Lecture #1

- What is a dynamical system?
  - → Any system that evolves through time.
  - → Examples (request from the class)

- Mathematically
  - → differential equations (ordinary, partial, stochastic, integrodifferential)
  - → difference equations

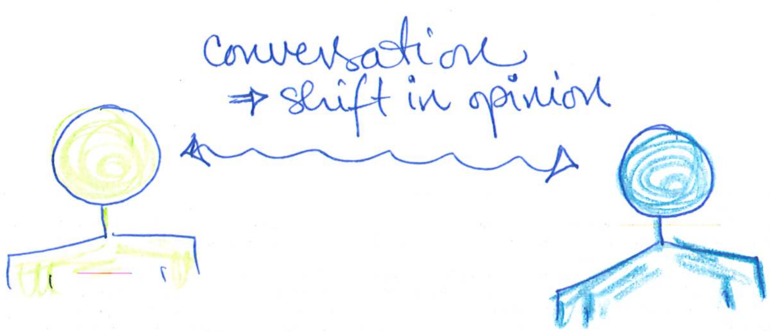
- Course

  learn how to interpret & solve
  - nonlinear ODE models / equations
  - " ΔE " / equations

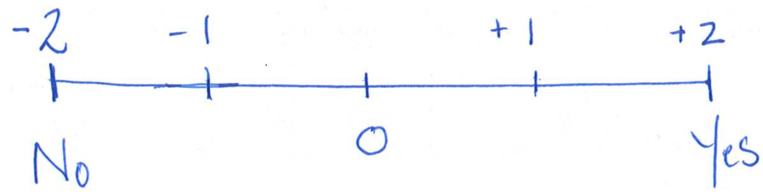
Model 1

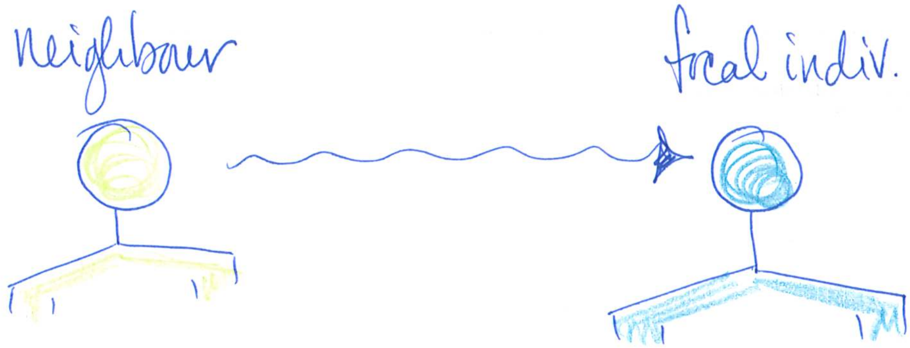
www.wikipedia.org/wiki/Opinion_polling_for_the_2019_Canadian_federal_election

- discuss the first figure
  - what do the students see?
  - stable behaviour, oscillations, steady increases + decreases
- can we predict such behaviour?
  - lots of complex factors
  - insights from a simplified view?



How to measure opinion? Single issue:





current opinion	−2	−1
outcome	−2	−2

shift toward No by one step

		neighbour		
focal indiv.	−2	−1	+1	+2
−2	−2	−1	−1	−1
−1	−2	−1	+1	+1
+1	−1	−1	+1	+2
+2	+1	+1	+1	+2

fill in w/ the students

Amplification Case

	−2	−1	+1	+2
−2	−2	−2	−1	−1
−1	−2	−2	+1	+1
+1	−1	−1	+2	+2
+2	+1	+1	+2	+2

Suppose that amplification occurs w/ probability p_a.

Let

$$\begin{cases} L_2 = \text{fract of individuals w/ opinion } -2 \\ L_1 = \text{" " " " " } -1 \\ R_1 = \text{" " " " " } +1 \\ R_2 = \text{" " " " " } +2 \end{cases}$$

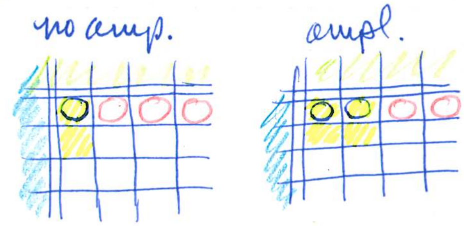
$$\therefore L_2 + L_1 + R_1 + R_2 = 1$$

interactions

$$\frac{dL_2}{dt} = \boxed{\text{things that increase } L_2} - \boxed{\text{things that decrease } L_2}$$

OR

$$= \boxed{\text{things that increase } L_2} - \boxed{L_2 - \text{things that don't change } L_2}$$



get a new -2

lose a -2

keep a -2

$$= L_1 \left[L_2 + p_a L_1 \right] - L_2 \left[(1-p_a) L_1 + R_1 + R_2 \right]$$

OR

$$= L_1 \left[L_2 + p_a L_1 \right] - \left[L_2 - L_2 (L_2 + p_a L_1) \right]$$