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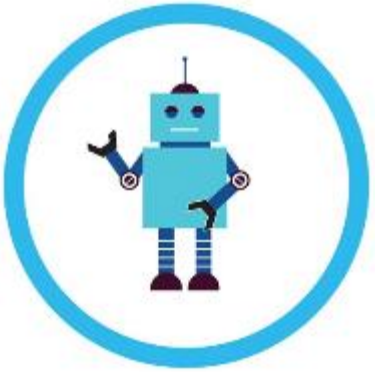
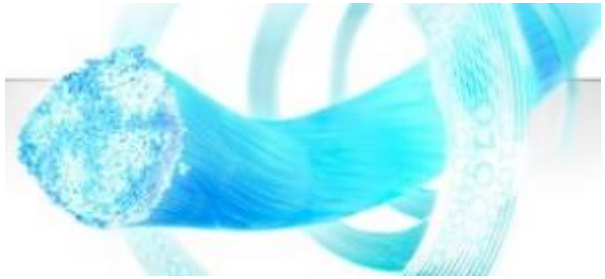


Potential Technology Developments Over the Next Decade

Time taken to reach 50 m users

- Telephone 75 y
- Radio 38 y
- TV 13 y
- Internet 4 y
- Facebook 3.5 y
- Angry Birds app 35 days

http://visual.ly/reaching-50-million-users



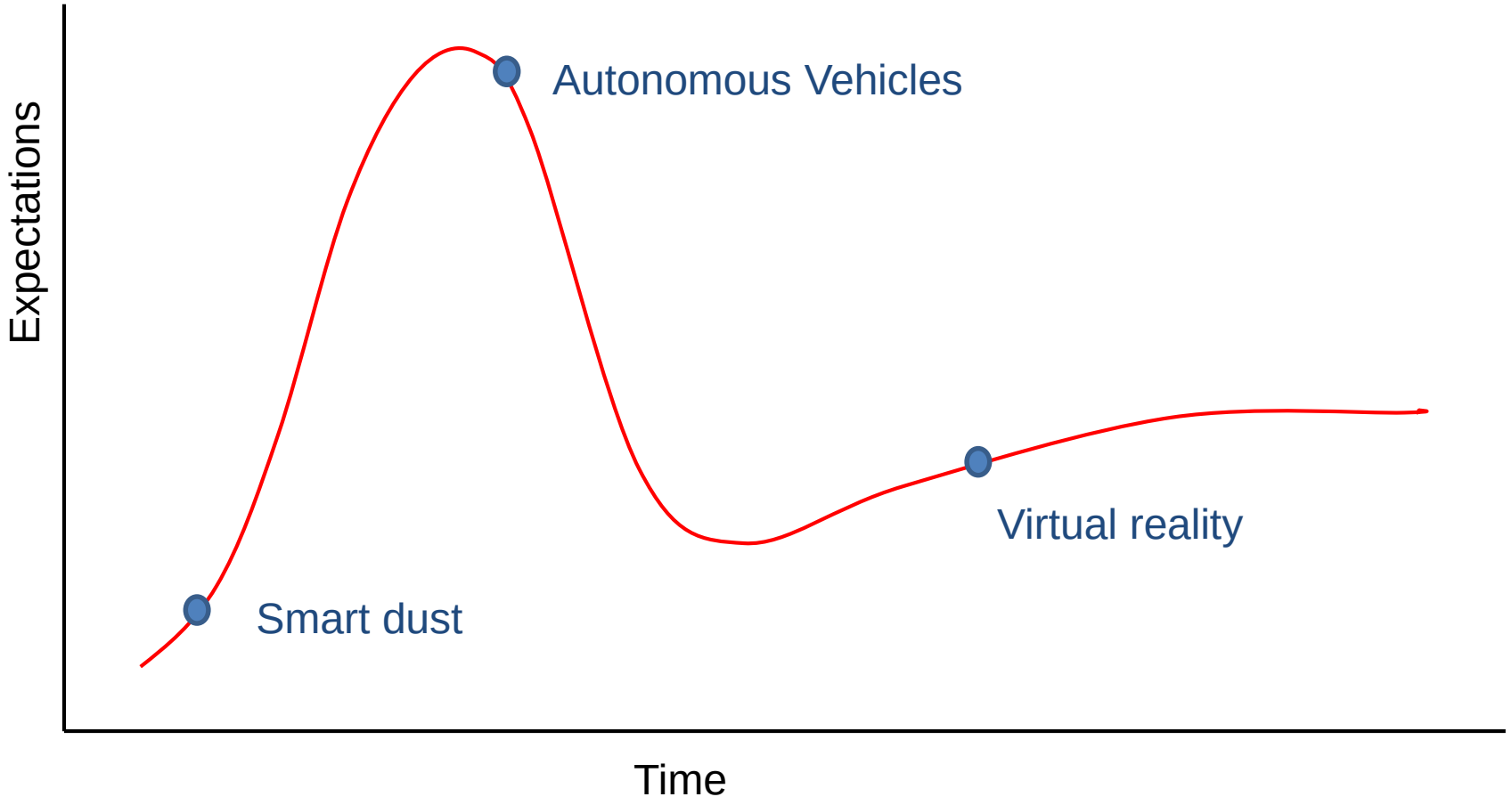
Source: Citi Digital Strategy Team

Potential Exponential Growth

- Most people have a linear view of change
- The fourth industrial revolution is taking place at an exponential rate
- This means that people are taken by surprise.
- This is illustrated by the graphics found at:

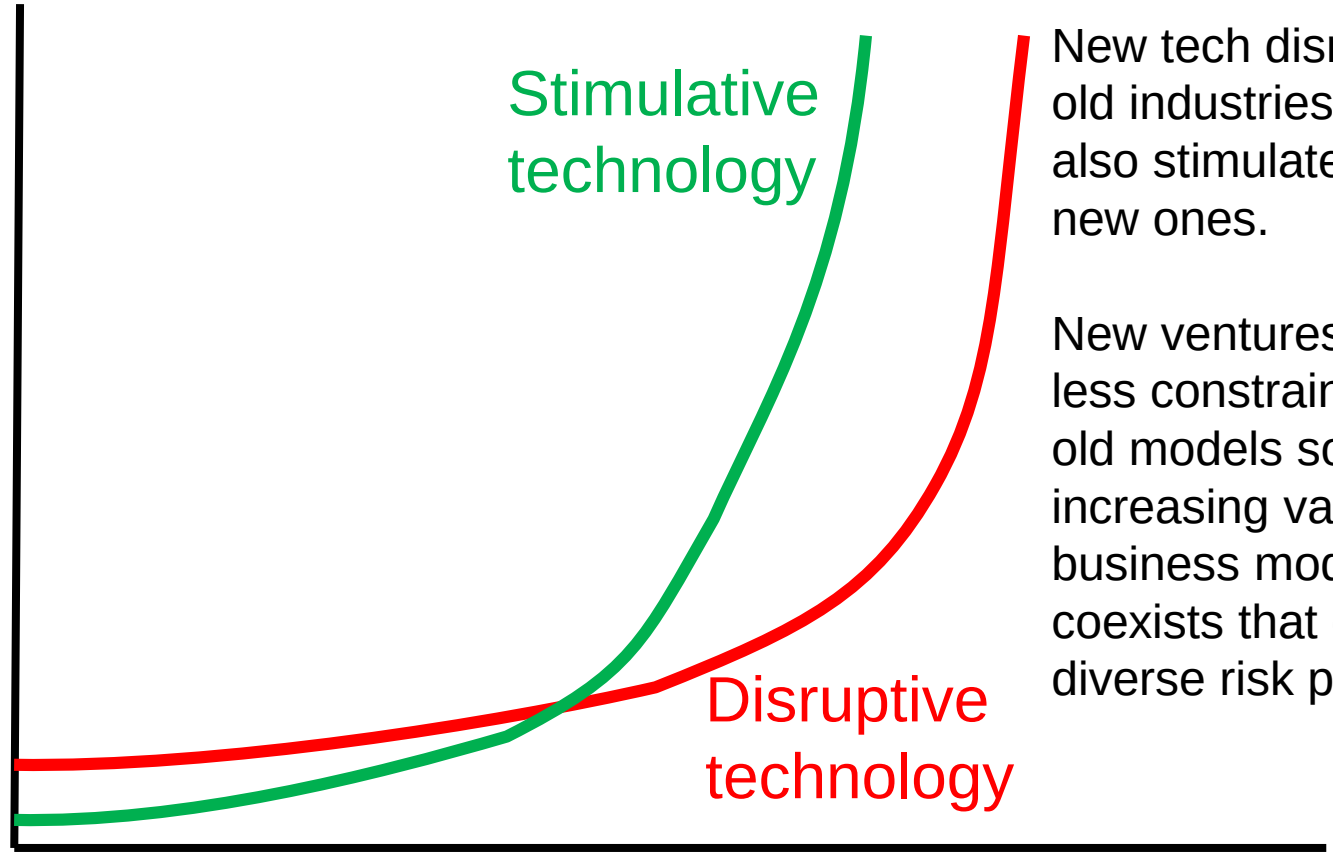
https://singularityhub.com/2016/04/05/how-to-think-exponentially-and-better-predict-the-future

The Gartner Hype Cycle (2016)



http://www.gartner.com/newsroom/id/3412017

Disruptive v stimulative tech



New tech disrupts old industries but it also stimulates more new ones.

New ventures are less constrained by old models so an increasing variety of business models will coexists that creates diverse risk profiles

Effect of ICT on Jobs

<u>New Occupations and Industries</u>

- Already ICT has had a transformational effect on work
- Since the PC was invented over 1500 new job titles in occupational classifications

  E.g. Database administrator, Web Designer, Cyber-security
- Also changed many jobs

Big Data

- The availability of useful ‘big data’ has allowed technologies to increasingly take on human tasks.
- The volume of global data volume is thought to be doubling every 18 months.
- Cisco estimated global internet traffic in 2016 as 1 x 10^{21} bytes). Compared to text in all books written (1 x 10^{14}) and text transcript of all words ever spoken (1 x 10^{18}).

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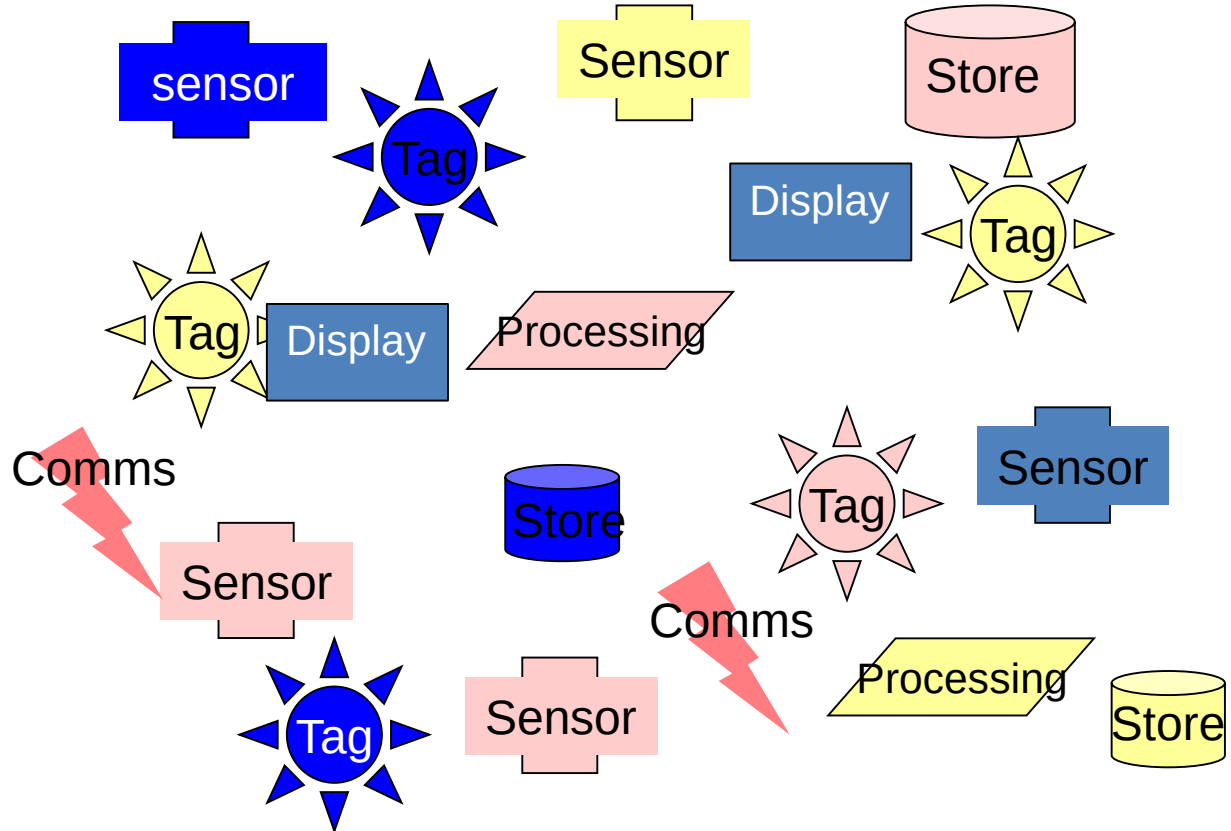
Internet of Things (IoT)

- Where everyday machines, devices and appliances are connected and able to send and receive internet data.
- Sensors can be embedded in almost anything from cow's stomachs to windscreen wipers.
- IoT market estimated growth of 20% per year
- Gartner estimate that a typical family home could have 500 'smart' devices by 2022.
- Cisco estimate that 500 billion devices will be connected by 2030, from 13 billion in 2013.

IoT: Clouds, tags, sensor networks

new working locations and practices, sometimes dangerous, exposure to new substances, ingestion risks, electrical risks, hacking risks, backdoor into safety systems



Self organising to produce massive data pools with their own intelligence. Big data will be replaced by biomimetic smart systems.

Work will involve wide range of devices using diverse mechanisms in diverse locations, making complex systems

Artificial Intelligence (AI)

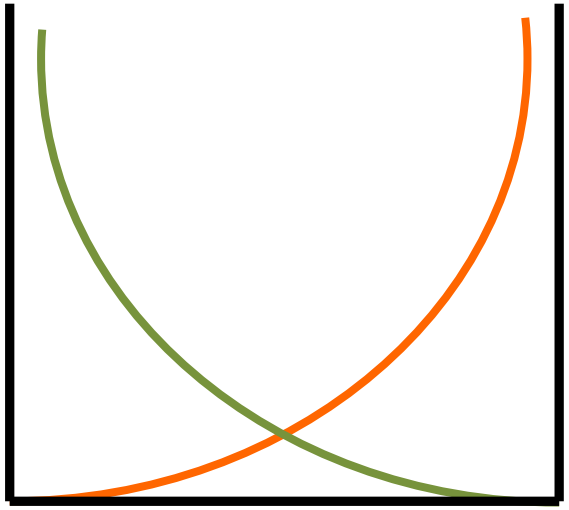
- Technology is enabling the automation of more complex human tasks such as cognitive tasks requiring judgement
  (driving, clinical diagnosis, legal casework, journalism)
- Beating Humans at their Own Games
  (Chess, Jeopardy, Go!)
- Virtual Assistance

  (Your shopping, your PA, social insights)

  100 million ‘smart speakers’ installed

AI and humans

Value of physical/ intellectual work as AI develops



Value of Community & Personal contact

Care economy, human care-based jobs
Less IQ advantage, less status, social levelling
Growth of arts, crafts, personal services
Restructuring towards micro-enterprises

Miniaturisation

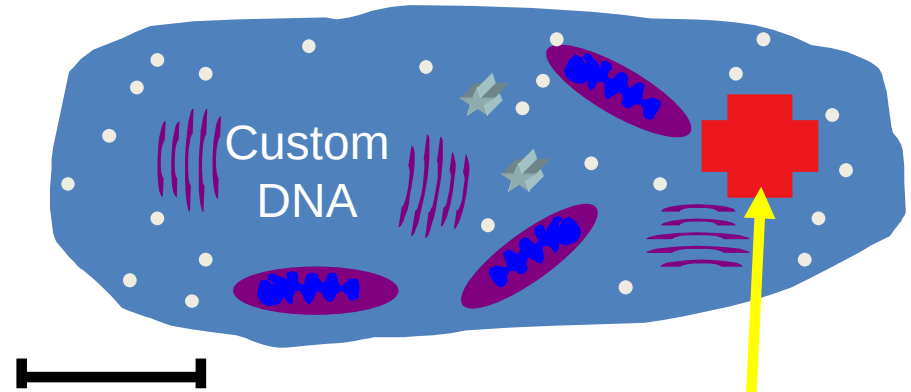
Ingestion, terrorism, hacking, espionage, electrical risks,
Need to check inaccessible places regularly may dictate redesign

Small specks of smart dust can be concealed anywhere

Passed on by handshake, settling from the air, in food, seeds, gravel or in clothes, stick to shoes. Air conditioning or open windows are new security risks.

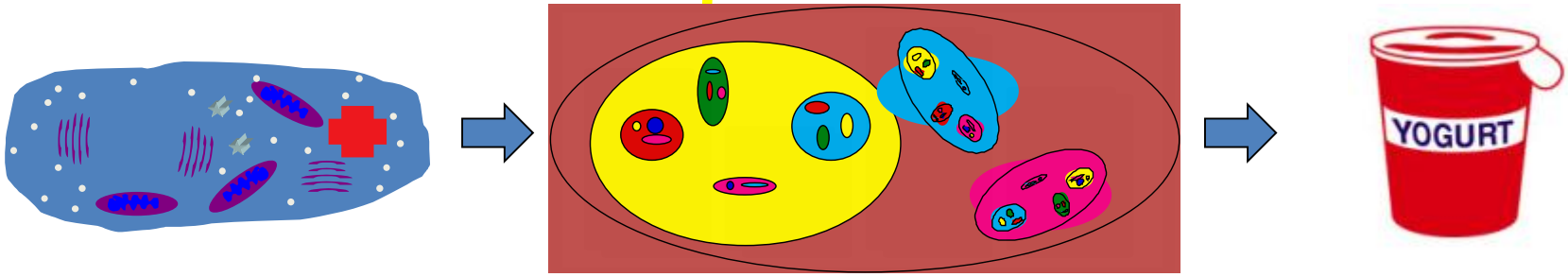
Human vision limit: 0.1mm
Apple 2 computer: 0.008mm
0.25MB memory chip: 0.01mm

Smart cells



Could be implemented using organic or synthetic biology

Part organic, part synthetic, part virtual



Self-organising via chemical gradients

The body as an IT platform

Ingestion, rejection, allergy, shock, distraction, new ergonomics

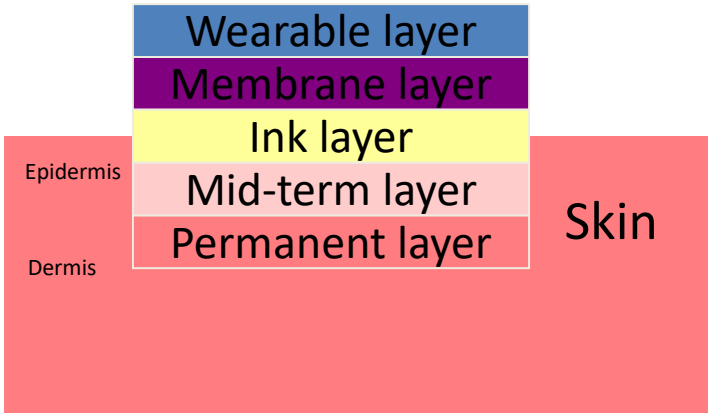


Photo of active skin

e.g. https://wordlesstech.com/smart-skin/

Skin-based electronics links blood chemistry & nerve signals to external networks and systems. Body becomes part of IoT.

Generally reduces physiological risks due to monitoring capability.

Potential use for security may introduce risk

May increase stress and self-absorption.

Potential for smart makeup, smart drugs, recording and replaying sensations, hyper-realistic VR…

This could have many merits for productivity but also could cause allergic reactions in some workers, and for others could be distracting.

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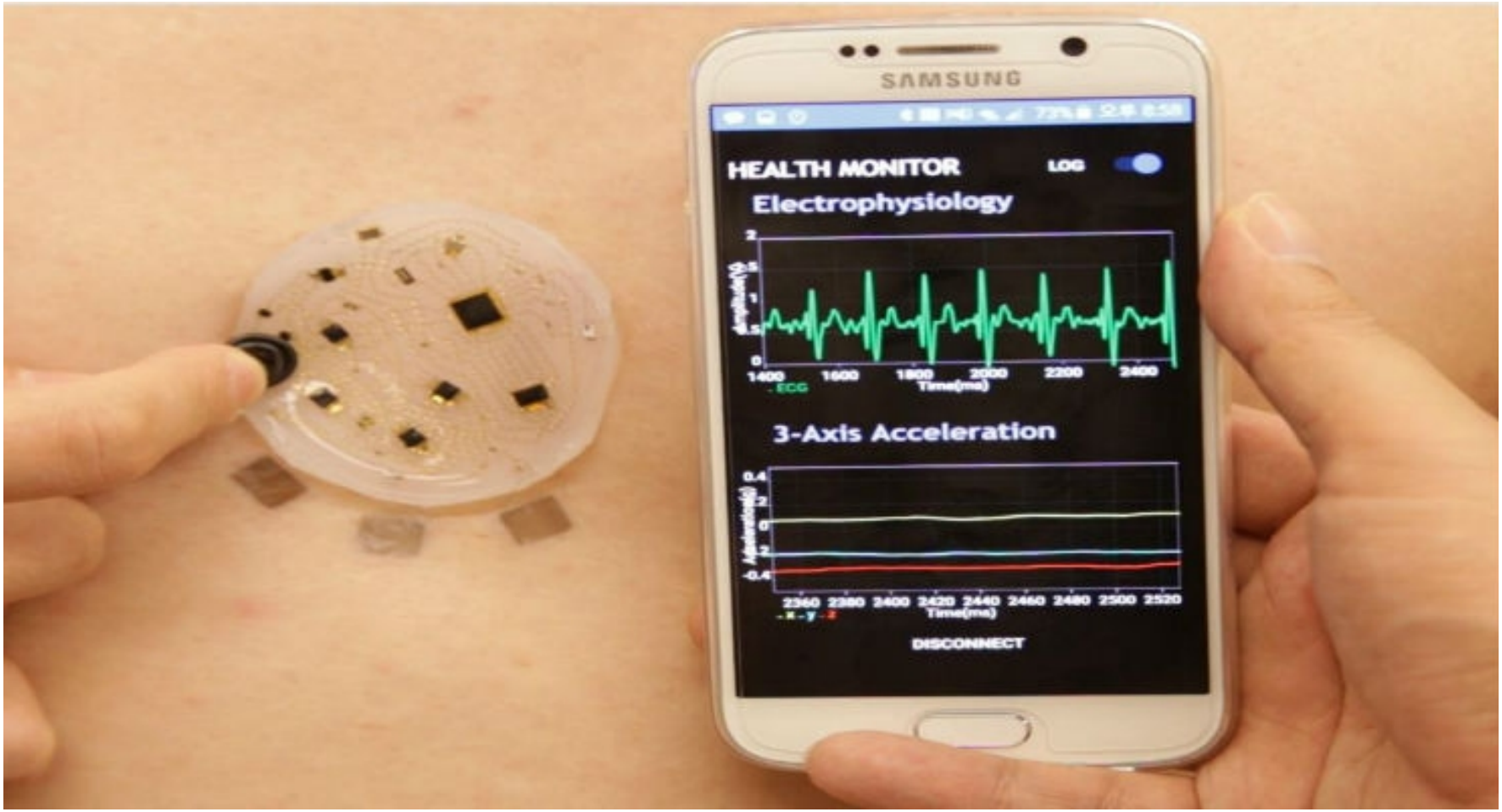
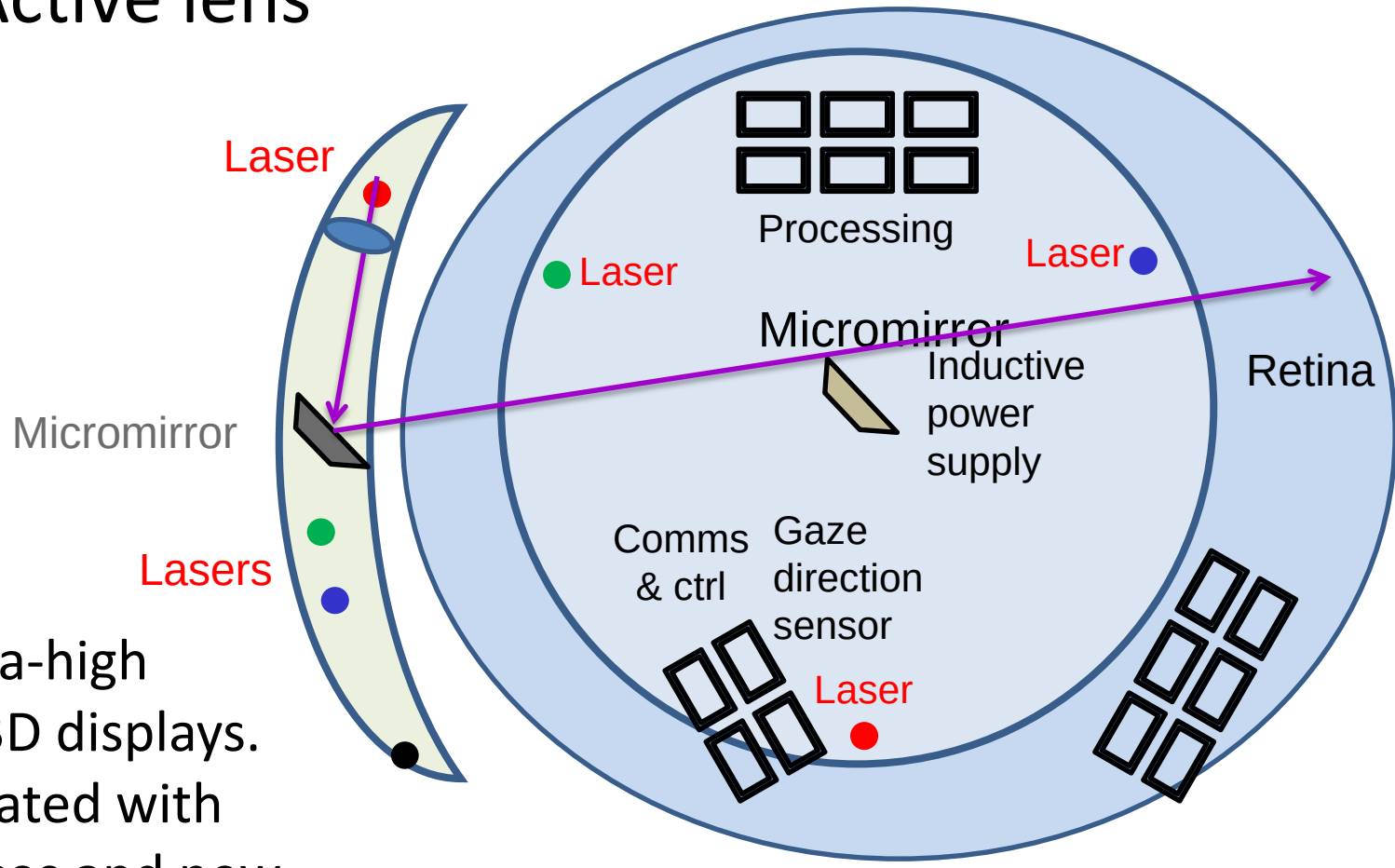


AR/VR: Active lens



Provide ultra-high resolution 3D displays. Risks associated with contact lenses and new interfaces/ergonomics

Augmented and virtual reality

Distraction, disorientation, confusion, information overload, eye strain

Upskills staff but requires wide range of new movements, repetitive gestures, new postures

Example of augmented reality interface can be found at: https://i.forbesimg.com/media/video/2016/12/01/5231382583001_still.jpg

Example of very cluttered retail with augmented reality can be found at: https://assets.rbl.ms/9669380/980x.jpg

Distribution drones

Trip and collision hazards, terrorism, battery explosions, retrieval hazards, resistance activism, mischief

Amazon just patented labels that explode to deploy parachutes for air-drop deliveries!

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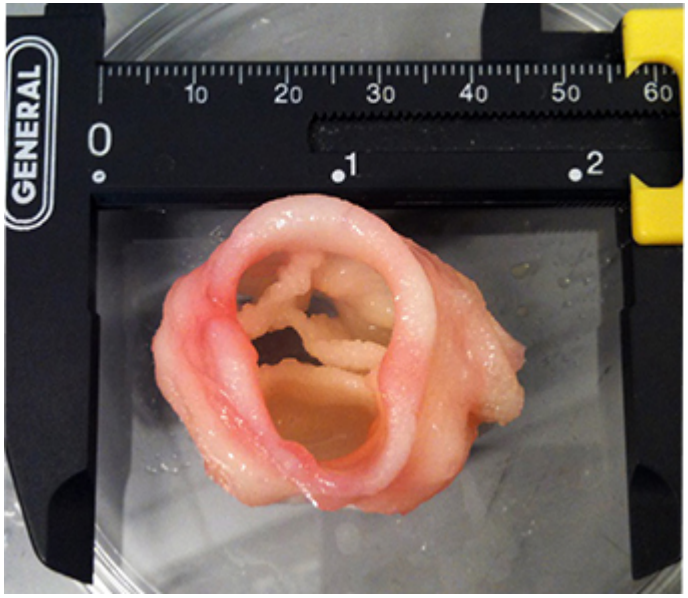
3D printing



3D printing is more useful for some things than others.

Pick and place robotic assembly may hybridise with 3D printers soon and that will be much better!

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Robots

Physical, emotional, AI-related, IoT, Li Ion battery explosion risks, activism

Drone swarms

Existing robots mostly fixed with good safety protocols. Not so Androids
People may form bonds with them.
Emotion-ready AIs in robots may conflict with other AIs and people too.

Transport

Powered roads, hacking, unexpected collisions, high EM fields, terrorism, poor AI open to exploitation by muggers

Inductive mats can charge capacitors as vehicle passes over them

Linear induction motors v engines & batteries

Robotic vehicles of all types will need safety protocols to be well-designed

Jobs in the Future

- Estimates, 65% of children entering primary school today will ultimately end up working in new jobs that don't yet exist.

(Research from the World Economic Forum)

- 35% of the skills necessary to thrive in a job today will be different five years from now.

(McLeod, Scott and Karl Fisch, "Shift Happens")

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Discussion