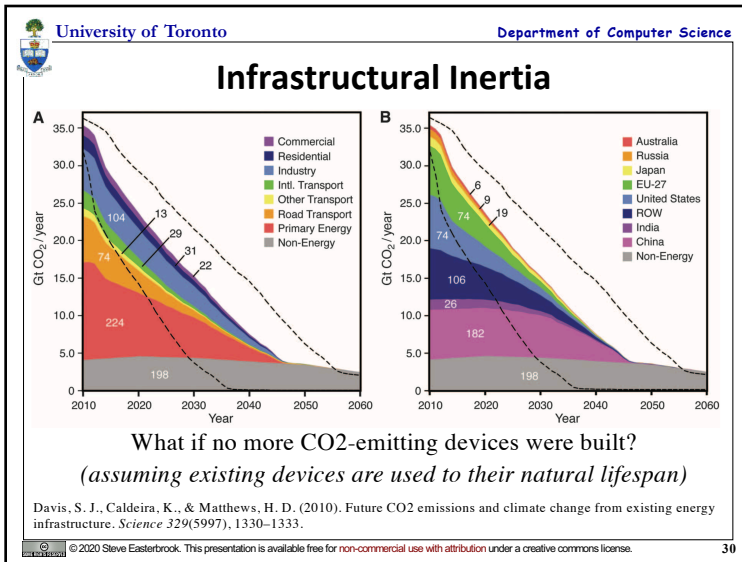
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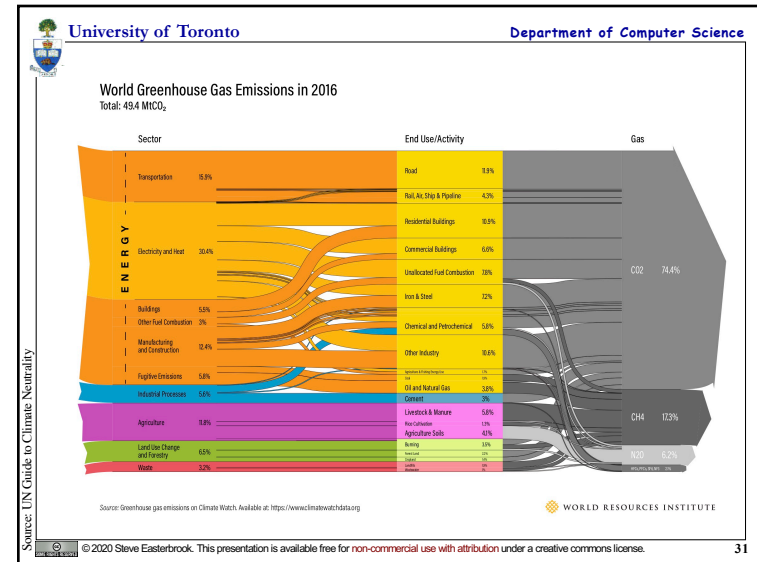
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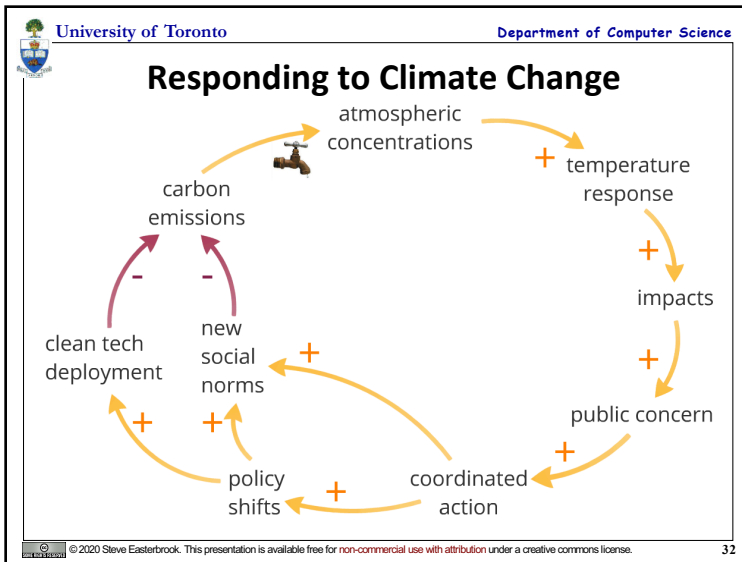
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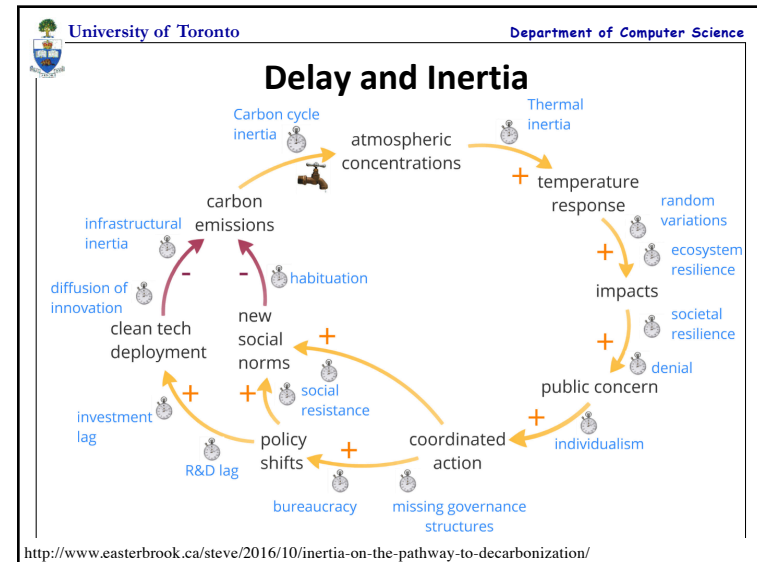
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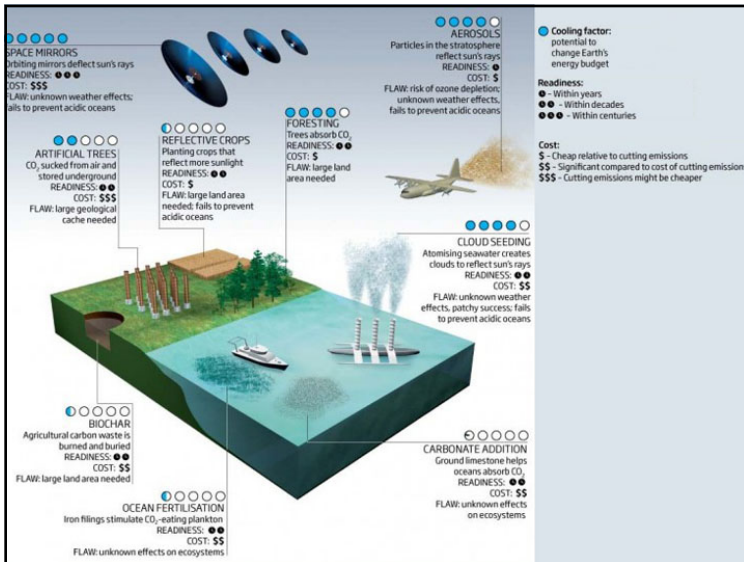
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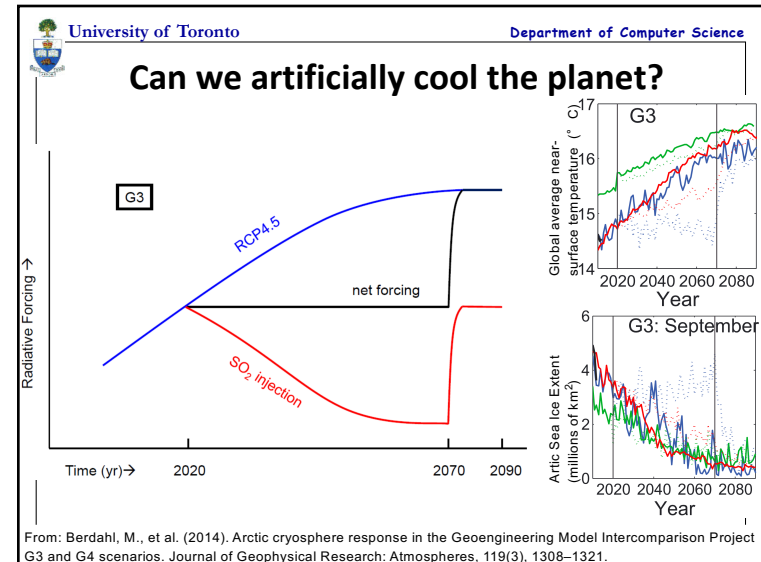
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33



34



35

Systems Activity: Harvest

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36

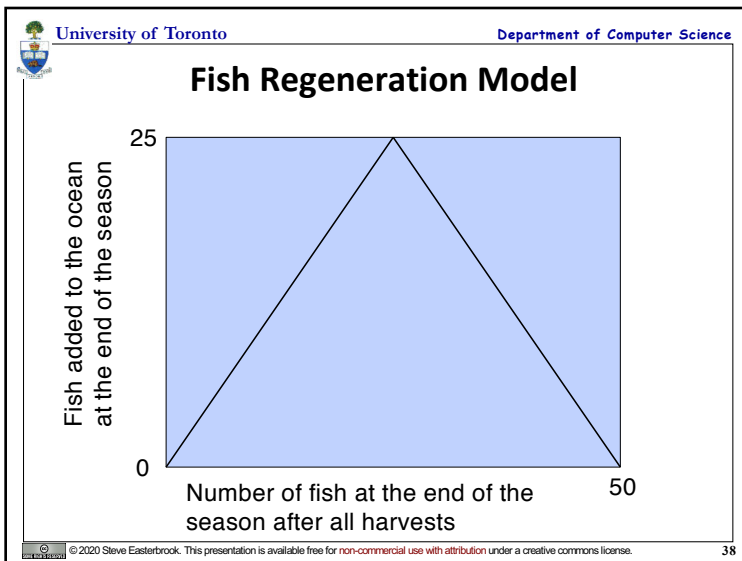
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Harvest (rules)

1. Each team owns a fishing boat. Your goal is to maximise your assets by the end of the game.
2. The ocean can support max 50 fish. Initially, between 25 and 50 fish in the ocean
3. We will play for 10 fishing seasons
4. Each season, you decide how many fish you will try and harvest. Place the "order" in your boat
5. I will fill your boats in a random order. If your order exceeds total remaining fish, you get nothing that season
6. After all orders processed, fish will re-generate, according to the chart...

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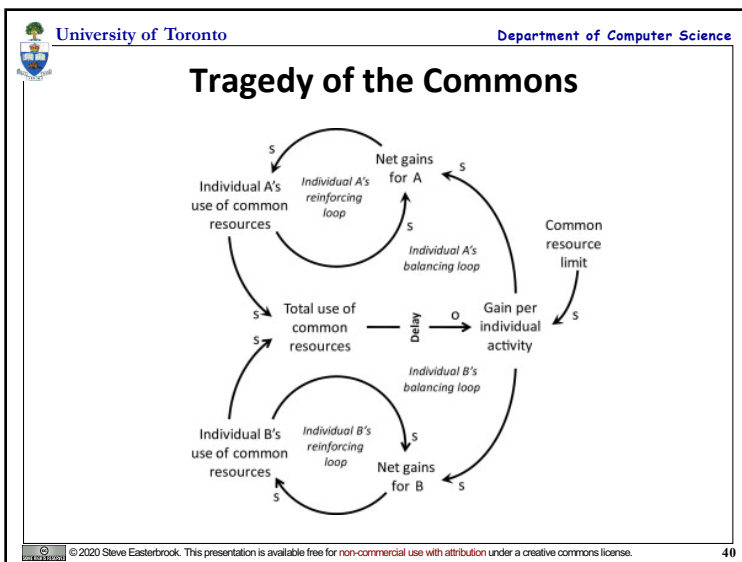
37



38

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- ### Steps of Play
1. Decide on your team's long-term strategy
 2. In each decision round, select the number of fish you wish to harvest
 3. Record the number of a slip of paper, insert the paper in the ship and pass it to me.
 4. Harvest requests will be filled in a random order
 5. Receive your ship back, remove the fish, and start the next round.
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39



40