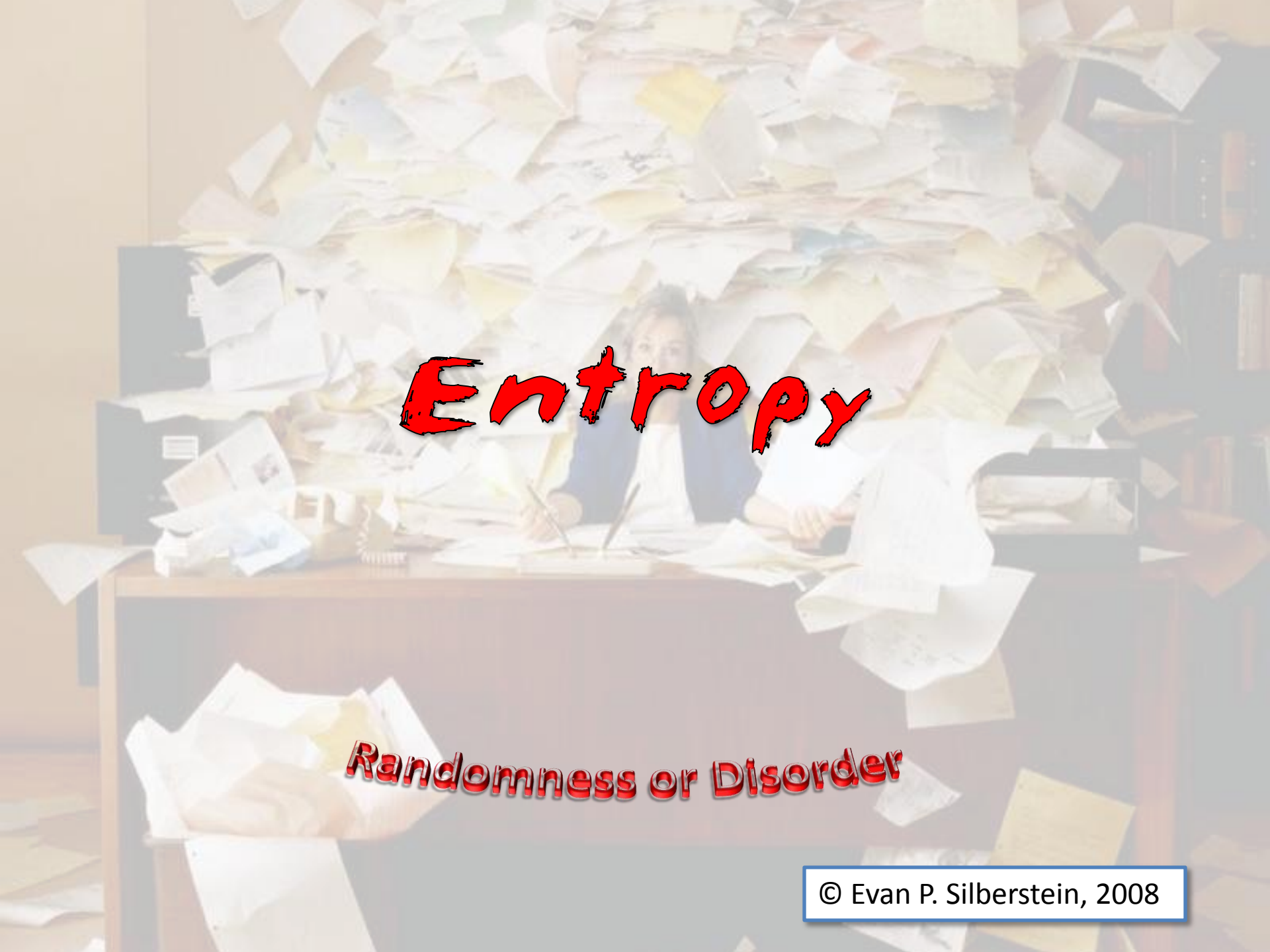
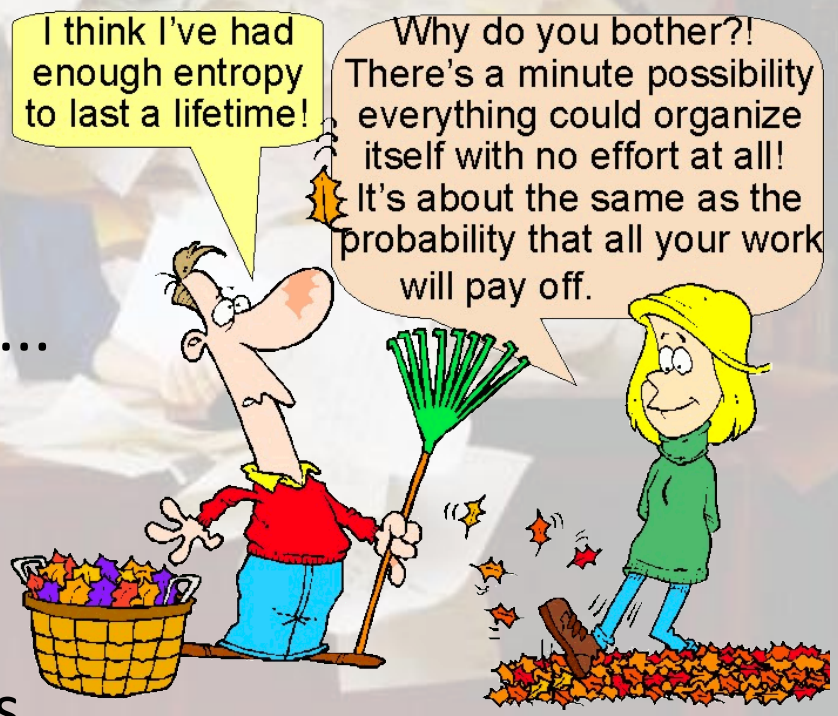


Entropy and Probability

- No matter how careful you are, busy rooms always become messy.
- This is because there are very few arrangements of all your things that are organized, but …
- There are thousands of arrangements that are disorganized.
- Probability favors disorganization or randomness.
- Disorganization or randomness is known as **entropy.**



Entropy and Change

- A chemical or physical change that results in more particles or more possible arrangements of particles, causes entropy to increase.
- What effect do each of the following changes have on the entropy:
  - $H_2O(s) \rightarrow H_2O(g)$ — Increases
  - $N_2(g) + 3H_2(g) \rightarrow NH_3(g)$ — Decreases
  - $2KClO_3(s) \rightarrow 2KCl(s) + 3O_2(g)$ — Increases

Nature's Favorites

Enthalpy

- What will happen to a quarter left standing on edge?

It will fall.

- What happens to the quarter's potential energy when it falls?

It decreases.

- **Conclusion: Nature favors decreasing enthalpy.**

Entropy

- What will happen to a pile of leaves left in the open?

It will spread out.

- What happens to the leaf pile's entropy as it spreads?

It increases.

- **Conclusion: Nature favors increasing entropy.**

Nature's Conflicts

Entropy and enthalpy sometimes conflict with each other. Consider steam and snowflakes, both arrangements of water.

Steam

- The particles in steam are spread out randomly, so they have very high entropy.
- Steam forms at high temperatures. It has high enthalpy.
- When steam forms:
  - Enthalpy increases. ☹
  - Entropy increases. 🙂

Snowflakes

- The particles in snowflakes are arranged in repeating geometric patterns , so they have low entropy.
- Snowflakes form when it is cold. They have low enthalpy.
- When snowflakes form:
  - Enthalpy decreases. 🙂
  - Entropy decreases. ☹