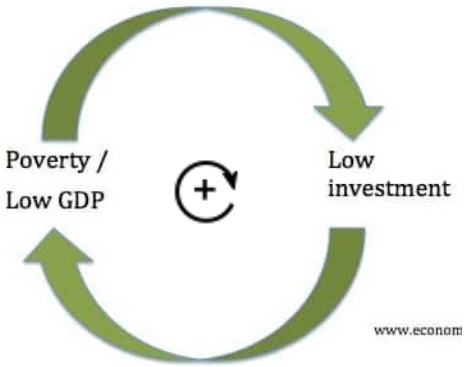
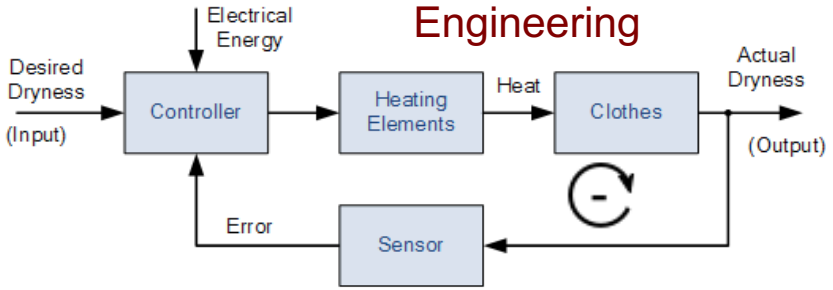
How to make excellent Causal Loop Diagrams

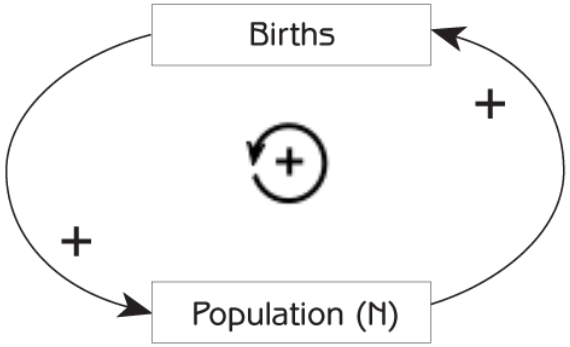
Economics



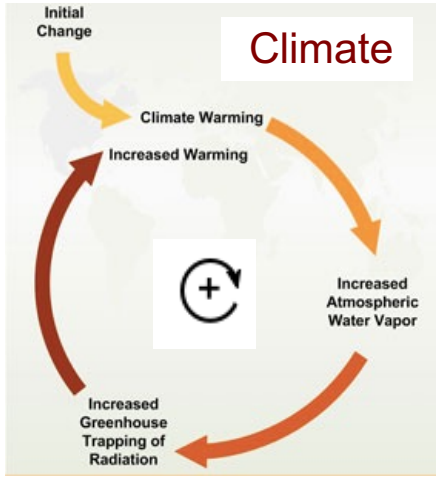
Engineering



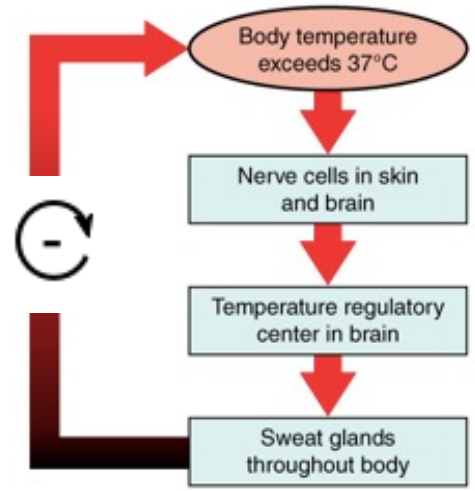
Ecology



Climate



Physiology



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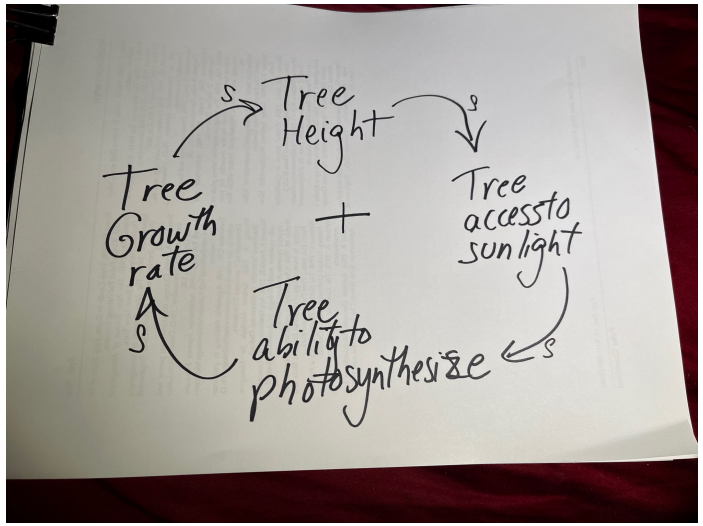
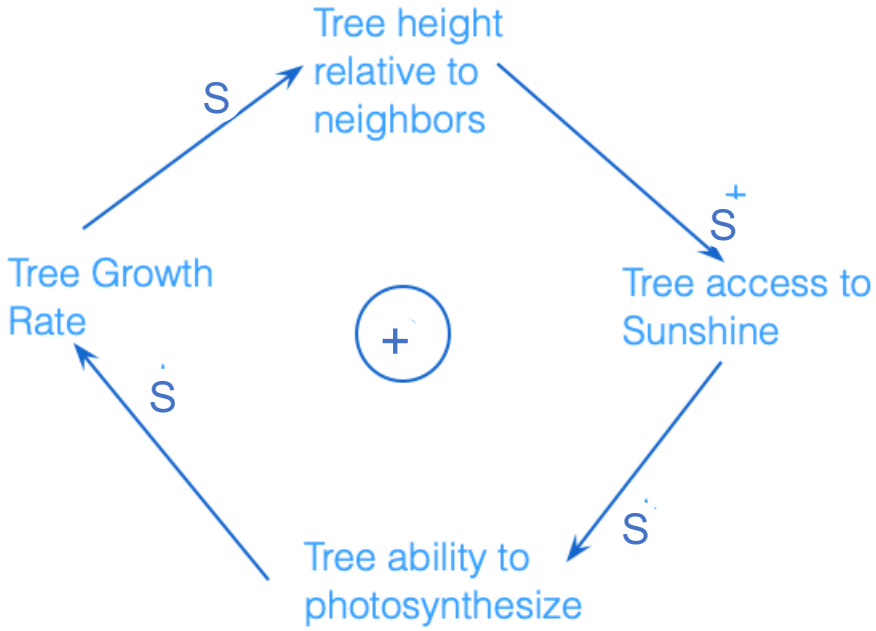
Why are Causal Loop Diagrams useful?

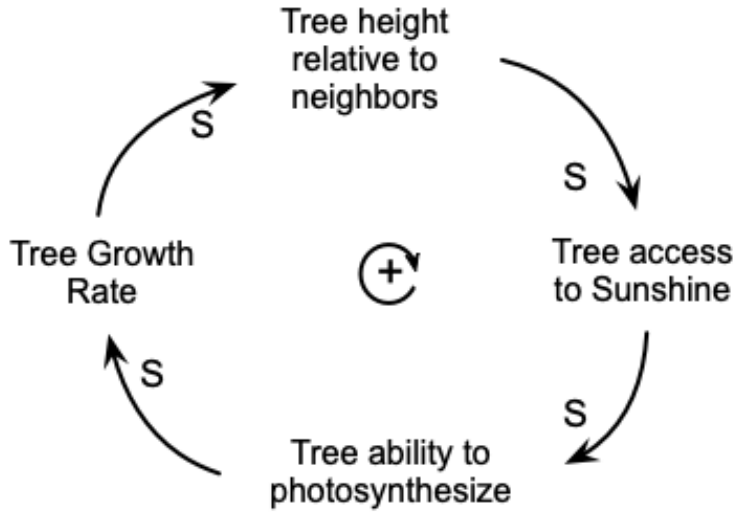
- They let you convey your ideas about how an aspect of the world works, should work, could work in the future, or might have worked in the past.
- They let you think about one part of the system at a time—while keeping track of what you think is going on other parts of the system.
- They let you see how the different parts of a system fit together.
- They let you preserve your thinking about the system for future use.
- They let multiple people compare and combine their ideas.
- They make it easier to identify leverage points where the system might be nudged in a desirable direction.

Use any medium you are comfortable with



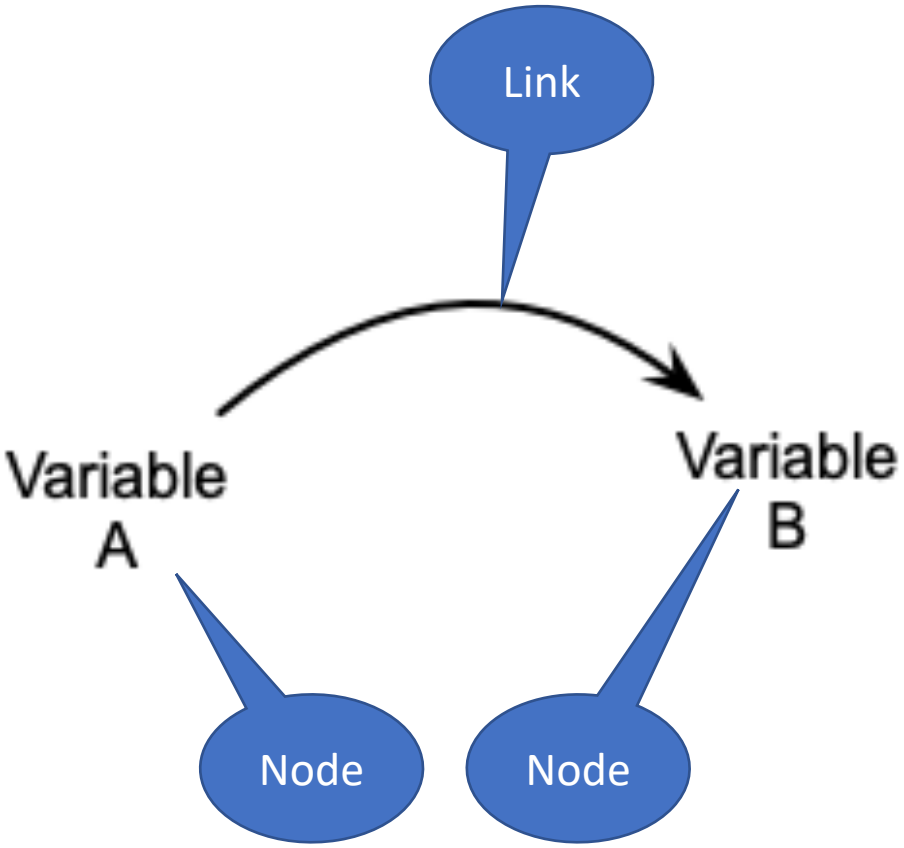
Paper and pencil





Any drawing software you already know how to use

Nodes and links



Links represent actions or changes

Nodes represent parts or aspects of the system that are acted upon

Nodes

Nodes should be elements of the system that can increase or decrease.

versus

Usually good:

- Numbers of
- Amounts of
- Fractions
- Percentage
- Strength of

Usually not good:

- Verbs

Links:

Links (arrows) denote that:

- A influences B,
- If there is a change in A, a change in B will tend to follow.

If you change the number of people who are invited to a celebratory event, that will change the amount of food that will be eaten at the event.

“Same” links – s→

”S” or “Same” links indicate that in your model system A and B tend to move in the SAME direction

When A increases, B will also tend to increase.

If there are more people invited to a celebratory event, more food will be eaten at the event.

AND

When A decreases, B will also tend to decrease.

…If there are fewer people invited to a celebratory event, less food will be eaten at the event.

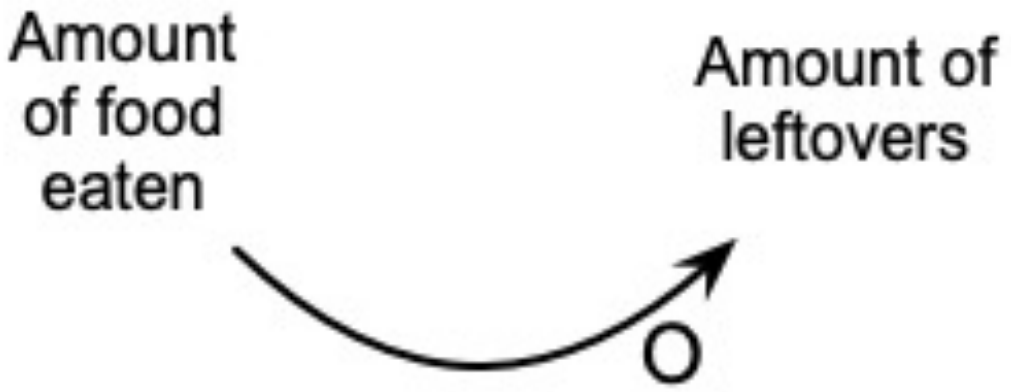
Nuances of “Same” links – S→

“S” links can convey:

- “A causes B”
- ”A favors B”
- “A encourages B”
- “A enables B”
- “A tends to be associated with B”
- etc.

“Opposite” links –– o→

”O” or “Opposite” links indicate that in your model system A and B tend to move in the opposite direction



When A increases, B will tend to decrease.

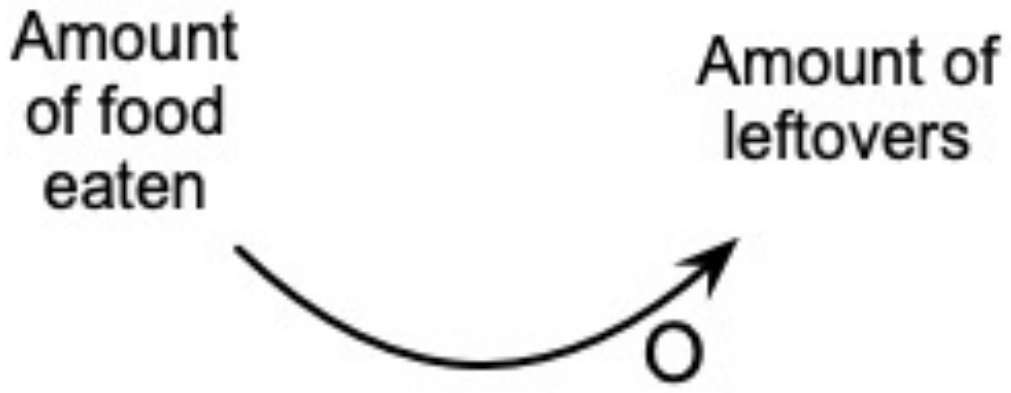
When the people at an event eat more food, then the amount of leftovers will be less.

AND

When A decreases, B will tend to increase.

When the people at an event eat less food, then the amount of leftovers will be more.

Nuances of “Opposite” links –- o→



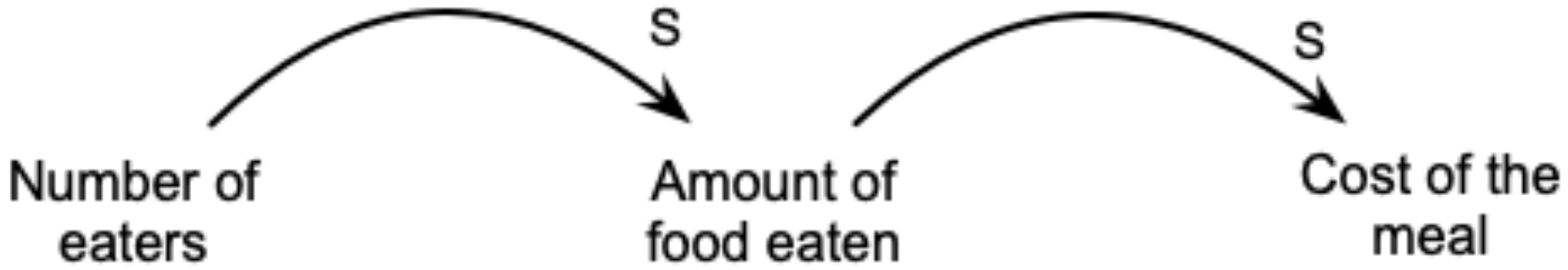
“Opposite” links can convey:

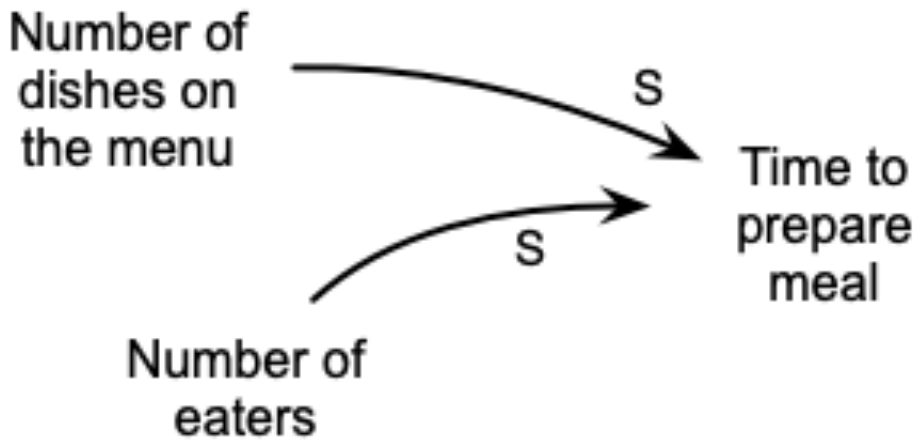
- “an increase in A tends to weaken B; a decrease tends to strengthen B”
- “an increase in A inhibits B; a decrease in A fosters B”
- “an increase in A prevents B; a decrease in A enables B”

Test your confidence in each link:

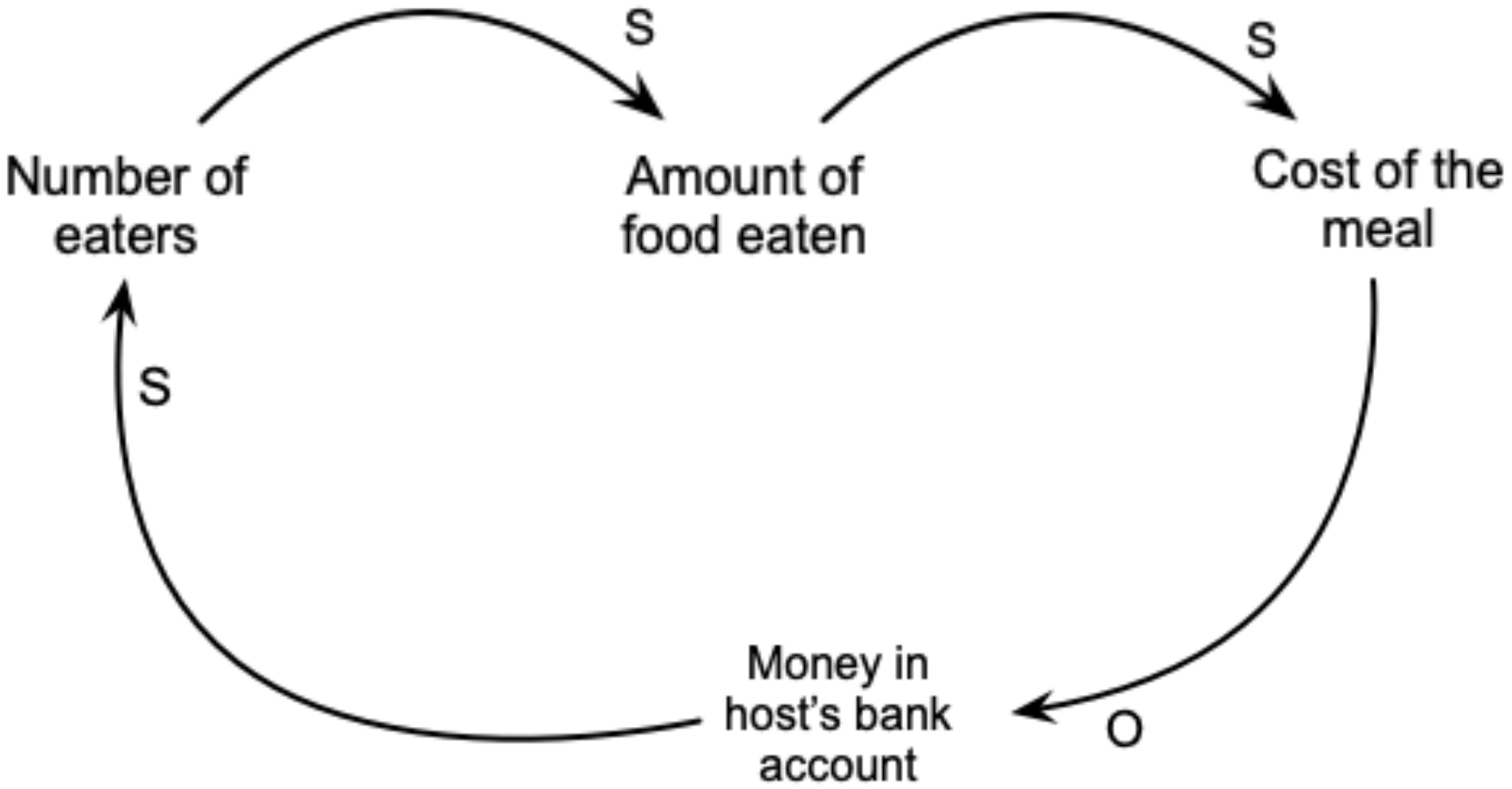
- Do I have a plausible mechanism in mind for why a change in this A should influence this B?
- Do I have empirical evidence that -- in the real world -- a change in this A is associated with a change in this B?

Not all causal link diagrams depict feedback loops

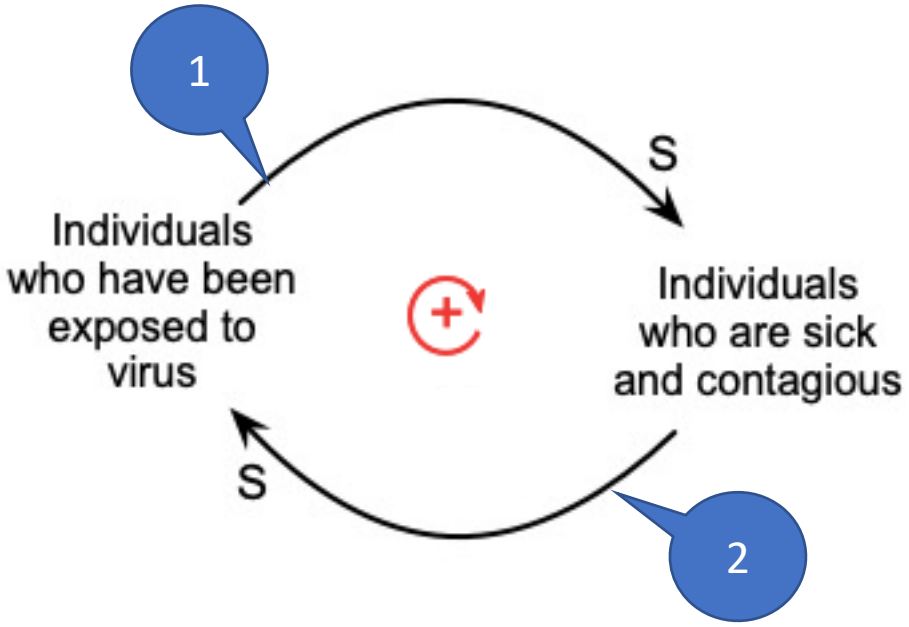




Closing the loop



Positive or negative loop?



1: If more people are exposed to the virus, then more people will become sick and contagious.

2: If more people in a community become sick and contagious, then even more people will be exposed to the virus.

Talk or write your way around the loop. Envision a nudge to one node, and trace the impact of that change all around the chain of influences.

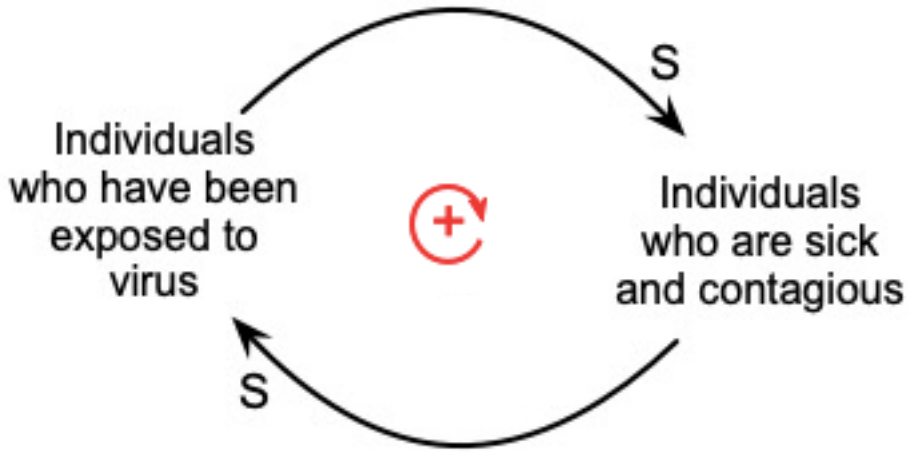
After completing your passage around the chain of influences, did the first-nudged node get pushed even farther in the initial direction? If so, you have a POSITIVE loop.

Put a **plus** sign in the center of the diagram.

What is the net effect of the loop on the broader system?

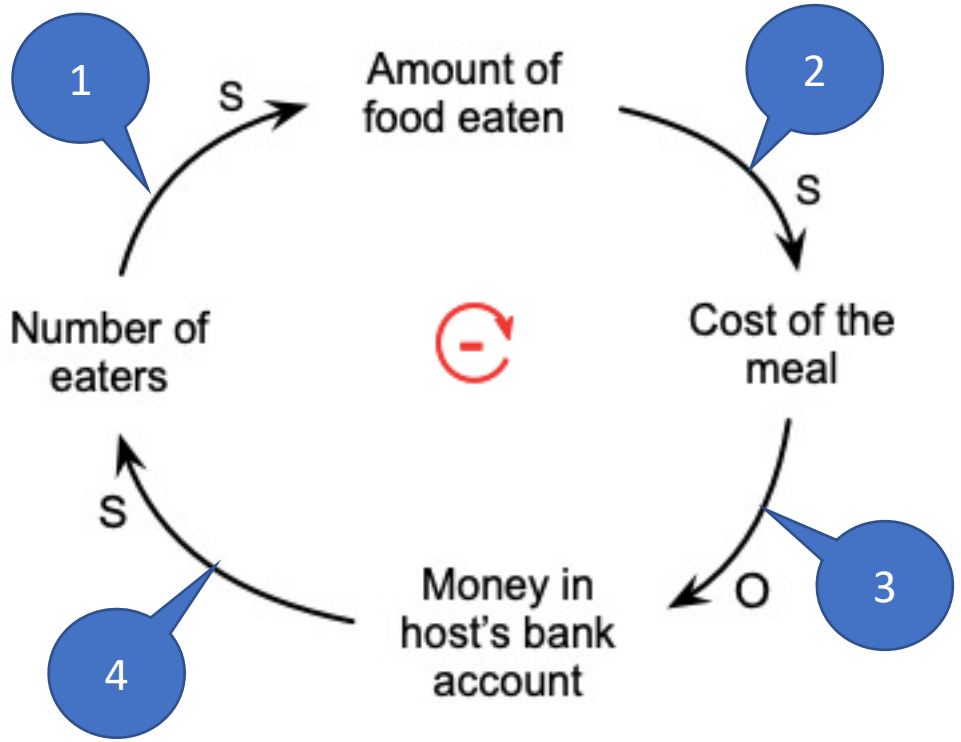
The broader system is the community impacted by the disease

The net effect of the loop is to cause the disease to spread faster than it would in the absence of an effective feedback loop.



This model fits our lived experience that in the early days of the Covid-19 pandemic the virus spread very rapidly.

Positive or negative loop?



1: If there are more people invited to a celebratory event, more food will be eaten at the event.

2: If more food is eaten, the total cost of the meal will be higher.

3: The higher the cost of the meal, the lower will be the money remaining in the host's bank account after paying for the meal.

4: After experiencing diminished bank account, the host may be inclined to invite fewer people to the next event.

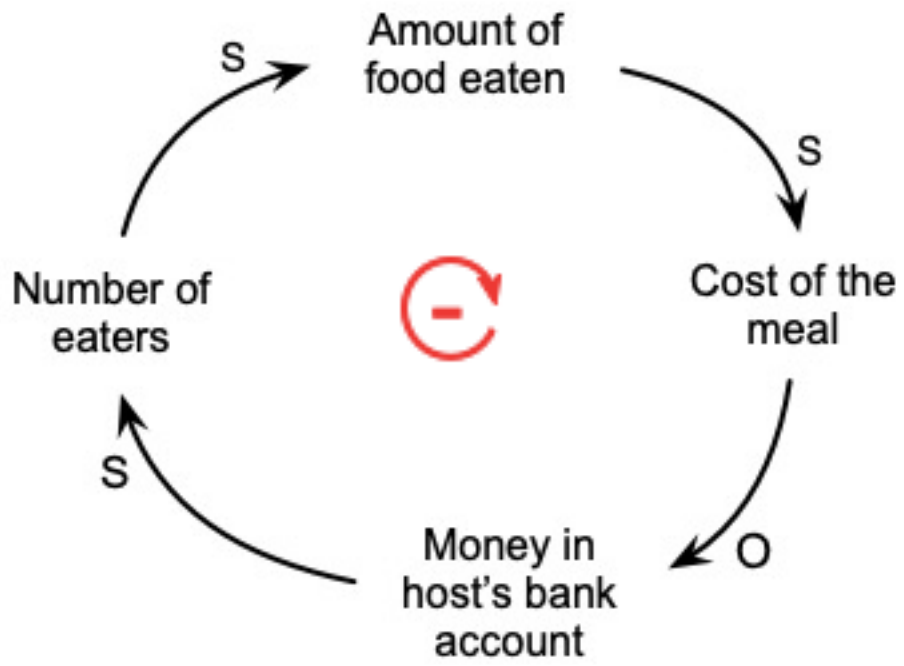
Talk your way around the chain of influences

If the final nudge tends to contradict or undo the initial nudge, you have a NEGATIVE loop.

Put a **minus** sign in the center of the diagram.

What is the net effect of the loop on the broader system?

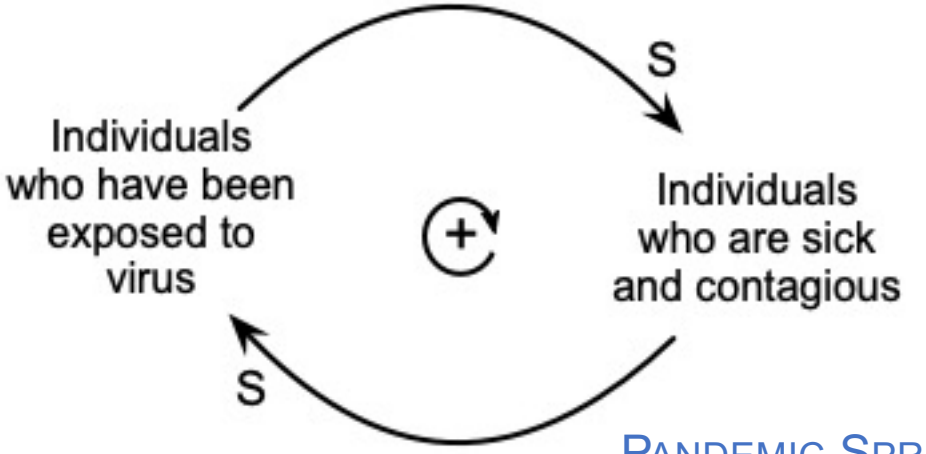
The broader system is the host's social life



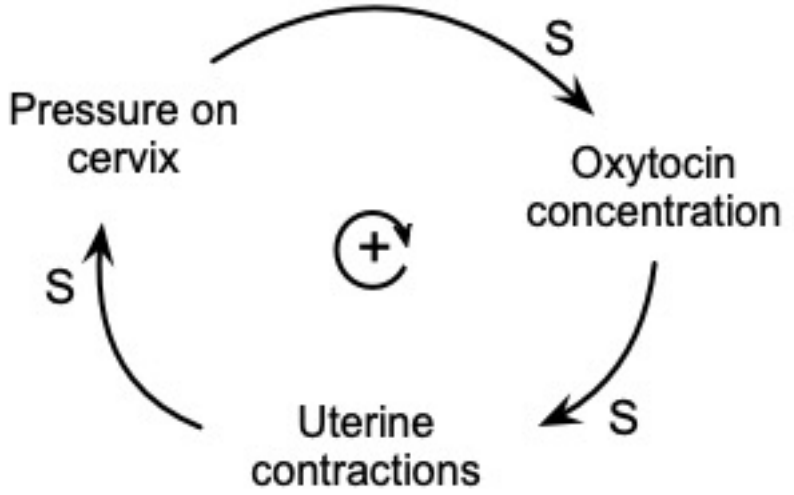
The net effect of the loop in its entirety is to rein in the extravagance of celebrations hosted by this individual.

This fits our lived experience that overspending episodes do tend to nudge people towards living within their goal state – their budget

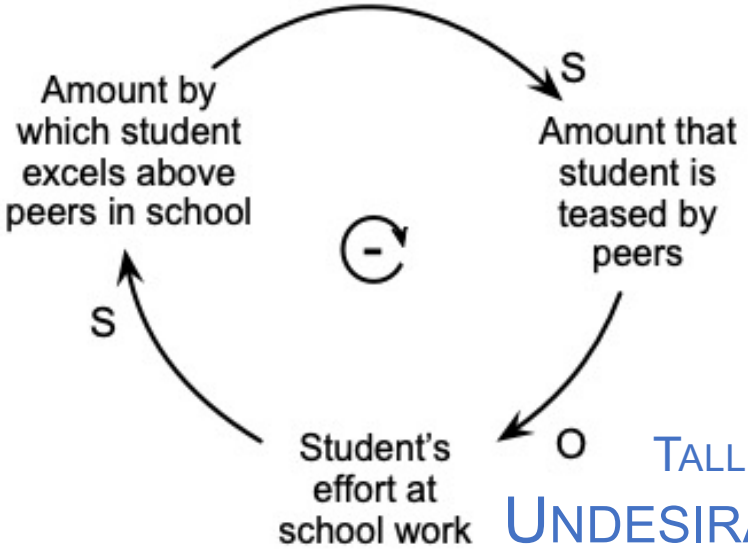
Don’t confuse + and – *structure* with good and bad *outcome*



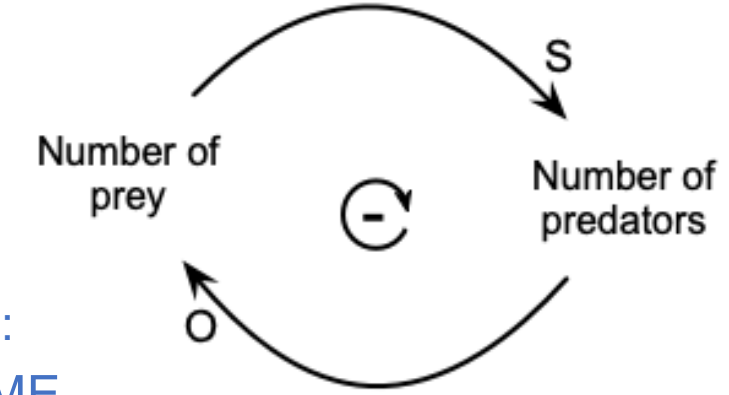
PANDEMIC SPREAD:
UNDESIRABLE OUTCOME



CHILDBIRTH:
DESIRABLE OUTCOME



TALL POPPY SYNDROME:
UNDESIRABLE OUTCOME



BALANCED ECOSYSTEM:
DESIRABLE OUTCOME

Summary (1): Build nodes and links

- Causal loop diagrams (CLDs) are a form of representation that you or another person can use to convey how you think an aspect of the world works, or should work, or might work in the future, or could have worked in the past.
- Use text blocks (nodes) to represent aspects or attributes of the world that can change, usually by increasing or decreasing.
- Use arrows (links) to represent how a change in the upstream node will cause or tend to cause a change in the downstream node.
- Use -S- links to indicate that you think that the downstream node will change in the ***same*** direction as the upstream node.
- Use -O- links to indicate that you think that the downstream node will change in the ***opposite*** direction as the upstream node.
- Build your CLD link by link. As you go, test your confidence in each link by asking yourself:
  - Do I have in mind a ***mechanism*** by which a change in A would tend to cause a change in B, in either the –S- (same) or –O- (opposite) direction ?
  - Do I have ***empirical evidence*** that in the real world a change in A tends to be associated with a change in B, in either the –S- (same) or –O- (opposite) direction?

Summary (2): Close the loop, examine the net effect

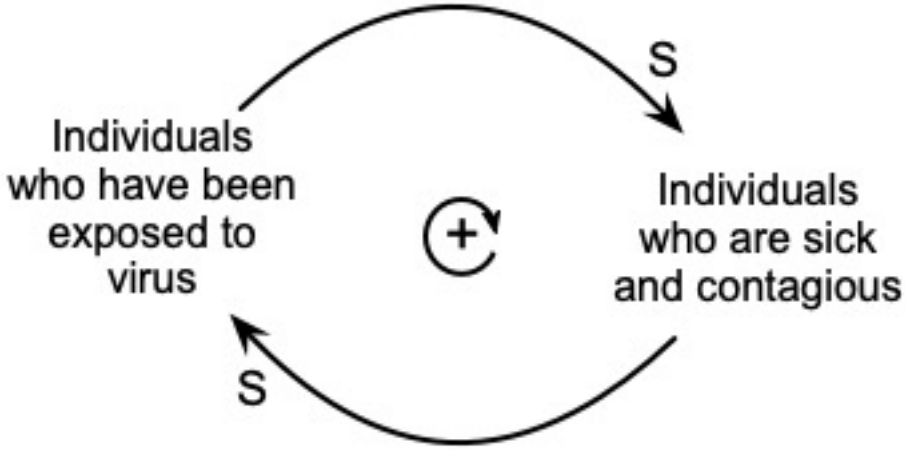
- Identify or create a link which has its downstream node matching another node that already exists in your model. Use that link to close your loop.
- Determine whether you have depicted a positive feedback loop or a negative feedback loop.
  - Envision a nudge to one node. Talk (or write) your way around the circuit of influences.
  - If the initial nudge and final nudge are in the same direction, you have a positive feedback loop.
  - If the final nudge contradicts the initial nudge, you have a negative feedback loop.
  - Don't be misled by whether the outcome of the loop is desirable or undesirable!
- Contemplate the net effect of the loop as a whole on the broader system.
- Ask yourself: does my experience with, or knowledge of, this system match the model I have drawn?
  - If my experience is that over time a key element of the system tends to go ***up-up-up*** or ***down-down-down***, then I need my model to depict a ***positive feedback loop***.
  - If my experience is that a key element of the system tends to go ***up-and-then-down***, or ***down-and-then-up,*** then I need my model to depict a ***negative feedback loop.***
- If your experience with the behavior of the system over time does not match the positive or negative nature of your representation, re-examine each link: Mechanism? Evidence? S versus O?

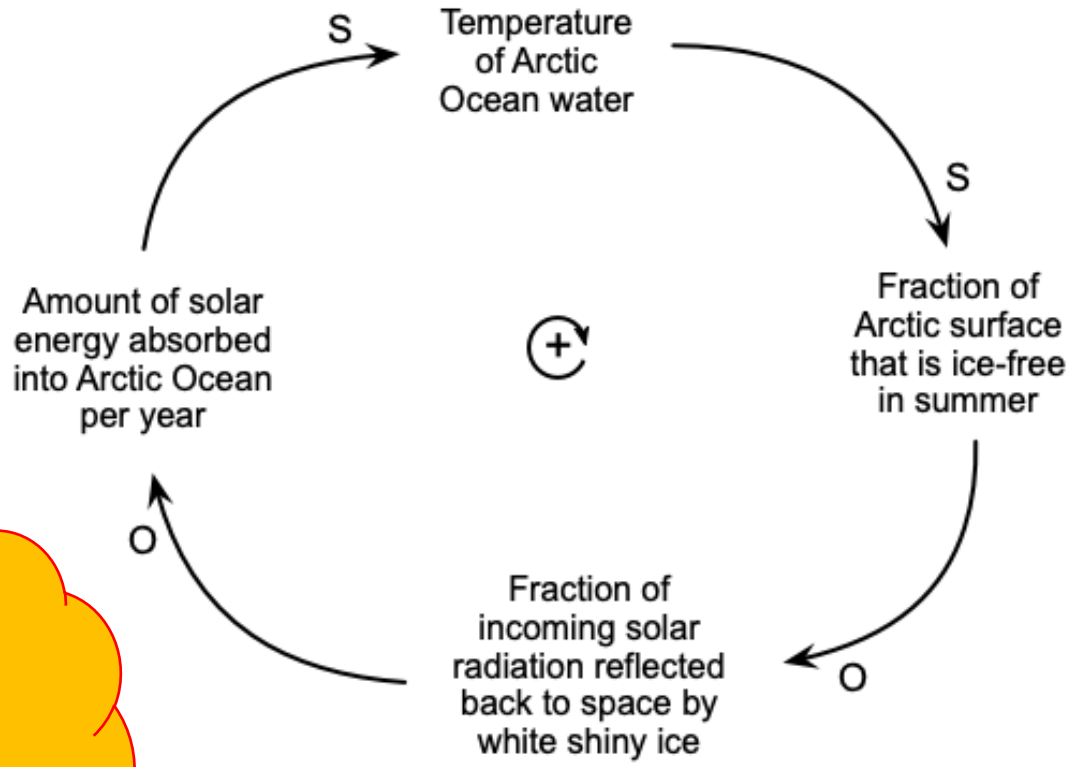
Summary (3): Use your causal loop diagram!

- Use your CLD to explain to other people how you think this aspect of the world works.
- Use your CLD to think about conditions under which the impact of the loop would be stronger or weaker.
- Brainstorm how the system could be improved, sketching additional causal links onto your diagram to show where your proposed intervention would nudge the system.

Extra Slides

A short cut to determine + or -

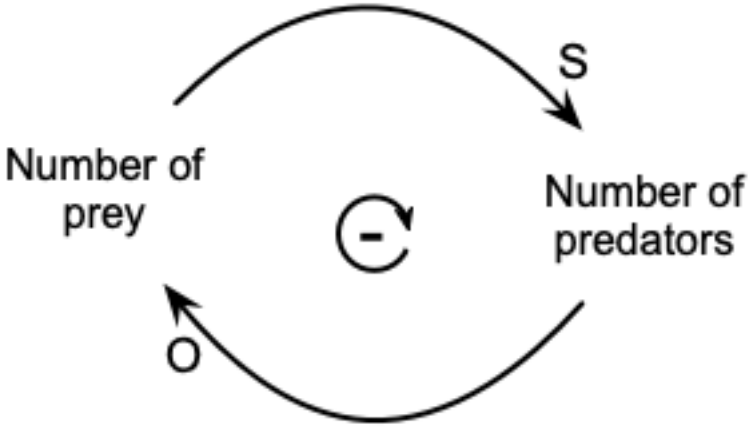




If none of the links are "O" links (all links are "S" links), you have a **positive** loop

More generally, if there is an **even** number of "0" links, you have a **positive** loop

A short cut to determine + or -



If there is an odd number of "O" links, you have a **negative** loop