C.P. Snow in The Two Cultures

“Once or twice I have been provoked and have asked the company how many of them could describe the Second Law of Thermodynamics. The response was cold; it was also negative. Yet I was asking something which is about the scientific equivalent of ‘Have you read a work of Shakespeare’s?’”

Chapter 18 - Main Ideas

• Reversible/Irreversible Processes
• The Law of Increasing Disorder (Entropy) or the Second Law of Thermodynamics
• Order and Disorder
Irreversible Processes

- Processes which spontaneously occur in one way but never in exactly the reverse way. The disorder (entropy) increases.

- Examples
  - diver jumping into pool
  - mixing sand
  - pool balls rolling to a stop

Reversible Processes

- It's harder to find reversible processes, especially in mechanical systems.
  - Friction
  - No perpetual motion machines

- We need to look at chemical processes.
  - Ice $\leftrightarrow$ Liquid, at exactly 0 °C
  - Blue shaken bottle experiment
  - Only occurs in a narrow range of temperatures and pressures

Law of Increasing Disorder (Second Law of Thermodynamics)

- Changes occurring in natural systems always proceed in such a way that the total amount of disorder in the universe is either unchanged or increased. If total disorder is increased, the process is irreversible. If the total disorder doesn't change, the process is reversible.
Types of order

- Structure
  - Shape
  - Function
- Arrangement
  - Mixed versus sorted
- Type of Energy
  - Energy hierarchy

Structure

- Messy house to clean house
- States of matter
- Decaying apple

Arrangement

- Mixed vs. sorted
  - Hydrogen + oxygen = water
  - Hot and cold separated (refridgerator)
Energy Hierarchy

- Macroscopic kinetic and gravitational potential energy
- Nuclear potential energy
- Electrical household energy
- Chemical potential energy
- Ambient temperature thermal energy

Increasing Order

- We see a large amount of order in the world
  - life
  - cities, buildings
  - wind, ocean currents
  - separation of water and land
- How is this consistent with the Second Law of Thermodynamics?

Decreasing Order Applies Globally

- Order is decreasing in Sun
  - energy from Sun drives life, wind, ocean currents
- Man creates order by decreasing order elsewhere
  - ordered chemical energy reduced to less ordered ambient thermal energy to build buildings, run cars, separate heat, etc.
Increasing order

- You can increase order in part of a system.
- When you do, something or some part of the universe becomes even more disorganized so that the total disorder is increased.

Examples:
- Refrigerator
- Car engine

Example: Refrigerator

- Which is more ordered - ice or warm air?
- Compressor and condenser use highly organized electrical energy to cool down room temperature air in the refrigerator and to make ice.
  - an ordering process
- Pushes hot air exhaust out
  - a disordering process

“Energy Conservation”

- Energy is conserved in normal processes on the earth without any special efforts on our own.
- What we need to concerned about is the order of the energy.
Pollution

• Mixing of pollutants in the environment has less order than having them separated.
• It requires extra energy to remove pollutants.
• To decrease pollution, one must either increase efficiency or energy consumption.

Equilibrium

• When left to themselves, all systems change to the arrangement with maximum disorder. This state of maximum disorder is called “Equilibrium”.
• No further macroscopic changes occur once the system is in equilibrium.

A Question to Ponder

• If disorder is constantly increasing in the Universe and Time Symmetry holds, how did we get what order we see today?
• Heat Death
  “This is the way the world ends, not with a bang but a whimper.”
  T.S. Eliot
Related Revealed Truths

• D&C 88:119
• Abraham 4:1
• Moses 1:2-4
• Alma 30:44