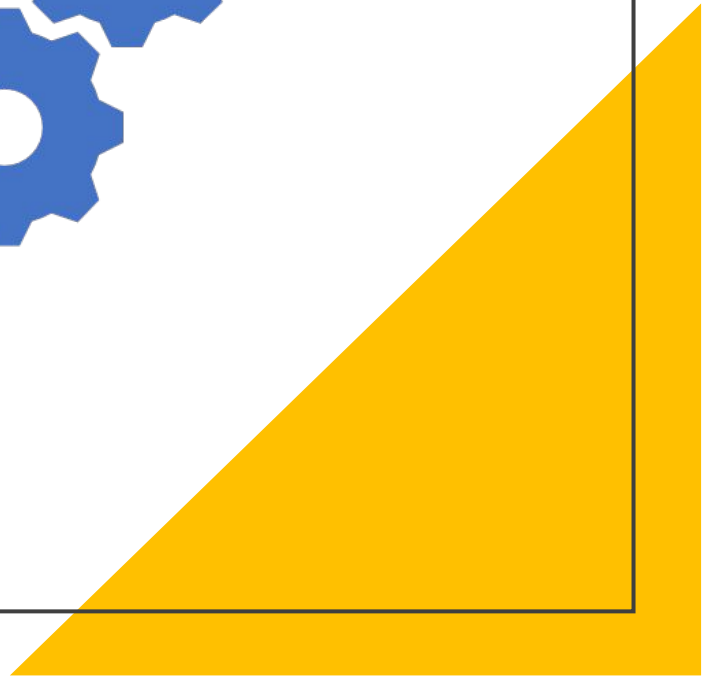
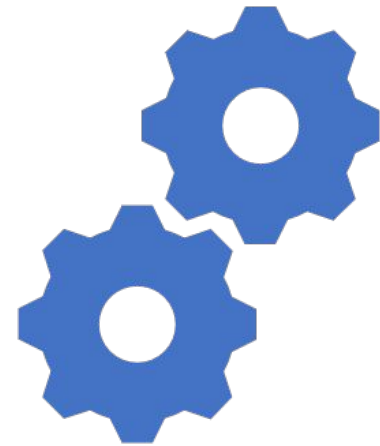


System Dynamics

Dor Hirsh Bar Gai



What is systems dynamics?

Feedback and delay processes

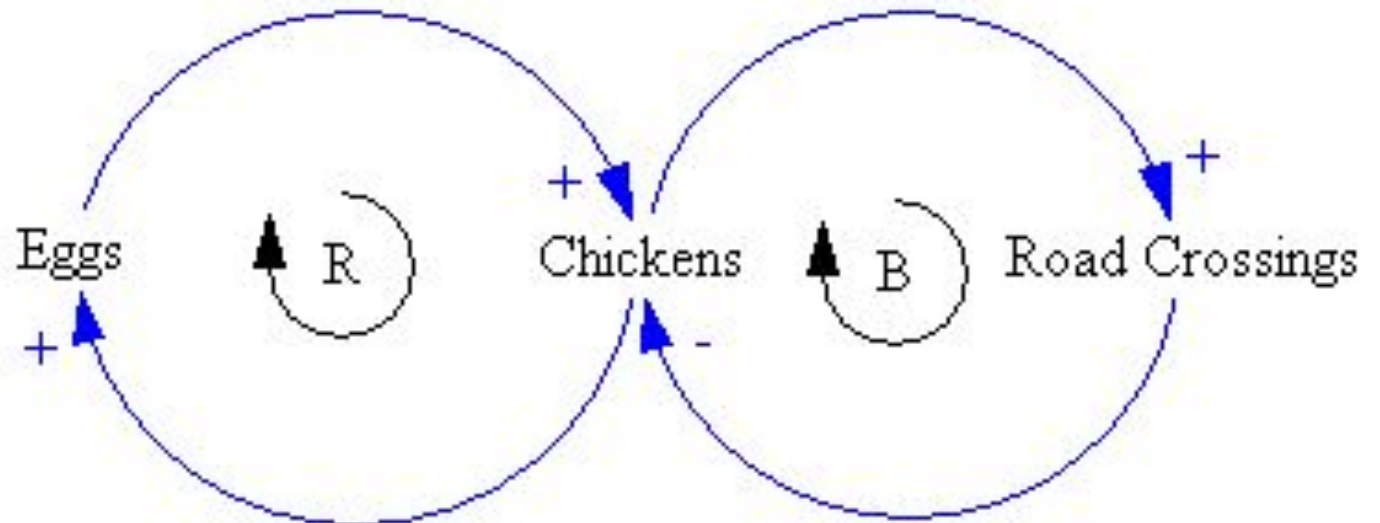
Causal loop diagrams

Stock and flow modeling

Systems thinking

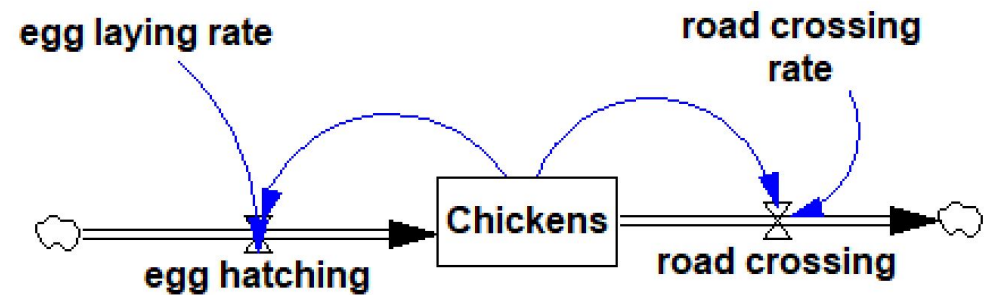
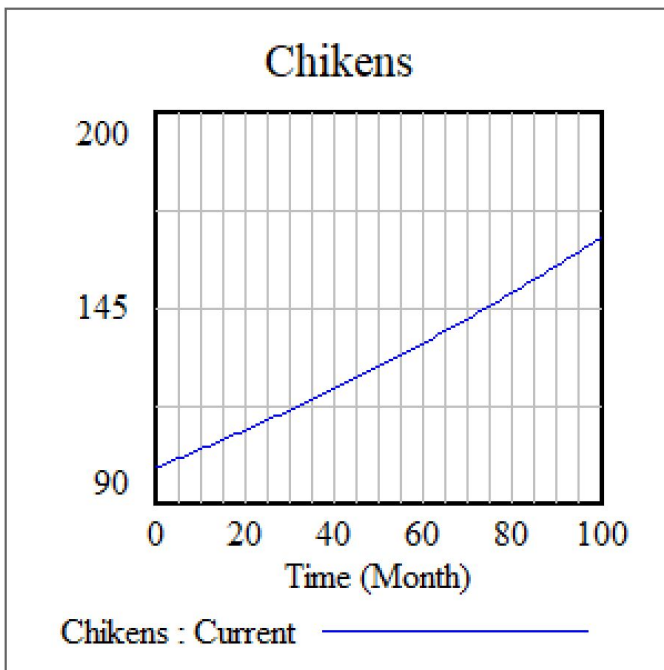
Causal loop diagrams

- Qualitative system relationship
- Reinforcing or balancing feedback
- Conceptual characteristics



Stock and Flow

- Quantitative representation
- Reference mode
- Policy analysis



THE ICEBERG MODEL

Use this tool to help you think more systemically!



EVENTS

What is happening?

PATTERNS OF BEHAVIOR

What trends are there over time?

SYSTEMS STRUCTURE

How are the parts related?

What influences the patterns?

MENTAL MODELS

What values, assumptions, + beliefs shape the system?

Increasing Leverage

System thinking

System Dynamics Application

- Healthcare
- Energy
- Ecosystem management
- Climate change impacts
- Technology and information adoption



Disease Spread

- https://www.youtube.com/watch?v=WNyB_o8MpcA

- <https://www.youtube.com/watch?v=9pVy8sRC440>

Healthcare – Disease spread

- Types of Transmission:
 - Droplet
 - Contact
 - Aerosol
- Important periods:
 - Incubation
 - Latent
- Spread:
 - Imported case
 - Local
 - community

Parameters

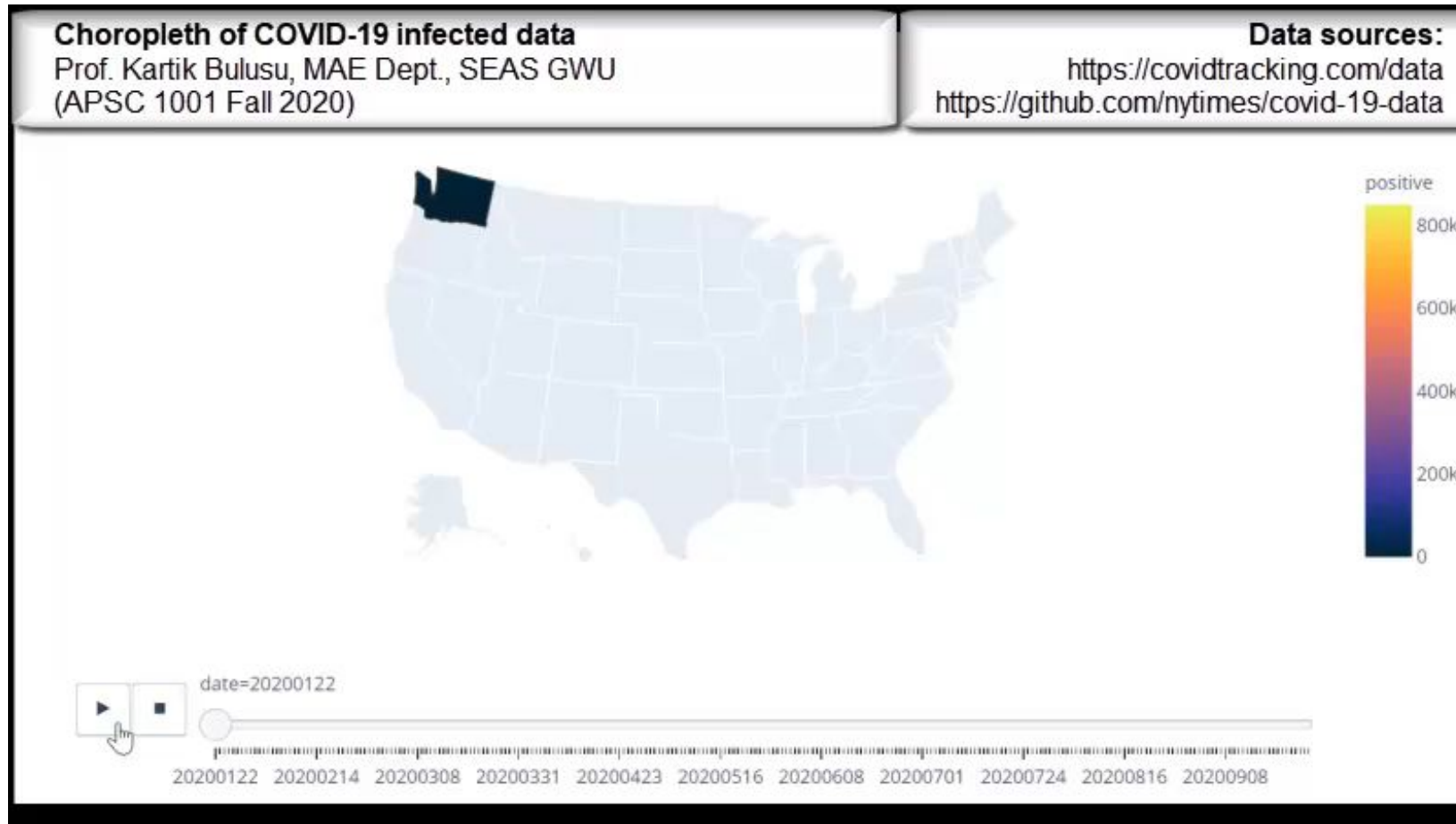
- R_0
 - Reproduction number
 - Basic reproduction number (maximum potential)
 - Effective Reproduction number (current vulnerability)
- Other important factors
 - Probability of infection
 - Number of people that are sick
 - Contact rates



Activity 1

Covid-19 Iceberg Model

US Choropleth Animation of Covid-19 Infection



THE ICEBERG MODEL

Use this tool to help you think more systemically!



EVENTS

What is happening?

PATTERNS OF BEHAVIOR

What trends are there over time?

SYSTEMS STRUCTURE

How are the parts related?

What influences the patterns?

MENTAL MODELS

What values, assumptions, + beliefs shape the system?

Increasing Leverage

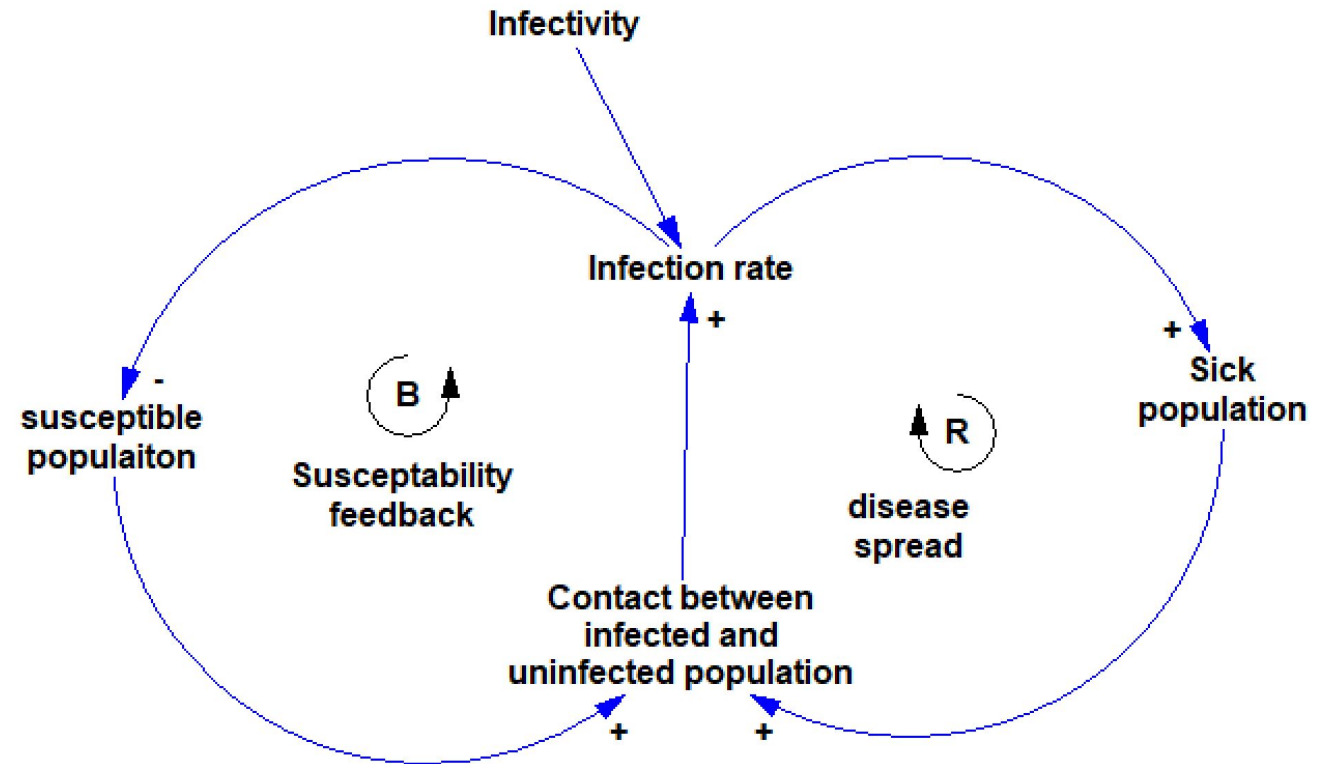
Increase in infection rate
no containment

Politicization of science
Distrust in government
“pandemic fatigue”

Economic pressure
Political dynamics
Mental health

Civil Rights vs public health
State vs. Federal enforcement

Causal Loop Diagrams

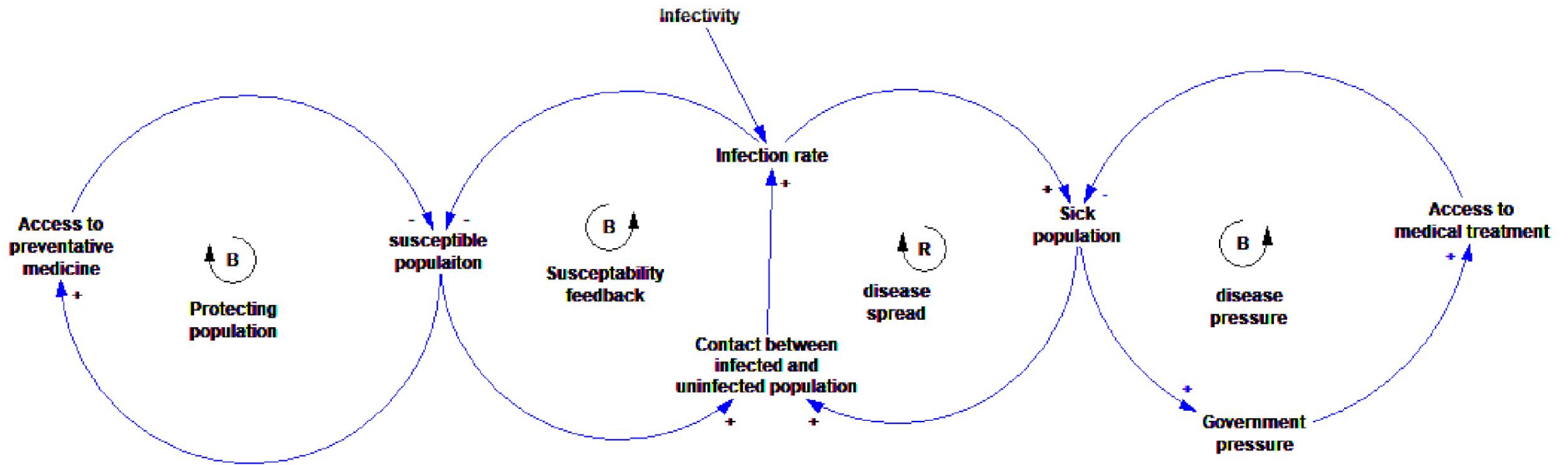


Model the problem NOT the system



Activity 2

Infection CLD



Interventions




Stock & Flow



Activity 3

Infection stock & flow

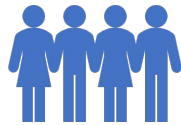
Key parameters

- How can you mitigate disease risks?
 - Transmission
 - Treatment
 - Explore the impact of individual parameters (assuming no vaccine)
 - Contact rate
 - Infectivity
 - Recovery rate
 - Loss rate
 - Death rate
 - Explore impact of multiple changes
- 
- A large yellow triangle is positioned in the bottom right corner of the slide, pointing towards the top right.

To conclude

- Conceptualization of causal relationships
- Powerful tool for observing accumulation and feedback impacts
- Meaningful platform for scenario analysis

Future considerations - COGS



What challenges influence our ability to model disease spread?



Which opportunities exist in public health to enhance mitigation efforts?



What are potential gaps and how do they impact us?



What surprises could the future hold, and how should we prepare for them?

COGS exercise developed for APSC 1001

The image features a white background with decorative curved lines in shades of green and blue. One set of lines is in the top-left corner, and another is in the bottom-right corner. The text "Questions?" is centered in the middle of the page.

Questions?