

ATOC 1060-002: Our Changing Environment

Lecture 2: Rules for feedback demos

Two groups of (5) students (one at U. Washington, one at U. Miami) share a dorm room, and are trying to work out the best temperature to set the heater/air conditioner.

Since they have just moved in the initial temperature in both cases is 10C (building manager turns all off over vacation).

Students have the preferred temperature.

U. Miami.:	21	22	23	22	21
U. Washington.:	14	15	16	15	14

Case 1

Set up: Each group decides over breakfast what should be done with the thermostat based on the present temperature of the room. They can only say “hotter” or “colder”, and a scribe determines some consensus and changes the thermostat (change in temperature). This change is applied to the present temperature to determine the next morning's temperature. This discussion is continued for a week (7 days), with a time series of temperature generated and plotted.

Outcome: Each group comes to their own equilibrium temperature after about 4 days. Each group independently has their own negative feedback.

Extensions:

Visitor from other University for a day or two after equilibrium has been reached. This gives a perturbation. Once the visitor leaves the temperature again returns to the original equilibrium.

Case 2

Set up: The scribe from the two universities is switched – i.e., gets a transfer. As such, the scribe now changes the local temperature based on the decision of the other university. That is, the temperature change in Miami is determined by what the folks at U. Washington want to do about the temperature in Washington. Similarly the change Washington is determined by what folks at U. Miami want to do with the temperature at U. Miami. Again the temperature for each is plotted. The temperature again starts from 10C.

Outcome: The temperatures fluctuate wildly since there is a strong positive feedback that amplifies small changes away from the equilibrium.

Case 3

Set up: Everyone decides they should meet in the middle and attend C.U. – there the dorm room temperatures are more reliable. Is this true? Now all 10 students discuss what should be done and articulate this to the scribe, who determines a consensus, and keeps track of temperature over the week. Temperature again starts from 10C.

Outcome: Now with three negative interactions (each group with the scribe, and the scribe with the temperature), we now again have a negative feedback. The temperature reaches an equilibrium (which is in between the two individual equilibria).

21 22 23 22 21

14 15 16 15 14