

University of Colorado
Colorado Springs

CS4950/5950

Homeland Security & Cybersecurity

Critical Infrastructure

CS 4950/5950


Homeland Security & Cybersecurity

Lesson 11

Critical Infrastructure

Rick White, Ph.D.


University of Colorado, Colorado Springs



1

Esc

1




University of Colorado
Colorado Springs

CS4950/5950

Homeland Security & Cybersecurity

Critical Infrastructure


What is critical infrastructure?



2

Esc

2




University of Colorado
Colorado Springs

CS4950/5950
Homeland Security & Cybersecurity

Maslow's Hierarchy of Needs


- A psychological theory proposed by Abraham Maslow in 1943 paper "A Theory of Human Motivation" in *Psychological Review*.
- Each level represents a set of individual needs that must be fulfilled before a person can advance to the next level.
- For 99.99% of human history, 99.99% of our time was spent satisfying Physiological and Safety needs.**



The diagram shows a five-level pyramid. From top to bottom: 1. Self-actualization (blue): desire to become the most that one can be. 2. Esteem (green): respect, self-esteem, status, recognition, strength, freedom. 3. Love and belonging (orange): friendship, intimacy, family, sense of connection. 4. Safety needs (red-orange): personal security, employment, resources, health, property. 5. Physiological needs (red): air, water, food, shelter, sleep, clothing, reproduction.

3
 Esc

3

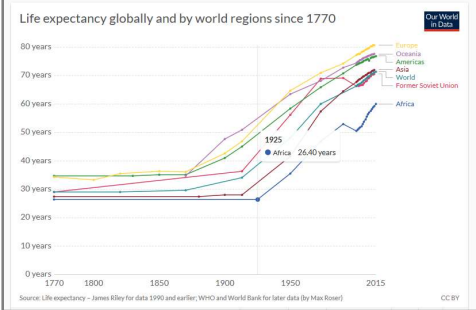


University of Colorado
Colorado Springs

CS4950/5950
Homeland Security & Cybersecurity

Life Expectancy

- For 99.99% of human existence, life was “Nasty, brutal and short”
- The average life expectancy was no more than 30 years.**
- Then, starting less than 200 years ago, life expectancies began to rise, due mainly to the introduction of infrastructure.**



The graph shows life expectancy from 1770 to 2015. The y-axis ranges from 0 to 80 years. The x-axis shows years from 1770 to 2015. A vertical line marks 1925 with a life expectancy of 26.40 years. Regions shown include Europe, Oceania, Americas, Asia, World, Former Soviet Union, and Africa. All regions show a sharp increase in life expectancy starting around 1850-1900.

<https://ourworldindata.org/life-expectancy>

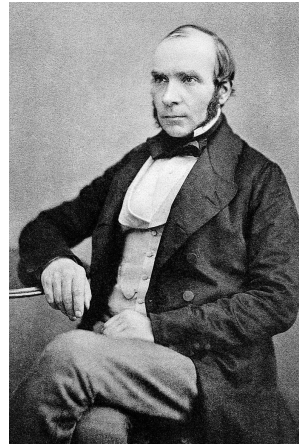
4
 Esc

4



Safe Drinking Water

- In 1854, **Dr. John Snow** conclusively linked a London cholera outbreak to a drinking well contaminated by a nearby cesspit filled with human waste.
- **His findings resulted in new sewers and new water sources to deliver safe drinking water to the people of London.**
- As a result, the incidence of disease was greatly reduced, and London became the first Western city to exceed 1 million inhabitants since the fall of ancient Rome.



John Snow

5

Esc

5



Public Health

- Dr. Snow confirmed a growing "germ theory" of disease.
- In 1865, **Louis Pasteur** patented a heating process to kill bacteria.
- In 1870s, Pasteur pioneered ways to create immunizing vaccines.
- In 1880s, **Carlos Finlay** found that mosquitos spread Yellow Fever.
- The subsequent application of **pasteurization, immunization, and sanitation**, saves millions of lives every year.



6

Esc

6



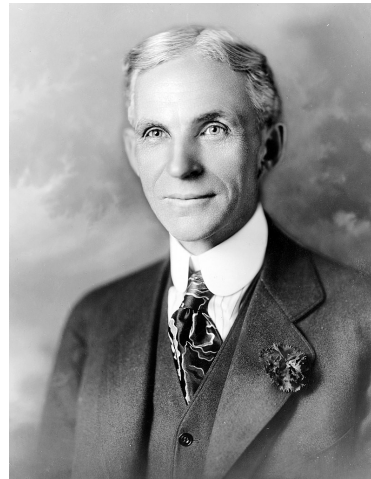
University of Colorado
Colorado Springs

CS4950/5950

Homeland Security & Cybersecurity

Mass Production

- In 1794, **Eli Whitney's** "gin" quickly removed seeds from cotton bolls.
- Cheap cotton spurred rapid growth in the weaving industry.
- Steam-powered looms kicked off the **Industrial Revolution**.
- Expensive handmade goods were replaced by cheap factory goods.
- Mass production culminated with **Henry Ford's** assembly line.
- **Mass production improved quality of life by freeing people to reach higher in Maslow's Hierarchy.**



7

Esc

7



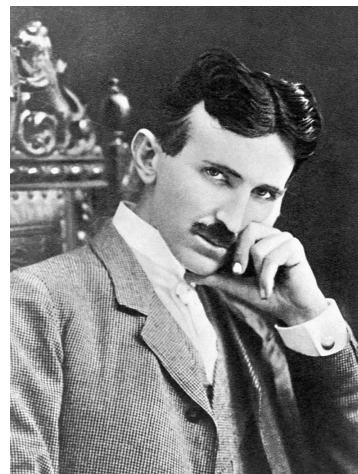
University of Colorado
Colorado Springs

CS4950/5950

Homeland Security & Cybersecurity

Electricity

- **Edison's** light bulb in 1879 created demand for residential electricity.
- Edison's DC power system was inefficient and expensive.
- **Tesla** invented AC power system that was efficient and cheap.
- Tesla AC power replaced Edison DC power for home and industry.
- Tesla AC motor became integral to home and industry technologies.
- **Labor-saving devices also freed people to aim higher in Maslow's Hierarchy.**



8

Esc

8



University of Colorado
Colorado Springs

CS4950/5950

Homeland Security & Cybersecurity

Transportation

- In the 1870s, **railroads** greatly reduced the cost of delivering goods & services across America.
- Railroad construction spurred steel production, which also benefitted the **shipping** industry, increasing international trade.
- In 1908, the Model-T ushered in the **automobile**, freeing society to pursue new opportunities.
- In 1903, the **Wright Brothers** ushered in the age of **aviation** which is still revolutionizing the global movement of people.



9

Esc

9



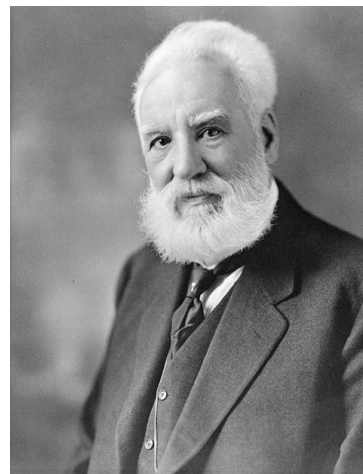
University of Colorado
Colorado Springs

CS4950/5950

Homeland Security & Cybersecurity

Communications


- The 1840s **telegraph** ushered in speedy global communications.
- In 1876, **Alexander Bell's telephone** made person-to-person global communications possible.
- In 1895, **Marconi** invented practical **radio** communications.
- Both the radio and telephone gave rise to the field of **electronics**.
- Electronics gave rise to machines that replaced human **computers**.
- The high cost of early computers gave rise to the **Internet** to share expensive computing resources.



10

Esc

10




University of Colorado
Colorado Springs

CS4950/5950
Homeland Security & Cybersecurity


Technical Revolution

- The technical revolution of the past 200 years transformed the US and the world.
- Because of it, 2% of the nation feeds the US and world.
- Because of it, 82% of the US now live in cities, up from 64% in 1950, and expected to rise to 90% by 2050.
- Because of it, US life expectancy now averages over 78 years!**



11
 Esc

11




University of Colorado
Colorado Springs

CS4950/5950
Homeland Security & Cybersecurity


Technology Trap

- The price we pay, however, is that what was once “nice” is now “necessary”.
- Critical infrastructure is “critical” because 82% of the US population who live in cities, 268 million people cannot survive without this technology.**
- And there's no going back!



12
 Esc

12



University of Colorado
Colorado Springs

CS4950/5950
Homeland Security & Cybersecurity


Critical Infrastructure

- Critical Infrastructure provides services essential to sustaining complex urban society.**
- PPD-21 issued in 2011 identifies 16 critical infrastructure sectors.
- Every infrastructure sector and subsector relies on cyber components to properly function.
- Every infrastructure sector is vulnerable to cyber attack.**

#	Specific Agency	Sector
1	Agriculture	Food & Agriculture
2	Defense	Defense Industrial Base
3	DHS	Chemical Sector
4	DHS	Commercial Facilities
5	DHS	Communications
6	DHS	Critical Manufacturing
7	DHS	Dams
8	DHS	Emergency Services
9	DHS	Information Technology
10	DHS	Nuclear Reactors, Materials, & Waste
11	DHS & DOT	Transportation Systems
12	DHS & GSA	Government Facilities
13	Energy	Energy
14	EPA	Water & Wastewater Systems
15	HHS	Healthcare & Public Health
16	Treasury	Financial Services

13
Esc

13




University of Colorado
Colorado Springs

CS4950/5950
Homeland Security & Cybersecurity


Top 3 Security Concerns

- Simultaneous meltdown of two nuclear power plants.
- Shutdown the entire North American electric grid.
- Undermine the Federal Reserve system.



14
Esc

14




University of Colorado
Colorado Springs

CS4950/5950
Homeland Security & Cybersecurity


Worst Disaster in US History

- The worst disaster in US history, outside the Civil War, was the 1900 Galveston Hurricane.
- It killed upwards to 6,000 people.
- **A coordinated cyber attack against critical infrastructure could be worse.**



15
Esc

15

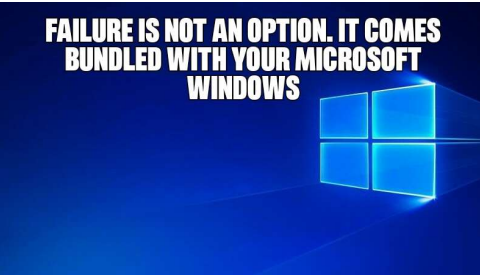


University of Colorado
Colorado Springs

CS4950/5950
Homeland Security & Cybersecurity

Little Government Can Do

- One reason is they don't own most of it, and therefore can't touch it.
- Similarly, they have little regulatory authority to direct security changes.
- **More importantly, there is no guaranteed security; there is no cure for cyber-attack.**



16
Esc


16

UCCS University of Colorado
Colorado Springs

CS4950/5950
Homeland Security & Cybersecurity

Conclusion

Questions?



17

Esc