UICL 2302
Thinking of Science & Technology

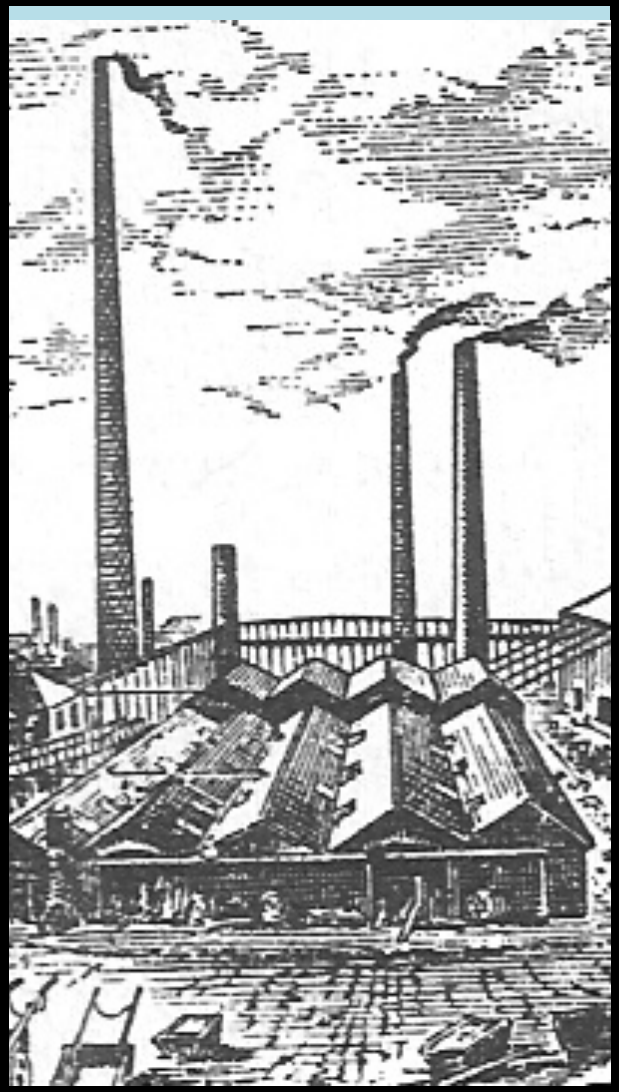
Industrial Revolution (IR)

Inter into

the 4th Industrial Revolution…

What is Industrial Revolution (IR)?

Industrial Revolution is basically a transition to new manufacturing process. It was started in Great Britain in 1760.



1st Industrial Revolution (IR)

The 1st industrial revolution **was** began in Britain in the late 18th century, in this industrial revolution water and steam power used to mechanize the production. The main purpose of the first industrial revolution was to shift from the manual production process to machine manufacturing.

Main Factors Behind First Industrial Revolution:

- Agriculture Production
- Industrial Production
- Coal Extraction
- The Railways
- Steam Power

AGRICULTURE PRODUCTION

By Agriculture production British people could be feed more at lower prices with less effort than ever before.

Industrial PRODUCTION

By Industrial production British people could be develop machines and then these machines would produce more goods and more quickly for the growing population.

Coal Extraction

Humphrey Davy invented a new type of safely lamp which enabled coal miners to work longer hours in deeper pits without fear of explosions. This led to an increase in the production of coal, which was needed to power steam machines.

The Railways

The transport network improved by building railways and bridges for the new steam trains. This meant that fuel and people could be moved into the new industrial factories and goods could be carried away.

STEAM POWER

By producing effective steam engines powered by coal that made industrial and agricultural machines run more quickly and which led to the development of steam trains.

Roles Of Political Thoughts On IR

After the industrial revolution many things changed including the government. People could now go to work for themselves. People like Stuart Mill really started to emerge after the Industrial Revolution. Their goal was not to destroy Capitalism, but rather to change it slightly by adding more government control. Liberals continued to support Capitalism and economic freedom, but they also wanted government to limit the excess of the individual wealth.

SOCIALISM

As a result of the industrial revolution Socialism was created. Originally it was a response to Capitalism and the way that companies treated their workers. Socialists believed that the benefits of production should be for all people not just the small wealthy class. Socialists big proposition was that cooperation should replace competition.

SUMMARY

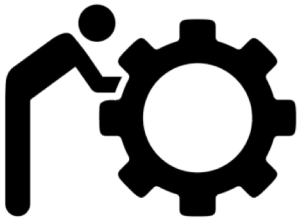
Many political changes came because of the industrial revolution. At first all of the money went to the government then after the revolution, Capitalism started to take over. Because of this liberal thinkers came and tried to spread the word of equality. On the extreme end came the Socialists who thought that the product is the work of everyone and that everyone should share the same benefits.

What is an industrial revolution?

When there are **major changes** in...

Industry **Economy**

The way we work, buy and sell things



Transportation

The way we travel

Society (social structure)

The way we live

It's usually new ways of thinking and doing and new technologies that cause the change to happen.

Number of industrial revolutions so far?

3

And we are now starting number 4. It is changing...

The way we work, buy and sell things

The way we travel

The way we live

4th Industrial Revolution

From Industry 1.0 to Industry 4.0

Degree of complexity

First Industrial Revolution

based on the introduction of mechanical production equipment driven by water and steam power

First mechanical loom, 1784

1800 1900 2000 Today Time

From Industry 1.0 to Industry 4.0

Degree of complexity

First Industrial Revolution

based on the introduction of mechanical production equipment driven by water and steam power

First mechanical loom, 1784

Second Industrial Revolution

based on mass production achieved by division of labor concept and the use of electrical energy

First conveyor belt, Cincinnati slaughterhouse, 1870

1800 1900 2000 Today Time

From Industry 1.0 to Industry 4.0

Degree of complexity

First Industrial Revolution

based on the introduction of mechanical production equipment driven by water and steam power

First mechanical loom, 1784

Second Industrial Revolution

based on mass production achieved by division of labor concept and the use of electrical energy

First conveyor belt, Cincinnati slaughterhouse, 1870

Third Industrial Revolution

based on the use of electronics and IT to further automate production

First programmable logic controller (PLC) Modicon 084, 1969

1800 1900 2000 Today Time

From Industry 1.0 to Industry 4.0

Degree of complexity

First Industrial Revolution

based on the introduction of mechanical production equipment driven by water and steam power

First mechanical loom, 1784

Second Industrial Revolution

based on mass production achieved by division of labor concept and the use of electrical energy

First conveyor belt, Cincinnati slaughterhouse, 1870

Third Industrial Revolution

based on the use of electronics and IT to further automate production

First programmable logic controller (PLC) Modicon 084, 1969

Fourth Industrial Revolution

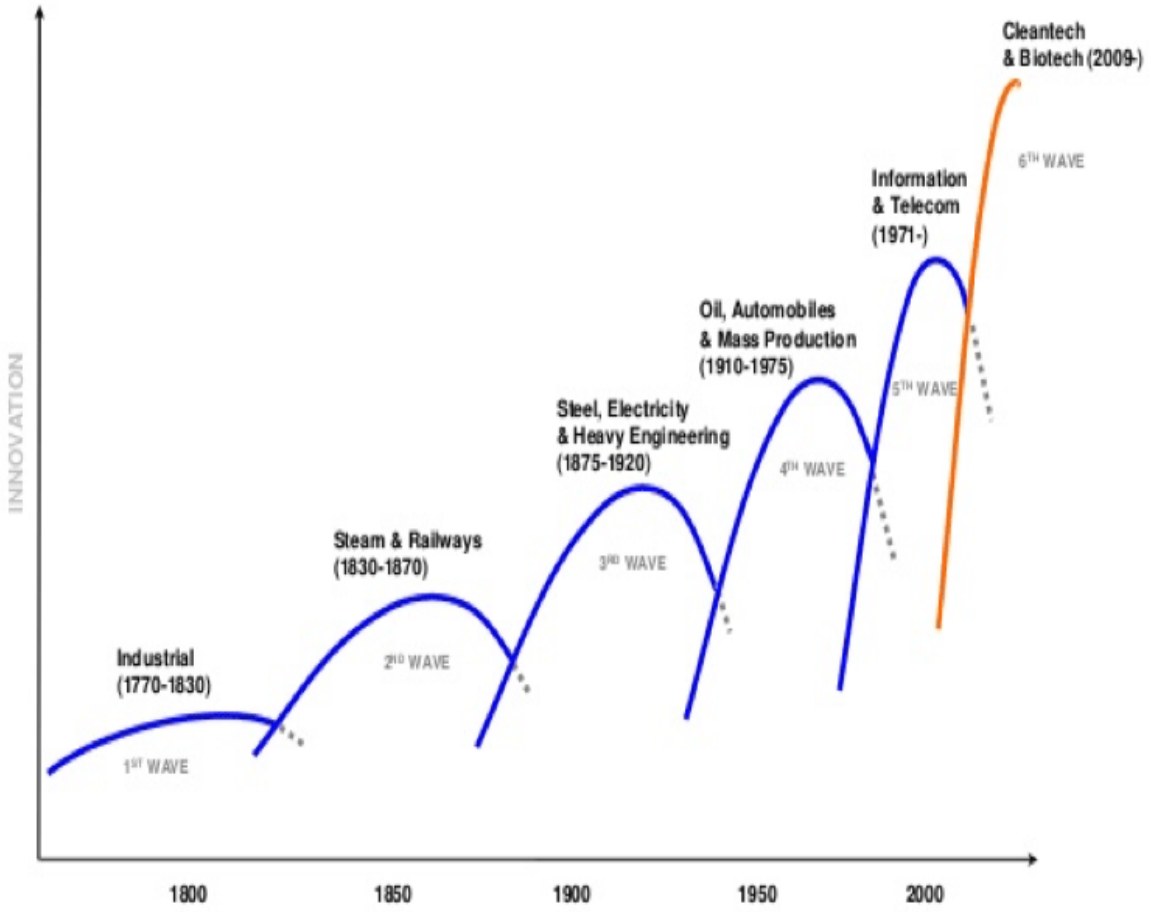
based on the use of cyber-physical systems

1800 1900 2000 Today Time

Human Programming

Artificial Intelligence

Waves of innovation



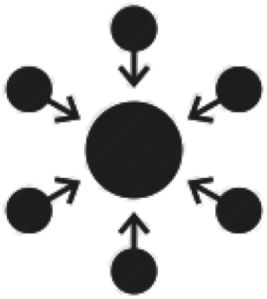
Source: DONG Energy (2009); diagram based on Perez (2002) drawing on report by Merrill Lynch (2008) (schematic not precise quantitative vertical axis).

Grantham Research Institute on Climate Change and the Environment


Autonomous robots
Cybersecurity
System integration
Big data
Internet of things
Industry 4.0
Augmented reality
Simulation
Cloud computing
Additive manufacturing

4th Industrial Revolution

What's happening?



Different technologies are coming together

(convergence)

This is bringing different areas together

Physical
Digital
Biological

This affects social & economic sectors

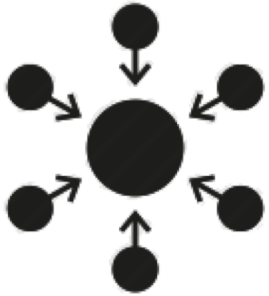
The way we work, buy and sell things

The way we travel

The way we live

What is happening?

Different technologies coming together and bringing different areas together



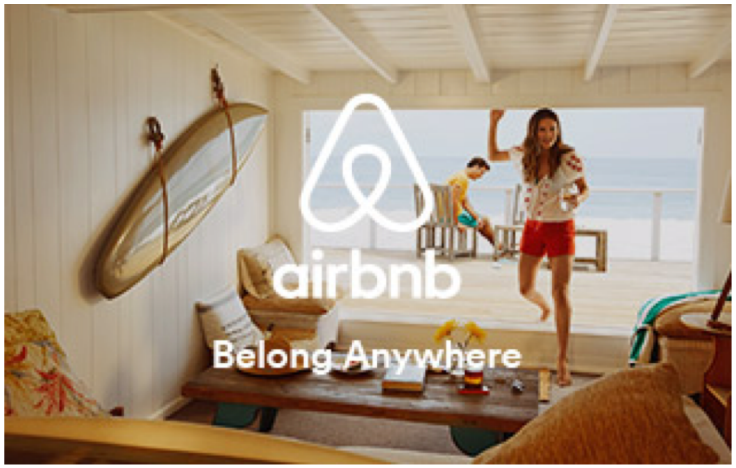
New products & services

with increased efficiency (working better and faster)

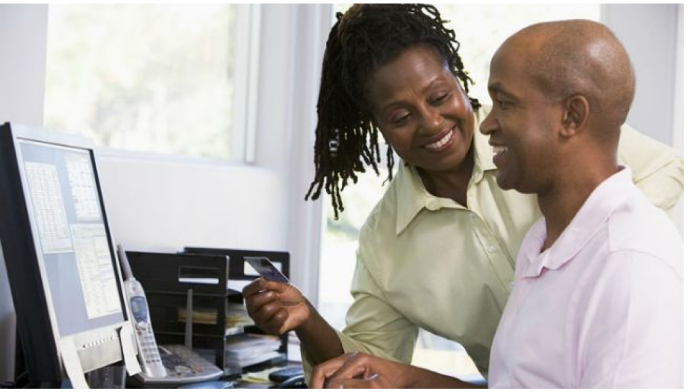
for a better life

Order a taxi (Uber)

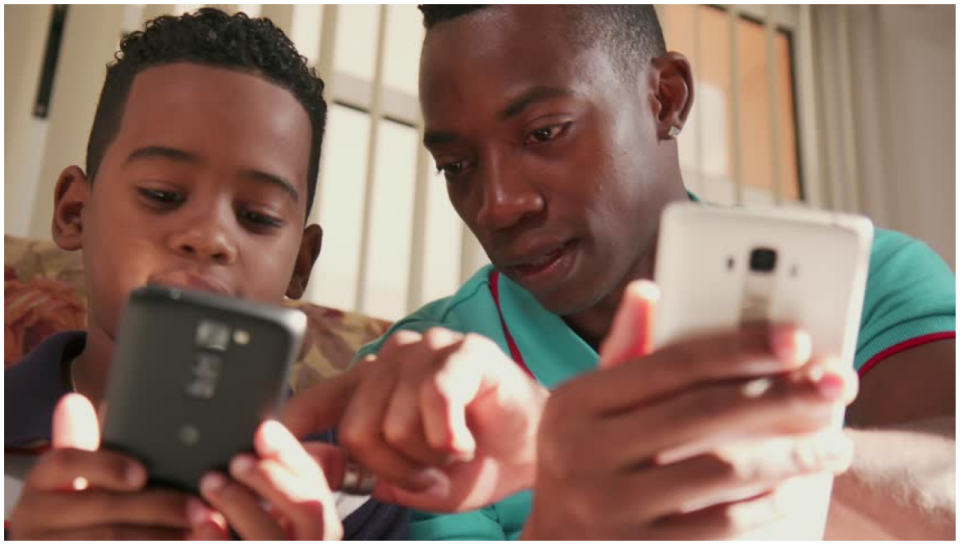
Book accommodation



What is happening?



Buying goods online



Paying bills online

- Learning online – education
- Listen to music
- Watch a film
- Play an online game

Being developed or new on the market

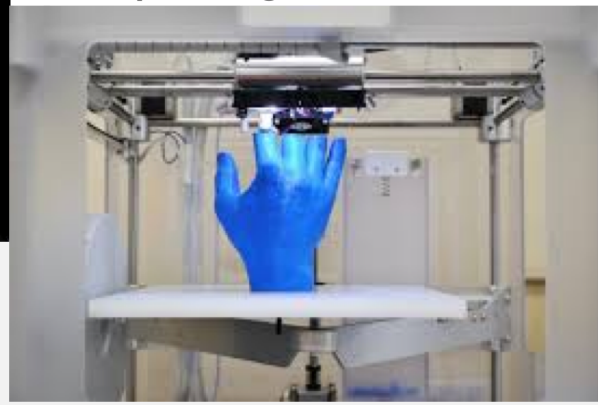
Robotics

Artificial intelligence

Virtual reality

Self driving cars

3D printing



Internet of Things (IoT)

Quantum computing

Metadata & analytics

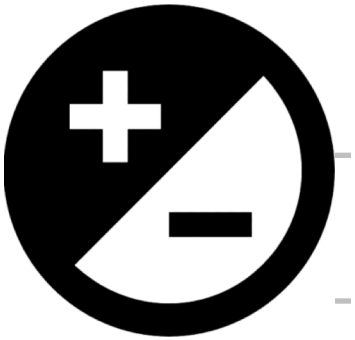
Bioengineering

Digital currencies and blockchain

Pluses & minuses

See there are advantages and risks

For example



Connection	Inability to change
Efficiency	**People not ready and skilled**
Improve lives	Not able to capture benefits
New opportunities	**Inequality may grow**

7 forerunners in the world

Finland
Switzerland
Sweden
Israel
Singapore
Netherlands
United States

→ generating economic impact from investments in ICTs

According to the World Economic Forum's *Global Information Technology Report 2016*.

Understanding the system

For nearly a decade, we have been talking about the opportunities technology gives us...

to unlock effective citizen service delivery,

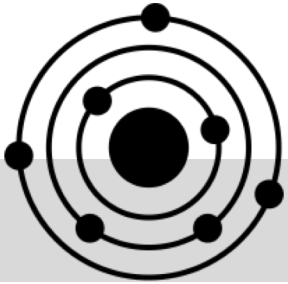
enhance customer experience

and bring about innovative solutions

for a better life for all

A number of things were not known at the time

More importantly the societal aspect was largely missed



Today addressing youth unemployment & harnessing human innovation forms part of the whole

Some threats and opportunities…

Increase of mobile and internet use comes with own threats – cybersecurity – **become a massive global problem. We need the e-skills to combat this.**

Cybersecurity: protecting organisations and their customers' data, assets and reputations. Also fundamental to successful digital transformation.

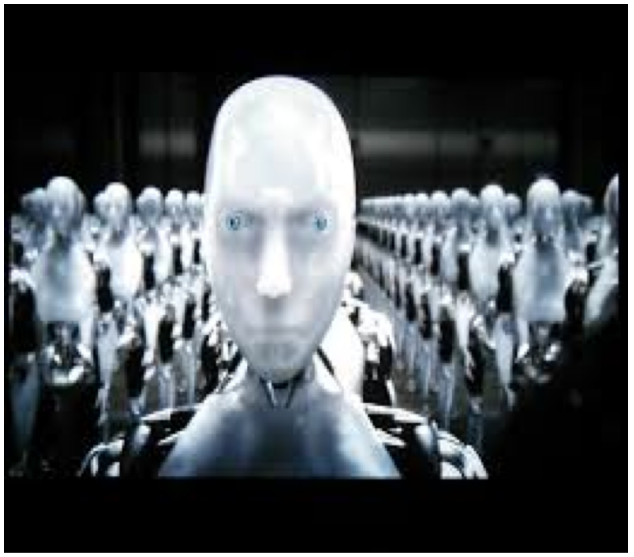
Digital skills enable services growth.
Service industries require digital skills as part of transitioning its population from low-skill and low-pay jobs to high-skill and high-pay jobs.

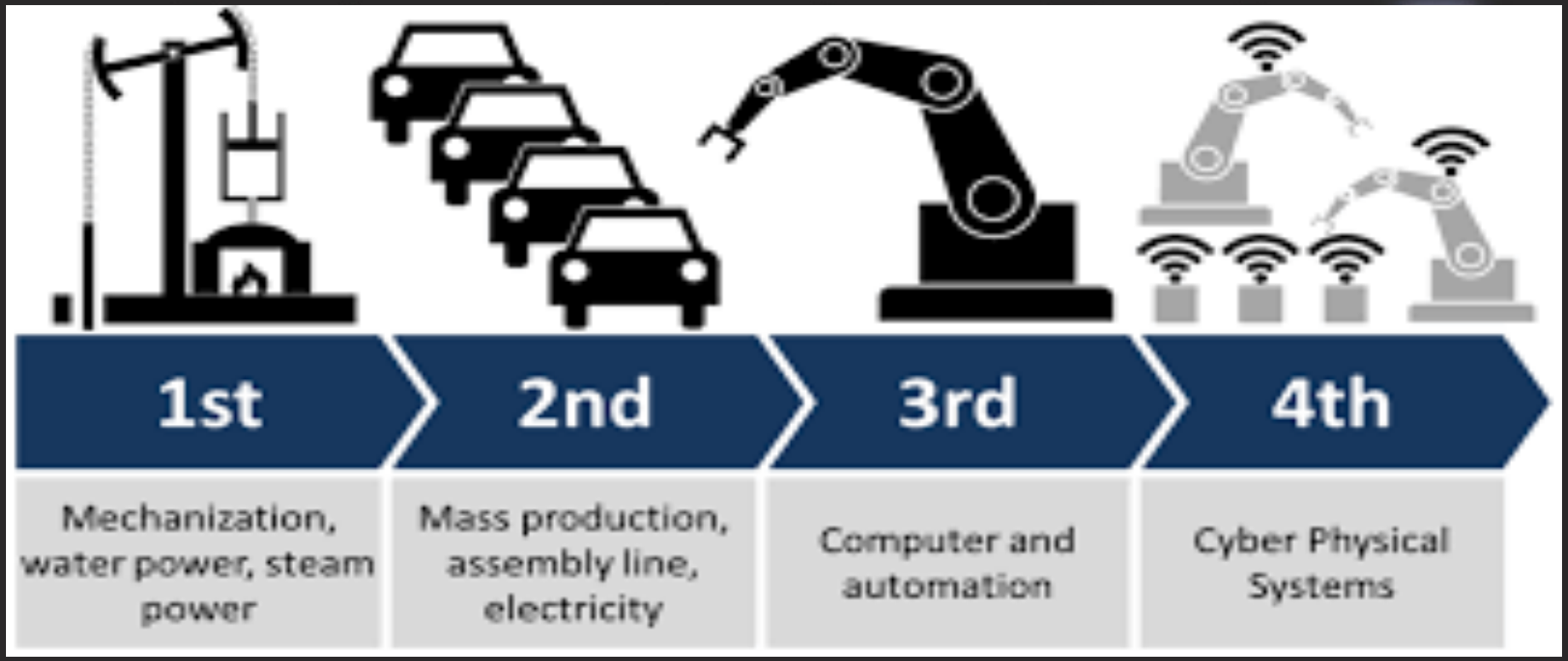
Data gathering

"Going forward, it will be important to reinforce data gathering efforts in order to more closely track the distributional impacts of the current transformations.

This will make it possible to shape the digital economy in a way that delivers broadbased gains."

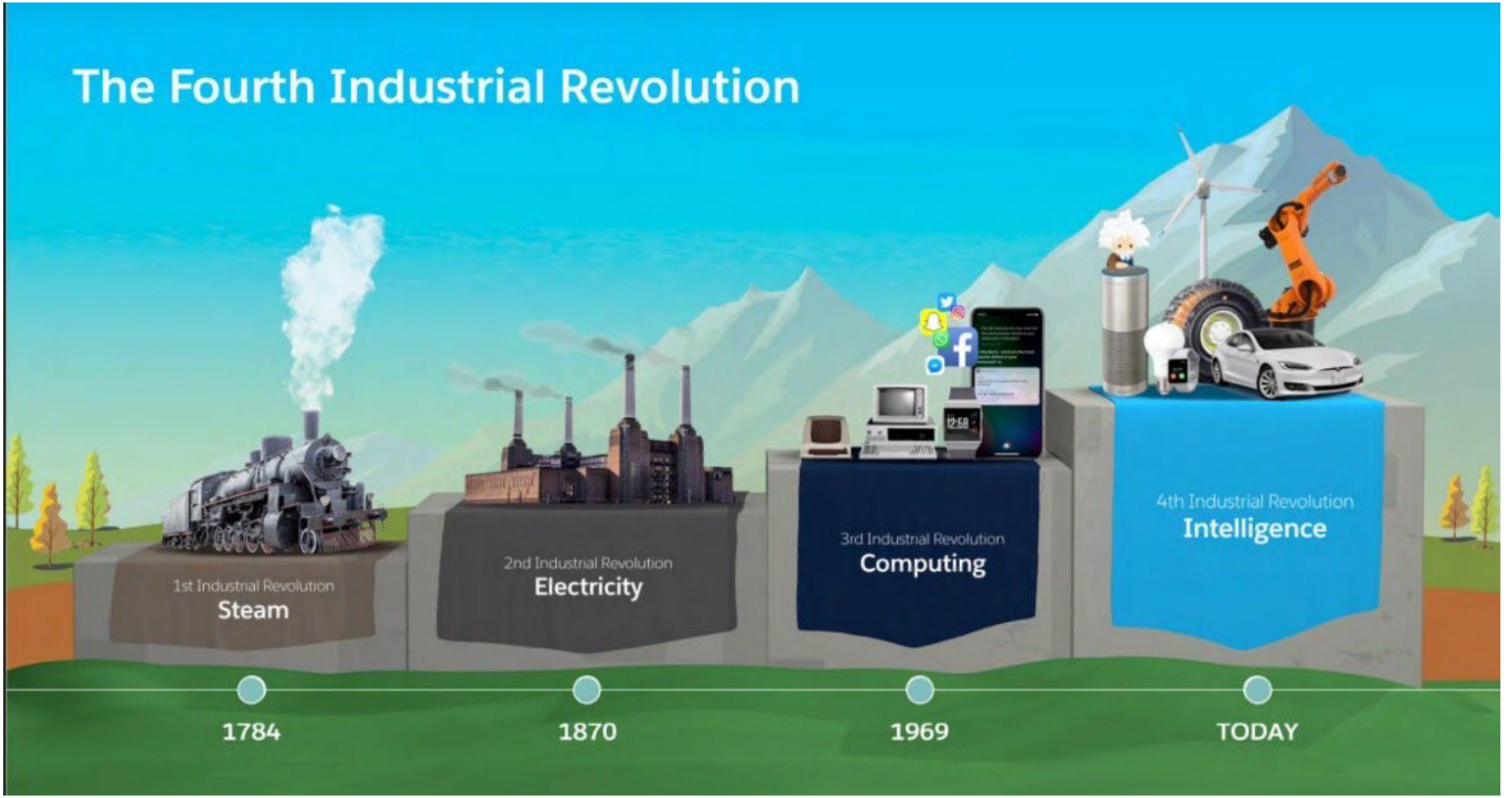
Silja Baller, World Economic Forum



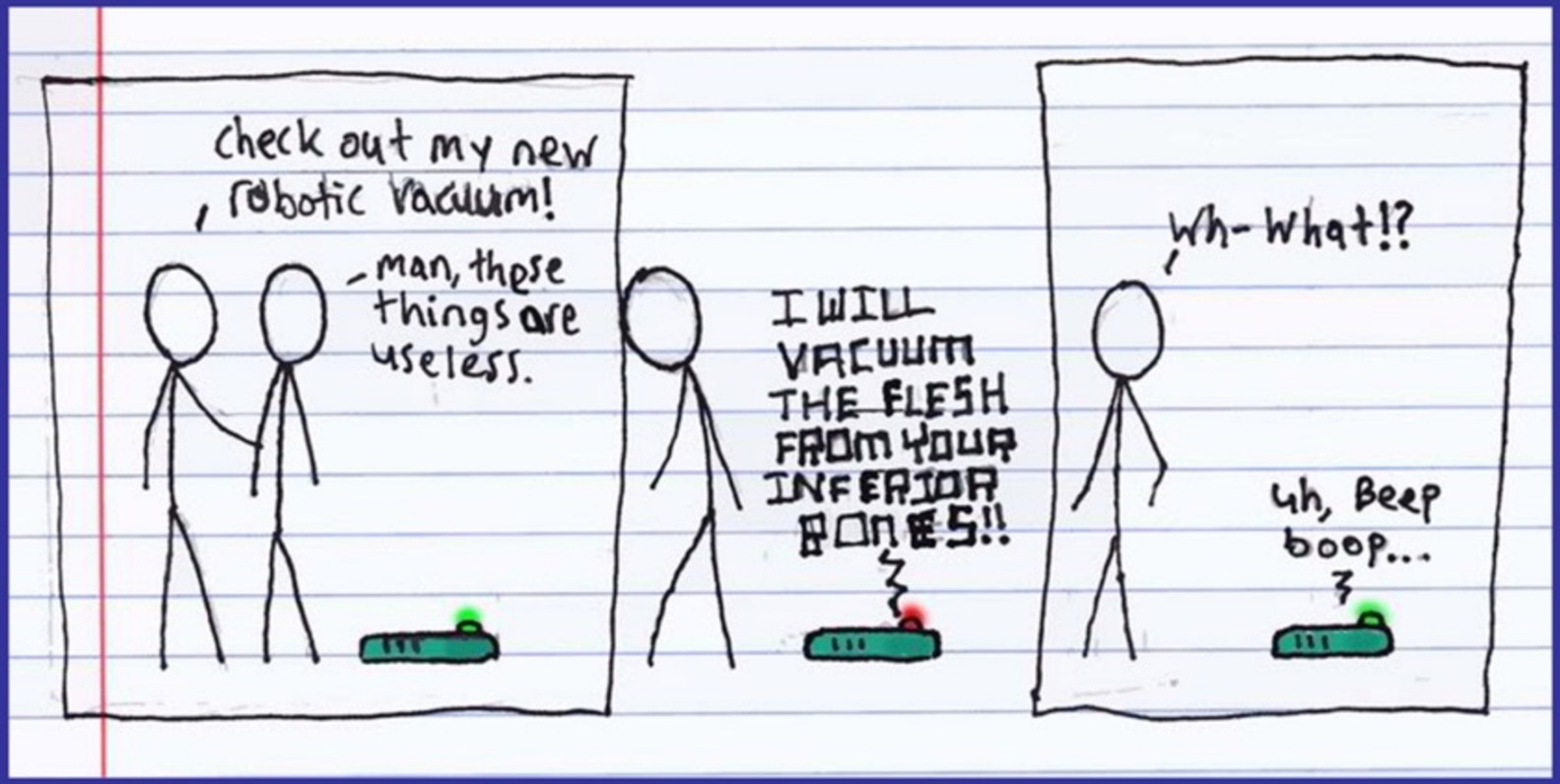


World leaders are predicting our entrance in the 4th industrial revolution lead by

Artificial Intelligence


The Fourth Industrial Revolution
1st Industrial Revolution
Steam
2nd Industrial Revolution
Electricity
3rd Industrial Revolution
Computing
4th Industrial Revolution
Intelligence
1784
1870
1969
TODAY

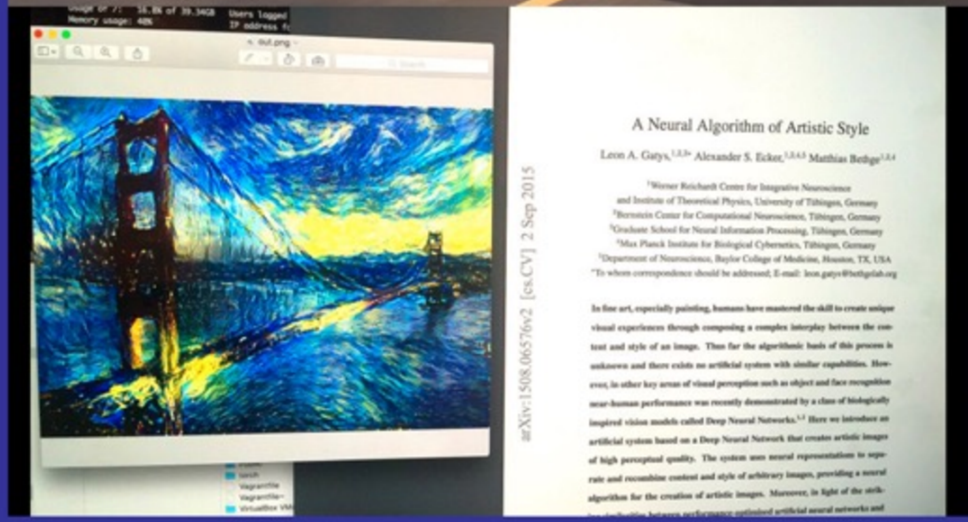
AI can already do more than that...



Drive cars

Drive cars

Make art



A Neural Algorithm of Artistic Style

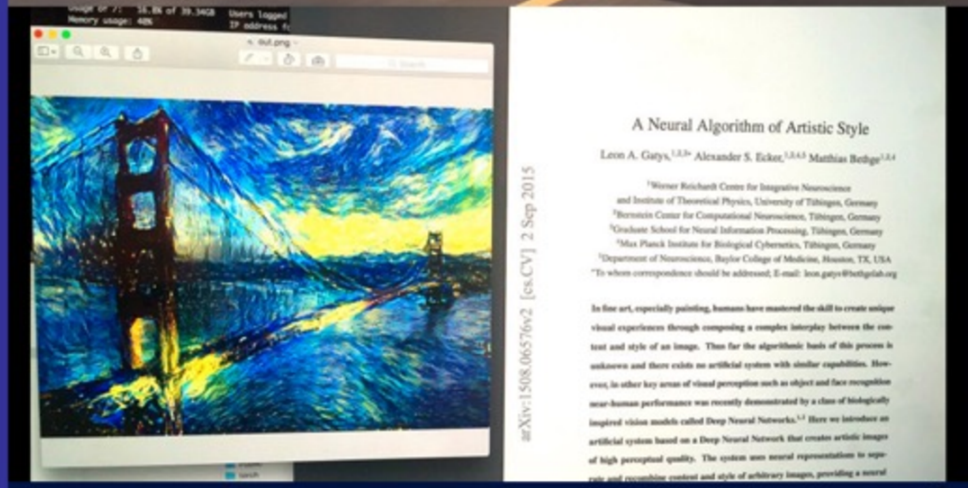
Leon A. Gatys,[1,2,3*] Alexander S. Ecker,[1,2,4,5] Matthias Bethge[1,2,4]

[1]Werner Reichardt Centre for Integrative Neuroscience and Institute of Theoretical Physics, University of Tübingen, Germany
[2]Bernstein Center for Computational Neuroscience, Tübingen, Germany
[3]Graduate School for Neural Information Processing, Tübingen, Germany
[4]Max Planck Institute for Biological Cybernetics, Tübingen, Germany
[5]Department of Neuroscience, Baylor College of Medicine, Houston, TX, USA
*To whom correspondence should be addressed; E-mail: leon.gatys@bethgelab.org

In fine art, especially painting, humans have mastered the skill to create unique visual experiences through composing a complex interplay between the content and style of an image. Thus far the algorithmic basis of this process is unknown and there exists no artificial system with similar capabilities. However, in other key areas of visual perception such as object and face recognition near-human performance was recently demonstrated by a class of biologically inspired vision models called Deep Neural Networks.[1,2] Here we introduce an artificial system based on a Deep Neural Network that creates artistic images of high perceptual quality. The system uses neural representations to separate and recombine content and style of arbitrary images, providing a neural algorithm for the creation of artistic images. Moreover, in light of the strik-

Drive cars

Make art



A Neural Algorithm of Artistic Style

Leon A. Gatys,[1,2,3*] Alexander S. Ecker,[1,2,4,5] Matthias Bethge[1,2,6]

[1]Werner Reichardt Centre for Integrative Neuroscience and Institute of Theoretical Physics, University of Tübingen, Germany
[2]Bernstein Center for Computational Neuroscience, Tübingen, Germany
[3]Graduate School for Neural Information Processing, Tübingen, Germany
[4]Max Planck Institute for Biological Cybernetics, Tübingen, Germany
[5]Department of Neuroscience, Baylor College of Medicine, Houston, TX, USA
*To whom correspondence should be addressed; E-mail: leon.gatys@bethgelab.org

In fine art, especially painting, humans have mastered the skill to create unique visual experiences through composing a complex interplay between the content and style of an image. Thus far the algorithmic basis of this process is unknown and there exists no artificial system with similar capabilities. However, in other key areas of visual perception such as object and face recognition near-human performance was recently demonstrated by a class of biologically inspired vision models called Deep Neural Networks.[1,2] Here we introduce an artificial system based on a Deep Neural Network that creates artistic images of high perceptual quality. The system uses neural representations to separate and recombine content and style of arbitrary images, providing a neural

arXiv:1508.06576v2 [cs.CV] 2 Sep 2015

Beat humans at Go

And will soon take over your job...

Governments are starting to prepare for this Tsunami.

The White House recently released a report

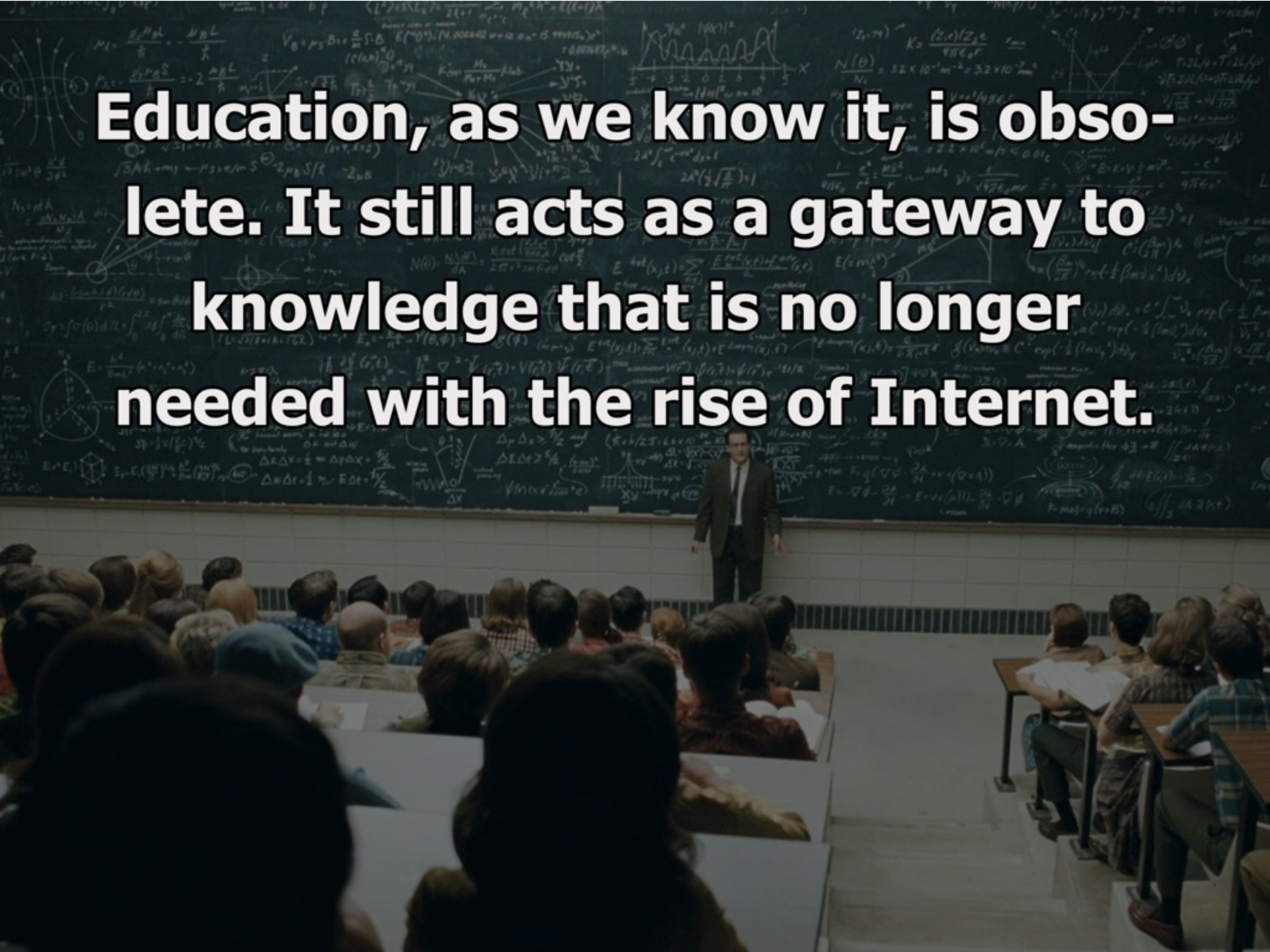
Estimating that

83%

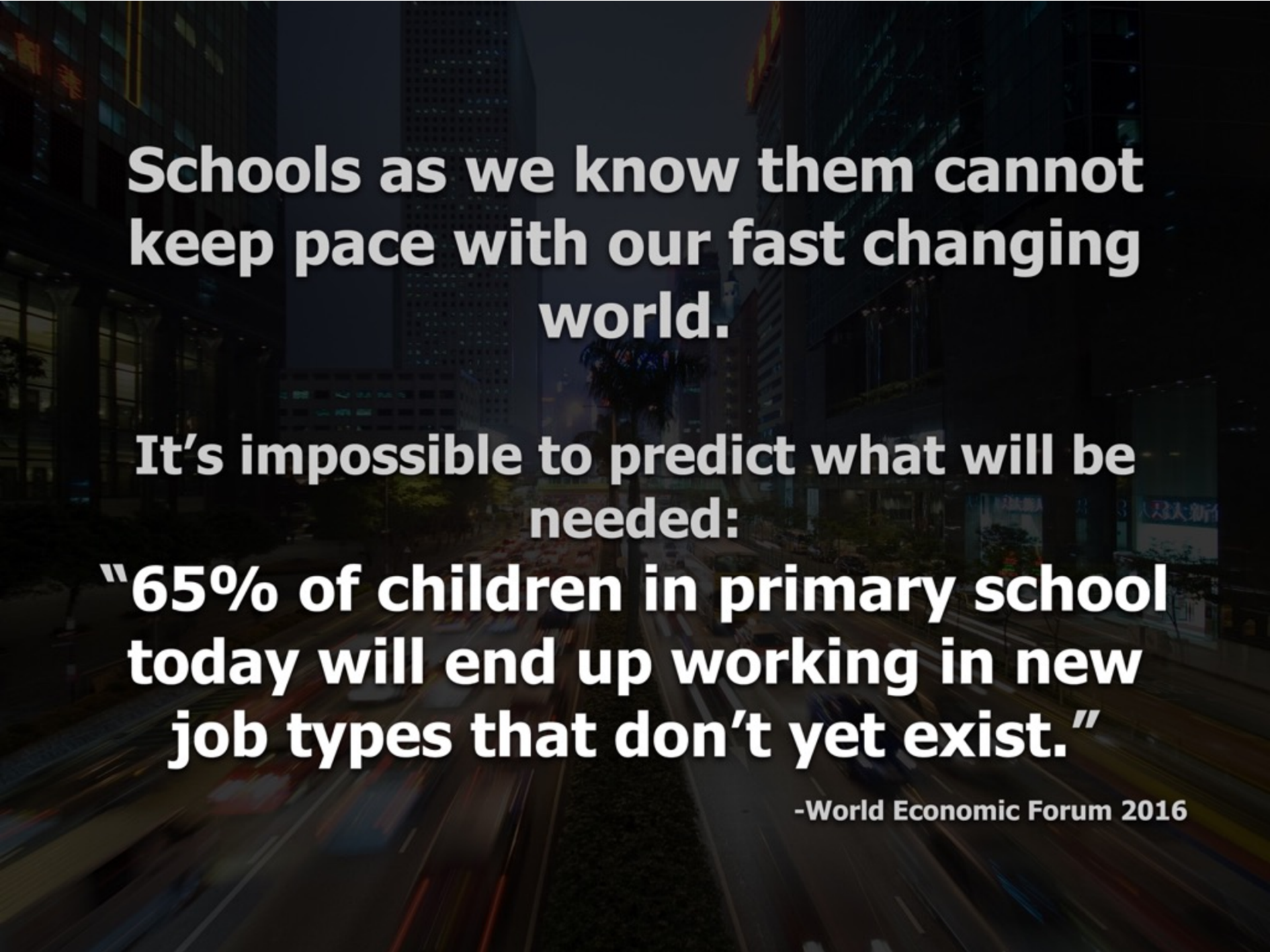
of U.S. low wage jobs will be

AUTOMATED


That represents
66 Million Jobs
Affecting 62%
of American Workers.


Education, as we know it, is obso-
lete. It still acts as a gateway to
knowledge that is no longer
needed with the rise of Internet.


Schools as we know them cannot keep pace with our fast changing world.


Schools as we know them cannot keep pace with our fast changing world.
It's impossible to predict what will be needed:
"65% of children in primary school today will end up working in new job types that don't yet exist."
-World Economic Forum 2016

To be successful
professionals will need 3 important skills:

To be successful
professionals will need 3 important skills:

Complex Problem Solving

To be successful
professionals will need 3 important skills:

Complex Problem Solving

Critical Thinking

To be successful
professionals will need 3 important skills:

Complex Problem Solving

Critical Thinking

Creativity

Individuals will have to quickly adapt to take on new opportunities; they will no longer have a single career, but multiple careers that span different areas of expertise, which require them to master completely different sets of skills.

Critical skills needed

Influence curriculum

Influence approaches to teaching & learning

New skills and competencies required

- Critical thinking
- Communication
- Collaboration and teamwork
- Complex problem solving
- Creativity
- Emotional intelligence
- Global awareness
- Financial, economic, business and entrepreneurial literacy
- Civic literacy
- Health literacy
- Environmental literacy
- Computational thinking
- Judgement and decision making
- Service orientation
- Negotiating
- Cognitive flexibility

The 4th Industrial Revolution

Historical Industrial Revolutions:

1st: 1784
Steam, water, mechanical production equipment

2nd: 1870
Division of labour, electricity, mass production

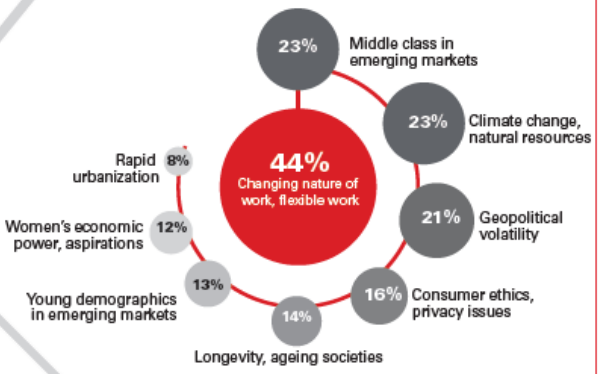
3rd: 1969
Electronics, IT, automated production

4th: ??
Cyber-physical systems

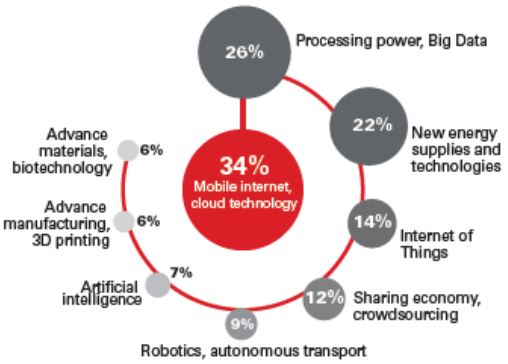
Source: World Economic Forum

Drivers of 4th Industrial Revolution:

Demographics & Socio Factors



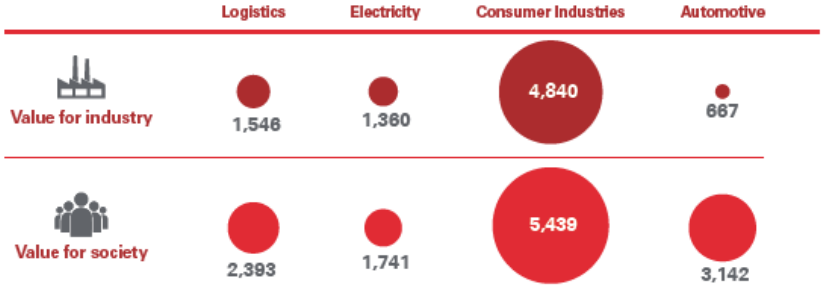
Technological Factors



Source: World Economic Forum, Future of Jobs Survey 2016

Impact on Key Industries:

Impact of Digital Transformation until 2025 (USD BN)



Source: World Economic Forum, Accenture analysis

GCC Employment Outlook Current Workforce (000s)

Source: World Economic Forum

Future Workforce Strategies:

Share of respondents pursuing strategy (%)

65% Invest in reskilling current employees

39% Support mobility and job rotation

25% Collaborate, educational institutions

25% Target female talent

22% Attract foreign talent

22% Offer apprenticeships

14% Collaborate, other companies across industries

12% Collaborate, other companies in industry

12% Target minorities' talent

11% Hire more short-term workers

Source: World Economic Forum, Future of Jobs Survey 2016

So how can we apply this to better prepare our future workforce?