



Engineering in the Era of Convergence

The 4th Industrial Revolution:

Convergence

*of physical, chemical, biological, behavioral
and social phenomena*



TECHNOLOGY: EXPLOITING A *PHENOMENON** FOR *USEFUL* PURPOSES

- **PHYSICAL** (e.g. Photoelectric Effect)
- ◉ **CHEMICAL** (e.g. Catalysis)
- ◎ ***GEOLOGICAL*** (e.g. *petroleum*)
- ◉ **BIOLOGICAL** (e.g. Brain Imaging)
- ◉ ***SOCIAL-BEHAVIORAL***



Increasing complexity

* *And combinations of phenomena or technologies*

** *Including the discovering of new phenomena*



TECHNOLOGY: EXPLOITING A PHENOMENON FOR *USEFUL PURPOSES**

- ETHICAL-MORAL
- UNINTENDED CONSEQUENCES
- COMPLEXITY
- POLICY



ENGINEERING + X

Where X is anything!

E.g. Media, Medicine, Entertainment, Biology, Education,...

Three pathways: E2X, X2E, EUX

E2X (Engineering Empowers X)

X2E (X empowers Engineering)

EUX (Engineering and X comingle)

Note: E and X can be vectors (multidisciplinarity)



What if X is human or society-centric?

E2X: more “efficient”; better communication; e.g.
social media.

X2E: Ethical decision making by autonomous
systems- drones, driverless cars; e.g.
AI for Social Good.

EUX: HMI (human-machine interaction)
HBI (human-building interaction),
any business and organization



IMSC-
Communication
Informatics

USC Annenberg

School for Communication
and Journalism

DECIDE
USC Price
Sol Price School of Public Policy
CREATE
*Quantum
Communications*

USC Dornsife

Dana and David Dornsife
College of Letters, Arts and Sciences

**USC Michelson
Center for
Convergent
Bioscience**

**Protein
Engineering**

**CHARIOT
Personalized
Learning**

USC Rossier

School of Education

Discovery
Informatics

**Keck School of
Medicine of USC**

**Iovine
Center**

USC Roski

School of Art and Design

USC Viterbi

School of Engineering

**Center for Body
Computing**

HTE@USC

**USC School
of Cinematic Arts**

USC Games

**USC School
of Architecture**

USC Marshall

School of Business

**Min Family Engineering
Social Entrepreneurship
Challenge**

USC Suzanne Dworak-Peck

School of Social Work

**Maseeh
Entrepreneurship Prize
Competition**

**AI for Social
Good**

New Faculty Orientation

August 16, 2017



Make Solar Energy Economical
Provide Energy from Fusion
Develop Carbon Sequestration Methods
Manage the Nitrogen Cycle
Provide Access to Clean Water

sustainability

Engineer Better Medicines
Advance Health Informatics
Reverse Engineer the Brain

health

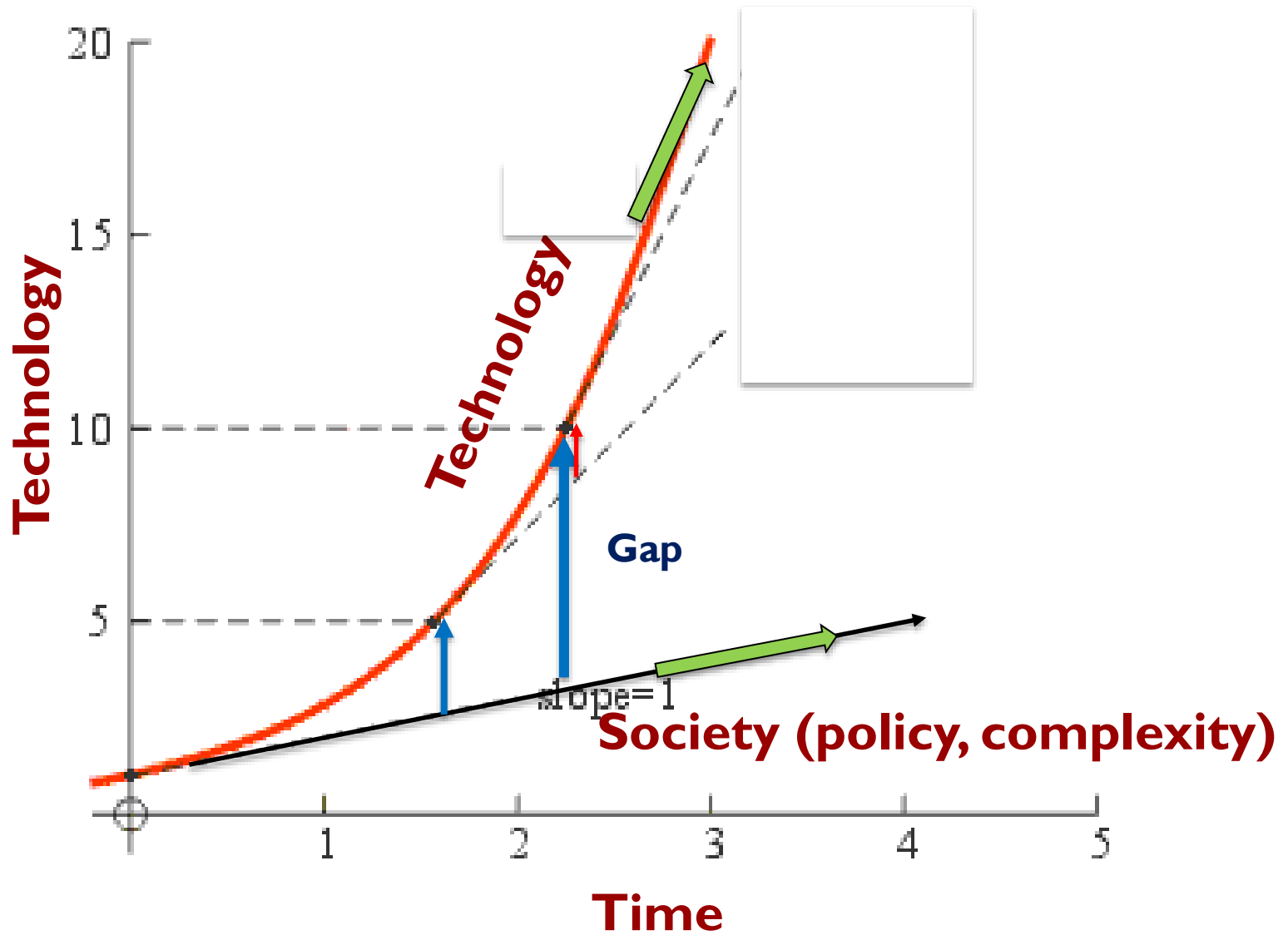
Secure Cyberspace
Prevent Nuclear Terror
Restore and Improve Urban Infrastructure

security

Enhance Virtual Reality
Advance Personalized Learning
Engineer the Tools of Scientific Discovery

enriching life







1. BIOSCIENCES

2. QUANTUM COMPUTING AND COMMUNICATIONS

3. IOT

4. CHARIOT

5. MACHINE LEARNING

6. AI FOR SOCIAL GOOD

7. DECIDE

8. ADVANCED MANUFACTURING

Viewed as VC investment- expected to result in large grants, gifts and sustainable growth



1. Talent

students, faculty, staff- and provide environment to flourish.

PEOPLE

2. Value

Continuously adding value to curriculum, programs, infrastructure.

PROGRAMS

3. Thought Leadership- Solving World Challenges

Grand Challenges: energy and sustainability, security and infrastructure, health and medicine, and scientific and technological discovery.

PAPERS

4. Impact: Technology Innovation and Entrepreneurship SCilicon Beach, Southern California, the United States, and the World.

PATENTS



Conceived in 2009 (USC, Duke, Olin):

Adopted by >40 schools nationwide: Supported by the NAE

1. Research/creativity

- › Mentored research or project experience related to a Grand Challenge:
TECHNICAL COMPETENCE

2. Multidisciplinary

- › Understanding gained through multidisciplinary
SOFT SKILLS AND COMMUNICATIONS

GROWTH MINDSET

3. Entrepreneurship

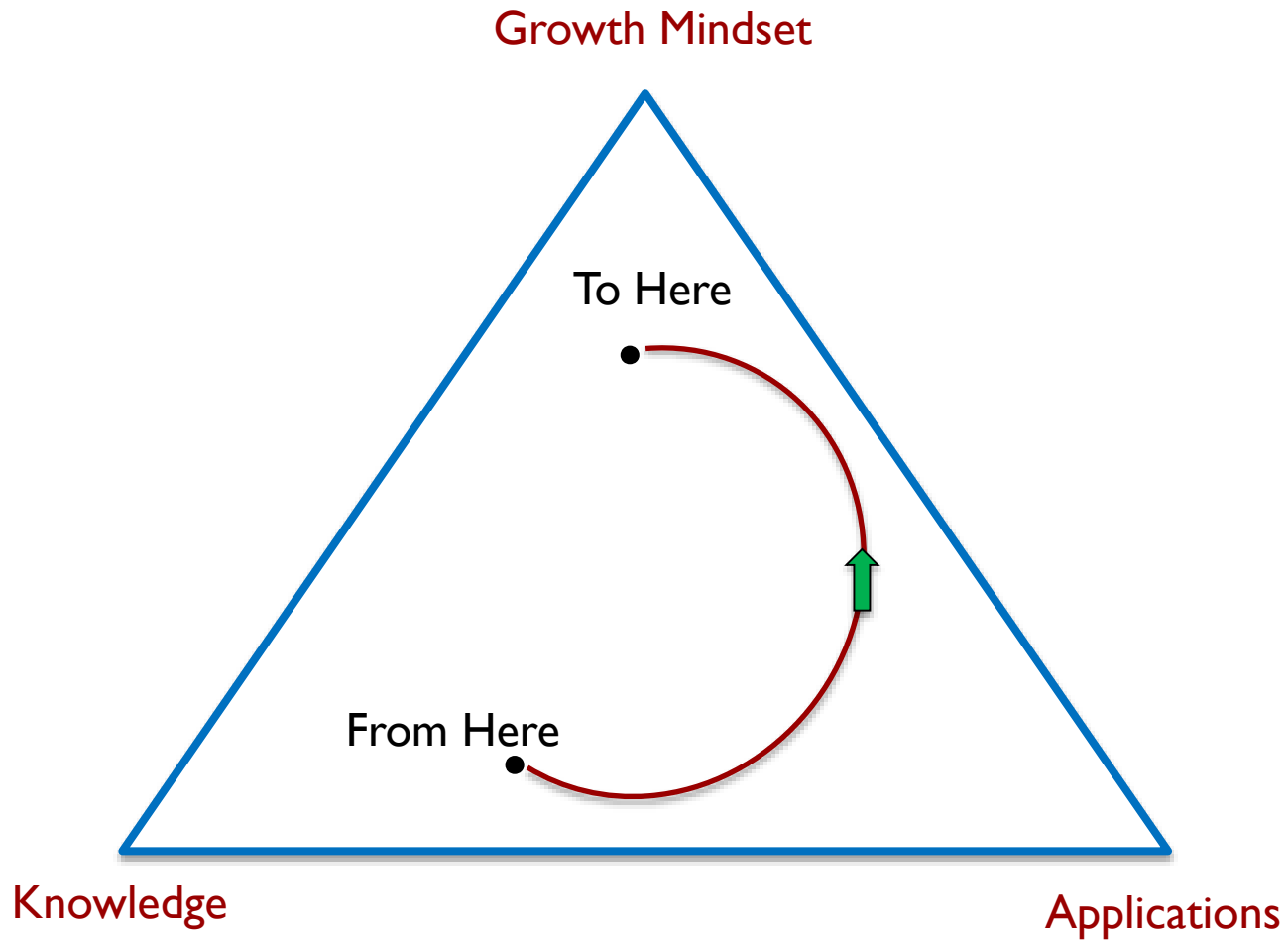
- › Understanding gained through experience that viable business models are necessary
- › **INNOVATION AND ENTREPRENEURSHIP**

4. Cultural Competence

- › Understanding gained through global or different cultural experience
GLOBAL and LOCAL

5. Social consciousness

- › Addressing societal problems, through service learning, K-12, social entrepreneurship
- › **SERVICE LEARNING; OUTREACH**



From Ortiz et al.



GCSP

Likely to be *the* engineering curriculum of the future

Consistent with WEF report on added skills for the 21st century:

Creativity, Leadership, Perseverance

Consistent with the *Engineer of 2020*

