



## Teaching Medieval History: The Age of Light with Dr. Junius Johnson

### Lecture 6: Science and Technology

#### Outline:

*“This is not only **not** a period of technological stagnation, it was really a time of technological and scientific explosion...If you're looking at this as a coherent age in human history, then it would have to go down as one of the most explosive technological ages, and major changes took place in society as a result of [it].”*

#### Introduction

- The Middle Ages, often mislabeled as the "Dark Ages," were a period of significant technological and scientific advancements.
- The lecture aims to highlight key inventions and scientific progress that laid the groundwork for the Renaissance and modern era.

#### Chronological List of Inventions (7th-15th Centuries)

- **Windmill (7th Century)**
  - Allowed for efficient grinding of grain, reducing manual labor.
- **Stirrups (7th Century)**
  - Enabled effective horseback combat and contributed to the development of knighthood and feudalism.
  - Charles Martel incentivized their use; Charlemagne required it.
- **Hourglass (8th Century)**
  - Provided a practical means of measuring time.
- **Tidal Mills (8th Century)**
  - Utilized tidal water to operate mills, facilitating grain grinding in coastal areas.
- **Heavy Plow (9th Century)**
  - Allowed for the cultivation of heavy, clay-rich soils, increasing agricultural productivity.



- Contributed to London's explosive growth from 1100-1300.
- **Castle (9th Century)**
  - Provided fortified structures for military defense and administrative control. Most consisted of:
    - Outer walls and bridge
    - Closing door/portcullis
    - Crenelated battlements for archers
  - Charlemagne (crowned in 800 AD) built castles throughout the Holy Roman Empire.
- **Central Heating (9th Century)**
  - Improved living conditions by providing consistent indoor warmth through underfloor channels.
- **Chain Mail and Plate Mail (9th Century)**
  - Enhanced the protection and mobility of knights in battle.
  - Note: A modern military soldier in the US Army carries more weight into battle today than a medieval Knight in full armor.
- **Mechanical Clock (10th Century)**
- **Stern-Mounted Rudder (11th Century)**
  - Improved the maneuverability and navigation of ships.
- **University (11th-12th Centuries)**
  - Established higher education and dissemination of knowledge.
  - Responsible for what we think of as the "High Middle Ages".
- **Longbow (12th Century)**
  - Allowed archers to shoot twice as many arrows as before.
  - Sometimes called "the medieval machine gun."
- **Wheelbarrow (12th Century)**
  - Revolutionized labor by enabling the easy transport of heavy materials (like dirt).
  - Time-saving farming inventions ultimately improve yield.
- **Compass and Astrolabe (12th Century)**
  - Significantly enhanced exploration and maritime travel.
  - With the stern-mounted rudder, conditions set for exploration.
- **Wine Press (12th Century)**
  - Increased the efficiency of wine production.
- **Artesian Well (12th Century)**
  - Invented in 1126 precisely.
  - Tapped natural water pressure for a reliable water source.
- **Flying Buttress (12th Century)**
  - External prop that supported the construction of large cathedrals and other buildings.
- **Chimney and Fireplace (12th Century)**



- Improved indoor air quality and heating efficiency.
- **Buttons (13th Century)**
  - Provided a practical method for fastening clothing, offering greater design flexibility.
- **Oil Paint (13th Century)**
  - Revolutionized art by allowing for richer colors and more detailed works.
- **Watermark (13th Century)**
- **Eyeglasses (13th Century)**
  - Improved vision, particularly for reading
- **Spinning Wheel (15th Century)**
  - Increased the efficiency of yarn production.
- **Printing Press (15th Century)**
  - Mass production of books, facilitating knowledge and literacy.
  - Note that this is still the Middle Ages, not the Renaissance, though it helped make it possible.

## Advances in Science, Medicine, and Astronomy

Far from suppressing science, the Church was closely involved in the scientific advancements of this time. It made possible the scientific discoveries that led to the Renaissance and early modern period.

- **Optics, Light, and Color Theories**
  - Made significant progress in understanding vision, light, and color.
  - This is largely why the invention of glasses was possible.
- **Theory of Impetus (6th Century)**
  - Precursor to inertia, momentum, and acceleration, influenced later scientific work, including Galileo's.
- **Arabic Numerals**
  - Simplified mathematical calculations with the adoption of Arabic numerals, including the concept of zero.
- **Scientific Method**
  - Emphasis on observation, experimentation, and calculation laid the groundwork for modern science.
- **Alchemy and Metallurgy**
  - Contributed to advancements in chemistry and metallurgy despite being reduced to caricatures today.
  - The Philosopher's Stone was believed to be a substance that would allow you to treat a wide variety of afflictions.



- The goal of alchemy wasn't just "turning lead to gold" but to distill mercury to a very pure form.
- **Music and Harmony**
  - Developments in harmony and musical notation during the Middle Ages formed the basis for modern music.
- **Causes and Effects of Motion**
  - Studies on motion informed celestial mechanics and engineering.
- **Medicine**
  - Introduction of pharmacies
  - Dissection practices
  - University training for physicians
  - Use of leeches to release blood from an affected area
  - Anesthesia
  - Cleaning and suturing of wounds
  - First successful C-section (for saving the life of mother as well as the child)
  - Concept of quarantine
  - Urology
  - Amputations
  - Cauterization of wounds using heat
  - Removal of cataracts
  - Dental Extractions
  - Trepanning - perforation of the skull
- **Astronomy**
  - Significant progress in tracking and measuring the movements of stars and planets during and beyond the Middle Ages.
- **Side Note: The Galileo Affair**
  - Although the Galileo affair occurred outside the Middle Ages, it is often viewed as evidence of a Medieval anti-scientific attitude.
  - At the time of Galileo's publications, experimental evidence did not support a heliocentric view.
  - More powerful telescopes than Galileo's were needed to provide sufficient evidence.
  - Contemporary scholarly consensus suggests that the Church's refusal to accept the new scientific theory was a rational decision, given the lack of observational support.
  - Galileo's method of presenting his ideas likely inflamed opposition unnecessarily.
  - His opposition to Aristotelian categories brought his theories into conflict with the Church's doctrine of transubstantiation.



- Galileo did not offer an alternative way to reconcile his theories with Church doctrine.
- The scientifically unsubstantiated claim directly contradicted Church teachings on a sacrament, leading to his trial for heresy.
- If Galileo had separated his heliocentric views from his criticisms of Aristotle, he might have encountered less opposition.
- Descartes avoided a similar fate by showing that his new physics did not challenge the doctrine of transubstantiation.

## Conclusion

- The Middle Ages were a period of remarkable technological and scientific advancement, contrary to the "Dark Ages" narrative.
- The Renaissance and modern era built upon the foundations laid during the Middle Ages.
- The Middle Ages were a period of reason embraced in faith, while the Enlightenment and modern era are the ascendancy of reason alone.
- Medieval intellectuals were curious, creative, and meticulous in their scientific endeavors.