



Automation and Artificial Intelligence Control Systems

- Trends of Engineering System Evolution Outlook

AKA - THE MACHINES ARE TAKING OVER THE WORLD!!!

WELL, NOT REALLY. OR RATHER NOT YET.

OK, MAYBE THEY ARE!!

4/25/17

David W. Conley



What is Artificial Intelligence (AI)?

- Definition – AI (noun) The theory and development of computer systems able to perform tasks that normally require human intelligence, such as visual perception, speech recognition, decision-making, and translation between languages.
- Once a particular AI application is in use, many in the field consider it as standard computing practice rather than AI.
- AI is part of the natural progression of computer controlled systems.



What is Artificial Intelligence (AI)?

- AI is not some new “intelligent” method of computing. Rather, it is simply advanced usage of sensing, decision making, and control systems that artificially mimic human activities.
- As with all computing systems since their original development, computational systems only understand 0s and 1s. It is the exponential increase in computers’ ability to handle large numbers of 0/1 computations that allows seemingly human like decision making by way of complex coding.
- AI is not leading to the development of sentient machines. However, machine learning focuses on the development of computer programs that can change themselves when exposed to new data. This can result in unexpected system responses.





Artificial Intelligence has been around for some time

- Programmable thermostat



- Cameras with “auto” features



- Accounting and tax prep software



- Traffic sensing traffic signals



- Auto pilot systems

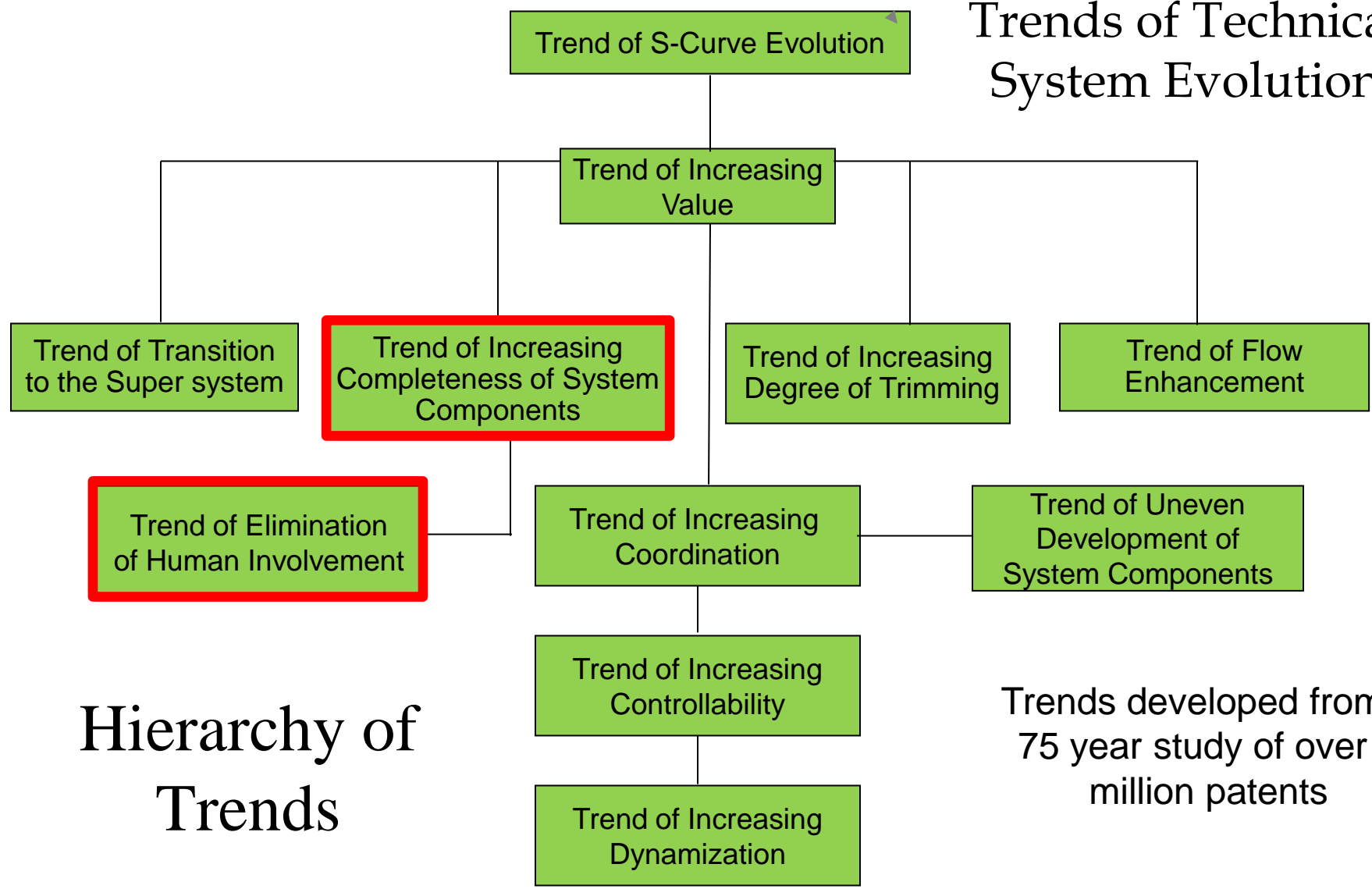


- Self-driving cars





Trends of Technical System Evolution



Hierarchy of Trends

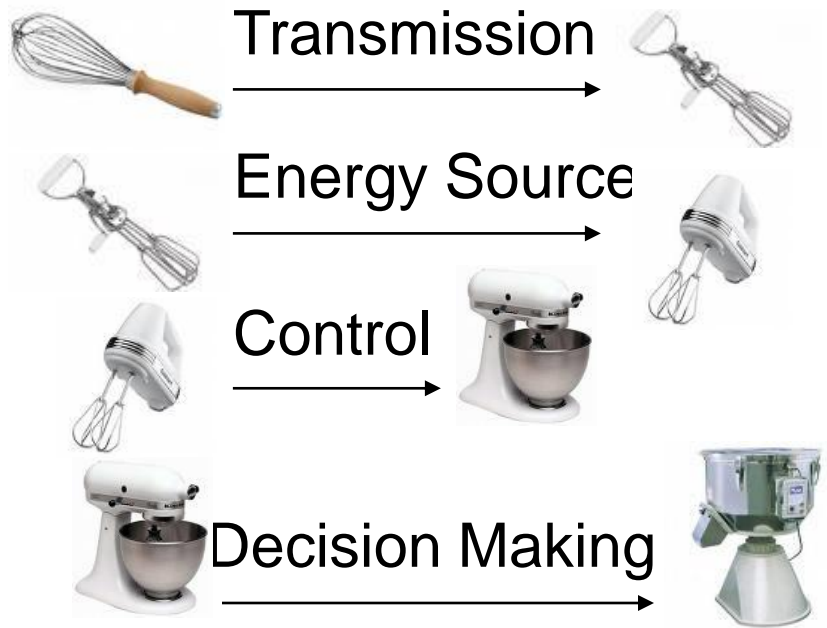
Trends developed from a 75 year study of over 4 million patents



- As an eng. sys. evolves the number of system functions performed by the system increases.
- A decrease in human involvement leads to an increase in system completeness.

Trend of Decreasing Human Involvement
Humans Stop Performing:

Trend of Increasing System Completeness
System Starts Performing:

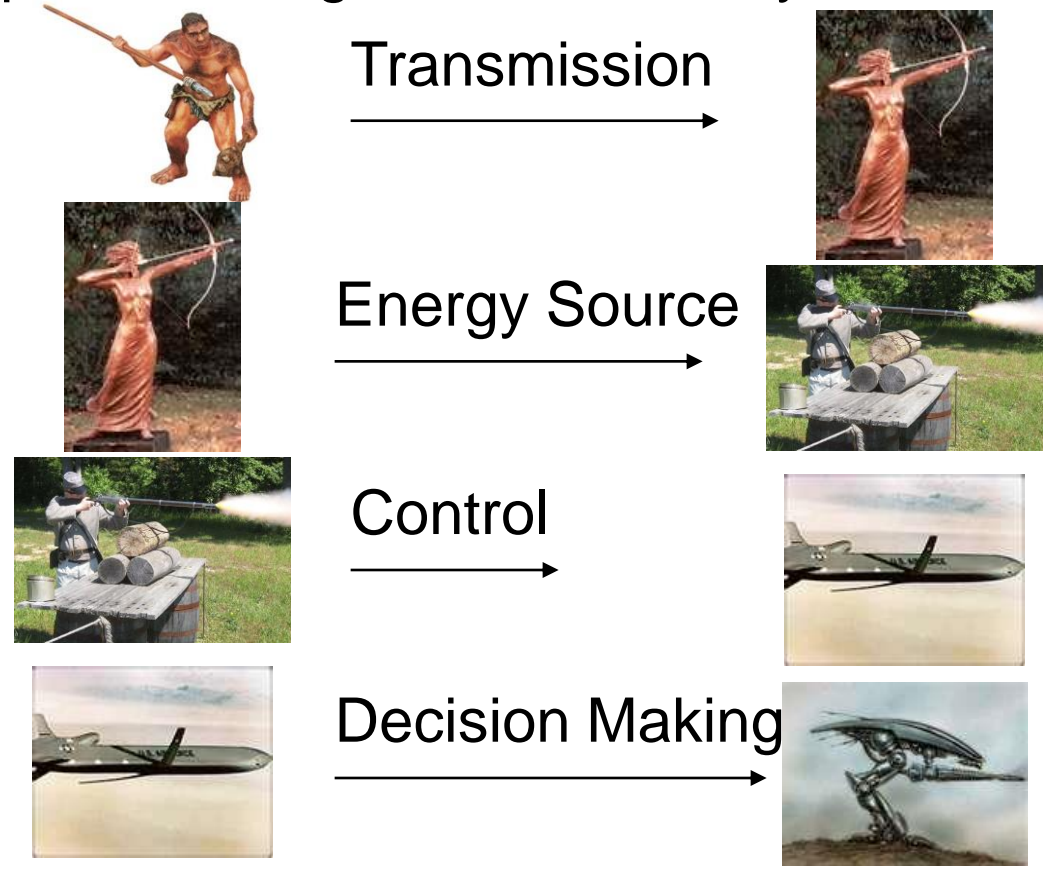




Another example.

Humans Stop Performing:

System Starts Performing:

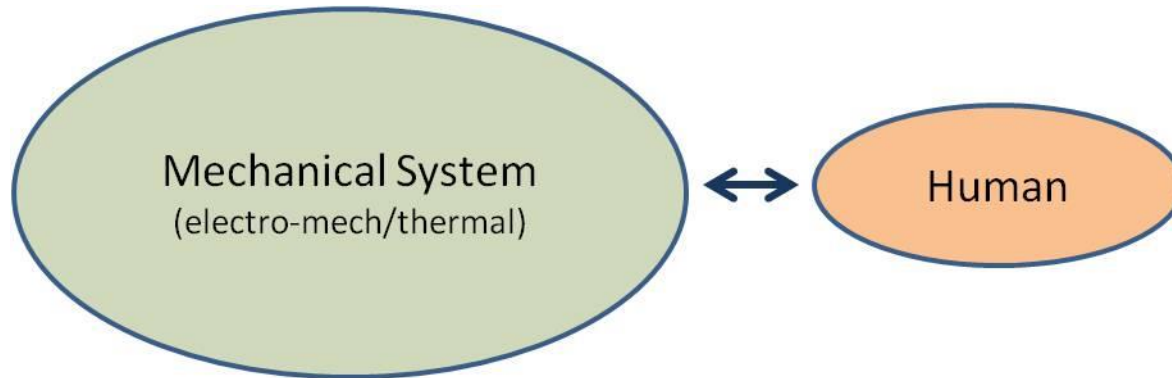




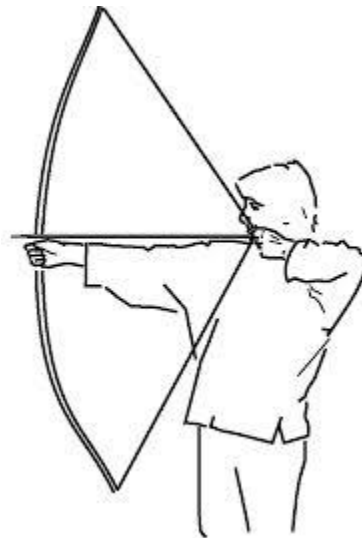
How did we get to where we are?

- Evolution of Human/Mechanical/Computational Systems

Stage 1



Mechanical systems developed to aid human efforts

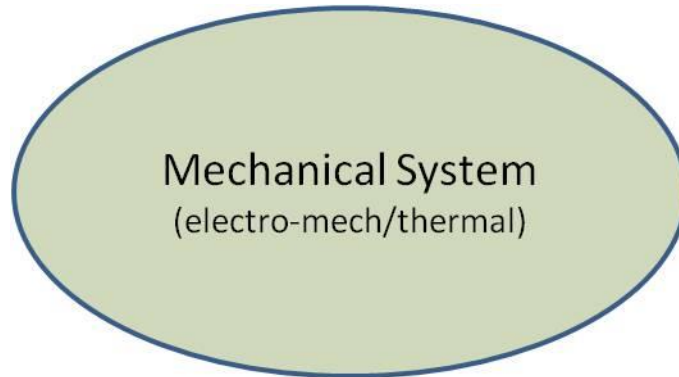




How did we get to where we are?

- Evolution of Human/Mechanical/Computational Systems

Stage 2



Mechanical systems developed to replace human efforts

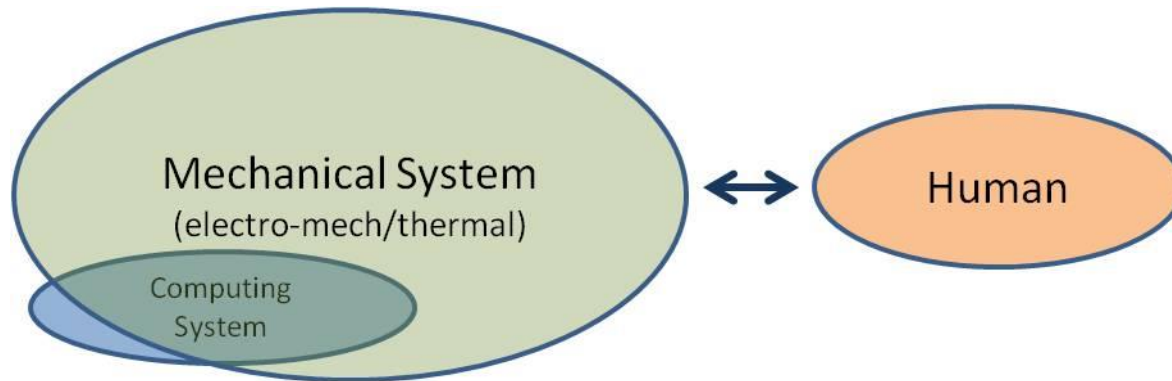




How did we get to where we are?

- Evolution of Human/Mechanical/Computational Systems

Stage 3



Mechanical/Computational systems developed to aid human efforts

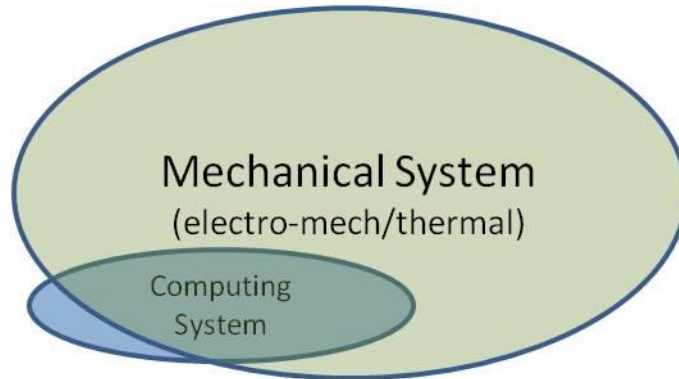




How did we get to where we are?

- Evolution of Human/Mechanical/Computational Systems

Stage 4



Mechanical/Computational systems developed to replace human efforts

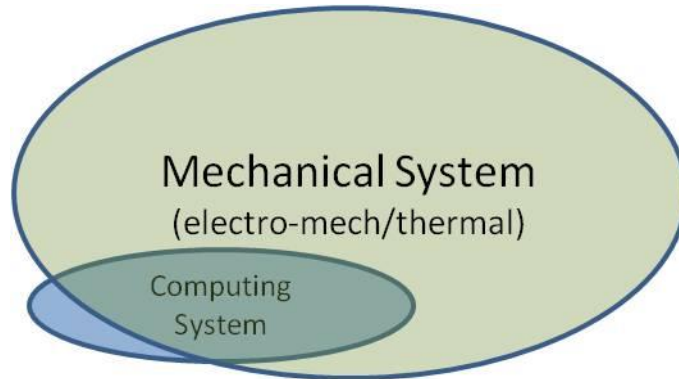




How did we get to where we are?

- Evolution of Human/Mechanical/Computational Systems

Stage 5



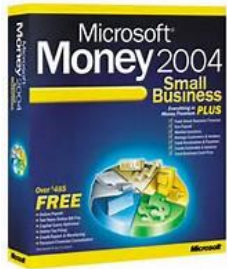
Mechanical/Computational systems becomes highly/completely integrated

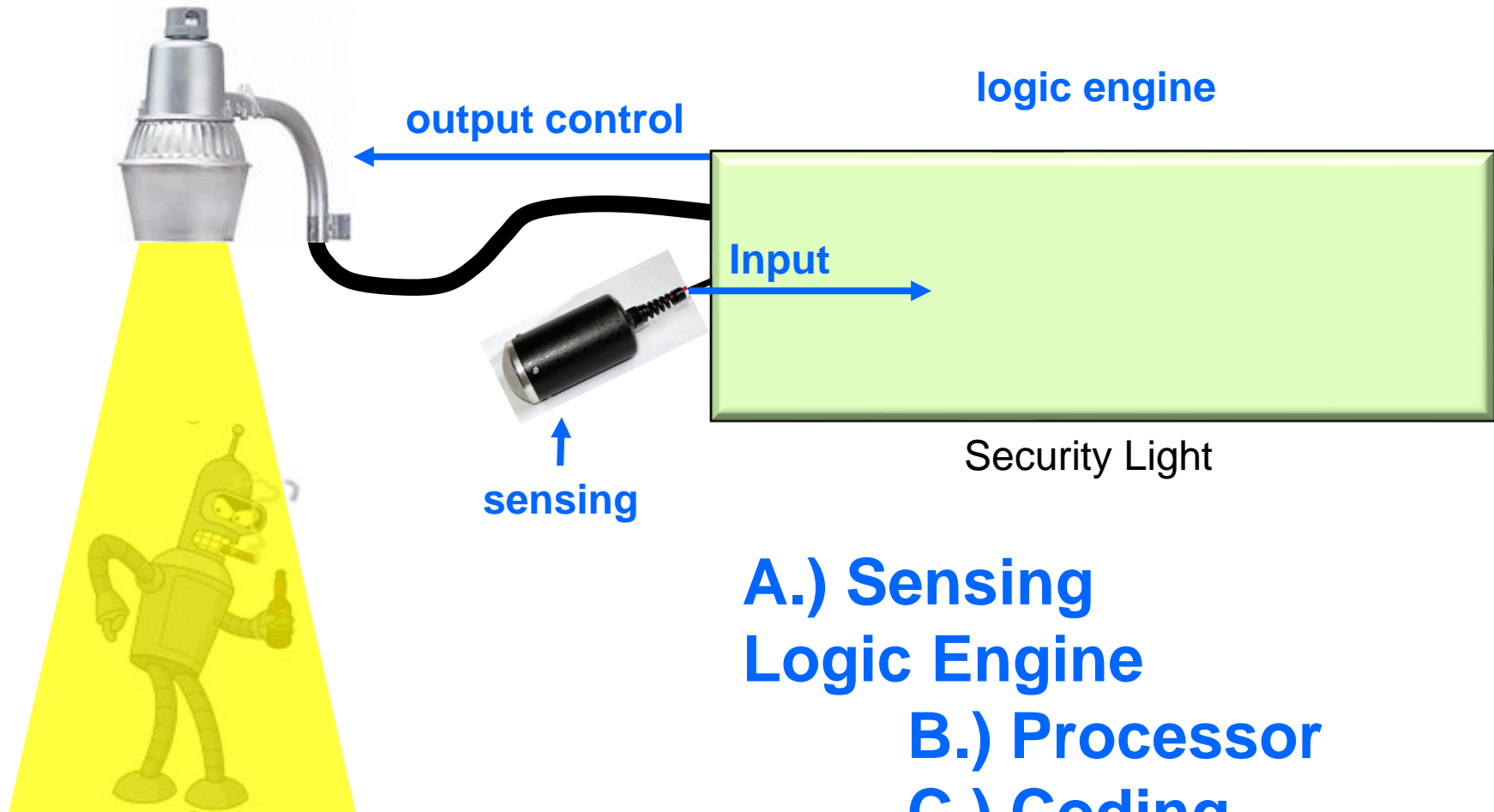




What do all these systems have in common?

- 1.) sensing
- 2.) logic engine (computer)
- 3.) output control





- A.) Sensing
- Logic Engine
- B.) Processor
- C.) Coding
- D.) Output Control

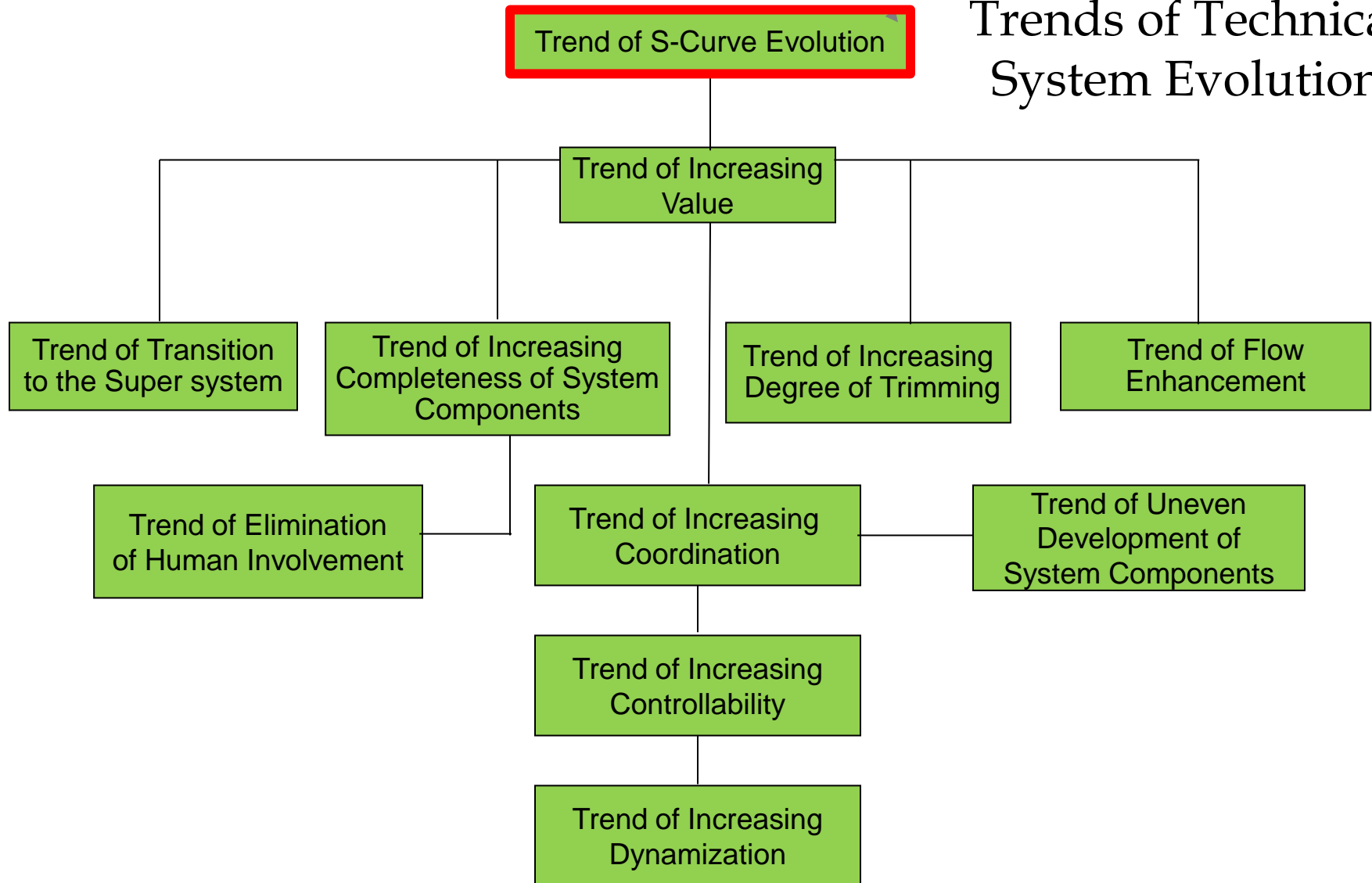


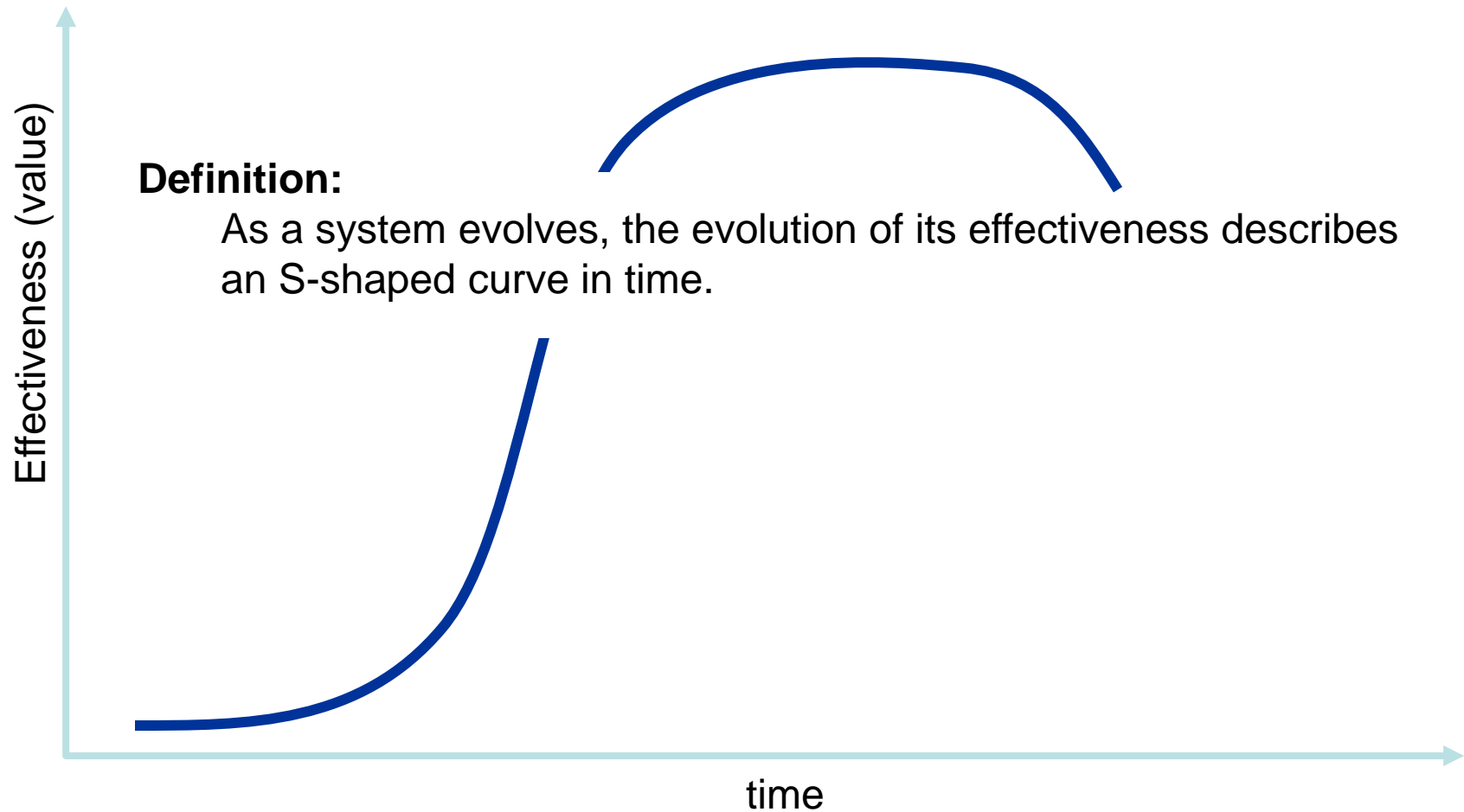
Where do these items lie on their respective trend of system evolution curves and where can we expect them to go?

- A.) Sensing
Logic Engine**
- B.) Processor**
- C.) Coding**
- D.) Output Control**



Trends of Technical System Evolution



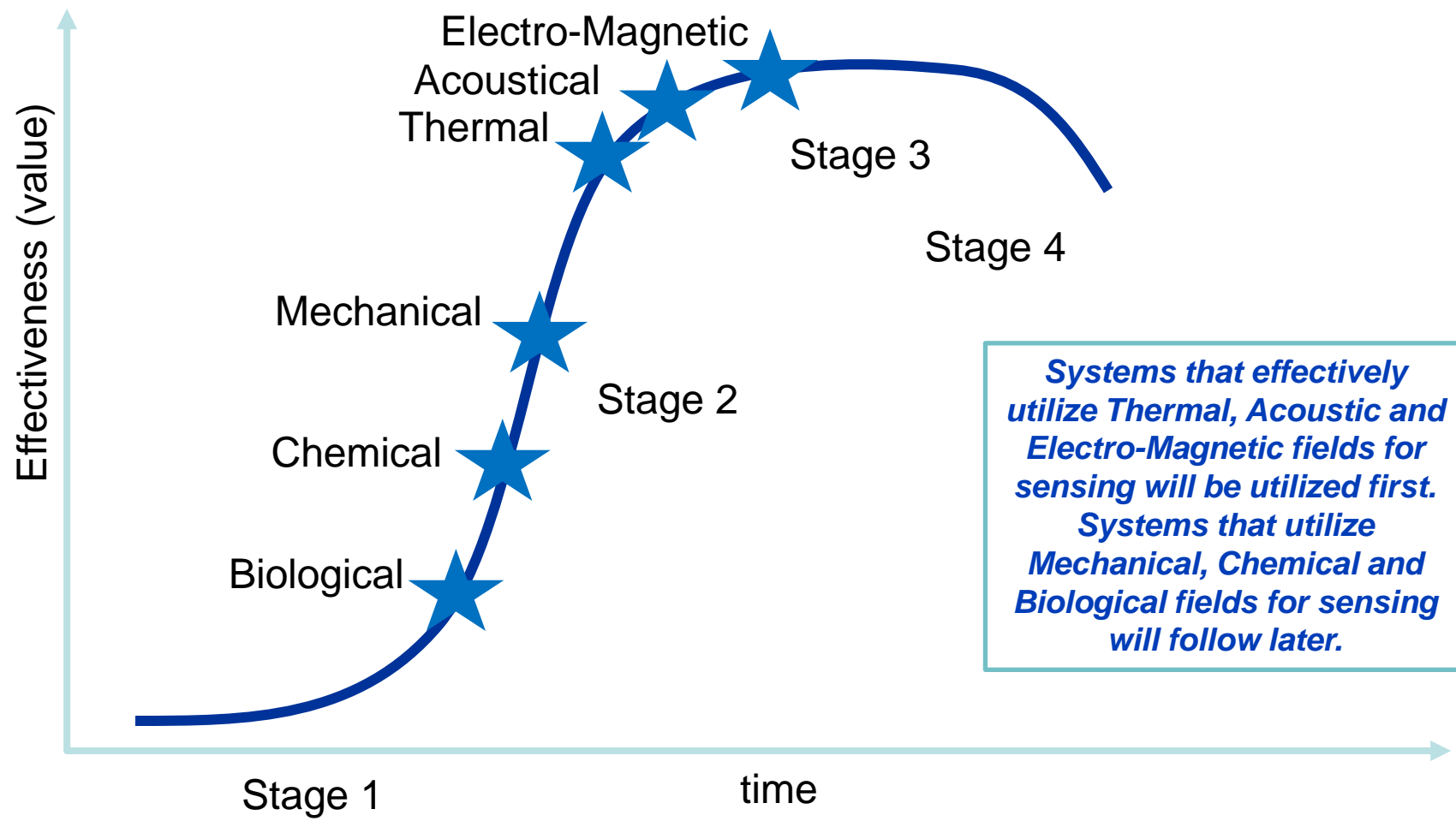




Trend of S-Curve Evolution

★ Fields by which sensing tools operate

Example: Sensing tools

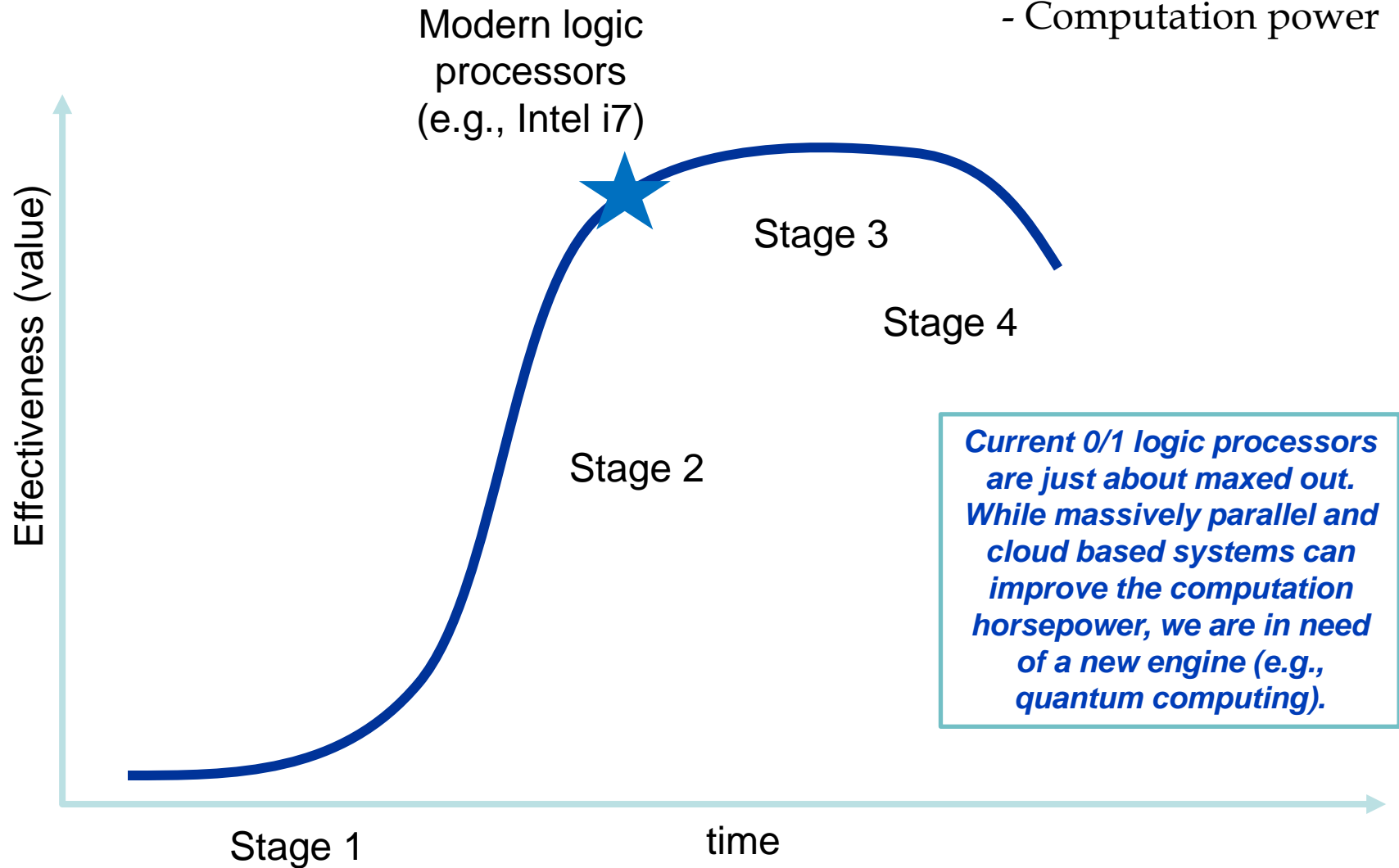


Systems that effectively utilize Thermal, Acoustic and Electro-Magnetic fields for sensing will be utilized first. Systems that utilize Mechanical, Chemical and Biological fields for sensing will follow later.



Trend of S-Curve Evolution

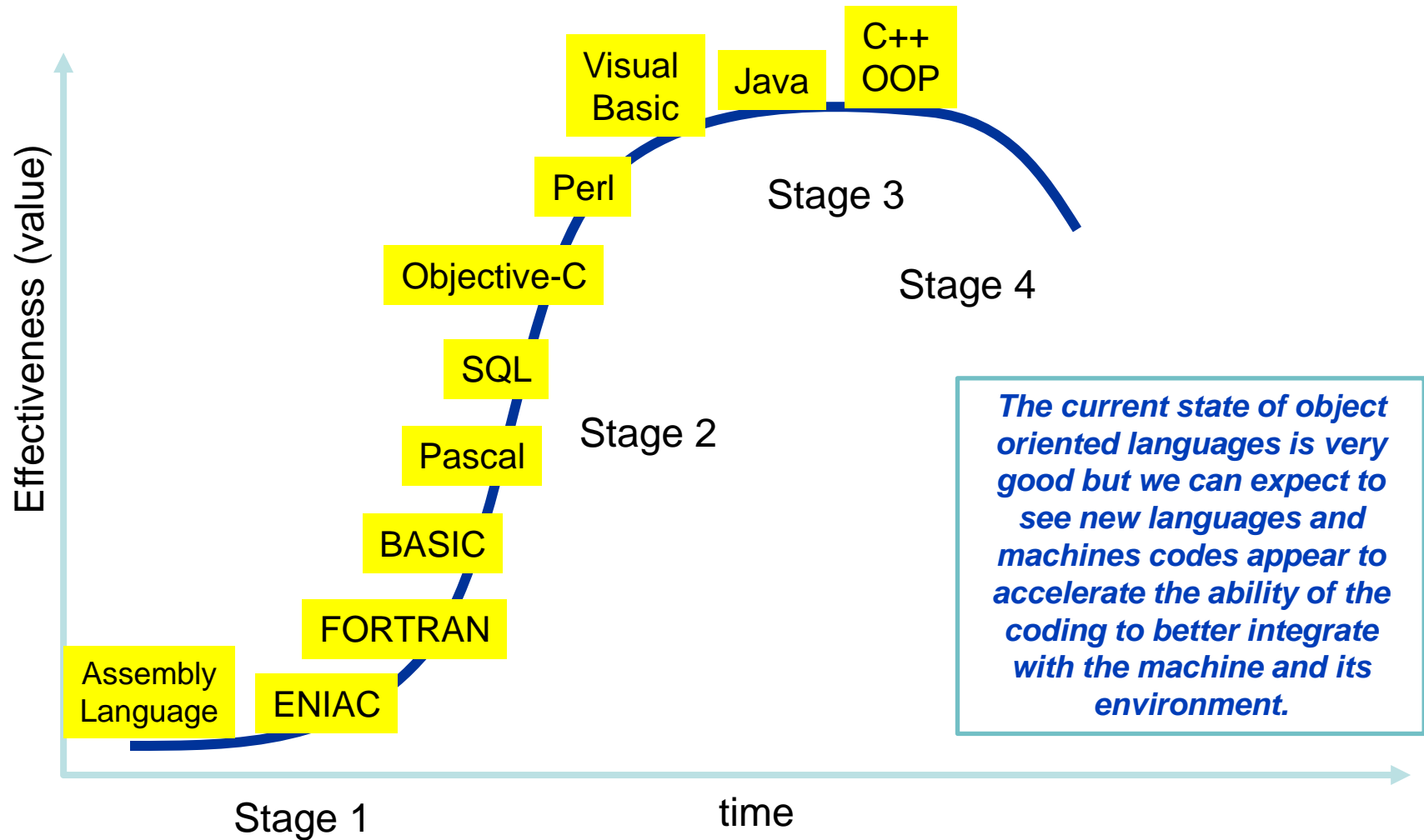
Example: Logic engines
- Computation power





Trend of S-Curve Evolution

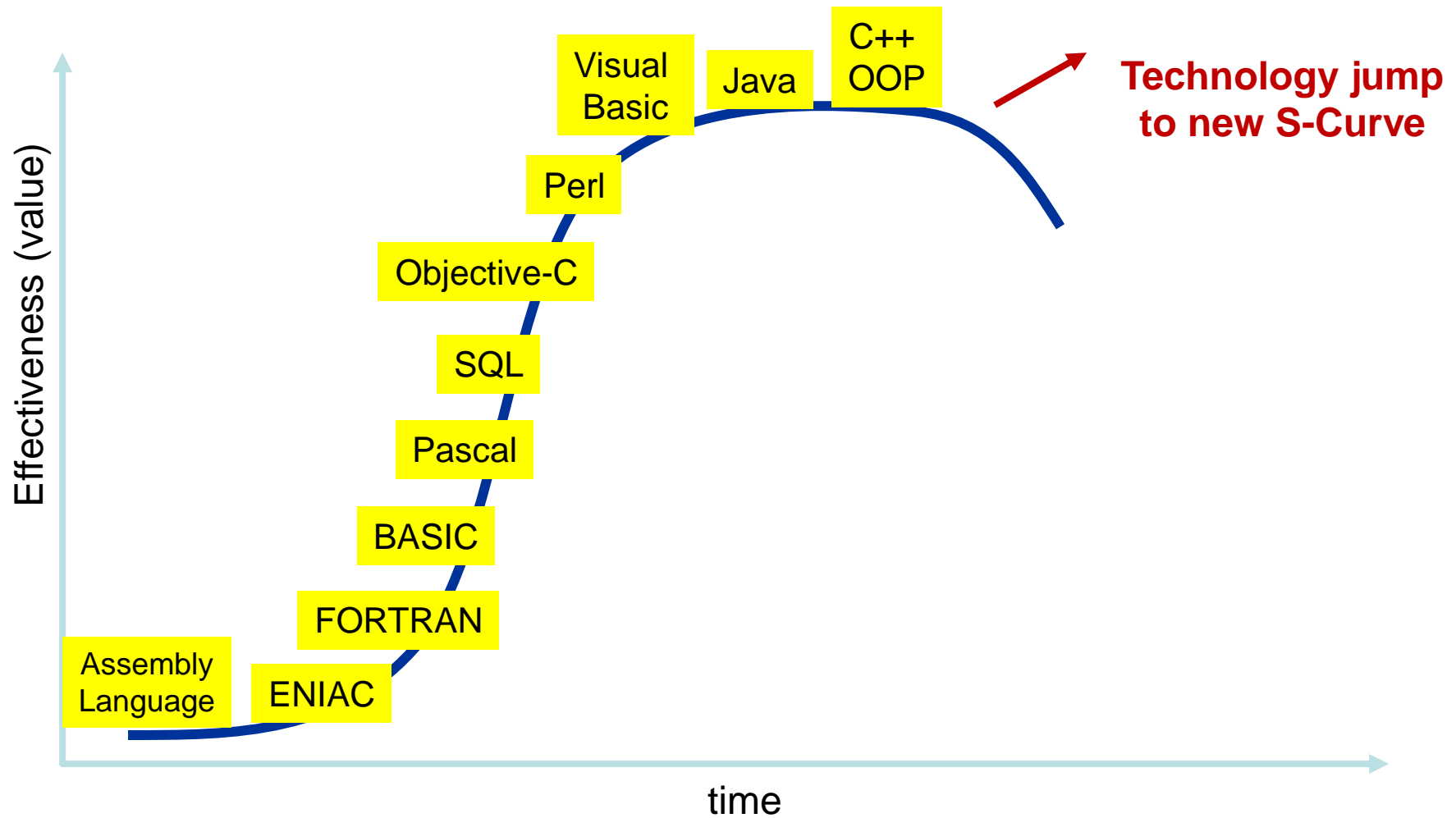
Example: Logic engines
- Coding languages





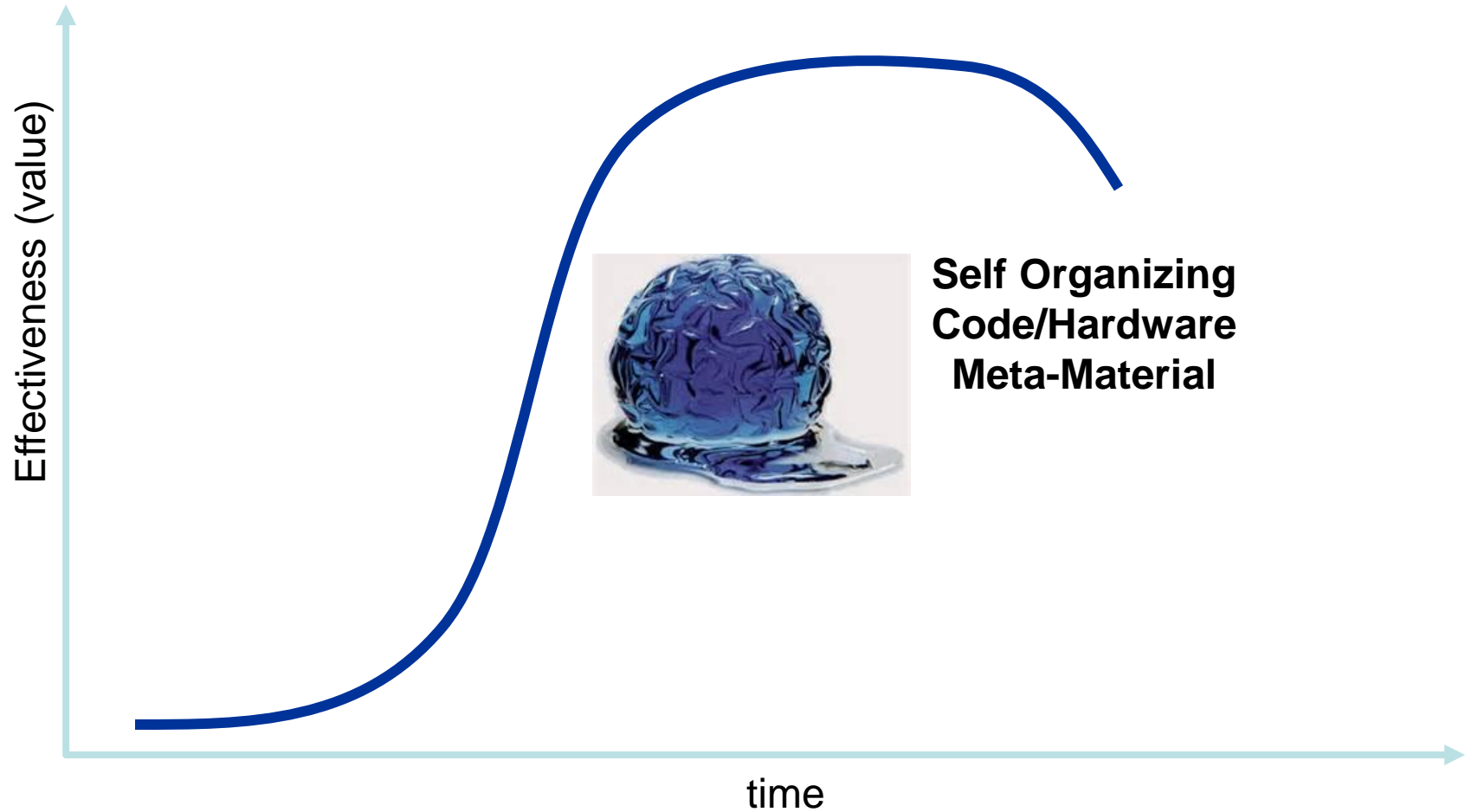
Trend of S-Curve Evolution

Example: Logic engines
- Coding languages





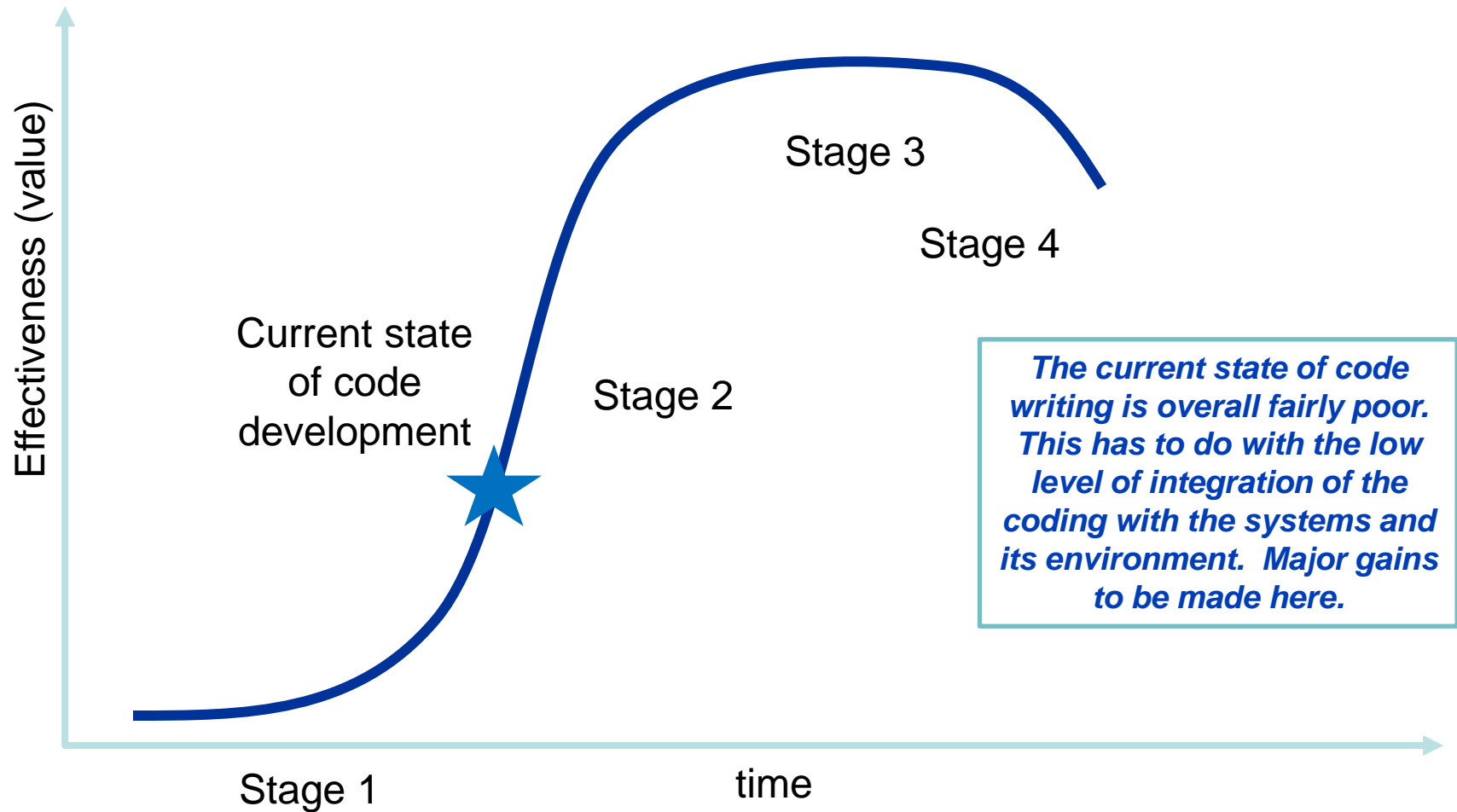
Example: Logic engines
- Coding languages





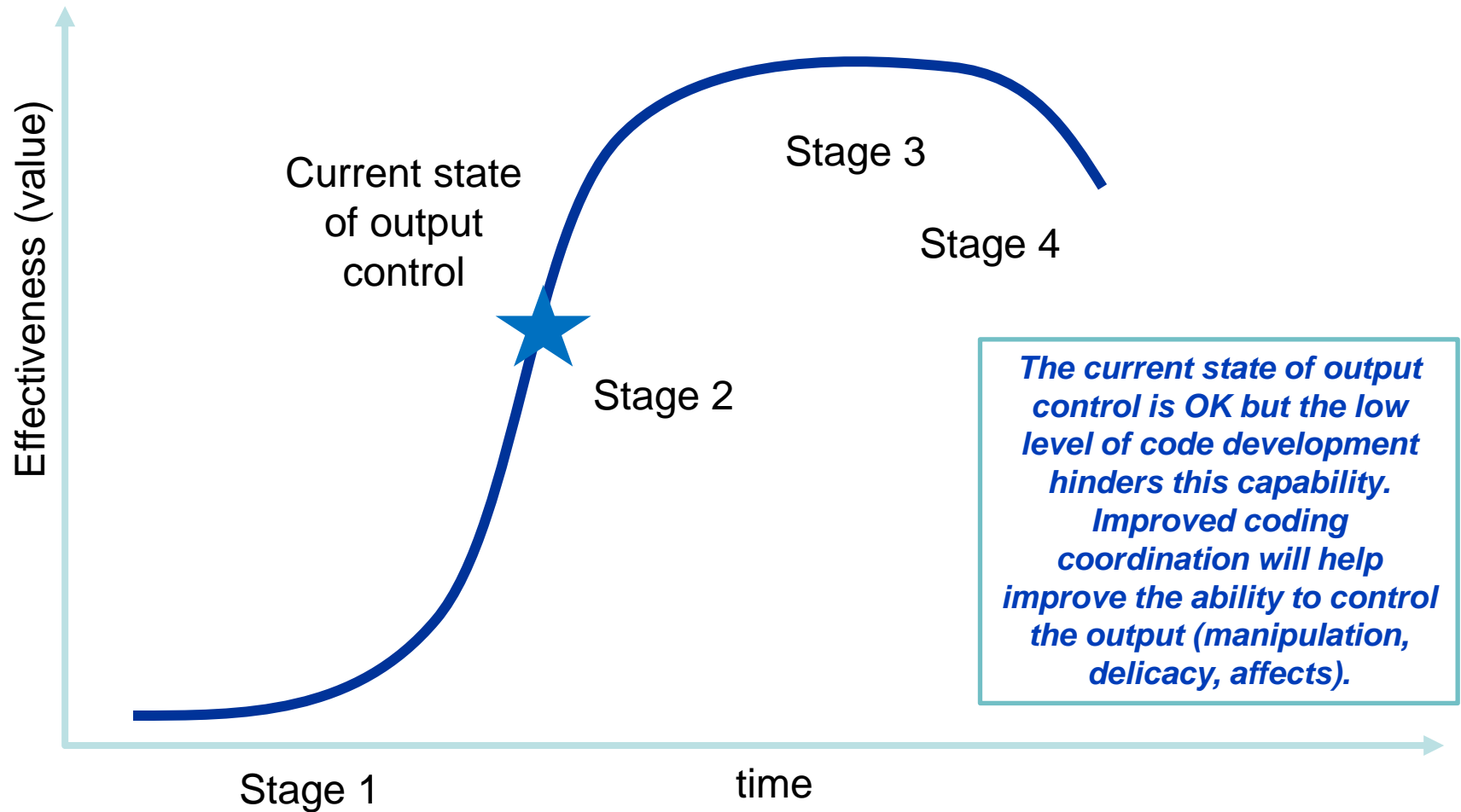
Trend of S-Curve Evolution

Example: Logic engines
- Coding integration





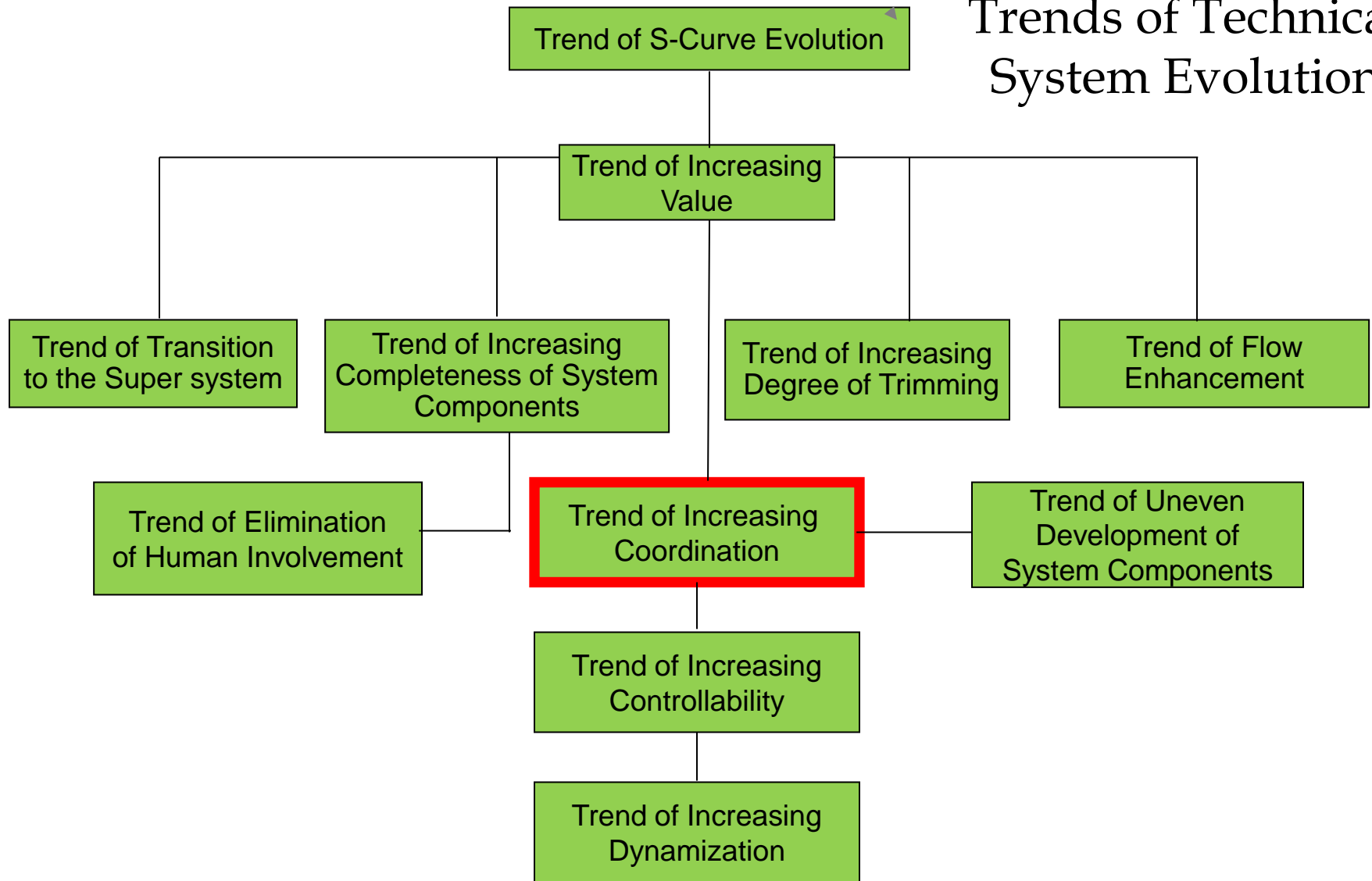
Example: Output control





What are Trends of System Evolution?

Trends of Technical System Evolution





Trend of Inc. Coordination – Coord. Of Action

As eng. systems evolve they become more coordinated with themselves and the environment.

Example: Sensing tools

Sampling



0D (point) action

Contour mapping



1D (line) action

Area mapping



2D (surface) action

3D mapping



3D (volume) action

0D-1D-2D-3D

time

Increasing Coordination



Trend of Inc. Coordination – Coord. Of Action

As eng. systems evolve they become more coordinated with themselves and the environment.

Example: Logic engine

Stand alone PC



0D (point) action

Computer controlled door lock



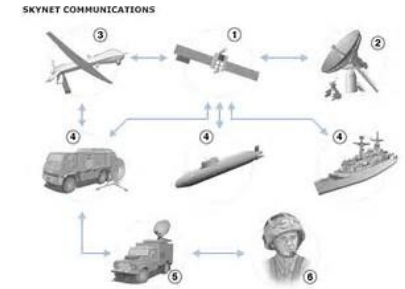
1D (line) action

Computer controlled security system



2D (surface) action

Global command and control



3D (volume) action

0D-1D-2D-3D

time

Increasing Coordination

Trend of Inc. Coordination – Coord. Of Action



As eng. systems evolve they become more coordinated with themselves and the environment.

Example: Output control

Drilling



0D (point) action

Linear cutting



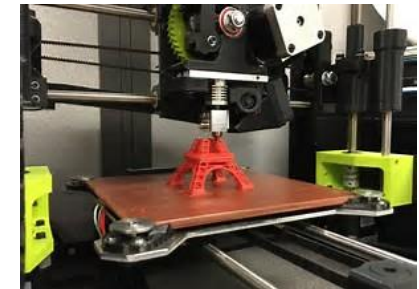
1D (line) action

2D cutting



2D (surface) action

3D shaping



3D (volume) action

0D-1D-2D-3D

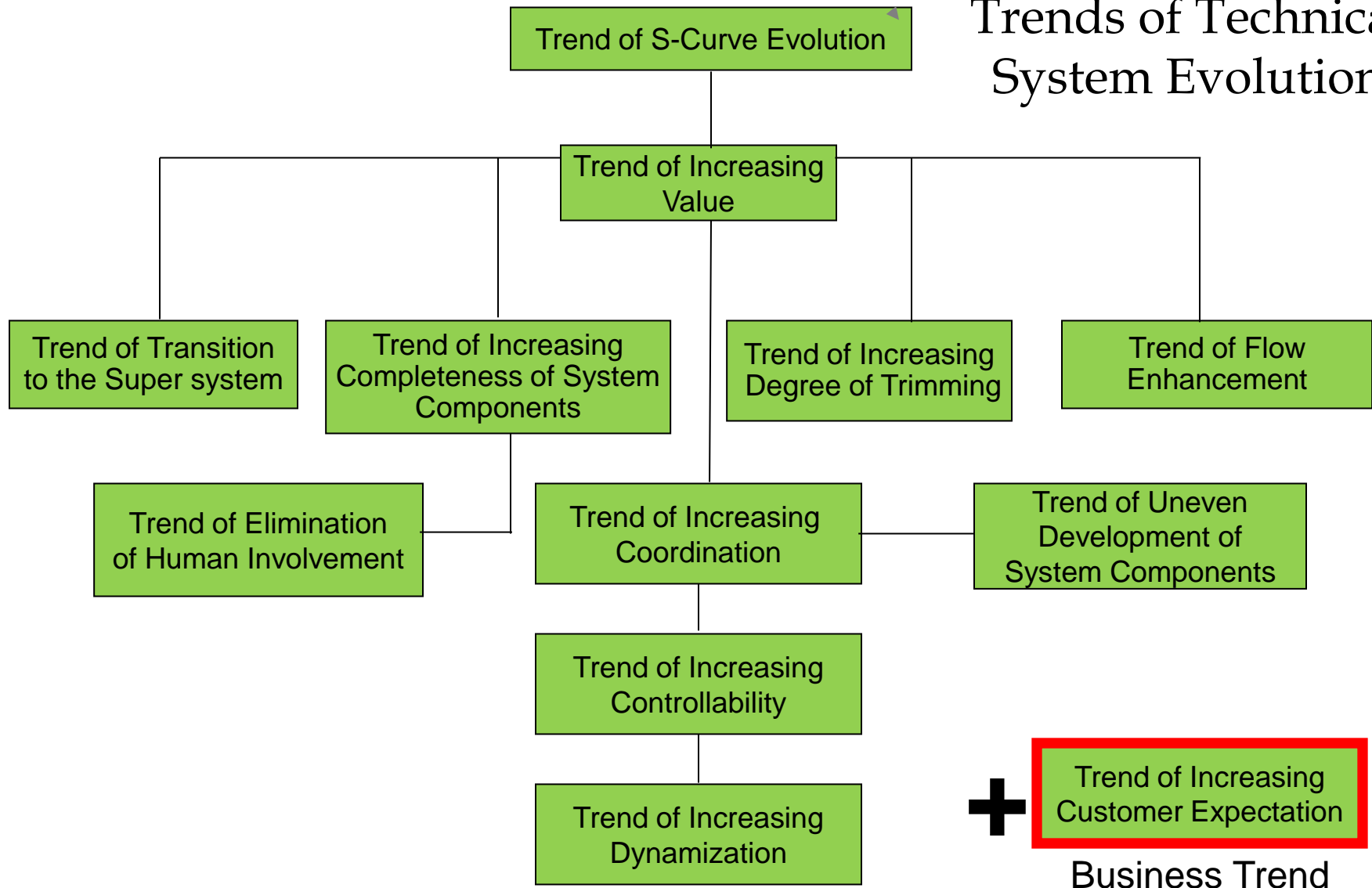
time

Increasing Coordination



What are Trends of System Evolution?

Trends of Technical System Evolution





Trend of Increasing Customer Expectations

As a business evolves its customer's expectations increase.

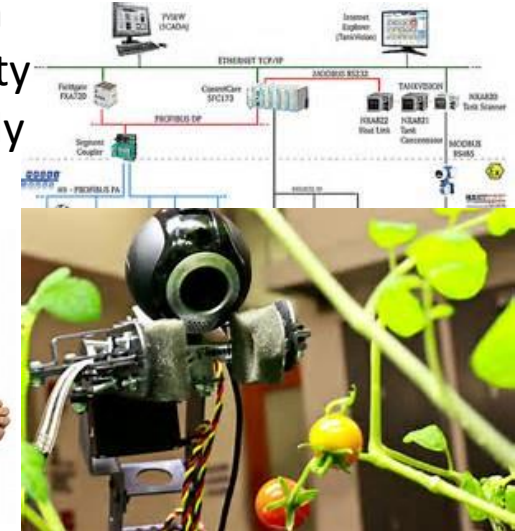
Customized services based on user preference

parts

machine

customer support, directory assistance, etc.

Treated with respect, dignity and in a timely manner



commodity

product

customer service

customer experience

service transformation (ST)

time Increasing Customer Expectations



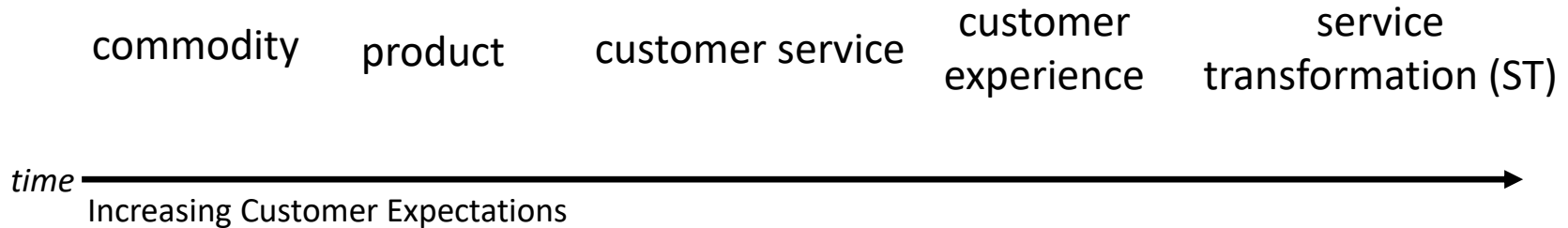
Trend of Increasing Customer Expectations

As a business evolves its customer's expectations increase.

Sensing – systems that can best sense customer's specific requirements will appear first (electro-magnetic, acoustic, thermal) – 0, 1, 2 D will show up first followed by 3D

Logic engine – computing power and code complexity (less demanding applications will appear first)

Output control – Systems that can interact with the customer through a 0, 1 and 2 D interface will show up first followed by 3 D





Job/Career Automation Forecasting

As the sensing, logic and output capabilities increase more and more automation will be deployed. Less “skilled” systems followed by more “skilled.” Less “judgement” followed by more “judgment.” note – the more valuable a market is for each automation target the earlier its development will be funded (e.g., self driving vehicles)

Forecast of order of jobs to be automated (some have already begun to appear) – not necessarily in this exact order:

Simple tax prep.
Freight handling
Fast food service
Janitorial service
Security (preventive)
Ground transportation
Mail delivery
Furniture making
Mining
Accounting
Loan processing
Photographer (journalism)
Masonry
Interior designer
House/Building painting

Waiter
Drafting (non-design)
Full-service teller
Pilot
Mechanic
Tax prep. (CPA)
Architecture – steel building
Equipment maintenance
Primary medical care
Dental – preventive
Athletic trainer
Pharmacist
Surgeon – general
Professor (lecturing)
Security (responsive)

Safe for now:
Acting
Advertising\Architecture (creative)
Artist (creative)
Computer sciences
Engineering
Journalism (investigative)
Legal (lawyers and judges)
Music producer
Musician (writer)
Photographer (artistic)
Politics
Professor (interactive and planning)
Sciences (R&D)
Surgeon - ER
Veterinarian



Job/Career Automation Forecasting – April '18 update

The April '17 analysis (and presentation) below lead me to tell the audience at the time “insure that your children study and pursue creative fields of work such as engineering, sciences, the arts, journalism,…” (reflected in green box below)

During the April 6th 2018 interview with MSNBC, Tim Cook (Apple CEO) said – “we (humans) need to focus on creative ventures as machines will take over everything else.” This proclamation from an industry expert (and with the added benefit of an additional year of market visibility) further demonstrates that the Trends of Engineering System Evolution, in the right hands, accurately predicts the future of technology.

Simple tax prep.
Freight handling
Fast food service
Janitorial service
Security (preventive)
Ground transportation
Mail delivery
Furniture making
Mining
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Loan processing
Photographer (journalism)
Masonry
Interior designer
House/Building painting

Waiter
Drafting (non-design)
Full-service teller
Pilot
Mechanic
Tax prep. (CPA)
Architecture – steel building
Equipment maintenance
Primary medical care
Dental – preventive
Athletic trainer
Pharmacist
Surgeon – general
Professor (lecturing)
Security (responsive)

Safe for now:

Acting
Advertising\Architecture (creative)
Artist (creative)
Computer sciences
Engineering
Journalism (investigative)
Legal (lawyers and judges)
Music producer
Musician (writer)
Photographer (artistic)
Politics
Professor (interactive and planning)
Sciences (R&D)
Surgeon - ER
Veterinarian



- *Simplified TRIZ: New Problem Solving Applications for Technical and Business Professionals, 3rd Edition*

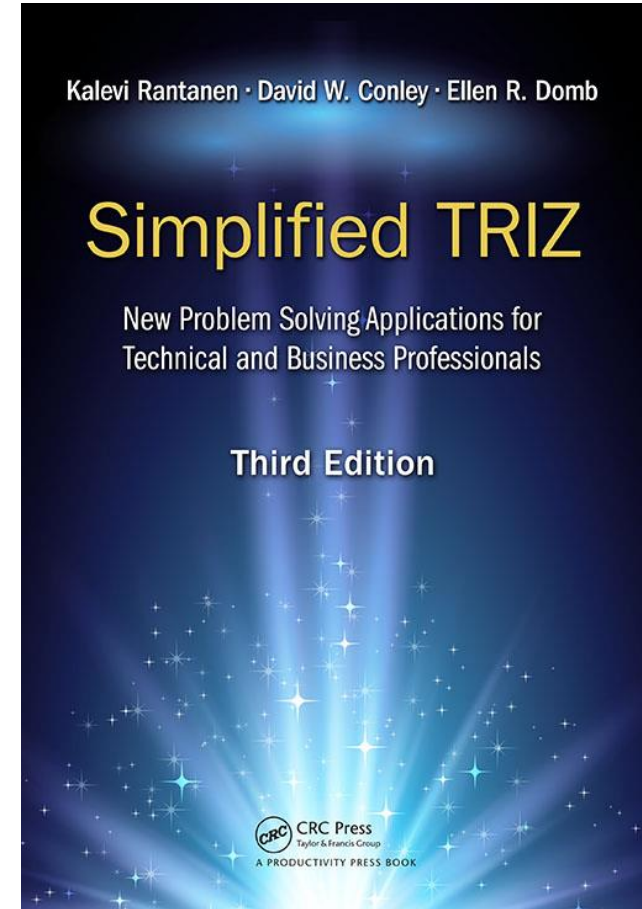


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David Conley
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David Conley is President of Innomation Corporation, which he founded after leaving his post leading systematic innovation initiatives for 7 of his 17 years at global semiconductor manufacturing leader, Intel.

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- **Education – Nuclear Engineering, Finance, TRIZ L4**

- **Work Experience**

- ▶ US Air Force Philips Lab – R&D Officer

- Plasma Physical

- Space Based Nuclear Propulsion



- ▶ Johnson and Johnson – Process Engineer



- ▶ Phillips – Facilities Engineer **PHILIPS**

- ▶ Lockwood Greene – Engineering Consulting



- ▶ Intel Corporation – Engineering, Automation, Manufacturing, Finance, Management, Innovation



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