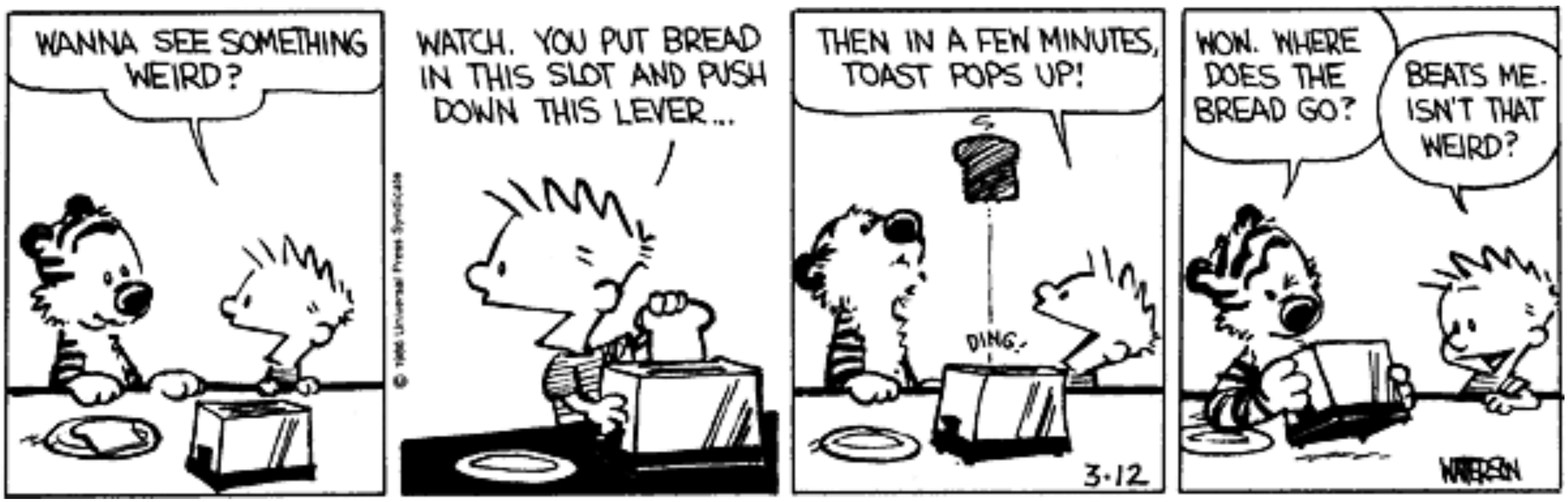
- **Theme Music:** **Cannonball Adderly**

  Work Song

- **Cartoon:** **Bill Watterson**

  Calvin & Hobbes



Foothold ideas: Kinetic Energy and Work

- Newton's laws tell us how velocity changes. The Work-Energy theorem tells us how speed (independent of direction) changes.
- Kinetic energy = $\frac{1}{2}mv^2$
- Work done by a force = $\vec{F} \cdot \Delta\vec{r}$ or $F_{||}\Delta r$ (part of force || to displacement)
- Work-energy theorem: $\Delta(\frac{1}{2}mv^2) = F_{||}^{net}\Delta r$

Foothold ideas: Potential Energy

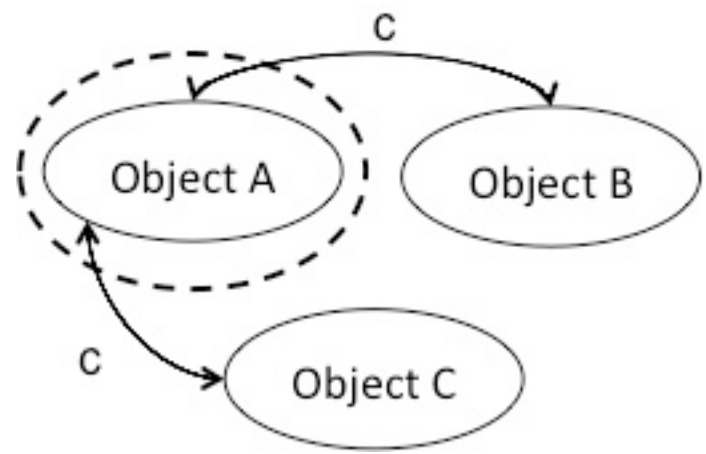
- For some forces (gravity, electricity, springs) work only depends of the change in position. Such forces are called <u>conservative</u>.
- For these forces the work done by them is written

$$\vec{F} \cdot \Delta\vec{r} = -\Delta U$$

- *U* is called a *potential energy*.
- For gravity, $U_{gravity} = mgh$

Reading questions

- Can the work be negative?
- Where does the ΔU come from?
- Why shouldn't the PE belong to the object?



Mechanical
~~An~~ Energy Conservation Theorem

- Suppose the only force that has a component along the direction of motion is gravity.
  - The only force that changes the object's speed is gravity.
  - Other forces (normal forces) can change direction.
  - Friction must be negligible.
- Examples:
  - free fall
  - object rolling on a track.

$$\Delta(\tfrac{1}{2}mv^2 + mgh) = 0$$

$$\tfrac{1}{2}mv_i^2 + mgh_i = \tfrac{1}{2}mv_f^2 + mgh_f$$