
Can Humans Flourish in the Age of Robots, Cyberspace, and Artificial Intelligence: Suggesting Theoretical Frameworks... and What this Might Mean for the University of the Future.

**Northern Plains Ethics Institute/NDSU
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□Note: The views and opinions are the author's
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Dakota

Recent Evidence of Rapid and Unprecedented Changes connected with Digital Technologies...

- ❑ Electronic/Computer systems under siege
 - Only 12 computer viruses in 1988...after 2015, approximately 200,000,000 (200 million)
- ❑ Robotic Revolution
 - Countries producing or designing unmanned systems: 2001, <10, now 80+
- ❑ Social Media a Disruptive Force
 - Middle East turmoil following a “Twittered” Arab Spring 2011... 2016 US election affected... 2020?
- ❑ Big Data/High Performance computing/AI
 - “Watson” wins Jeopardy 2011; AI self-teaches itself to play and win championship in “GO” in 2017

But Taken all Together.... at the Macro Level

- As distinct from multiple, preceding and coincident *micro*-techno revolutions... a **“Macro”** revolution is a combination of multiple technologies which create an entirely **new**, never before seen, **structure of global economic/social/military activity... what might be called, a new REALM of activity...**

Two Macro-Technological Revolutions underway...

- Robotic: AI guided digital machines in 3D dimensions
- Cyberspace/AI: a global information nexus (a purely digital information space, that is a marketplace, a meeting place, entertainment.... and battlefield)

The people Now Alive are the Most Important Generations in History, as they will navigate the emergence of Intelligent Machines and Cyberspace.

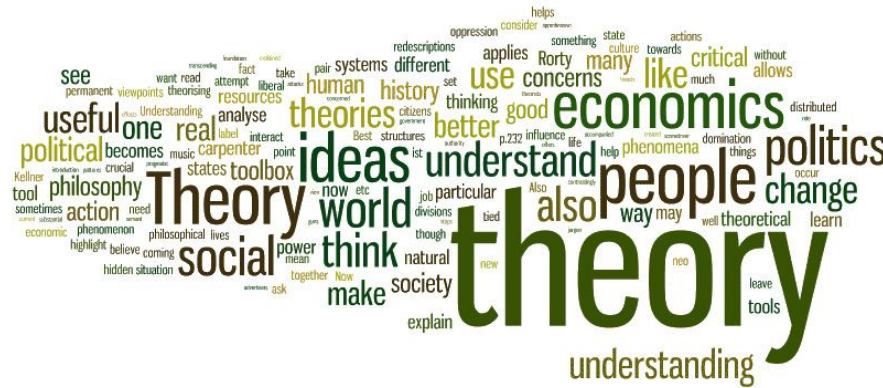
“ One Tragedy of the human condition is that each of us lives and dies with little hint of even the most profound transformations of our society and our species that play themselves out in some small part through our own existence.”

James Beniger, “The Control Revolution”

The Challenge of these Generations

- Those of us alive today have challenges: C^3R
 - Create the Technology, a competitive race (e.g., robots, code, businesses, services)
 - Control the Technology for safety, security.
 - Civilize the Technology (eg., law, policy, ethics, norms, art, history....)
 - Regenerate the learning mechanisms and educate the next generations to meet the continuing challenges of creation, control, and civilizing...

Some Theories of Technology to Inform our Thinking...



1. Seeking advantage in “Sense-Think-Act” is a human impulse...at speed, at distance, at reduced cost...
2. Framework of “Realms”... and two new Realms emerging
3. Advantage of early innovators...disadvantage of “lock in” if you are **late** to innovate... (think ‘QWERTY’)

Search for a Framework... by looking at Long Term Evidence... at historical trends in Technology

“ ... because our teachers ...focus their attention only on the present or at the most on the very recent past, they find the present more and more difficult to explain. They are like oceanographers who refuse to look at the stars because they are too remote from the sea, and consequently are unable to discover the causes of the tides.” Marc Bloch

Theory 1: Human Impulse to “Sense/Think/Act” is integrating with cyberspace and Intelligent machines...



□ Sensing

- Human senses (sight, hearing, taste, feel, smell)
- Machine sensing: (glasses, telescope, radio, radar, **perception at a distance?**)



(COMMUNICATION LINKS)

□ Thinking

- Human thinking (brain)
- Machine thinking (early analog, now digital, AI/Cloud, **thinking at a distance combined with Machine Learning?**)



(COMMUNICATION LINKS)

□ Acting

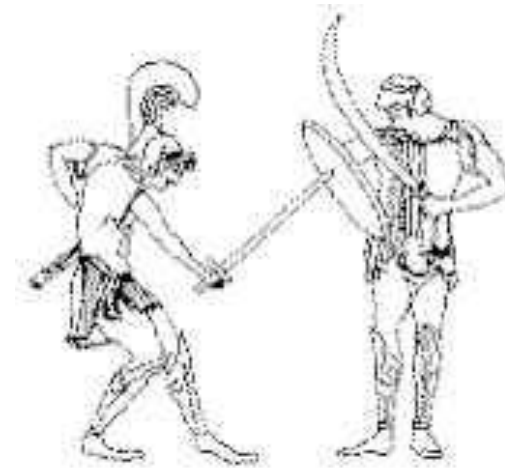
- Human acting (limbs...walking, holding, etc)
- Machine acting (cars, planes, ships, unmanned systems, robots, acting in cyberspace, **machine acting at a distance?**)



Theory 2: A Framework of “Realms”...

At first...there existed one realm of warfare/activity: the Social-Human Realm

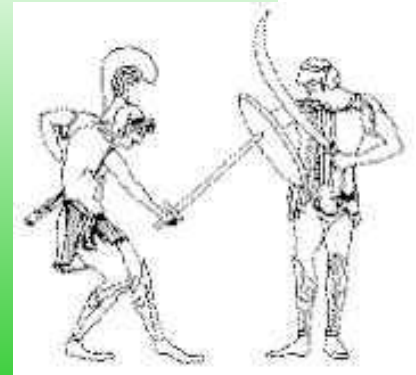
- Most of history and pre-history, the social-human factor was decisive action in war:
 - Human wit, will, strength, and ability to persuade....
 - Tools magnified or leveraged human strength, or protected the human body.
 - Humans dominated the Sense-Think-Act sequence



One Realm of warfare.... 'Social-Human' factors dominate Sensing-Thinking-Acting

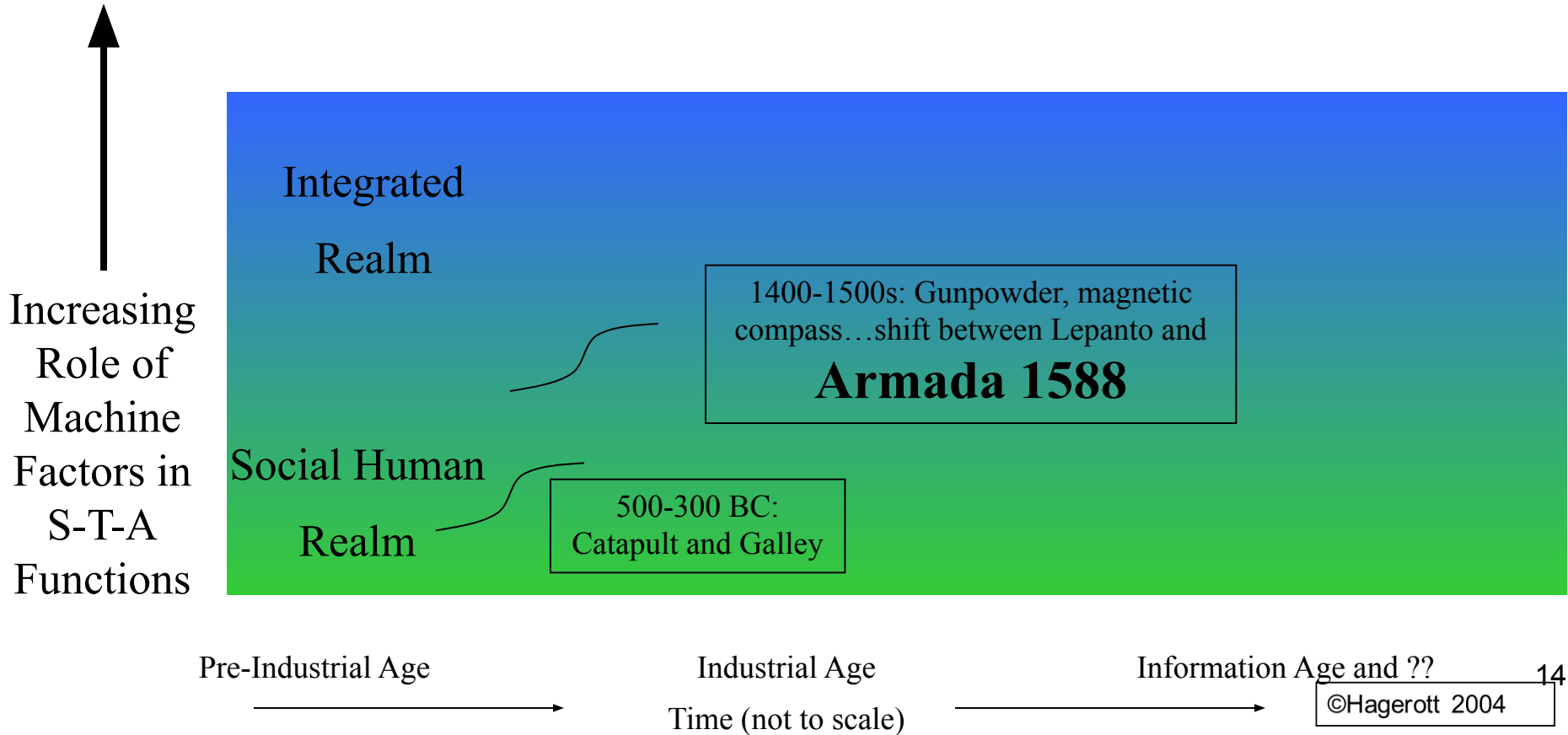
Social-
Human
Factors
Dominate
S-T-A

Social- Human
Realm



Enter Accelerating Technological Innovation,
Increasing Complexity, and the more tools to
better Sense-Think-Act (S-T-A)

Waves of Micro Innovation increases Human-Machine S/T/A integration in war...evolving the 2nd Realm



Unclassified

Human Sailors “Integrated” with Machines, a new “Realm” of warfare emerged... Catastrophe for some



Social-Human Realm: 1571 Battle of Lepanto dominated by mass infantry battles fought on/across fleets of galleys....

To Integrated Realm: 1588 Battle of Armada the English embark **ZERO INFANTRY** and fight an artillery duel at sea on ‘ships of the line.’

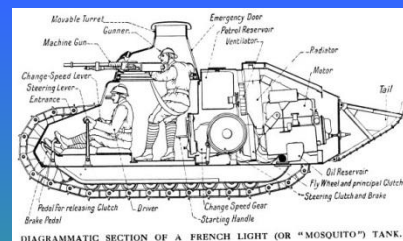
Now...two Realms of warfare co-exist...



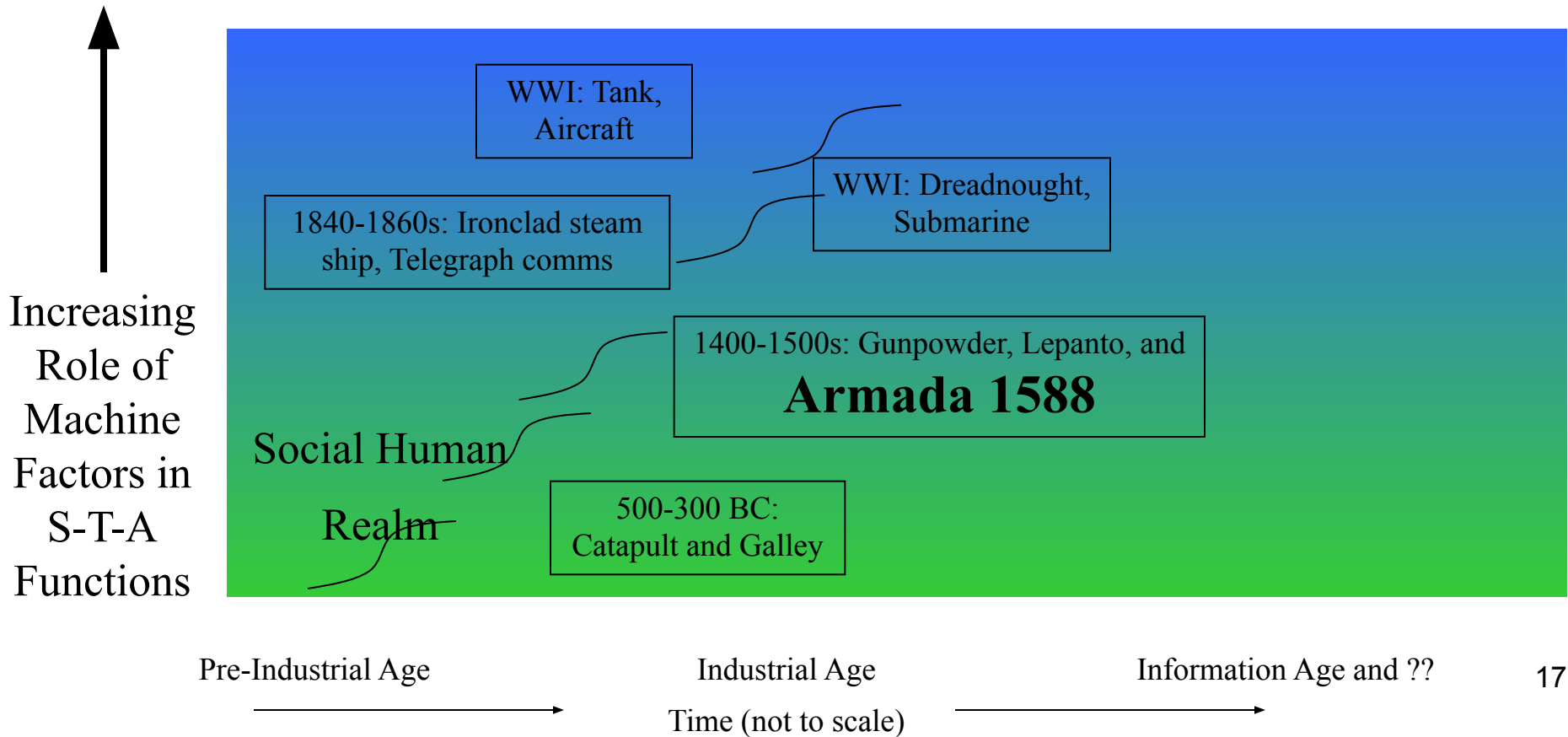
Increasing
Role of
Machine
Factors in
S-T-A
Functions

Integrated
Realm

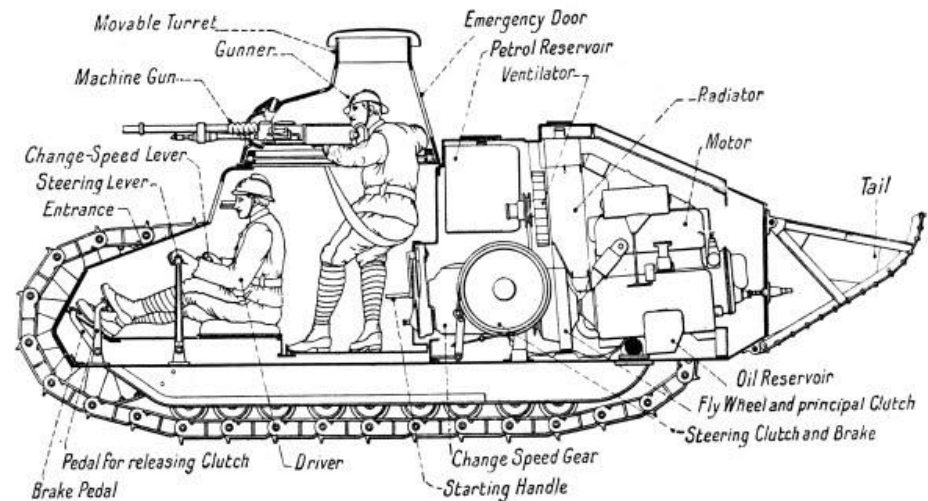
Social- Human
Realm



Waves of Micro Innovation... more Complex Machines Assume Increasing Role in the Sense-Think-Act Function



Integrated Battlefield of the Human and Machine on Land: Confused Leaders produce the Carnage of WWI



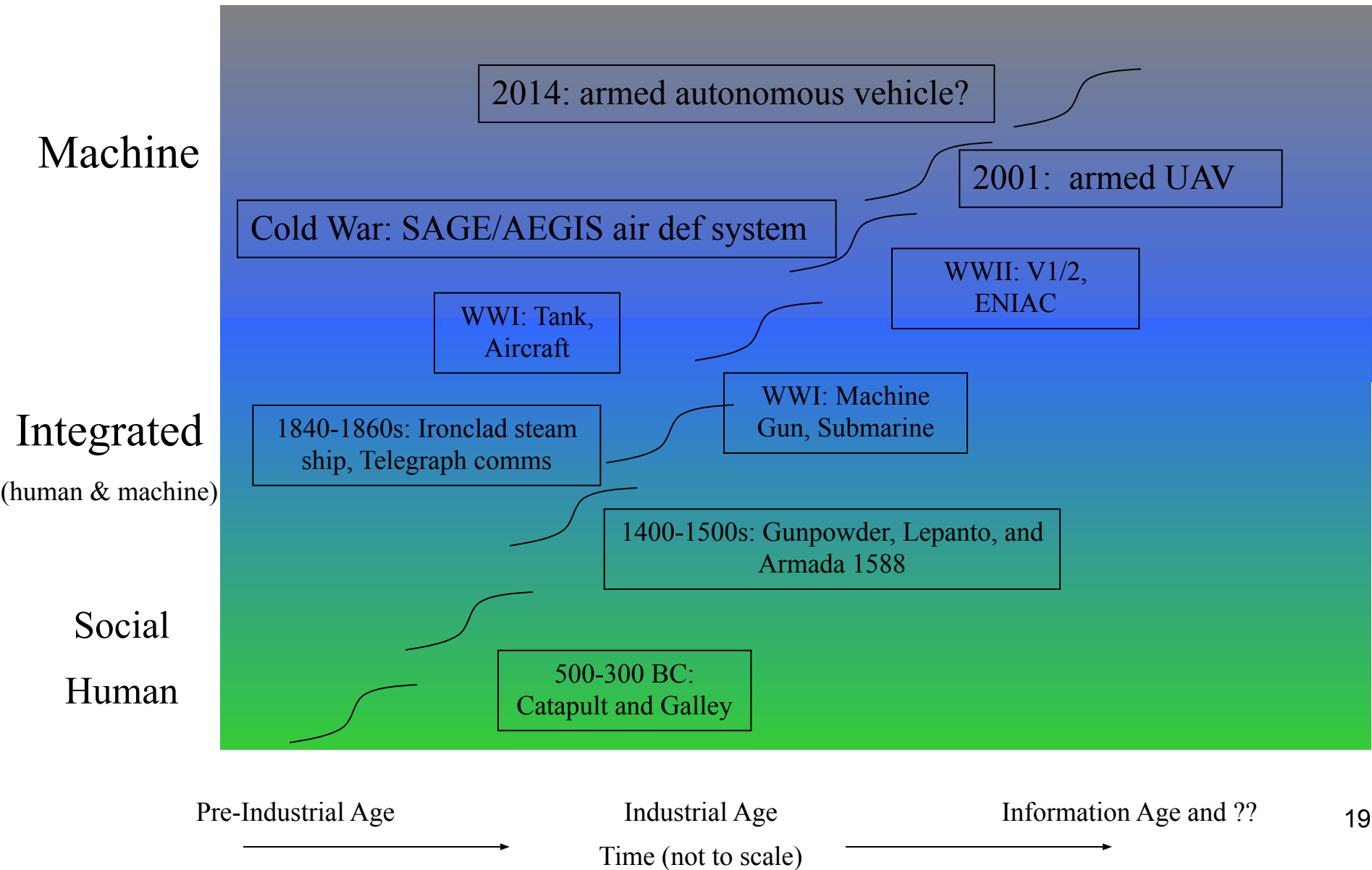
DIAGRAMMATIC SECTION OF A FRENCH LIGHT (OR "MOSQUITO") TANK.

“Artillery men with their cold blooded mathematics seemed subversive of all that made a soldiers life heroic, admirable, worthy.” William McNeill,

Pursuit of Power)

Unclassified

Waves of Innovation push warfare deeper into the Realm of Robotics/AI...upheaval inevitable...



Macro Revolution Yields Three Realms of War



**Machine
Factors More
Decisive**

Machine
Realm



Integrated Realm
(Human-Machine)



**Social-Human
Factors more
decisive**

Social-
Human
Realm



©Hagerott 2004

Military Technology Led the Economy/Society in this Emergence²⁰

Macro Revolution: Second Realm economy emerges... massive disruption... known as Industrial Revolution

- In pursuit of Sense-Think-Acting advantage and efficiency...
 - 1st: Social-Human Realm
 - (apprx10,000 BC... (rise of cities, farming, **human slavery era**))
 - 2nd: Integrated Human-Machine Realm (the Industrial Revolution)
 - 1701^{AD}: steam engine; 1865, industrial power ends slavery in U.S.



Macro Revolution 1st: The rise of agricultural communities...displace aboriginal communities in ND...

- For most of history...humans did most of the “Sensing-Thinking” but were aided by animals and basic machines to “ACT” (ie., muscle power and leverage)
 - 1st: Social-Human Realm
 - (apprx10,000 BC... rise of farming)



2nd Macro Revolution: Humans Create more Complex machines...huge implications for animal economy

- Second Realm emerges as machines do more heavy lifting...
 - 1st: Social-Human Realm
 - (apprx10,000 BC... rise of farming)
 - 2nd: Integrated Human-Machine Realm transform agriculture.... moving from animal to machine power



... and life and work was never the same... first for the horses!... Where are they?

2nd Macro Revolution Deepens... huge implications for the human workforce...

- Second Realm matures as machines replace people...
 - 1st: Social-Human Realm
 - (apprx10,000 BC... rise of farming)
 - 2nd: Integrated Human-Machine Realm
 - Industrial Revolution on the farm continues.....the “Combine”

...life and work was never the same...
where are the people...my
grandfather adapted and kept his
job...



Two Realms of Agriculture



**Machine
Factors More
Decisive**

Role of Machine
Factors in S-T-A
Functions

**Social-Human
Factors more
decisive**



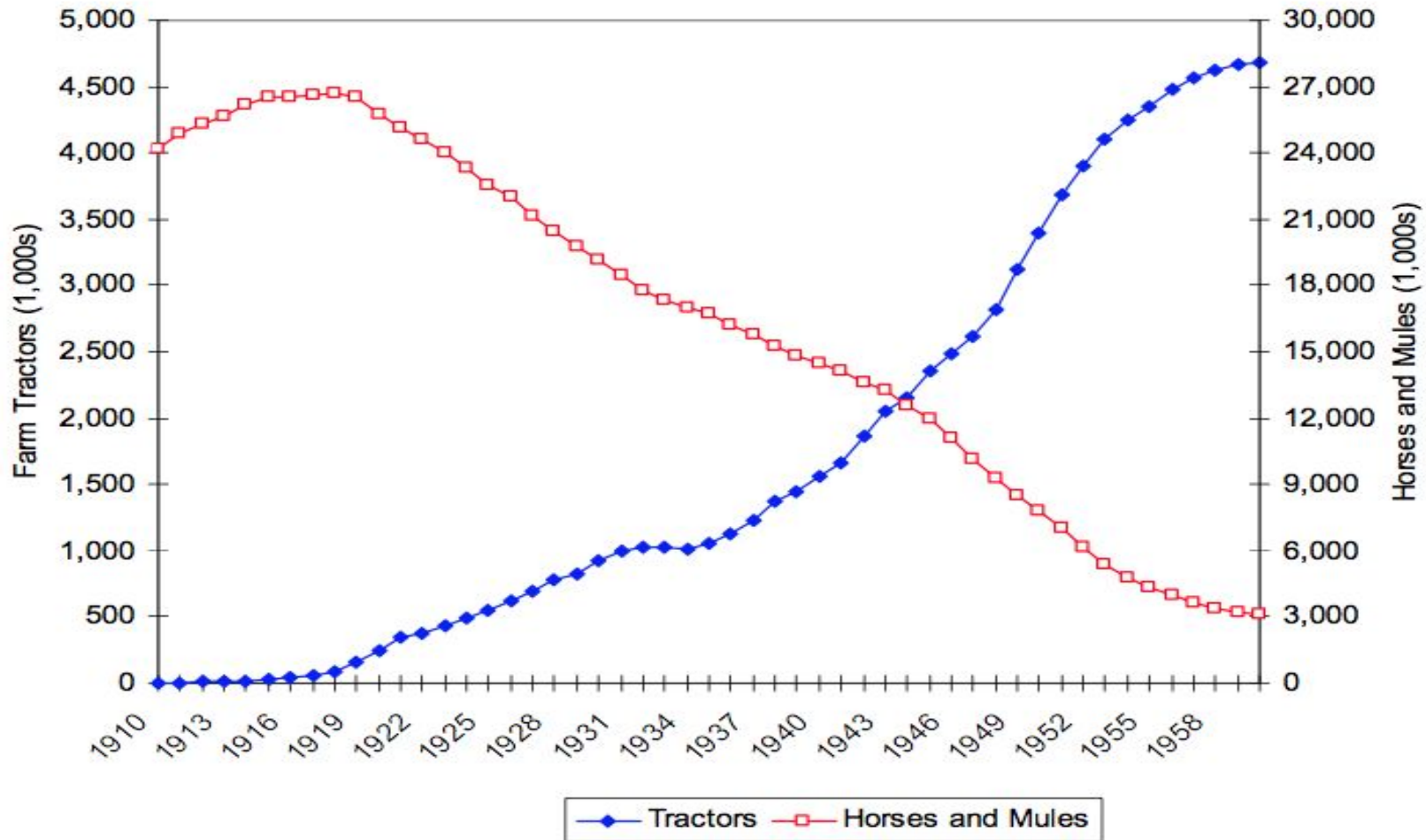
Integrated
Realm

Social-
Human
Realm



2nd Macro Revolution: horses replaced by machines... and....crop prices collapse late 1920s...Crash of '29

Replacement of Horses by Tractors on U.S. Farms—1910 to 1960



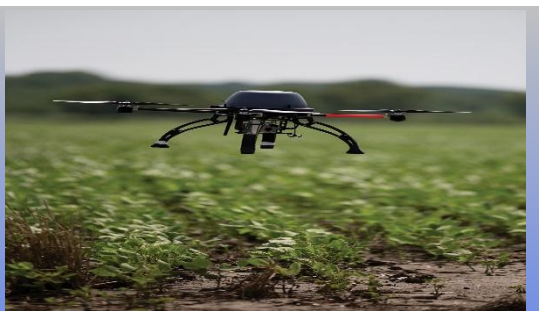
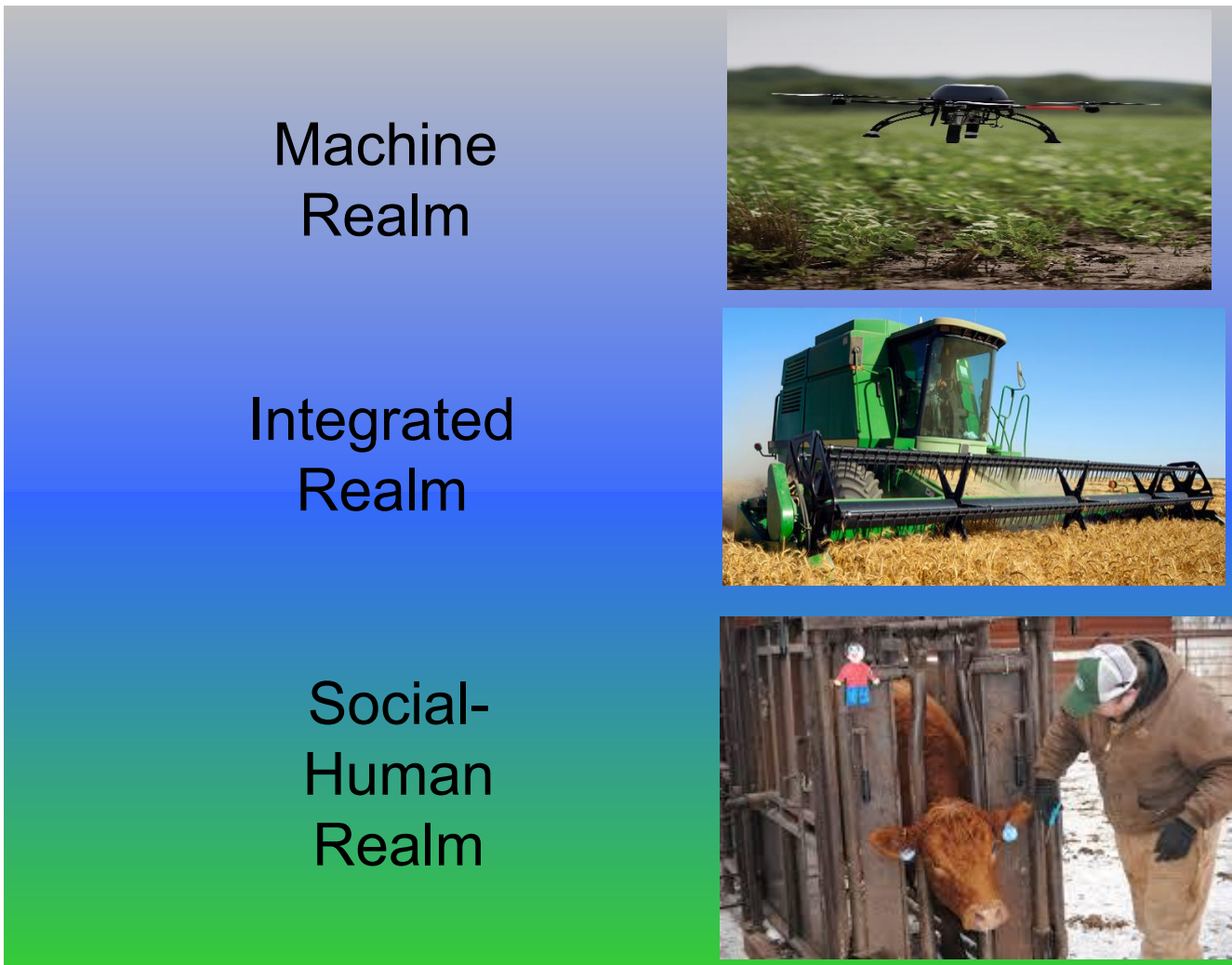
Third Realm of Agriculture appears before our eyes...



Machine Factors More Decisive

Role of Machine Factors in S-T-A Functions

Social-Human Factors more decisive



If the Rise of Robotics in the Military, AG, Manufacturing isn't enough....

... the emergence of the weirdest surprise.... not fully anticipated until Gibson, and his sci-fi novel, *Neuromancer*... the place we call **CYBERSPACE**... and **advanced A.I.**

Communication, Computing, and Information begins to move at the Speed of Light

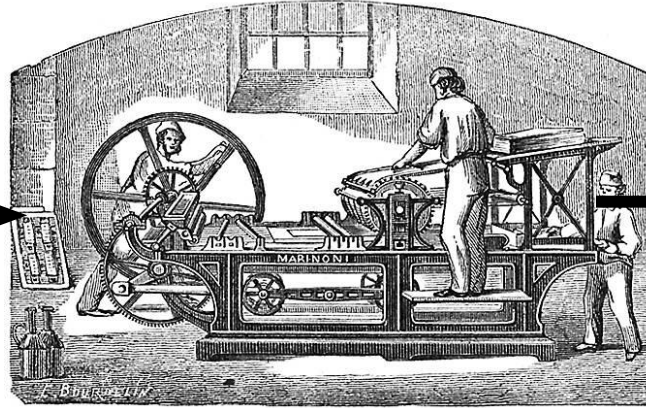
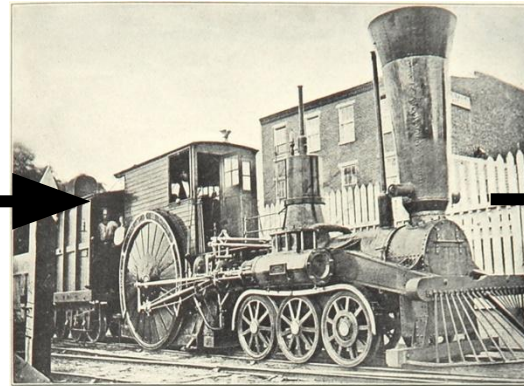
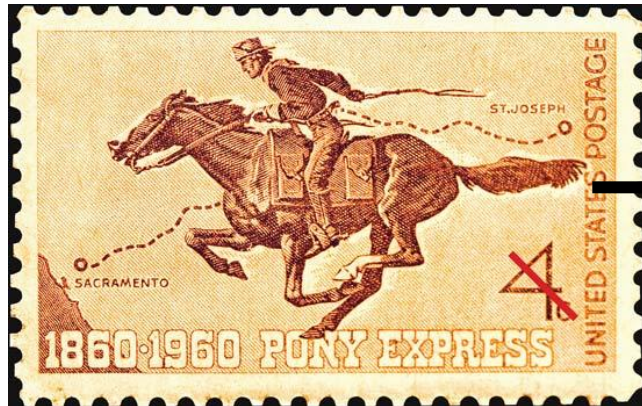
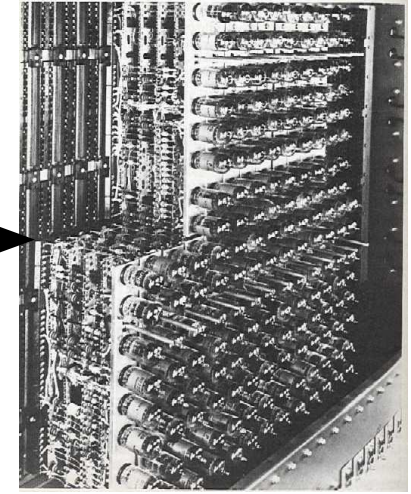


Fig. 3. Machine simple.

oldbookillustrations.com



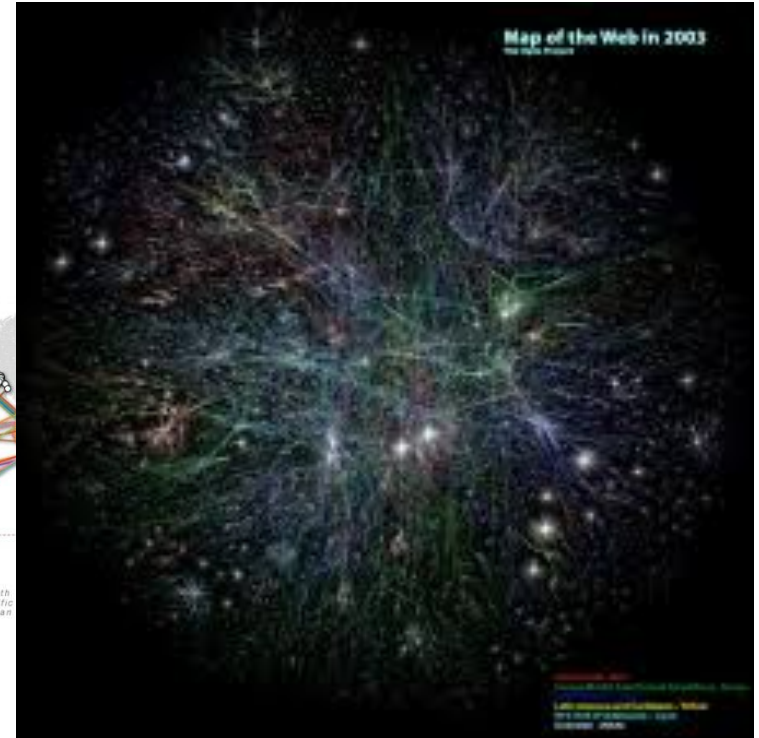
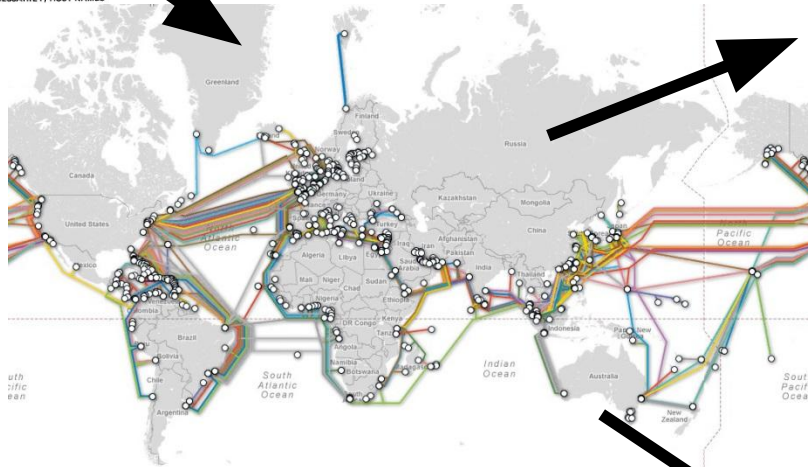
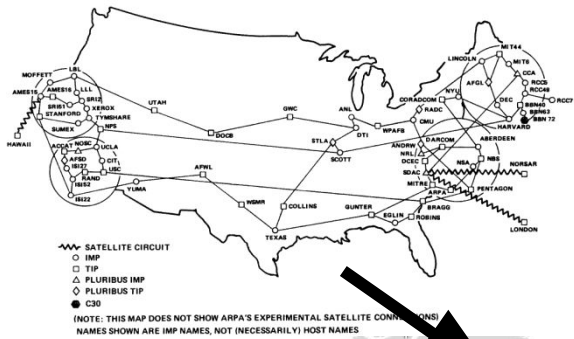
AN EARLY LOCOMOTIVE BUILT BY WILLIAM NORRIS FOR THE PHILADELPHIA & READING RAILROAD



wiseGEEK

4th Macro Revolution: ...Cyberspace and related AI breakthroughs...

ARPANET GEOGRAPHIC MAP, OCTOBER 1980



Rapid A.I. advance with access to massive internet/IoT data...

War in Cyberspace... attacks on the US infrastructure, IoT, and Individuals...



Video, Chinese DDOS attacks on FB:

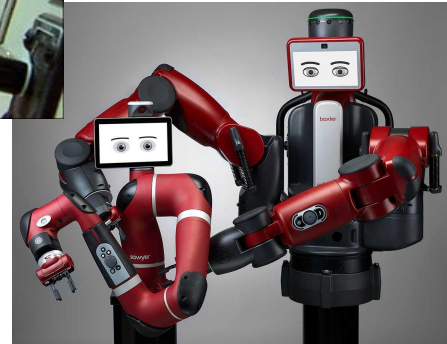
<https://www.youtube.com/watch?v=efmJsENgG-o>

Emergence of the Fourth Realm: Cyberspace powered by advanced A.I....

- ❑ We have NO IDEA what this will mean ultimately for humanity.... politics... economy....society... war.... medicine...
- ❑ But YOU are alive, now, to help create this emerging Realm of intelligent S-T-A... completely artificial...
- ❑ Artificial Intelligence: currently the most advanced AI machines are stationary, 'at rest', but operating thru Cyberspace

Three Realms of physical action and Fourth Realm of Cyberspace

- 1st: Social-Human (Natural?) Realm
- 2nd: Integrated Human-Machine Realm
- 3rd: **Machine Realm (Robotics/AI in 3 dimensions)**
- 4th: **Cyberspace (AI Machines in The Cloud)**



Four Realm Visual Framework...

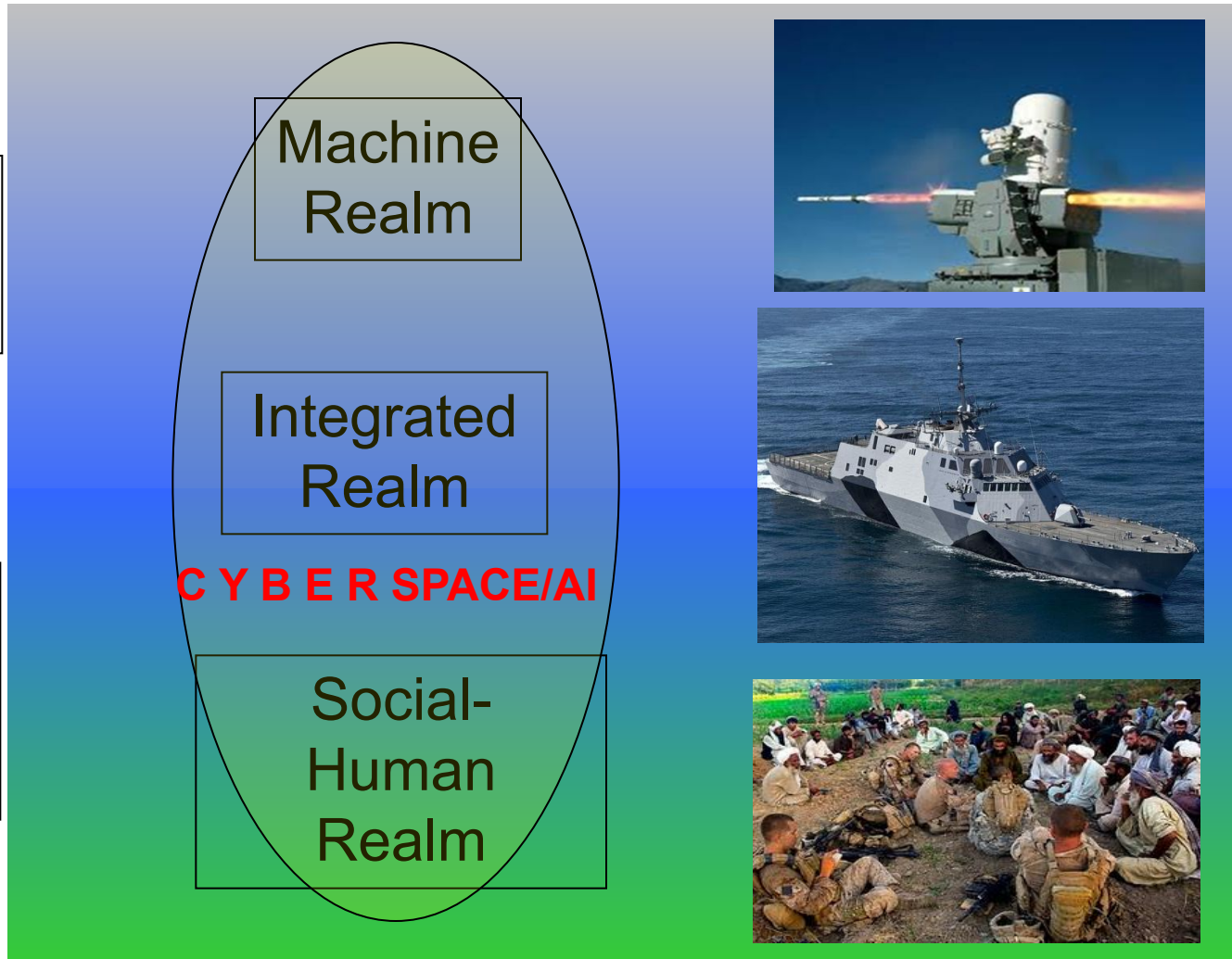
A Visual Framework...Four Realms of War



Machine Factors More Decisive

Role of Machine Factors in S-T-A Functions

Social-Human Factors more decisive



Machine Realm

Integrated Realm

C Y B E R SPACE/AI

Social-Human Realm



Cyberspace Intersects all Three Physical Realms

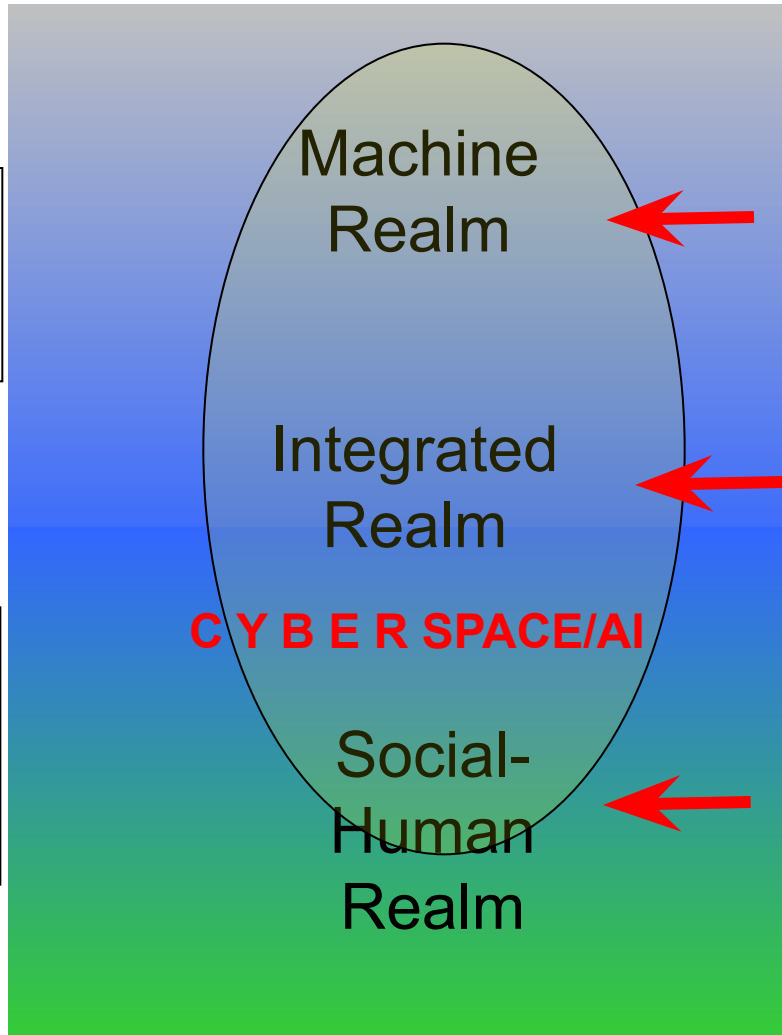
Apply the Framework to Manufacturing



Machine Factors More Decisive

Role of Machine Factors in S-T-A Functions

Social-Human Factors more decisive



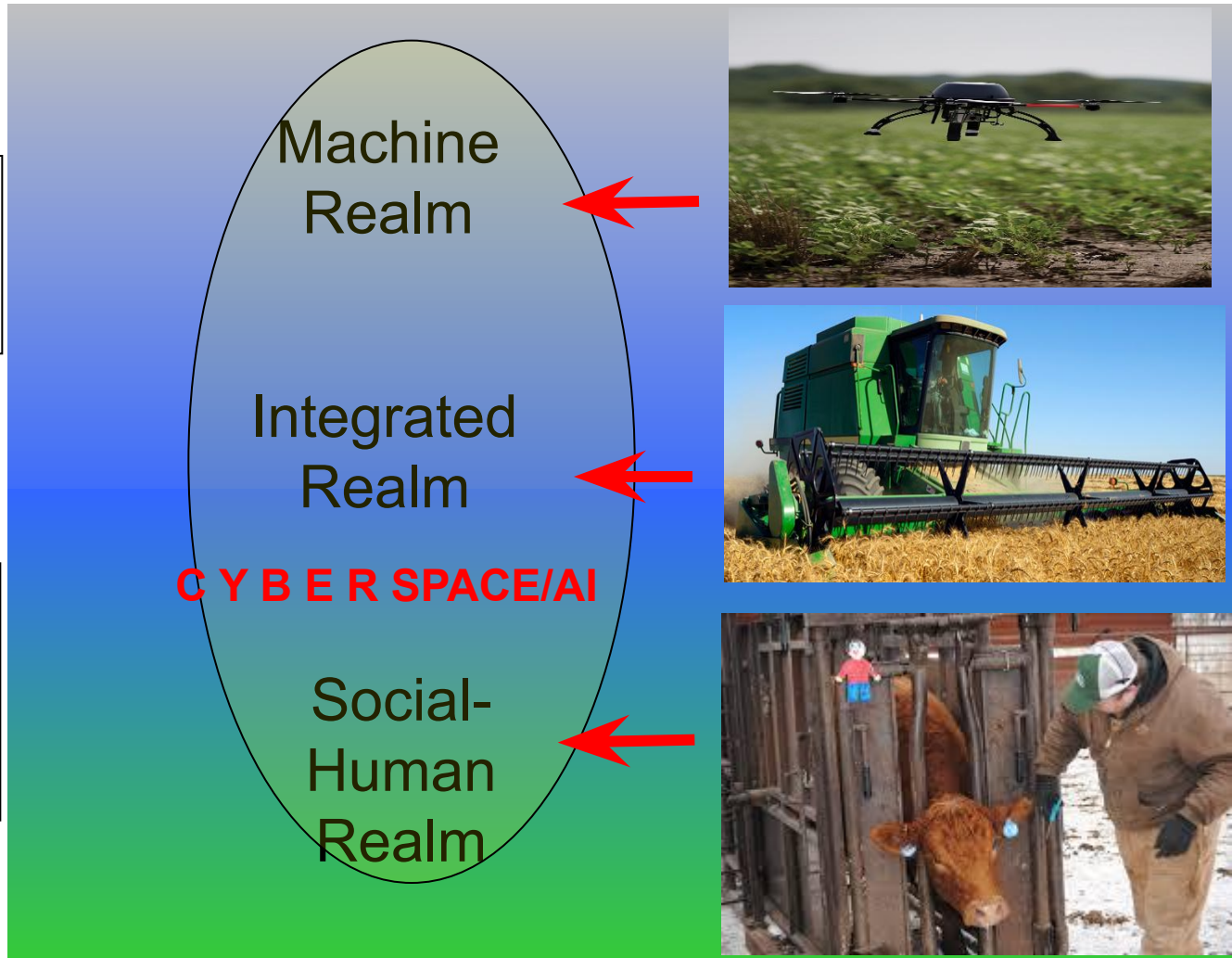
Apply the Framework to Agriculture



**Machine
Factors More
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Role of Machine
Factors in S-T-A
Functions

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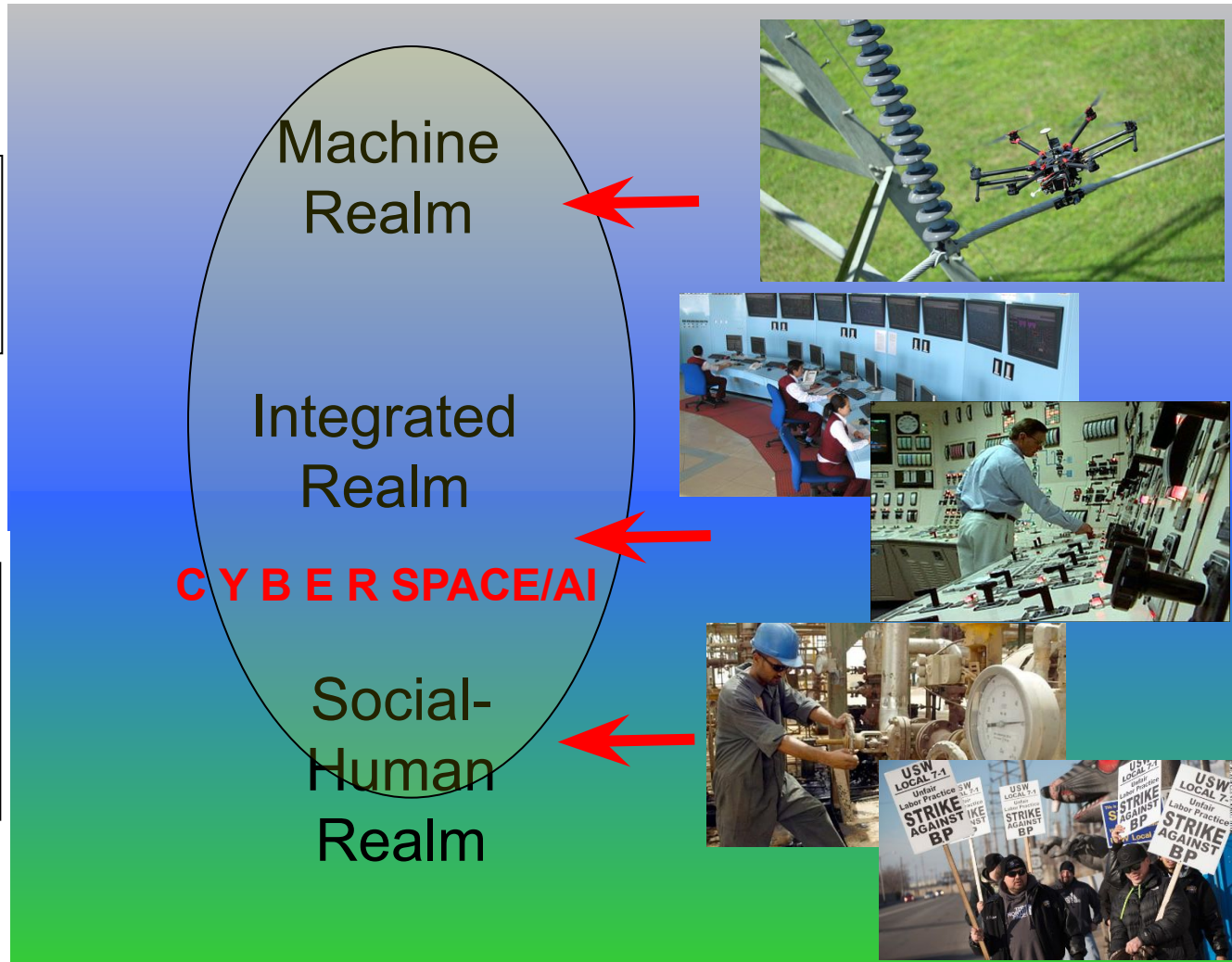
Apply the Framework to Energy



**Machine
Factors More
Decisive**

Role of Machine
Factors in S-T-A
Functions

**Social-Human
Factors more
decisive**



... the Cover of Time Magazine last week...



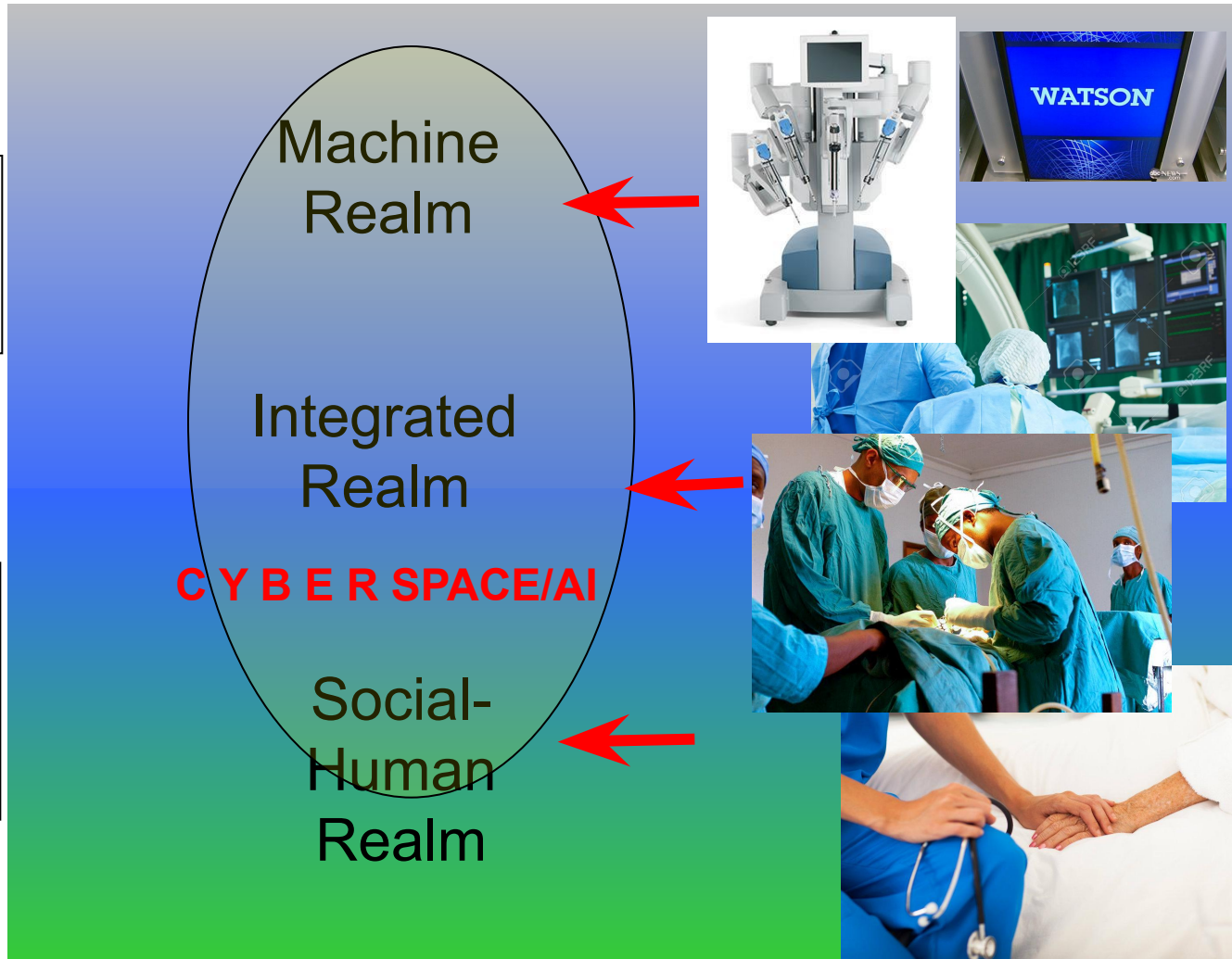
Apply to Surgical Field...



**Machine
Factors More
Decisive**

Role of Machine
Factors in S-T-A
Functions

**Social-Human
Factors more
decisive**



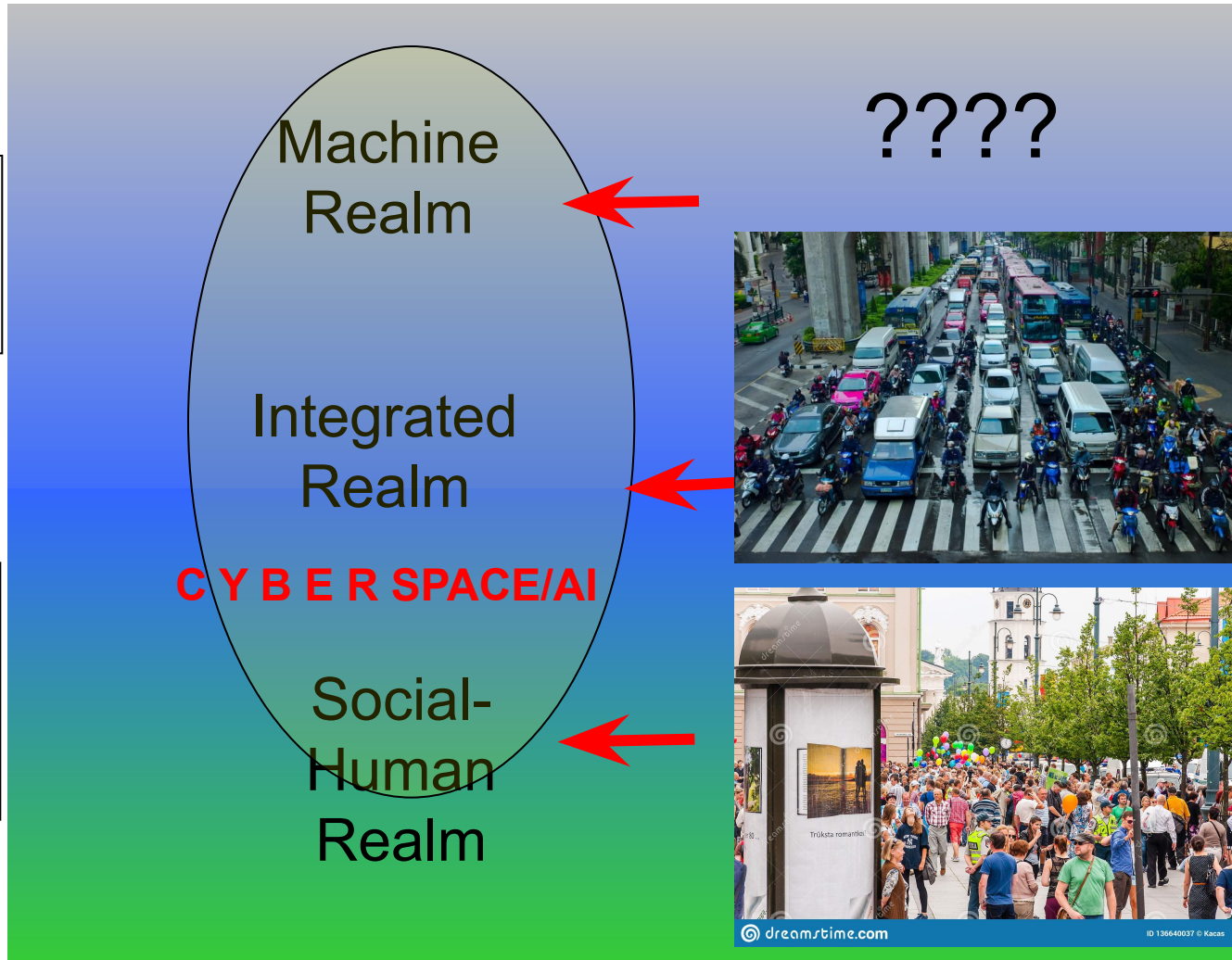
Apply to City/Civic Life ...



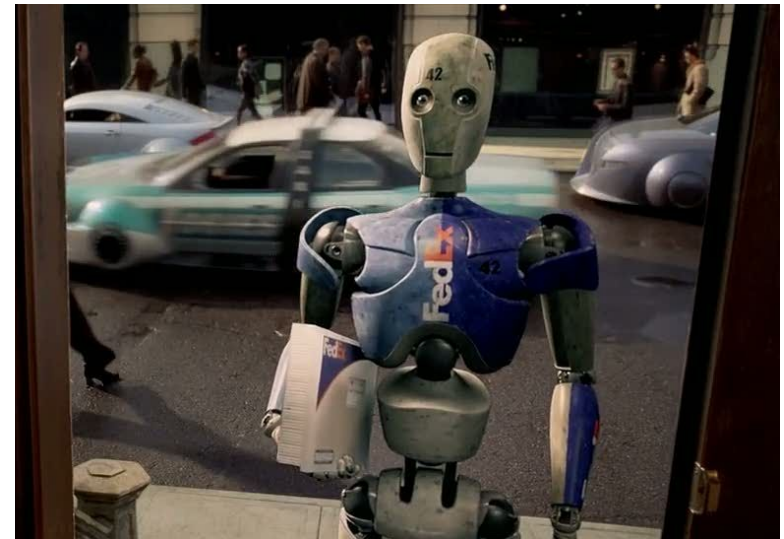
**Machine
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Do Robots have a right to share the sidewalk with People?



The most profound, unprecedented challenge in human history is upon us... multiple new Macro Realms of Robots, Cyberspace and Advanced AI are emerging... simultaneously...and it is urgent that we respond in a timely and thoughtful manner... Why? The danger of “lock In”

The Lesson of QWERTY...



Theory 3: the Observed Phenomenon of Technological “Lock In” or “Momentum”

- **Early Stages of Technology Innovation**: leaders and society exerts most influence. Redirecting technological change is relatively easy.
- **Middle Stage**: momentum accumulates around the invention (e.g., capital, labor, political)... redirecting change is harder but doable at moderate cost.
- **Late Stage**: technology is “Locked In” or beyond social redirection. (Think Minneapolis computer industry 1958 versus Silicon Valley 2019; military example: think Nuclear Arms Race (1945-62, Cuba); Nuclear power design flaws (1955-2011, Fukushima); think of walkable city challenge of today due to negative effects of automobiles road priorities from 1940s-2000s...)

Summary-S/T/A a force of nature...

An impulse of intelligent life is to expand the capacity to Sense-Think-Act in the physical world... this impulse creates pressure for change at the MICRO and MACRO level...



- Sensing
 - Human senses (sight, hearing, taste, feel, smell)
 - Machine sensing: (glasses, telescope, radio, radar, **perception at a distance?**)

(COMMUNICATION LINKS)



- Thinking
 - Human thinking (brain)
 - Machine thinking (early analog, now digital, AI/Cloud, **thinking at a distance combined with Machine Learning?**)

(COMMUNICATION LINKS)

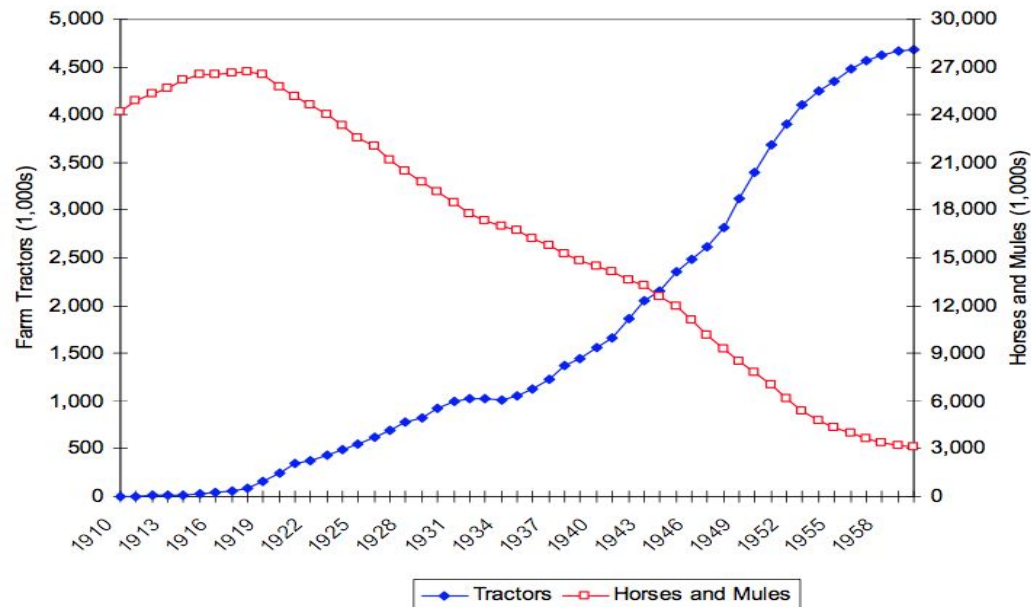


- Acting
 - Human acting (limbs...walking, holding, etc)
 - Machine acting (cars, planes, ships, unmanned systems, robots, acting in cyberspace, **machine acting at a distance?**)

Summary- New Realms are DISRUPTIVE

A Macro-Revolution compels the emergence of a new Realm of intelligent activity... it happened most recently with the Industrial Revolution (the integration of human operator with machine technologies)... this emergence was **RADICALLY DISRUPTIVE**.

Replacement of Horses by Tractors on U.S. Farms—1910 to 1960



Summary: Life will Consist of Four total Realms... each will need to be nurtured...

- ❑ the Realms are additive
- ❑ ...the ancient Social-Human (1) and the centuries old
- ❑ ...Integrated Realms (2) of human and machine continue to exist...
- ❑ We now face the simultaneous emergence of two new Realms:
- ❑ Third Realm: Machine Realm (3) of Robots/A.I. (intersecting/overlapping Realms 1 and 2)
- ❑ Fourth Realm (4) of Cyberspace/AI.... (overlapping and intersecting with the physical world (Realms 1, 2, 3) in uncontrolled ways; evidence of future chaos emerging)

Can the Social-Human Realm Best Flourish Apart or Integrated with Cyberspace...Anomie question...

- ❑ The most advanced information infrastructure in history... but does it convey truth to our youth?
- ❑ What happens to the young when their value frameworks are disrupted... “Anomie”...



Summary-Complexity of Four Realms and AI

The challenge of these generations now alive is hard to describe... we face not only the Dual-Emergence of new Realms, but we must also preserve and nurture the other, legacy realms (think of wave of human addiction, suicide in the Social-Human Realm; think of Boeing 737 Max and the dangers of over-automation on a manned piloted aircraft). But what will make this ever so challenging is that these machines will approximate THINKING.... what does that mean?

... a last thought...a caution....MIRI and their thought problem..... the ethics of super AI

Summary-the Civilizing Imperative

... a last thought: Law/Policy/Ethics/Norms must demarcate the Realms; technical limits no longer hold back negative change. The challenge is to ensure we improve the human condition in the face of dual Machine and Cyberspace Realms....

and in answer to the question:

Can Humans Flourish....

it depends on US.

The Challenge of these Generations

- Those of us alive today have challenges: C³R
 - Create the Technology, a competitive race (e.g., robots, code, businesses, services)
 - Control the Technology for safety, security.
 - Civilize the Technology (eg., law, policy, ethics, norms, art, history....)
 - Regenerate the learning mechanisms and educate the next generations to meet the continuing challenges of creation, control, and civilizing...

Higher Education ... Transformative Role

- ❑ But there is a problem:
 - Imbalance of investment versus the Coasts...
 - Poaching of Midwest/Mountain region campuses

The Decline of the Midwest's Public Universities Threatens to Wreck Its Most Vibrant Economies

And there could be far-reaching consequences for the national economy too.

John Marcus
The Atlantic
October 2017



Higher Education ... Transformative Role

- ❑ Solution 1: More H.E. support... ASAP
 - Working this now... Legacy Fund Study
 - Greater philanthropic and business support.
 - Economies of Scale: a ND Digital Academy made up of all eleven campuses to offer needed educ/training

- ❑ Solution 2: Complementary system to the Land Grant University system... a new national act, the “Digital-Cyber Land Grant Act”

Questions/Discussion

Back Up Slides

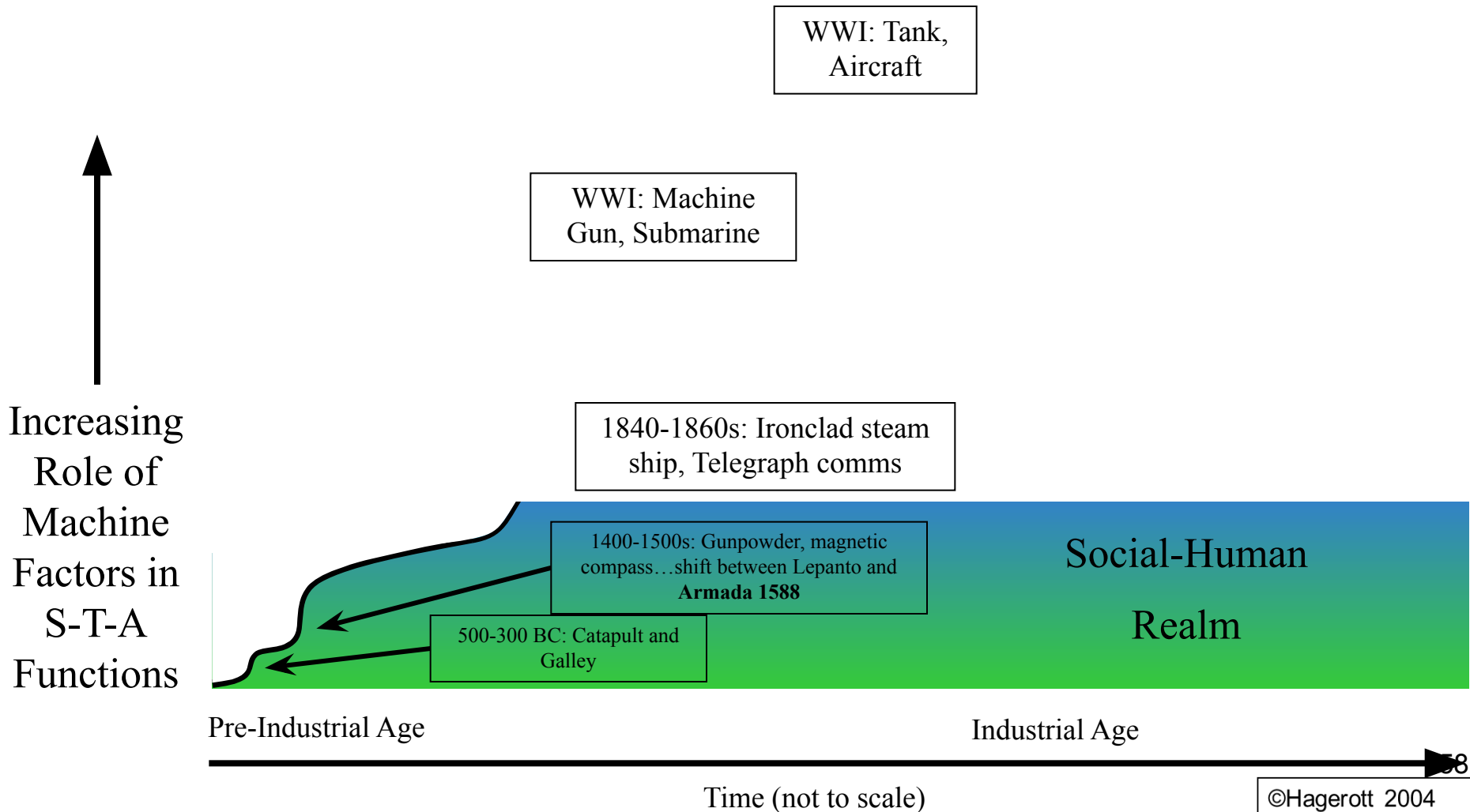
Some References

- ❑ Mazarr, “Un-Modern Men in the Modern World”
- ❑ Kelly, “What Technology Wants”
- ❑ McAfee/Brynjolfsson, “Race Against the Machine”
- ❑ Beniger, “The Control Revolution”

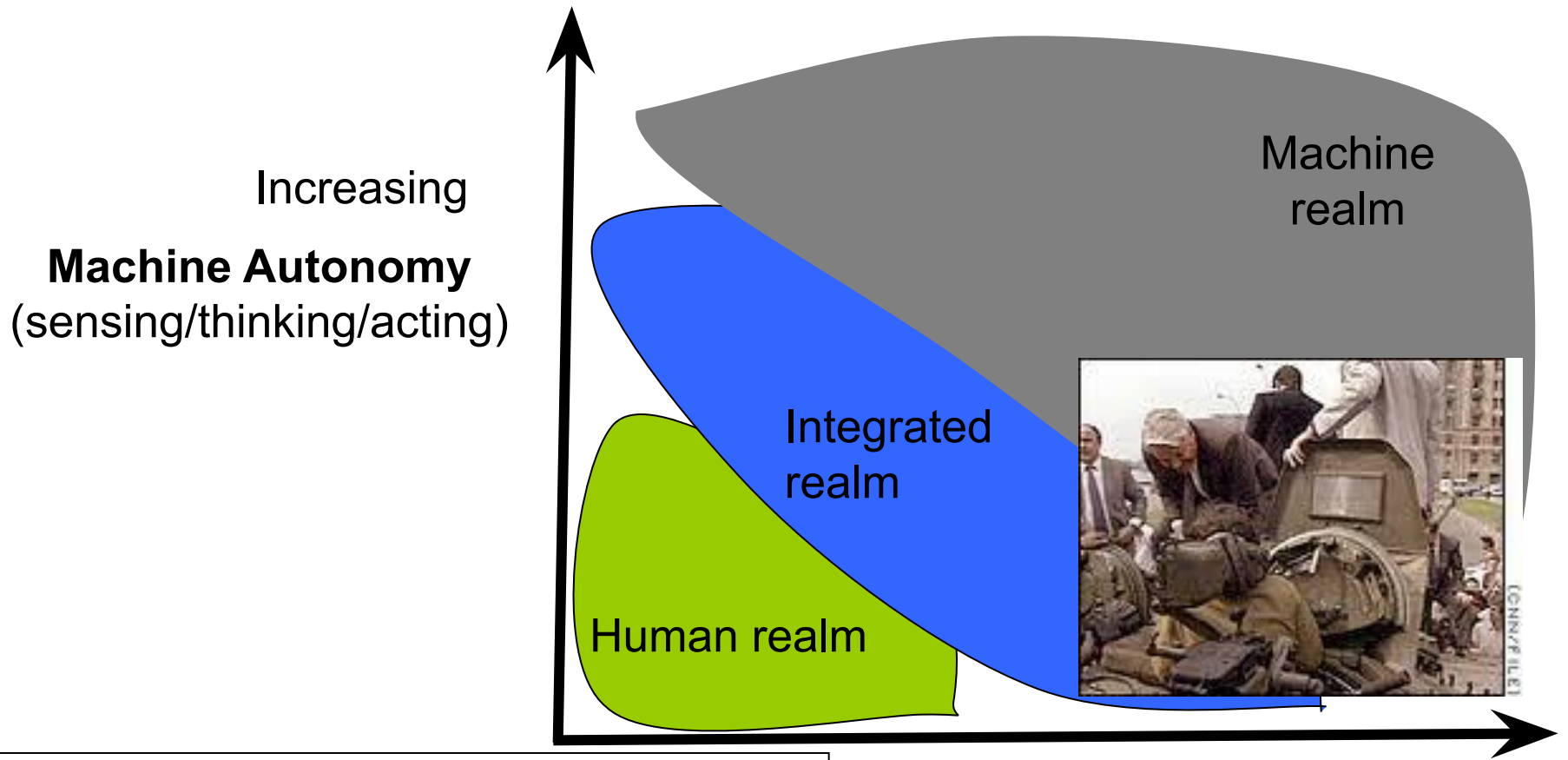
- ❑ *Significance of Robotics, Information, and Cyber?*
- ❑ Singer, “Wired for War”, “Cyber Security and Cyberwar”

- ❑ If you have time... Olson, “We are Anonymous” (for the human factor); Gleick, “The Information”
- ❑ And... Kasson, “Civilizing the Machine” (to inspire the lawyers/humanists/religious leaders in the group)

Waves of Innovation... Machines Assume Increasing Share of the Sense-Think-Act Function



A Tool to Locate Innovation in the Machine Realm... where there are machine advantages and speed... perhaps cost... then expect increasing autonomy...



Ethics, Law, Policy, Empathy, not technical barriers, will determine the living/dying space for human and machine

Increasing
Speed of Process
(sensing/thinking/acting)