Section 2

Technology and Progress

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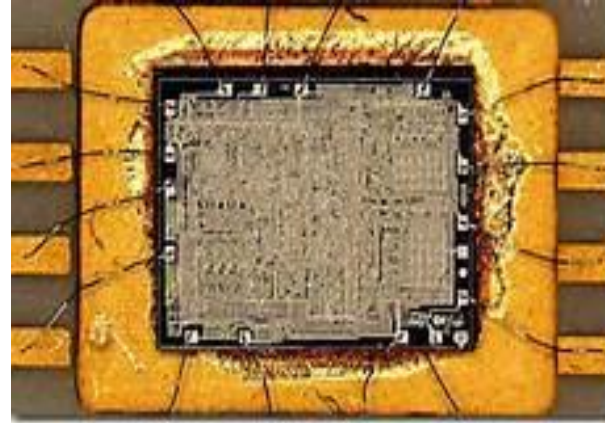
Technical Progress: Improvements in computing power

(1975) IBM5100 OS APL/BASIC

(1980) IBM 5120 OS APL/BASIC

(1982) Commodo-re 64 OS Rom BASIC

(1985) Atari Amiga 1000 OS Amiga DOS 1.0-1.34 "Workbench" GUI

(1989) Apple Macintosh Portable

(1991/1997) Apple release System 7 (MAC OS 7)

(1992) Microsoft release Windows 3.1

(1995) Microsoft release Windows 95 (introduce internet explorer)

(1999/2004) Apple release Power Mac G4

(2001/present) Apple release MAC OS X

(2009/present) Windows release Windows 7

(1977) Apple II OS Woz integer Basic in ROM

(1981) Apple III OS Apple SOS (Sophisticated OS)

(1983) Apple Lisa OS Apple Lisa GUI First time using GUI (Graphical User Interface)

(1991) Macintosh PowerBook OS Mac OS 7.01 – 7.6.1

(1993/2009) Microsoft release Windows NT

(2000) Microsoft release Windows 2000

(1986) IBM PC XT 286 OS PC-DOS v4

(1992) Amiga 4000 OS Amiga DOS 3.1

(1997) Apple release MAC OS 8

(2006/present) Apple release MacBook, MacBook Pro
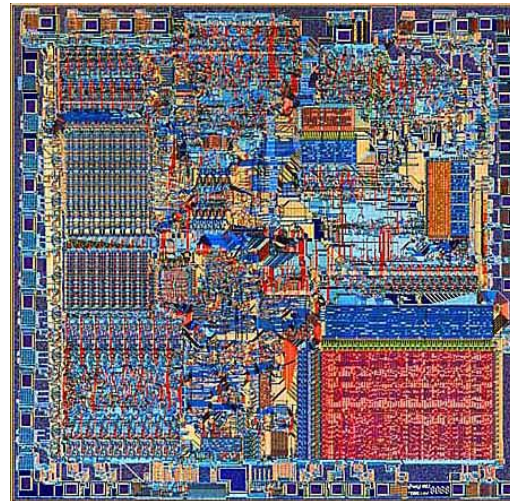
History of Computing

1971 Intel 4004

First fully integrated proper CPU, 4 bit processing,

Adding **TWO** 8 bit numbers took 1 milliseconds

2,300 transistors, smallest size 10μm

10μm is half the width of a blonde hair, the size of a red blood cell, width of a cotton fibre.
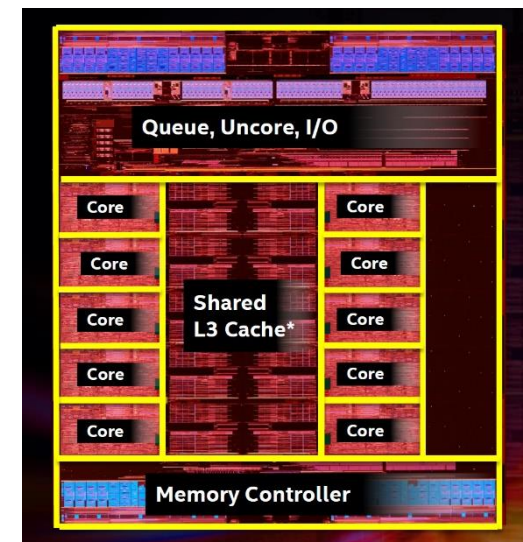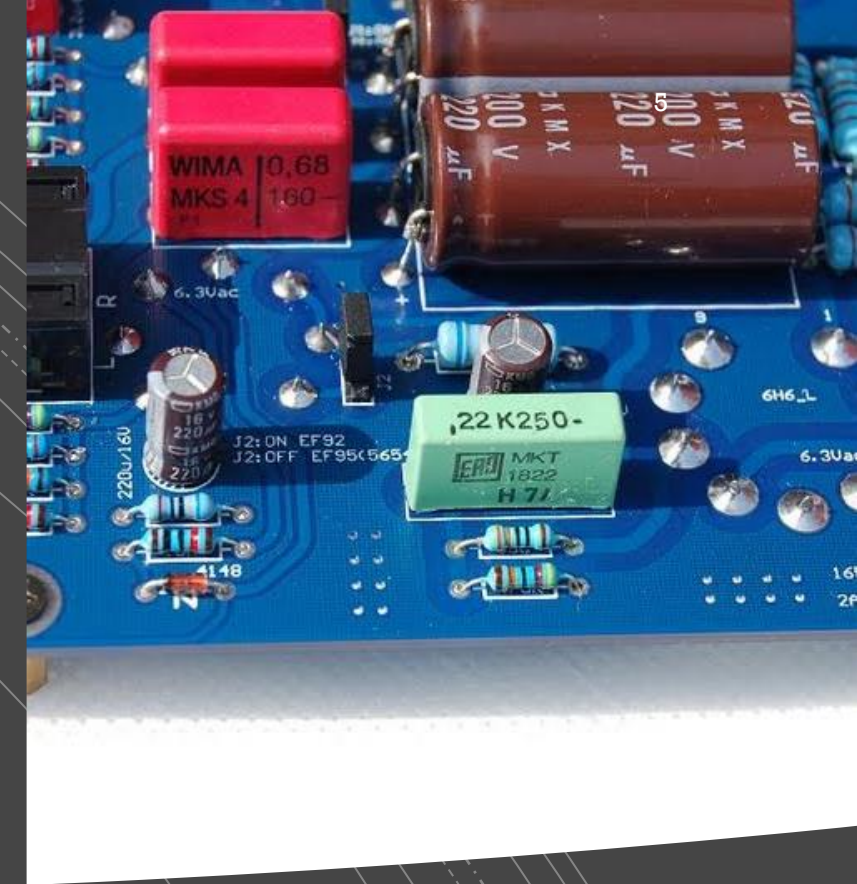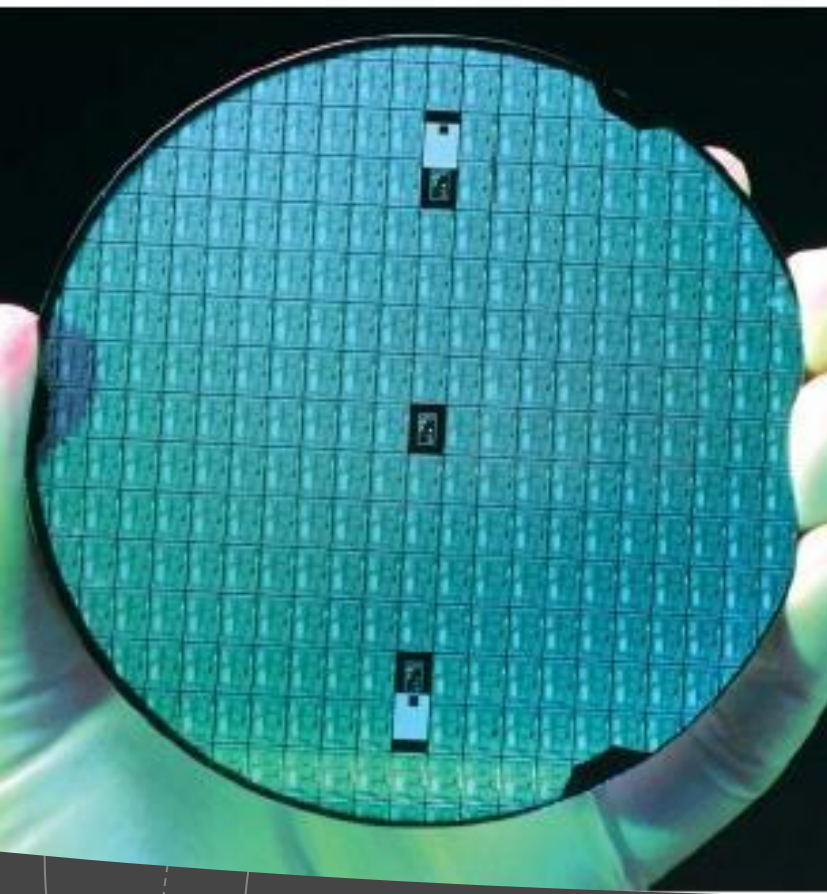
1979 Intel 8088

The chip that powered the first PC

29,000 transistors

2017 Intel i7 Haswell

Modern high end microprocessor

3,200,000 transistors

Each calculation takes 300 picoseconds

Or 3 trillion per second

...and they keep getting smaller

- Imagine building 100 million houses
- a city 100km wide (square)
- smallest bump in surface less than 2cm tall
- building and road widths precise to 5cm
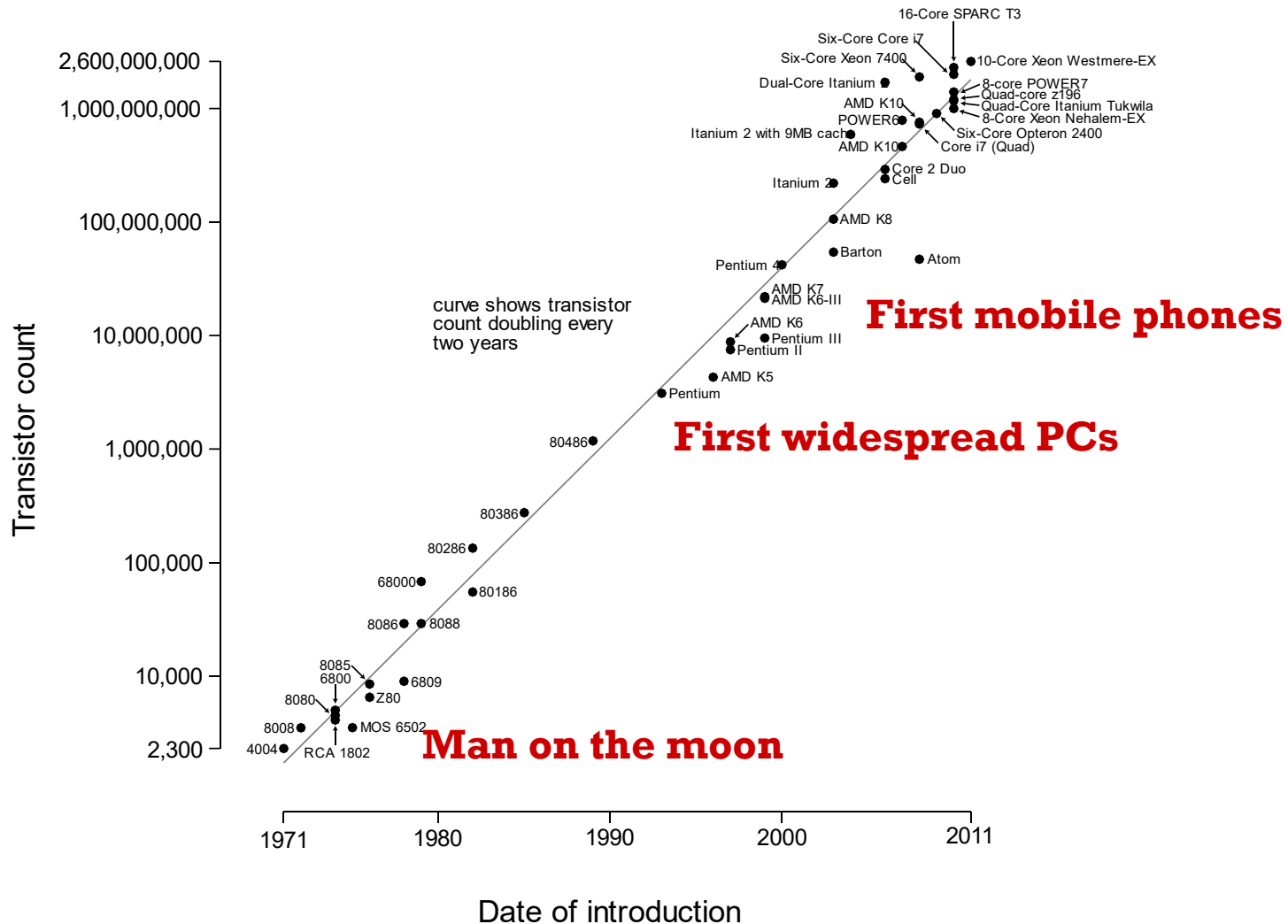- and not a single mistake allowed!!!!

Sony TR3
(the first transistor radio)

A Texas Instruments advert for
transistor controlled rockets

Great expectations

Moore's Law and a question?

curve shows transistor count doubling every two years

First mobile phones

First widespread PCs

Man on the moon

Transistor count

Date of introduction

1971   1980   1990   2000   2011

When computing power was rare, we did amazing things…
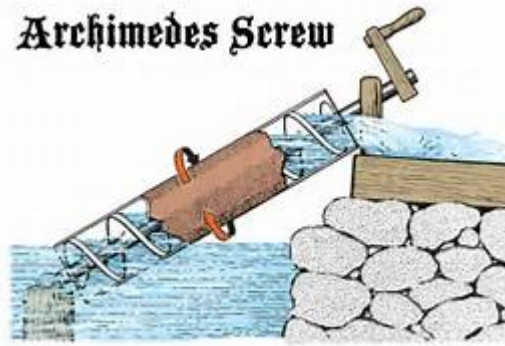**Now… what do we use this power for?**

- **Ordering Food?**
- **Paying?**
- **WeChat?**
- **Kitten videos?**

- **Exploring Space?**
- **Exploring the Ocean?**
- **Renewable Energies?**
- **Healthcare?**

So what is societal progress?

Technology and progress are often linked

Water pump
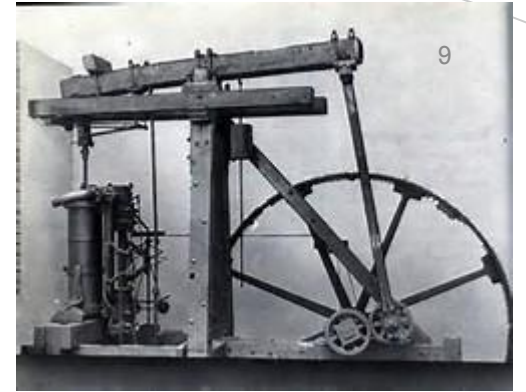
Steam engine

Printing press

Telephone

Hand gun

Progress ... what do we mean by it?

Progress ... how do we measure it?

Wealth? Material Goods?

Happiness?

Health?

Quality of life?

Environmental status?

A belief… or a doubt…

That technological progress leads to social progress.

→

If social progress means more than just increased wealth, but improvements in the quality of life, then this is not the case – at least not in recent years

→

Arguably, ICT Technology has helped create problems in society and has done little to really enrich society.

Technology is enforcing division in society

→

Some feel today's society is unsatisfying, feeling powerless, causing social issues

→

Technology may be a force for good, but not unambiguously so

Philosophers.. Many opinions but one is

"Like Marcuse, I relate the technological progress to the consequences of persisting divisions between classes and between rulers and ruled in technically mediated institutions of all types.

Technology can be and is configured in such a way as to reproduce the rule of the few over the many. *This is a possibility inscribed in the very structure of technical action which establishes a one way direction of cause and effect."*

*"Where society is organized around technology, **technological power is the principle form of power in the society**. It is realized through designs which narrow the range of interests and concerns that can be represented by the normal functioning of the technology and the institutions which depend on it. This narrowing distorts the structure of experience and causes human suffering and damage to the natural environment.*

***Those excluded from the design process eventually suffer the undesirable consequences of technologies and** protest. Opening up technology to a wider range of interests and concerns could lead to its redesign for greater compatibility with the human and natural limits on technical action. "*

Discuss

1. *Technological power is the principle form of power in the society. It is realized through designs which narrow the range of interests and concerns (facilitated by the technology).*

2. *This causes human suffering and damage to the natural environment.*

3. *Those excluded from the design process eventually suffer the undesirable consequences of technologies*

Thinking of this… review the following for societal impact

- The Internet

- 2G Phones (pre-smartphones)

- Smart Phones

- Dishwashing Machines

- Computerised Engine Management Systems in Cars

Technology without context

When a group have not experienced technology, there can be unforeseen problems when they are introduced to it

Captain Kirk and the Federation rules of first contact

Do not interfere with the development of a race of people

Primitive human society seeing a space ship for the first time

How would this affect these people after the ship has left?

Cargo Cult

- In the South Seas (Melanesia) there is a cargo cult of people. During WW2 airplanes would land with lots of good materials (Cargo), and they want the same thing to happen now. So they've arranged to imitate things like runways, to put fires along the sides of the runways, to make a wooden hut for a man to sit in, with two wooden pieces on his head like headphones and bars of bamboo sticking out like antennas--he's the controller--and they wait for the airplanes to land. They're doing everything right. The form is perfect. It looks exactly the way it looked before. But it doesn't work. No airplanes land.

- Richard Feynman, 1974 Caltech Commencement Address
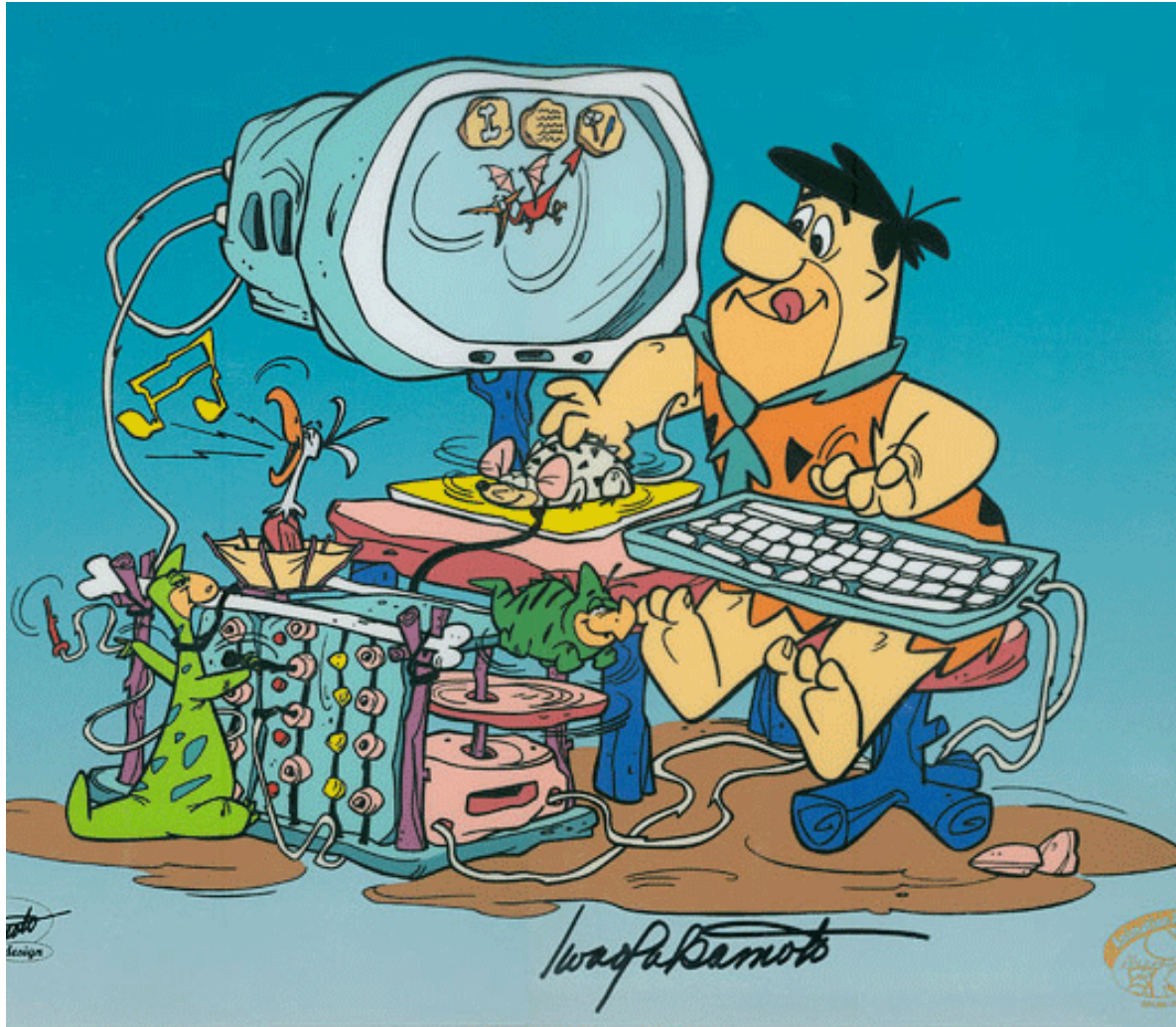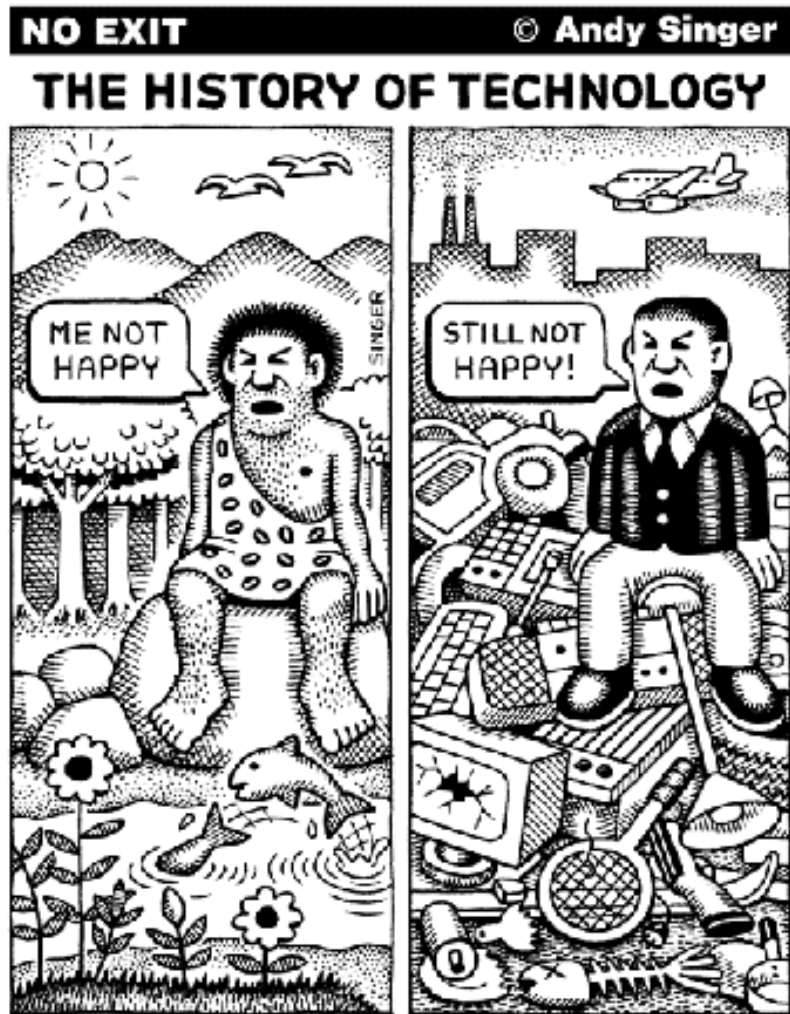
Cargo Cult

My modern version

If you move your fingers just right, and tap here and there, you can it to work!!! If it doesn't… keep moving and tapping!!!

My modern version

- Are we truly masters of our world?

Question

- As a society, have we progressed in the last 10 years due to new ICTs (Information and Communication Technologies)?
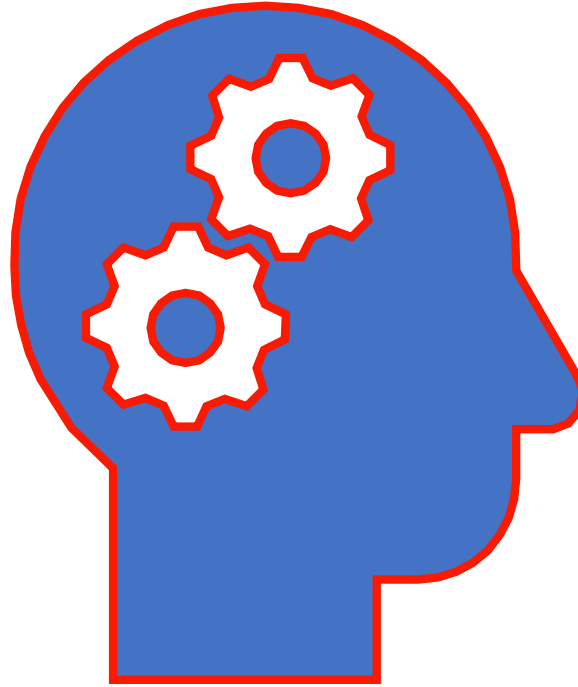
Understanding Tech Development

Technology and S-curves

In the figure: Performance (vertical axis), Time (horizontal axis).

"Limits of what is scientifically possible are reached and performance doesn't increase much more."

"A technology's performance evolves slowly in the beginning."

"At some point, a breakthrough happens and it now improves rapidly."
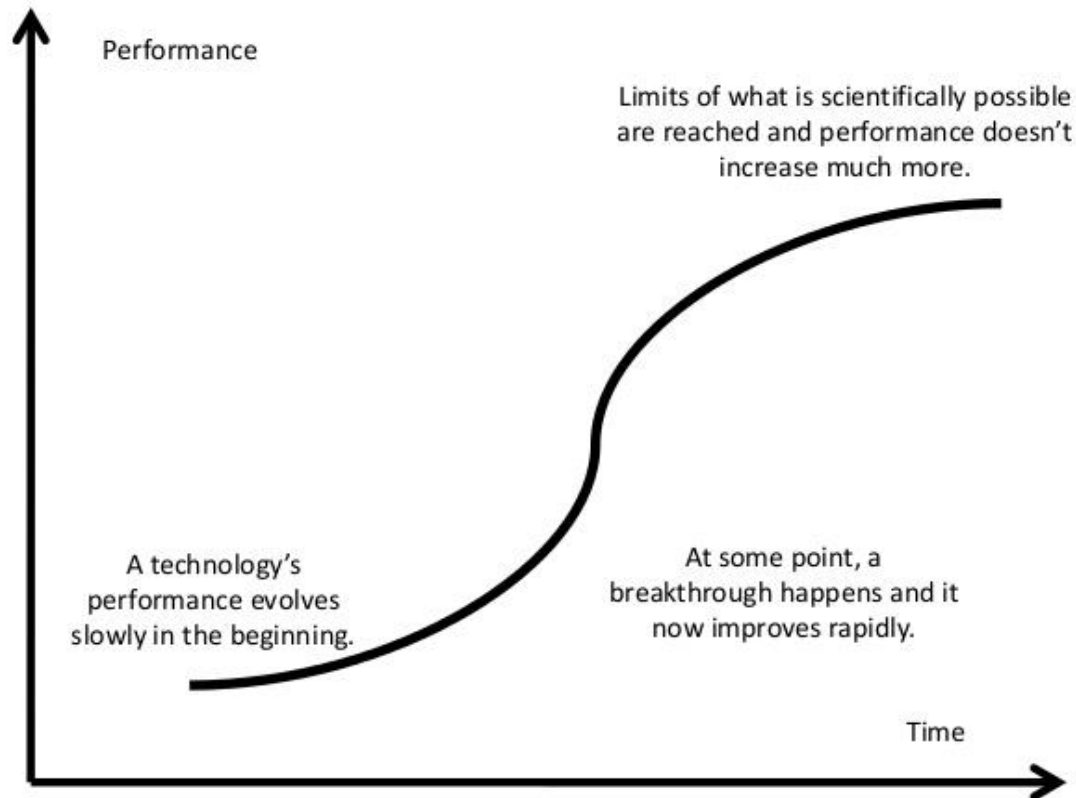
- The **S-curve** shows the innovation from its slow early beginnings as the **technology** or process is developed, to an acceleration phase (a steeper line) as it improves and, finally, to its stabilisation over time (the flattening **curve**), with the same increases in performance of the item or organisation using it.

Life lesson – increases in anything (eg houses prices) can never last but knowing when they stop is the tricky thing.
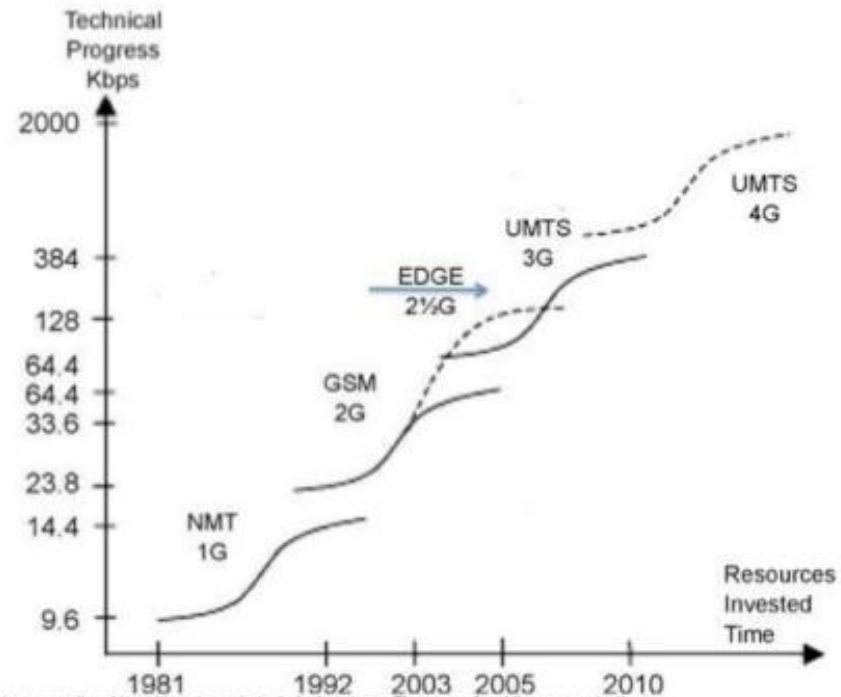
Replacing S-curves

The 'S' Curve model explains how innovations start slow, accelerate, then hit a ceiling requiring companies to jump to a new technology

THE 'S' CURVE

Performance

Eventually a performance ceiling is reached and improvement stalls

However, it improves rapidly, and companies need to jump to the new 'S' curve to improve performance

As experience with the technology grows, performance starts to improve rapidly

Initially the performance of a new technology is poor and it improves slowly

The next wave of technology initially is not as good as the old technology

Time

Timing the S-curves

S-Curve 1

Mobile Phone Evolution

Motorola to iPhone

S-Curve 2

iPhone

History [2007 - 2018]

Timing the S-curves

1890

In 1890, would you prefer to be the world leading manufacturer of horse & buggies or a small but successful petrol car manufacturer

2017

In 2017, would you prefer to be a car company using petrol/diesel or one using electricity

In 1910, would you prefer to be a startup car company using petrol or one using electricity (electric cars were initially better)

1910

Hype Curve

Model of how excited people get and how quickly they get adopt new technology.

Think of the new iPhone release

expectations

| On the Rise | At the Peak | Sliding Into the Trough | Climbing the Slope | Entering the Plateau |

Supplier proliferation

Activity beyond early adopters

Negative press begins

High-growth adoption phase starts: 20% to 30% of the potential audience has adopted the innovation

Mass media hype begins

Supplier consolidation and failures

Early adopters investigate

Second/thrid rounds of venture capital funding

Methodologies and best practices developing

First-generation products, high price, lots of customization needed

Less than 5 percent of the potential audience has adopted fully

Third-generation products, out of the box, product suites

Startup companies first round of venture capital funding

Second-generation products, some services

R&D

| Technology Trigger | Peak of Inflated Expectations | Trough of Disillusionment | Slope of Enlightenment | Plateau of Productivity |

time

Technology Business Development

Bleeding edge

Fast Follower

Large scale acceptance and production

Technology Trigger · Peak of Inflated Expectations · Trough of Disillusionment · Slope of Enlightenment · Plateau of Productivity

expectations · time
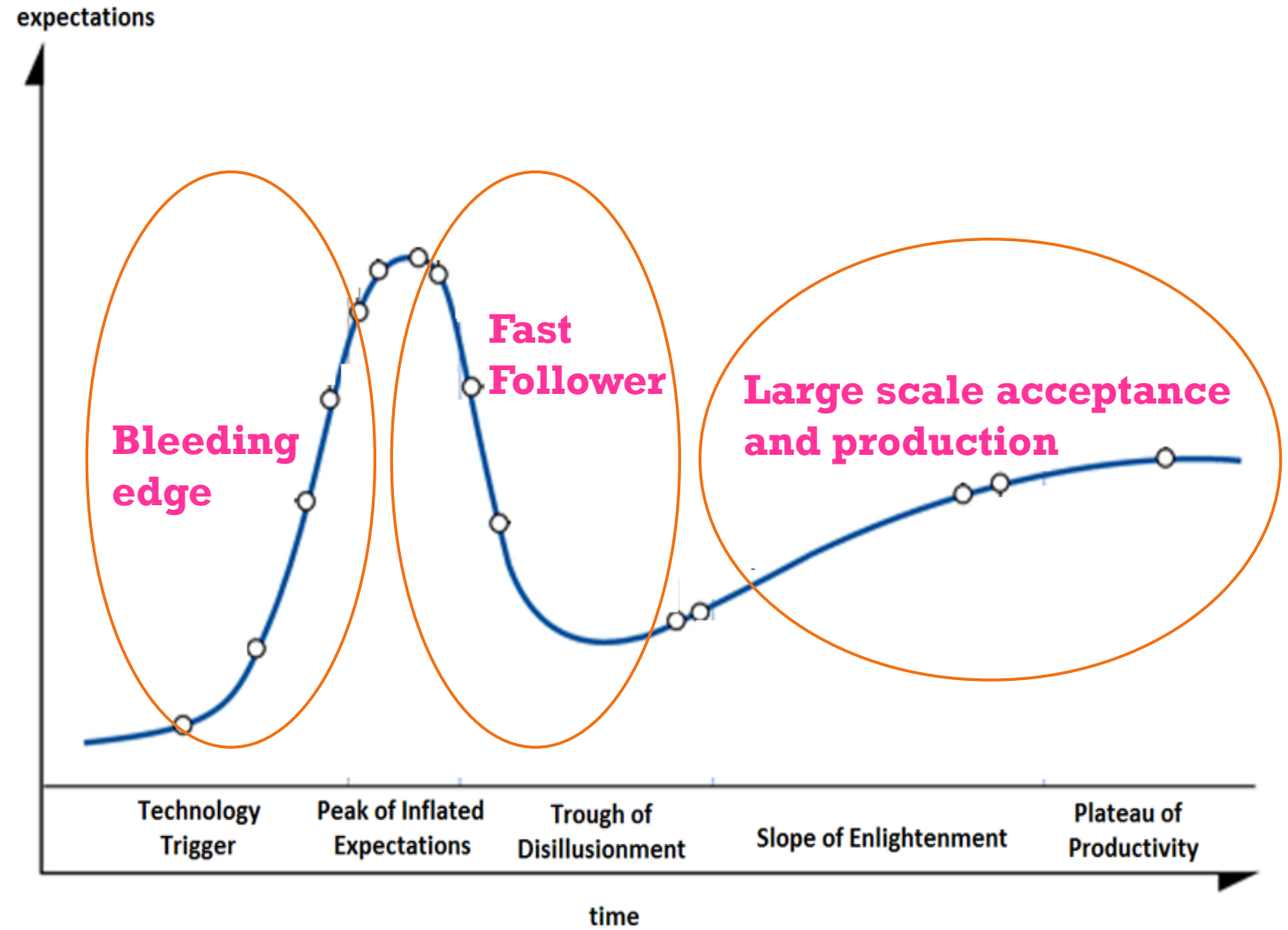
So…

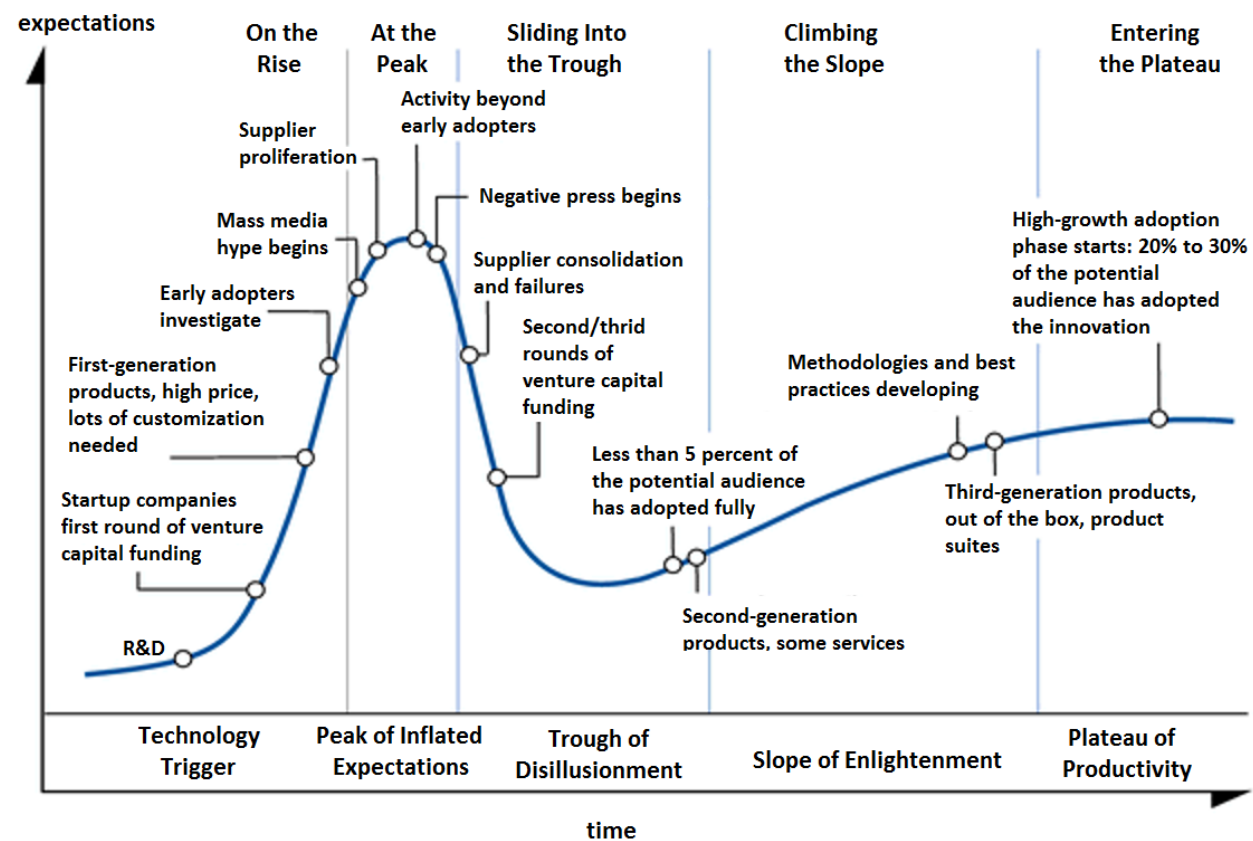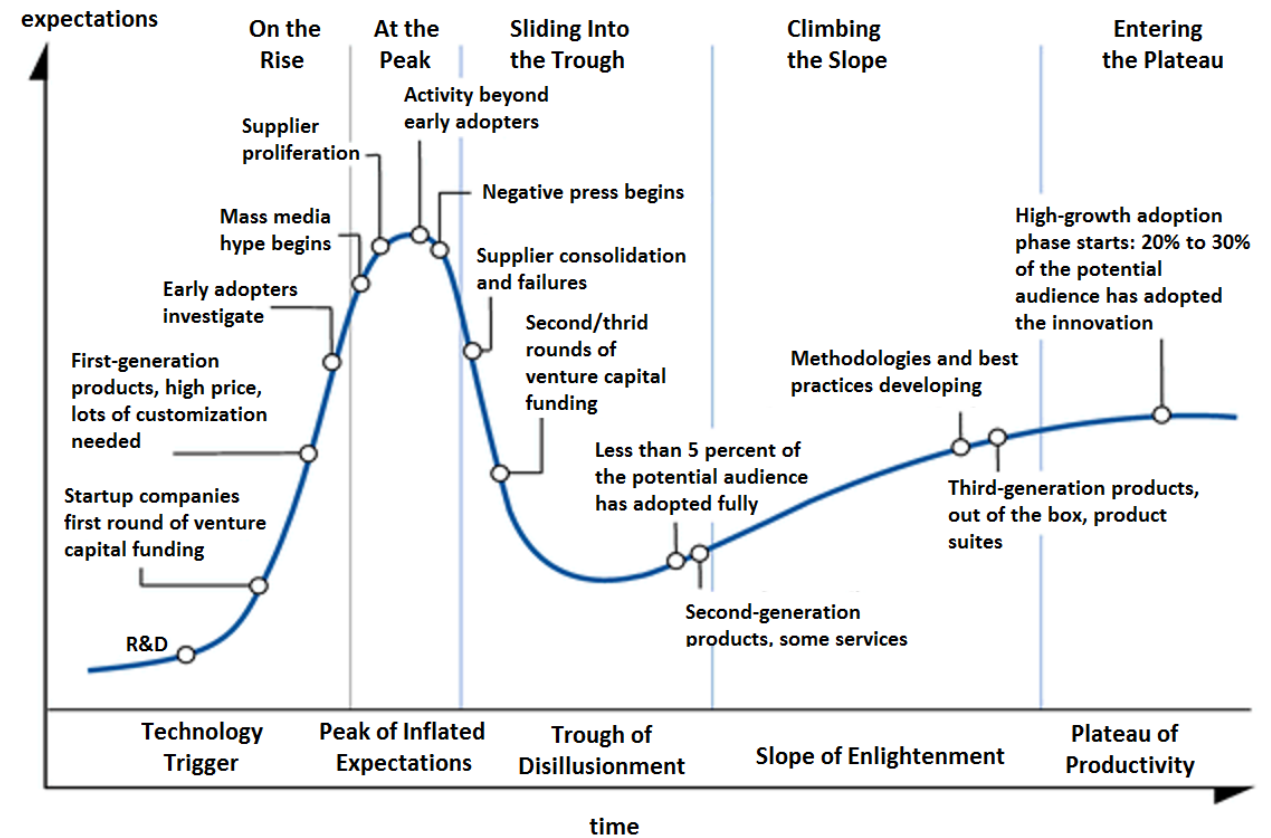- It is easier to copy someone who made a successful innovation

- Your first version is rarely perfect

- It's a race against global competitors
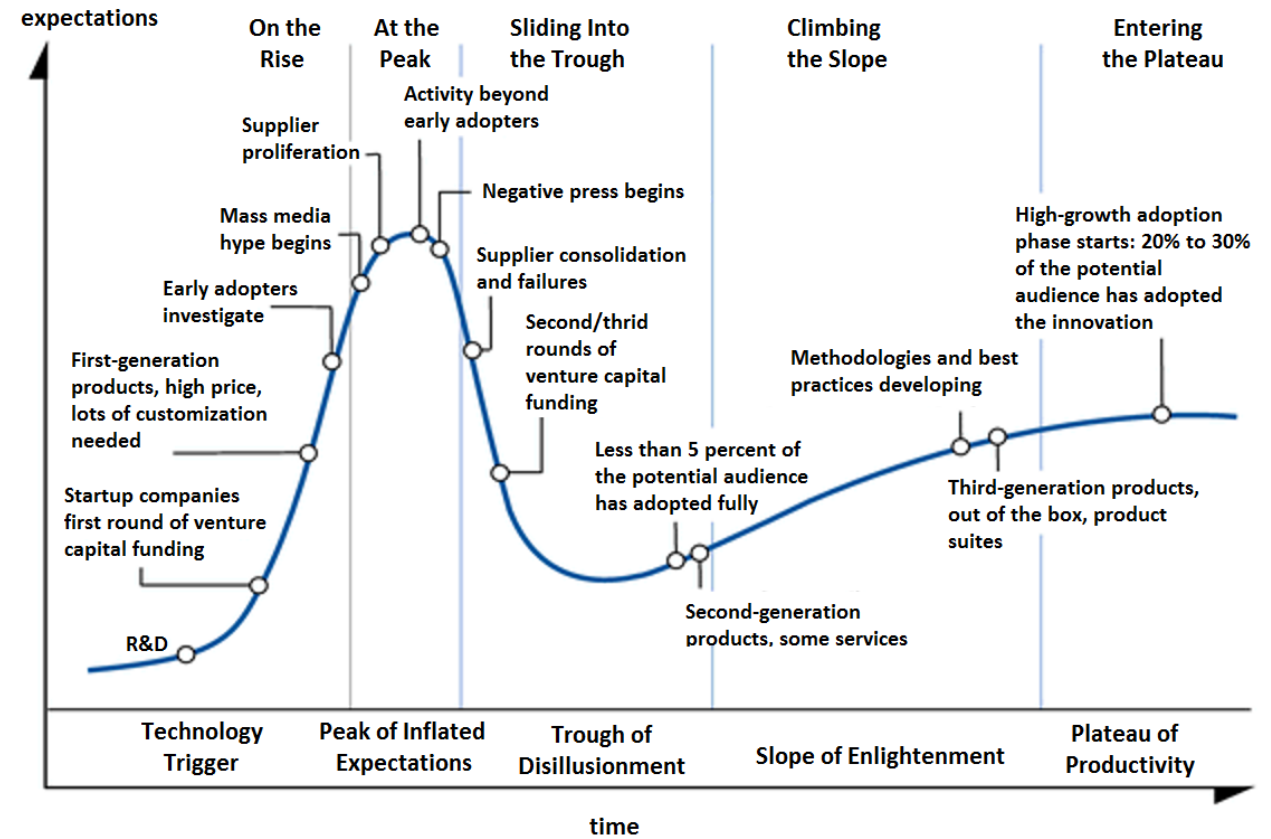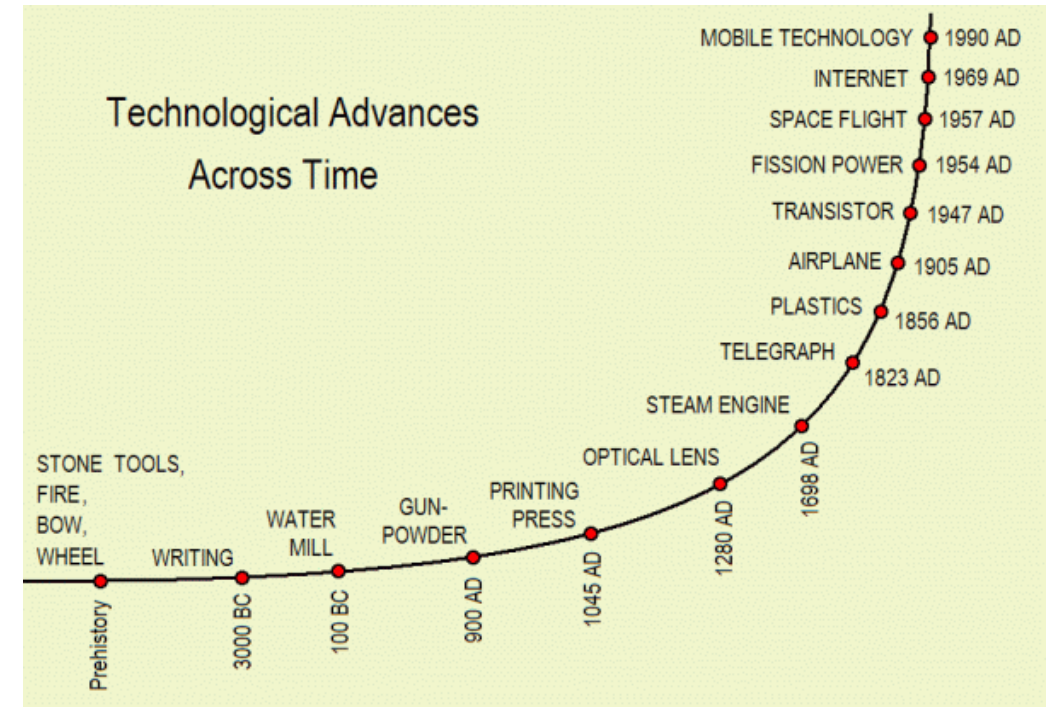
Where would you put smart phones?

Where would you put "BIG DATA"

expectations

| On the Rise | At the Peak | Sliding Into the Trough | Climbing the Slope | Entering the Plateau |

Supplier proliferation

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Second/thrid rounds of venture capital funding

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First-generation products, high price, lots of customization needed

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Startup companies first round of venture capital funding

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R&D

Second-generation products, some services

| Technology Trigger | Peak of Inflated Expectations | Trough of Disillusionment | Slope of Enlightenment | Plateau of Productivity |

time

Where would you put AI

Performance / Time

Initially the performance of a new technology is poor and it improves slowly

As experience with the technology grows, performance starts to improve rapidly

Eventually a performance ceiling is reached and improvement stalls

The next wave of technology initially is not as good as the old technology

However, it improves rapidly, and companies need to jump to the new 'S' curve to improve performance

Technological Advances Across Time

| Technology	Date
MOBILE TECHNOLOGY	1990 AD
INTERNET	1969 AD
SPACE FLIGHT	1957 AD
FISSION POWER	1954 AD
TRANSISTOR	1947 AD
AIRPLANE	1905 AD
PLASTICS	1856 AD
TELEGRAPH	1823 AD
STEAM ENGINE	1698 AD
OPTICAL LENS	1280 AD
PRINTING PRESS	1045 AD
GUN-POWDER	900 AD
WATER MILL	100 BC
WRITING	3000 BC
STONE TOOLS, FIRE, BOW, WHEEL	Prehistory

Stagnation or Singularity

- Do we keep finding new s-curves

- Or could we hit a max and pause.

- Was the last 100 years a freak lucky period?

What drives technology development?
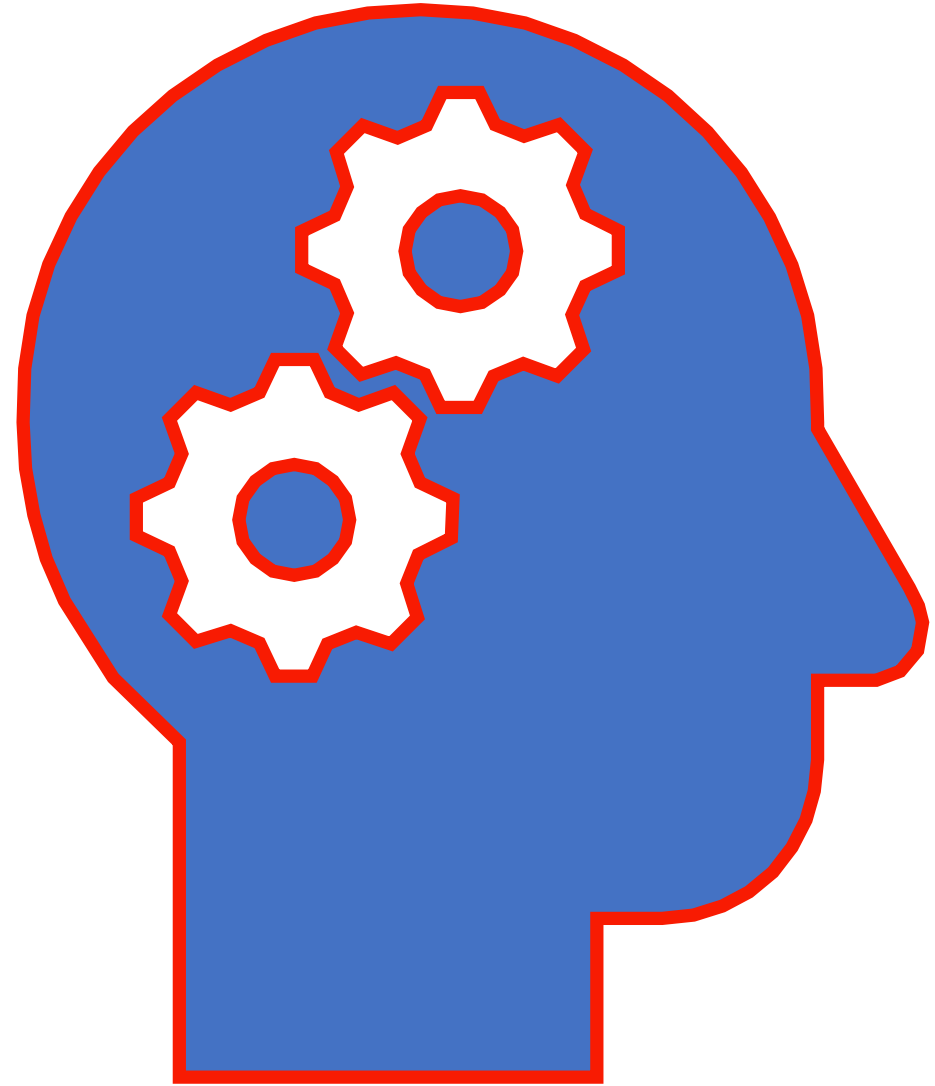
From a layman's perspective

- You are either trying to

  - solve a problem

or

  - Improve on a solved problem

The public must care about your problem

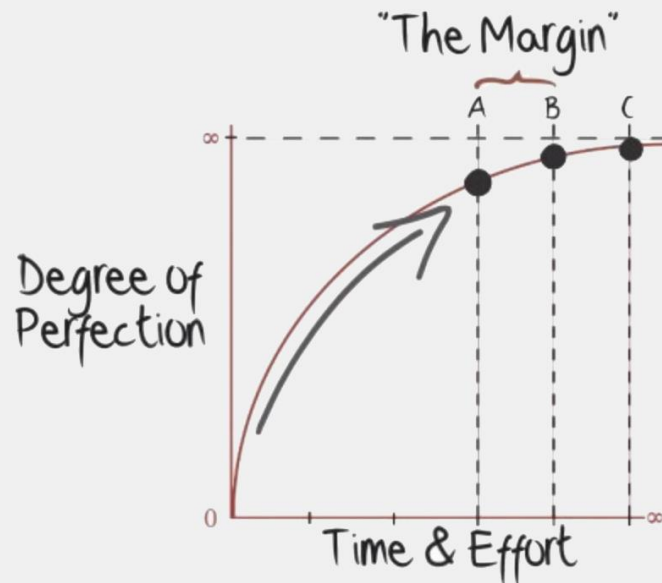# "Improving a problem"

Too expensive
So make it cheaper

Too dangerous
So make it safer

THE EXPONENTIAL CURVE OF EXCELLENCE

"The Margin"

Degree of Perfection

Time & Effort

WWW.SAMUELTHOMASDAVIES.COM

"Improving a problem"

- **At some point, getting better is not worth the effort**
- **Products in this space are user experience/fashion/style driven**
- **Hard to make an impact**

"Making it cheaper"

- People are expensive
- Machines don't go on strike, don't have headaches
- Machines have maintenance costs but not salaries
- Machines don't sleep or complain of extra shifts
- Machines don't need canteens, medical insurance, etc
- Machines don't steal your ideas
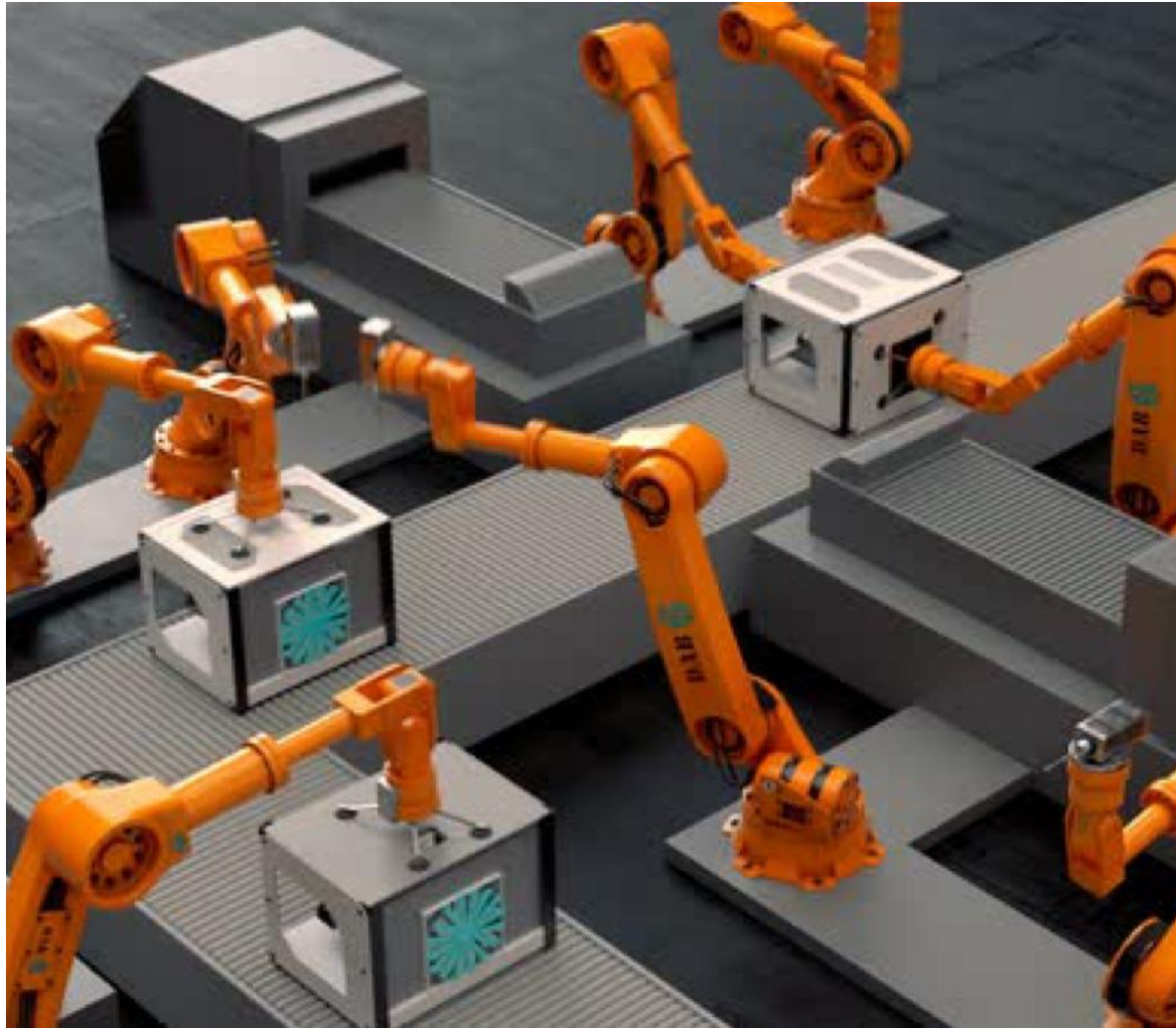
"Making it safer"

- People are unpredictable
- Machines will only do what they have been programmed to do
- Machines cannot feel pain
- Machines don't make mistakes because they are tired
- Machines don't spill food/liquid
- Machines don't sue

FLYTE: Floating plan pots

SpaceX: Vertical Landing Rockets

"Solving a problem"

Solve the impossible

So create a new ability

Changing the rules - Cooking Food?

What happens if we use robots to cook in restaurants?

WHO LOSES THEIR JOB?

- Chefs

- People who prepare the food

- People who wash the dishes

- People who organise the kitchen

WHERE CAN THE PEOPLE WHO LOST THEIR JOB FIND NEW ONES?

- Gourmet industry (Luxury)

- Retrain as service staff (waiters, greeters, front desk)

- Quality control

- Maintenance

What happens if we use robots to cook in restaurants?

WHERE CAN JOBS BE CREATED?

- Maintaining the cook robot
- Manufacturing
- Programming
- Quality control

WHERE DO WE FIND PEOPLE TO FILL THESE ROLES?

- Universities
- Retrain from other jobs
- Service industry