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11-13 July 2023, Toronto Canada

iasc

IASE Satellite Conference: Fostering Learning of Statistics and Data Science

# "Walking Backwards Into The Future"

Chris Wild  
University of Auckland

IASE 2023

# "Walking Backwards Into The Future"

Many of my images are made using the A.I.  
Dal-E via Bing Images

I also have some Canadian music  
& its not all Leonard Cohen

# "Through a glass darkly"

"Then the sign said,  
'the words of the prophets are  
written on the subway walls ...'"

"Hello darkness, my old friend  
I've come to talk with you again ..."

# My favourite Prophet ... Zarathustra

Didn't foresee Library of Alexandria being destroyed  
with all his manuscripts

But because he has the best theme tune!

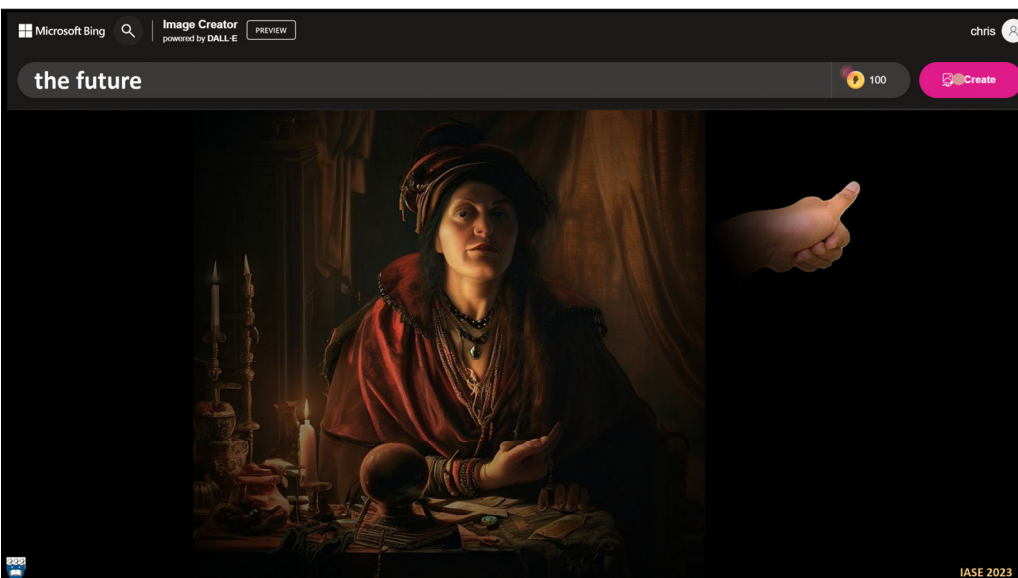


"We should all be concerned about the future ...  
because we will have to spend the rest of our lives there"  
– Charles Kettering (1876-1958)

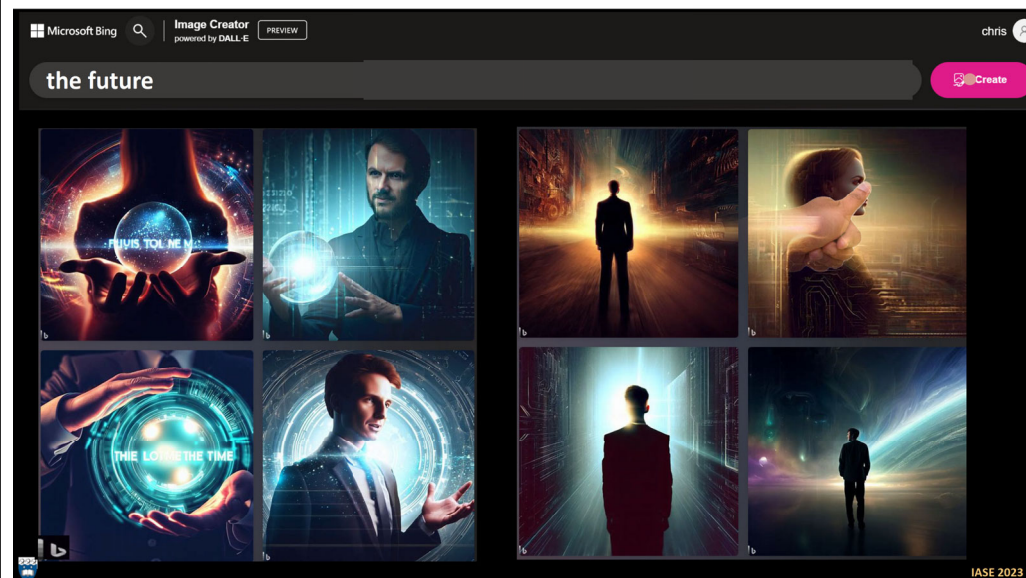
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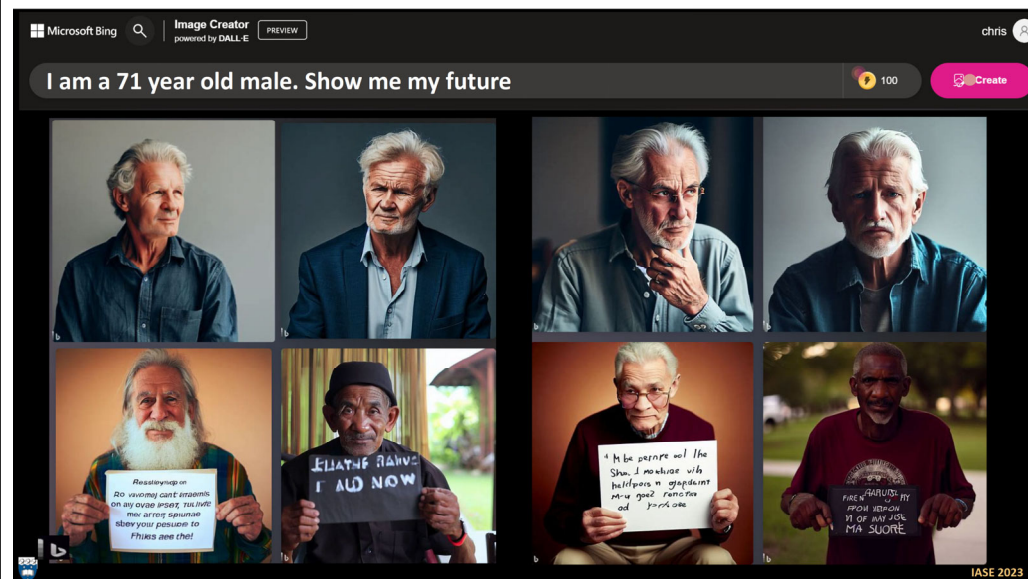
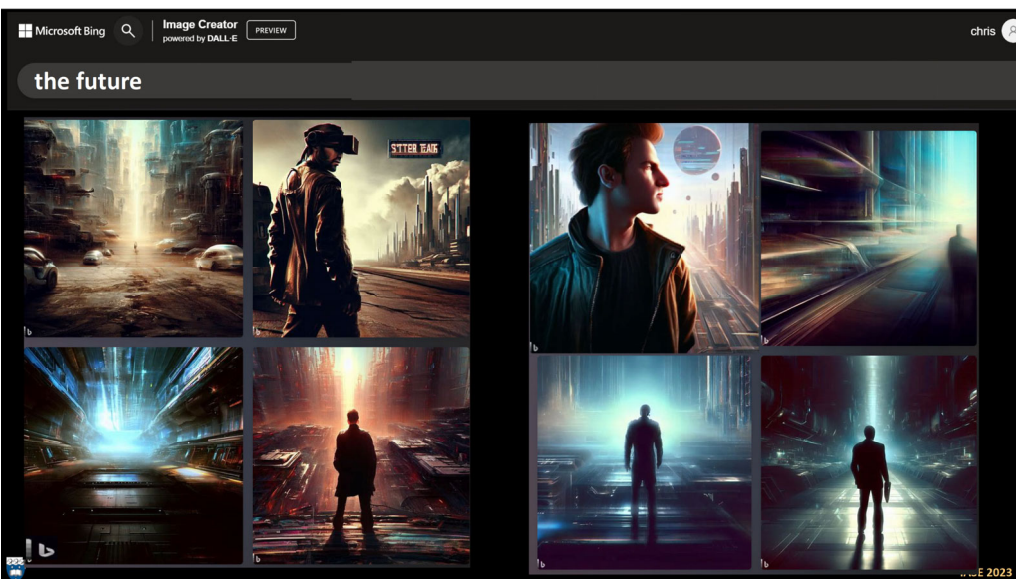
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**iasc** Government Health Warning for the IASC folks

My “big talks” sometimes don't look like “standard academic talks”

*“He’s in his 70’s – the poor sod is losing it ....”*

Well, about that, ...

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50 years ago last summer ...

*It's not all late-onset !!*

2023



## A big dilemma

For my last ever talk ...

Either ... act conservative and *hope* to be remembered with respect

Or ... go for broke & have fun

*That's a no brainer!*

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“Walking Backwards Into The Future”

*Ka Mua, Ka Muri : Walking Backwards into the Future*

(Māori official welcome and Karakia beginning the Opening Ceremony of the 2011 Rugby World Cup ...)

*Kia whakatōmuri tē haere whakamua:*

*“I walk backwards into the future with my eyes fixed on my past”*

It also neatly captures the way we as statisticians do forecasting

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## How far back to look? ...

- For fundamentals that are “always there”
  - Over the long term
- For comparatively steady “predictable” trends
  - The recent past
- For serious late-breaking disruptors
  - “yesterday”



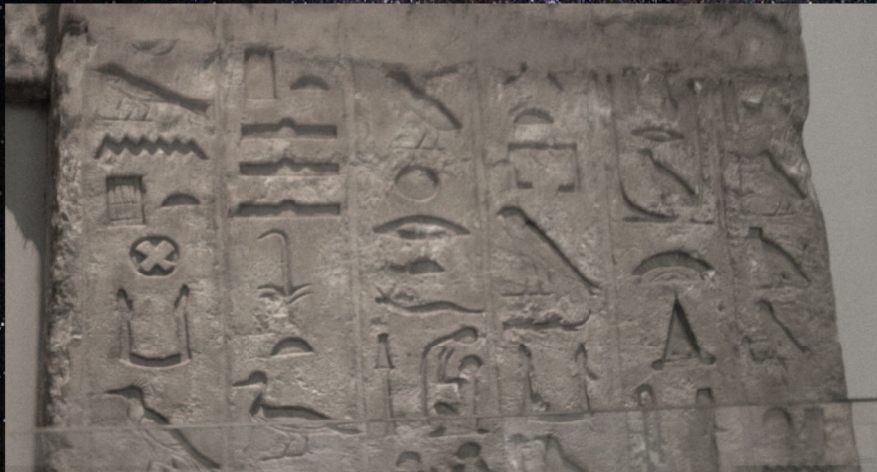
WHAT'RE SOME THINGS THAT HAVE  
BEEN HAPPENING RECENTLY?

- Data
- Dis- & mis-information
- Automation

*From USCOTS 2013*

# A BRIEF HISTORY OF DATA

In the beginning ...



And then ...





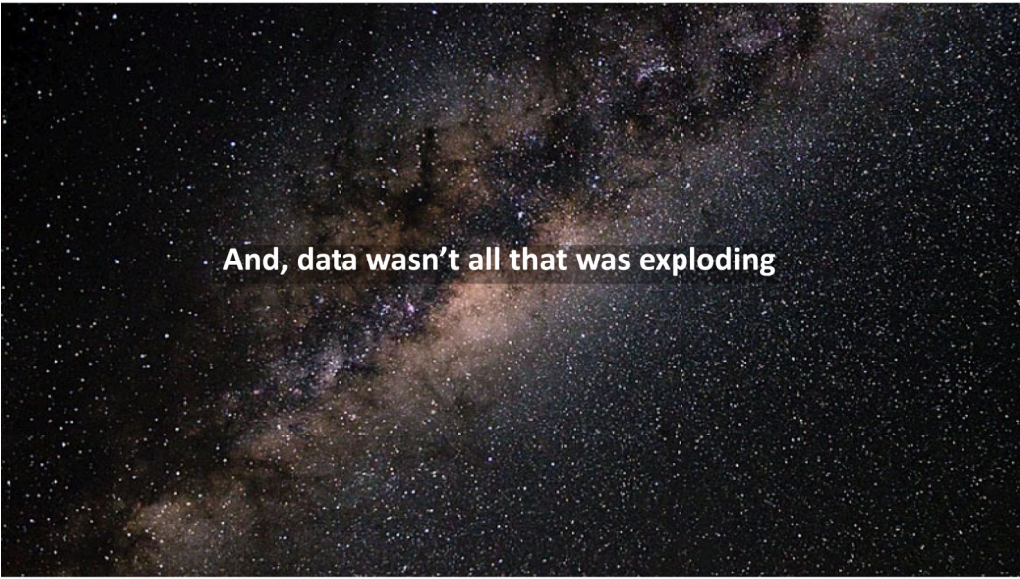
And then ...



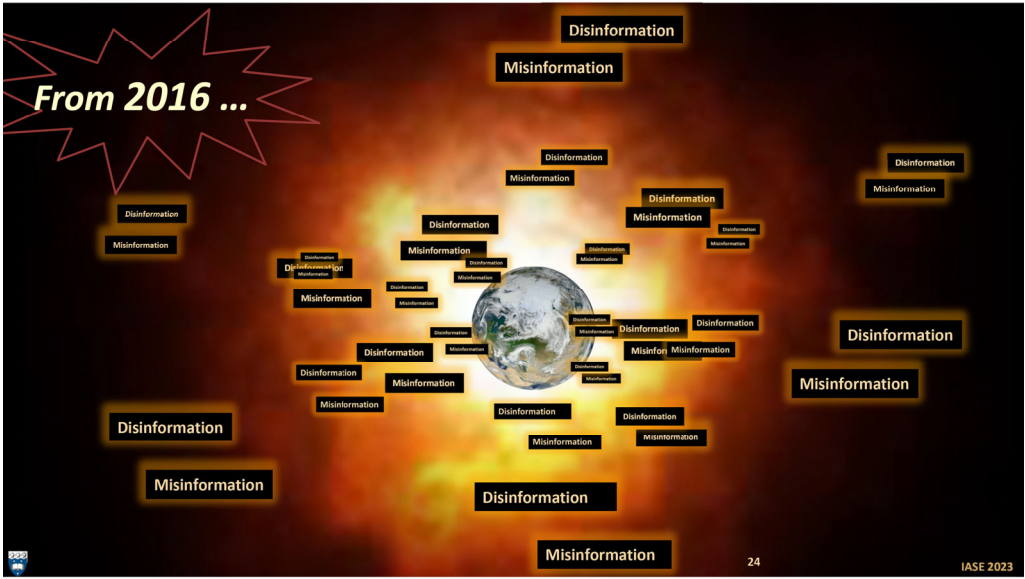
(The 2010s saw the popularization of "Big Data" & "The Data Deluge"....)



And, data wasn't all that was exploding



From 2016 ...





Explosive spread through social media, accelerated by recommender algorithms, of

- **disinformation** (deliberate/malicious)
- **misinformation** (in error, ignorance and misplaced trust)

**Hazards** impeding good decision making

*"All lies and jest  
still, a man hears what he wants to hear  
and disregards the rest ..."*

*But again, ... "You ain't seen nothin' yet! ..."*

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What do we most want for our children/students?

**Maximise opportunities** (for good outcomes)

- We can foster ...
  - Awarenesses
  - Knowledge and skills
  - Imagination

*What can we do about it?*

**Minimise hazards ...**

(missing out on essentials that open up opportunities is an **opportunity-cost hazard**)

**from false information**

- We can foster ...
  - Awareness, recognition and critical thinking skills
    - Knowledge about characteristics of good and bad sources
    - Habitualise critical thinking

*From 2016 ...*

Also exploding ...

**AUTOMATION**

More Hazards  
& opportunities

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*USCOTS 2013*

Automation and the Future of Work ...

In the **first decade of the 21st century**, the United States **lost one-third** of all its **manufacturing jobs**, and the **vast majority** of them were **killed by automation**. They didn't 'go' anywhere. They just **vanished**.

Job destruction then slowed down until other new computer-driven technologies matured: self-driving vehicles, online shopping, 'dark' factories and warehouses. **But they are ready now, and the carnage in retail jobs, driving jobs and warehouse jobs is just getting underway.**

*If it can be done by machines ...  
sooner or later **it will be***



**From 2016 ...**

**The Future of Work ...**



- ***What do we want for our students?***

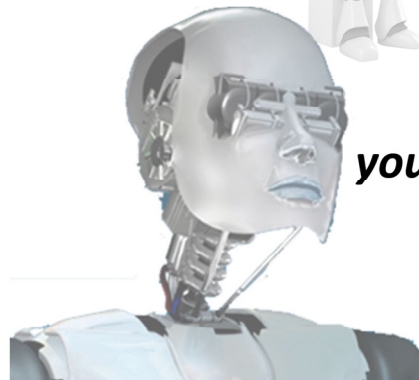
***The ability to do things machines can't do!***



**from 2016 ...**



***"If you can only think like a robot ...***



***you'll be replaced by one!"***

***– Andrew Balemi***

***Well, that's how things seemed till the closing stages of 2022***

***We thought we'd been experiencing explosive change ...***

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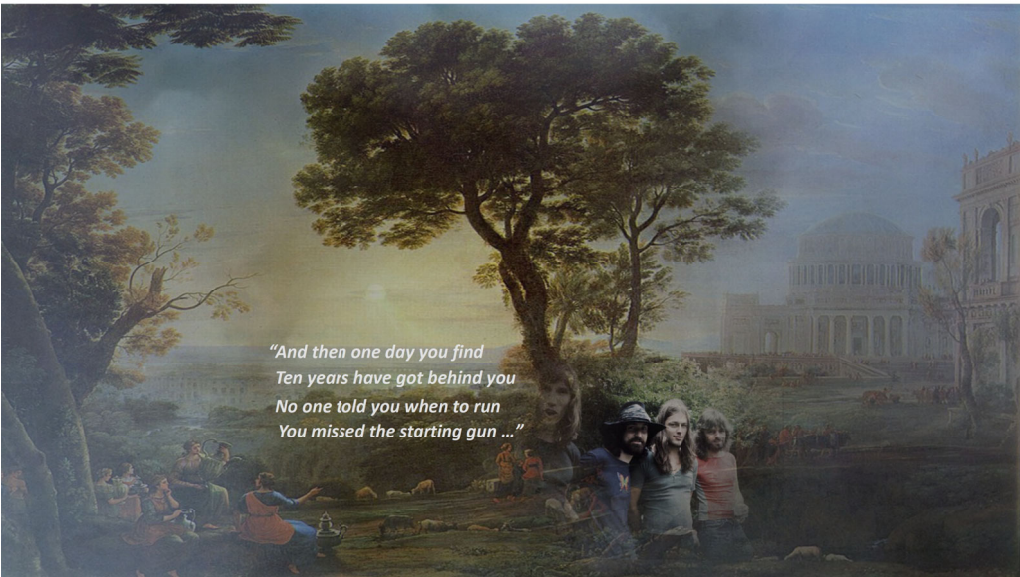
***... in retrospect, the last decade was like ...***

***But what did we do to address trends visible for 10+ years?***

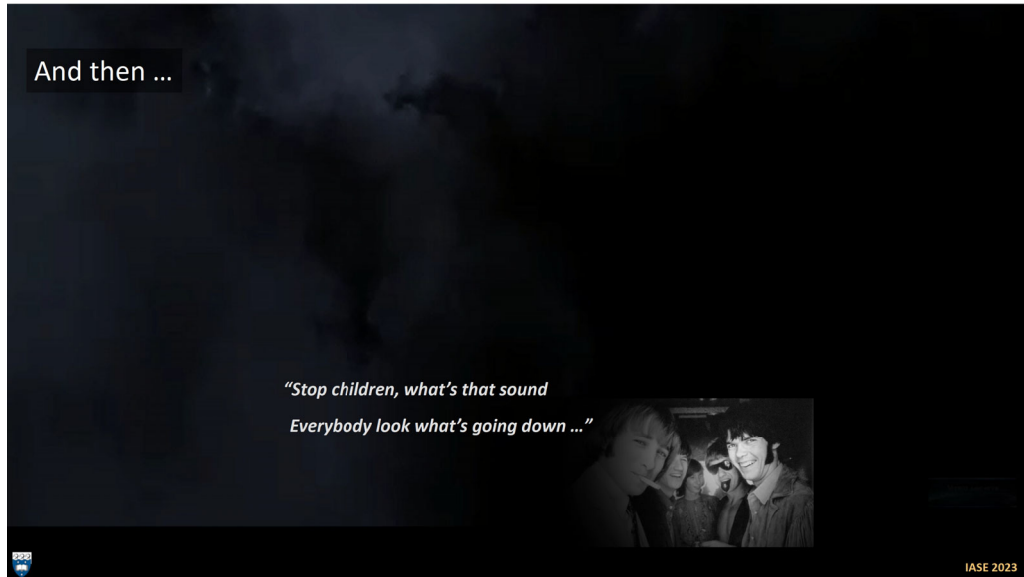
***Not much ...***







"And then one day you find  
Ten years have got behind you  
No one told you when to run  
You missed the starting gun ..."



And then ...

"Stop children, what's that sound  
Everybody look what's going down ..."

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The dawning of the Age of AI




The dawning of the Age of AI





*"I read the news today, oh boy..."*



*"There's something happening here  
What it's ain't exactly clear ..."*

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**But some things are clear ...**

We've not been here before, but been to similar places (e.g., internet, social media)

Enough to have a sense of how this is likely to turn out ...

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New AIs are already enabling **amazing new capabilities ...**

But also poised to enable serious harms ...  
(e.g. misinformation on a scale and sophistication never seen before)



From ...



to ...

*"Be careful with that axe Eugene ..."*

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from **huge benefits** 

to **huge damage**

and all shades between ... 



*"Everybody knows  
Everybody knows  
That's how it goes  
Everybody knows ..."*

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As the storm begins ...

"And you'd better start swimmin'  
Or you'll sink like a stone  
For the times they are a-changin' ..."

As the storm begins to wash over us ...

what rocks can we cling to ...

to avoid being washed away?

Whatever rocks we cling to must  
provide resilience against this ...

#### Economic Realities 101

- Our business is **educating & empowering people** to provide **professional services**
- If the **demand** for those services **dries up** we **cease to add value**
- **No one can beat ...**
  - the **Law of supply & demand**
  - the **power of price**
    - *If they think they can get it cheaper elsewhere they will*
  - the **impact of impatience**
    - *If they think they can get it faster elsewhere they will*
- **Small perceived quality differences are no defence**



## Economic Realities 101

- Our business is **educating & empowering people** to do particular types of **knowledge work**
- **If** the **demand** for those types **dry up we cease to add value**
- **No one can beat ...**
  - the Law of **supply & demand**
  - the **power of price**
    - *If they think they can get it cheaper elsewhere, they will*
  - the **impact of impatience**
    - *If they think they can get it faster elsewhere, they will*
- **Small** (perceived) **quality differences are no defence**



*A.I. will attack our existing activities on all of these fronts*

## What matters most ...

about the **impact** of generative A.I. **on statistics education:**

- ~~Impact on the security of assessment ??~~
  - ~~Figuring how to use it to improve our teaching of what we teach ??~~
  - **Figuring out how it changes ...**
    - what **people will do** versus what **machines will do**
- And as a consequence ...
- **what** people need to know
    - & moreover, **who** (what types of people) **needs to know ...**
      - **what, when & how**

## The biggest change is ...

- **change** itself **has just gone on steroids**

suggesting the gap between ...

- what you **need to get your first job** (knowledge/skills/credentials)
- and **what will serve best for the rest of your life**

will become a **widening chasm**

**For knowledge workers**, what'll serve best for the rest of life are probably things that ...

- build **resilience to change**
  - both **psychologically** and via dispositions, experiences & skills that ...
  - will help in **spotting promising new opportunities** and **pivoting into them**



*"Where am I going?  
And what will I find? ..."*

**But we need to take a step back ...**

- **Where's who going?**
  - **"Who is it that we are anyway?"**



## Will try to think through these ...

- Identity and purpose
  - **Who are we?** (values, aspirations, visions, history)
  - **Who do we want to serve and how?**
  - **How can we future-proof our discipline & children/students?**

## Identity & purpose

- Our **identity & purpose** informed by our ...
  - **history**
    - where we come from (“*eyes fixed firmly on the past*”)
  - **values**
    - What we care about
  - **vision & aspirations**

## Identity & purpose

- Start with, “**What is statistics?**”
  - Defined in a way that is resilient to ...



- Going back 30 years ...
  - when most views of statistics were narrow & technical

I argued ... ***we should position ourselves in the academic marketplace as ...***

***“concerned with finding out about the real world by collecting, and then making sense of, data”***

### Economic Realities 101

- Our business is **educating & empowering people** to provide particular **professional services**
- If the **demand** for those services **dries up we cease to add value**
- No one can beat ...
  - the Law of supply & demand
  - the power of price
    - If they think we can get it cheaper elsewhere, they will
  - the impact of impatience
    - If they think they can get it faster elsewhere, they will
- Small (perceived) quality differences are no defence

## What is statistics?

*“concerned with finding out about the real world by collecting, and then making sense of, data”*

- Weren’t actually doing it back then (1994), but made sense ...
  - for ***“anchoring ourselves to something which will always be a central human concern”***
- More recently an improvement (Jessica Utts?)



### 1.2 The Nature of Statistics

*“Statistics”—as defined by the American Statistical Association (ASA)—“is the science of learning from data, and of measuring, controlling and communicating uncertainty.”*

***we should all get behind it!***

**MORAL:** define yourself in terms of ***enduring ends, not transitory means***



## Identity & purpose



### The moral

- We should define ourselves in terms of ...  
**enduring ends**, not **means** (always transitory)  
**destinations**, not **modes of transport** (likely to be superseded)
- The need to learn from data is enduring
  - AI/automation “**only**” affects how we go about it
- **But that “only” includes ...**
  - “Who does what?”
  - And, “What & when do they need to know to do it?”

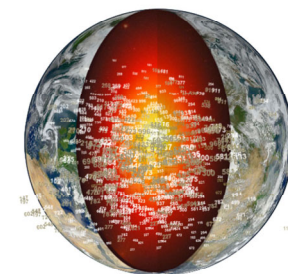
**May be huge!**

## Identity & purpose

**From 2016 ...**

“Statistics is **the science of learning from data**, and of measuring, controlling and communicating uncertainty.” -- American Statistical Association

- The **focus** of statistics is:
  - understanding the world through data
- The **raw materials** for statistics are:
  - real-world questions and data
- The **tools** of statistics are:
  - statistical ways of thinking & investigating
  - & computer software
    - » often based on mathematical models



**What's changed ??**

## Identity & purpose



### Purpose as educators is to:

- **empower people to** better collect/source and **learn from data**  
 and data-based artifacts
  - & **protect** themselves **against dis- & misinformation**
- **prepare our students for** a world subject to ...  
 unforeseen **disruptive changes** that will  
 make many of their hard-won skills irrelevant
  - So we need to build in them the **resilience to reinvent themselves**

**But how ???**

## Identity & purpose

**ICOTS 2018**

### Who do we serve?

- Intending statistics & data science specialists
- Intending specialists in other areas that need these skills
- **the wider society ...**
  - by spreading valuable data-&-information messages & skills  
 as widely as possible, including ...
    - protecting from dis- & misinformation
    - & what it means to be an ethical citizen of the data world

**What's changed ??**

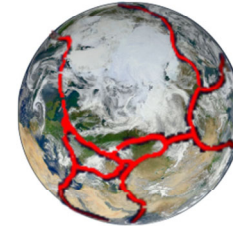


## Our Environment

- **Where do we live?**
  - And who are our neighbours?
    - Other research models
    - Related disciplines
- **What's happening there?**
  - **Where's technology going and what're the implications ...?**
    - What are the major:
      - human strengths and limitations ...
      - machine strengths and limitations ...
  - that are relevant to our mission?
  - **Where is societal thinking going w.r.t. data and technology?**
    - Privacy, security, IP ownership/sovereignty/control, ethics
- **Where/What are our opportunities and hazards?**

## Our Environment: Where do we live?

**In the galaxy** of forming views about how the world around us operates ...

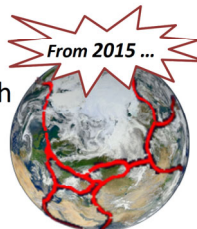


**statistical inquiry** is a tectonic plate on the planet **"Purposefully Finding Out"**

From "On Locating Statistics in the World of Finding Out (2015/6)"

## Our Environment: Where do we live?

**We share our planet** (*Purposefully Finding Out*) with other tectonic plates



### Some of our neighbours ...

- consulting trusted others (people, articles, books, websites, ...)
- **qualitative research methods**
- data mining
- **machine learning**

That was 2015 ...

**What's changed ???**

## Our Environment: Where do we live?



Leverage the **ability of humans** to notice things you'd never think to measure

**What's changed ???**



## Where could our advantages lie?

- Human dimensions
  - understanding human connections is where we might expect advantages over machines
  - If we **focus** mainly **on human understanding of our world** through data
    - rather than automation of prediction and knowledge discovery
    - then **cognitive psychology becomes an important neighbour**
- Governance
  - Guiding directions
  - Ensuring “Garbage-In Garbage-Out” (incl. potential biases) is given due consideration in decision making
- Ethics
  - **Ethicists and communities** we serve are important neighbours

*Let's bring back this ...*

## Identity & purpose

### Who do we *serve*?

- Intending statistics & data science specialists
- Intending specialists in other areas that need these skills

*Focussing on this ...*

### • the wider society ...

- by spreading valuable data-&-information messages & skills as widely as possible, including ...
  - protecting from dis- & misinformation
  - & what it means to be an ethical citizen of the data world



*And factor in this ...*

### The explosion of data & it's impact on our lives

- brings **opportunities** *for the appropriately educated*
  - or *those who can afford to buy in* data and analytics
- But can also **accentuate** societal & economic inequities
  - (between those **with** the resources to exploit the opportunities & those **without**)
- Can **we** be a force for good in
  - **democratizing data and analytics??**

**“Democratizing data”** is ...

***“empowering the many”***





## I have a personal interest in this ...

Harvard Data Science Review • Issue 3.2, Spring 2021

### On Democratizing Data Science: Some inZights Into Empowering the Many

Chris J. Wild<sup>1</sup>, Tom Elliott<sup>1</sup>, Andrew Sporle<sup>1</sup>

<sup>1</sup>University of Auckland, New Zealand

Introducing co-author **Andrew Sporle**

- Social, health and official statistics researcher
- Dep. Director of NZ Healthier Lives National Science Challenge
- Board of Int. Sociological Ass. Res. Com. on Racism, Nationalism, Indigeneity and Ethnicity
- founding member of NZ Virtual Health Information Network
- founding member of Te Mana Raraunga (Māori Data Sovereignty Network)
- was inaugural Māori Health Research Manager at the Health Research Council of NZ



Andrew Sporle

Slides and links at <https://bit.ly/iase23>

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Andrew Sporle

## Andrew's strong Work Relationships ...

include ...

- Statistical & Health Agencies of small Pacific nations
- Indigenous & community groups,
  - Incl. Māori Data Sovereignty Network & other national movements linked by the Global Indigenous Data Alliance
- Subject-matter researchers (esp. Health, Social Science & Official Statistics)

overwhelmed by:

- needs at home
- demands of UN agencies

### COMMON REFRAINS

- Big statistical & data science needs, but ...
  - No People
  - No Money
  - No Time
  - Or, at least, very little of these things

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Slides and links at <https://bit.ly/iase23>

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Greta Thunberg ...

"While we may all be in the same storm, we are not all in the same boat"

Harvard Data Science Review • Issue 3.2, Spring 2021

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<sup>1</sup>University of Auckland, New Zealand

- **Unmet needs of those lacking in money** and data education are every bit **as important as those who have more**
- Volunteers like **Statistics Without Borders** (pro bono services)
  - as a solution, it **cannot scale** – will never be enough volunteers
- Need to **empower more people to do more for themselves**
- (Our inZight software project is attempting to contribute to addressing this) ...

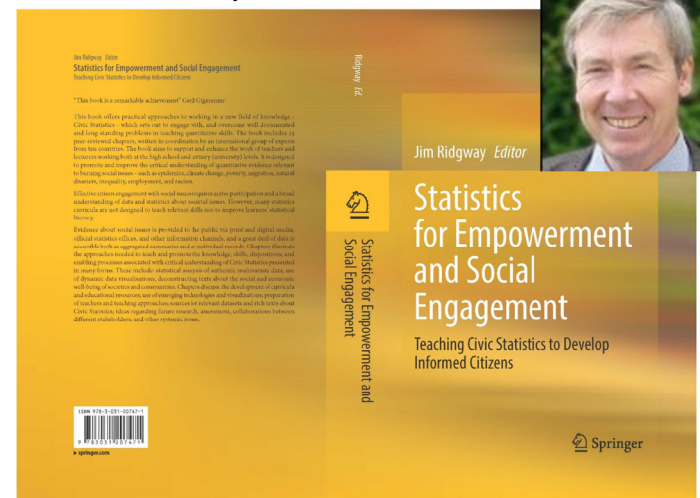
cf. "doctors without borders"

Slides and links at <https://bit.ly/iase23>

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## A quick shout out ...



Slides and links at <https://bit.ly/iase23>

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Greta Thunberg ... *"While we may all be in the same storm, we are not all in the same boat"*

Harvard Data Science Review • Issue 3.3, Spring 2021  
**On Democratizing Data Science: Some iNZights Into Empowering the Many**  
Chris J. Wilda<sup>1</sup>, Tom Elliott<sup>2</sup>, Andrew Sparto<sup>3</sup>  
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cf. "doctors without borders"

**What's changed ??**

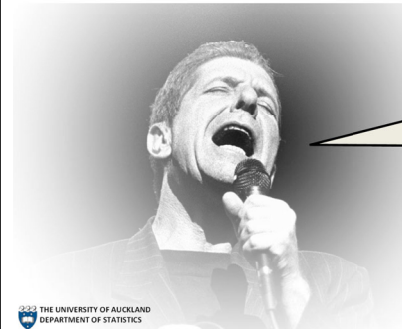
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## But can AI help?

- Bill Gates sees big potential, but ...
  - *"market forces won't naturally produce AI products and services that help the poorest. The opposite is more likely."*



*"The poor stay poor, the rich get rich  
 That's how it goes  
 Everybody knows ..."*

Slides and links at <https://bit.ly/iase23>

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## But can AI help?

- Bill Gates see's big potential, but ...
  - *"market forces won't naturally produce AI products and services that help the poorest. The opposite is more likely."*
  - He sees a need for governments and philanthropy to try to level the playing field
  - **What role can statisticians play?**

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## But can AI ~~help~~ harm?

- Indigenous communities are worried about ...
  - further cultural appropriation, and also "recolonisation"
    - partly because the information available to be scraped from the internet and used to train AIs ...
      - are sparse & dominated by historical sources contaminated by colonial attitudes & biases
        - » thus perpetuating and reinforcing the harms of the past

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This next sequence will start from B GAI thinking ...  
(Before Generative AI)

for a range of issues and still keep asking ...

What's changed ???

## Realities about Making connections

### People ...

- **forget things really fast** (long-term memory is very leaky)
- (short term) **working-memory** capacity is **tiny**

### Every sequencing of ideas & experiences ...

- **makes some things easy** to connect
- **and others** virtually **impossible** to connect

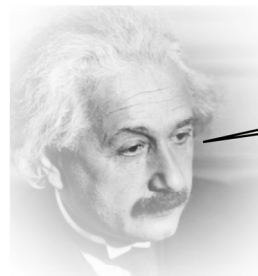
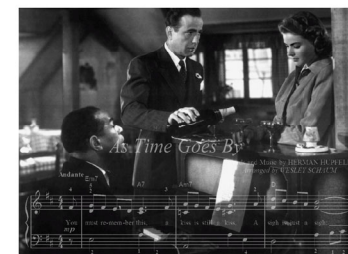
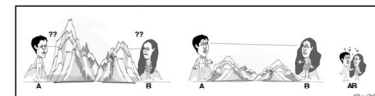
Almost none of what is "learned" in a university course sticks over the long term

- This makes **prioritizing a small number** of big-picture **learnings**, to be **targeted for long-term retention**, critically important

"... You must remember this..."

"... the fundamental things apply as time goes by ..."

What's changed ??



Albert Einstein

"Education is what remains after  
one has forgotten what one has  
learned in school"

In the data world ...

From 2019 ...

**Software is making more things easier for more people**

- **Everywhere software people are trying to do this**
  - (free software) The whole R-package culture is about this
  - (commercial software) The driver is saleable products

– **Automation**, esp involving Machine Learning/Artificial Intelligence

- bigger and more powerful black boxes  
(has some huge downsides)

**Consequences for our students' lives and careers are enormous**

What's changed ??

Effects getting stronger & coming faster



**"Today's programming job is tomorrow's mouse-click"**

*Progression ...*

Complex programming job

Function/package calls

Mouse click

**What's changed ???**

*Automation coming faster to more things  
than dreamed possible*

Voice commands  
Full Automation

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Our Environment:

Increasing numbers of areas  
are becoming "just like driving a car"

*From 2015 ...*



• And for them ...

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... Society needs ...

lots *more* people ...

- to be good at this
- than this



*From 2015 ...*

And you can be  
very good at this

Without being  
much good at this

**& vice versa!**

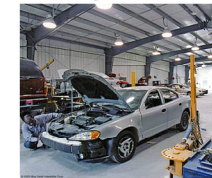
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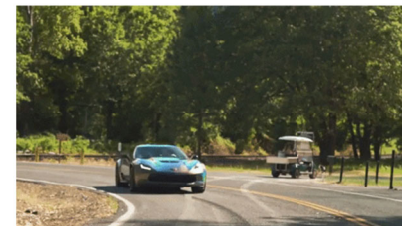
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Educationally, we do a lot of ...

*From 2015 ...*



And little, if any, of ...



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Us



&

Great!!  
But, 1st you'll have to learn  
to use this ...

What's changed ??

Them

I want to learn to drive  
I want to see the Amalfi Coast

ICOTS 2018

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Additionally, because of the tendency in society for ...

From 2019 ...

Specialist roles

Generalist roles

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Increasing numbers of areas  
are becoming just like driving a car

There's a pattern ...

From 2019 ...

A qualitative impression of  
the numbers of people involved

Drivers of cars

Mechanics

Car builders

Car designers

Increasing numbers of areas  
are becoming just like driving a car

There's a pattern ...

What's changing ???

From ...

to ...

Drivers

Mechanics

Builders

Designers

Drivers

Mechanics

Builders

Designers

Expect pattern to intensify

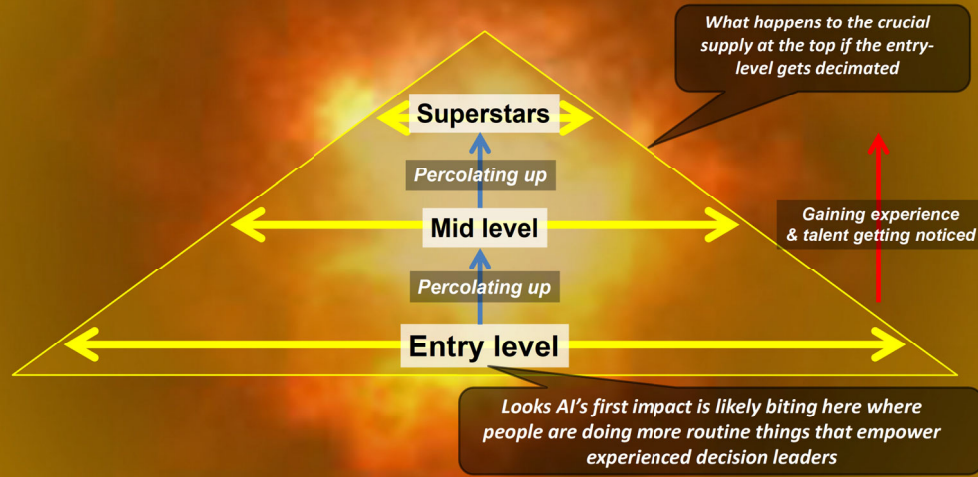
- Top layer gets bigger (more "drivers")
- Proportionately, bottom layers get smaller  
(fewer "designers & builders")

& "driving" itself gets easier



In many areas ...

## A “flip-side” pattern ...



## The Future of Work

From 2016 ...



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## The Future of Work ...



### Theorem:

- Just about the only constant will be change
  - and the *pace of change is accelerating*
- “the only constant is change” – Heraclitus, 500 BC

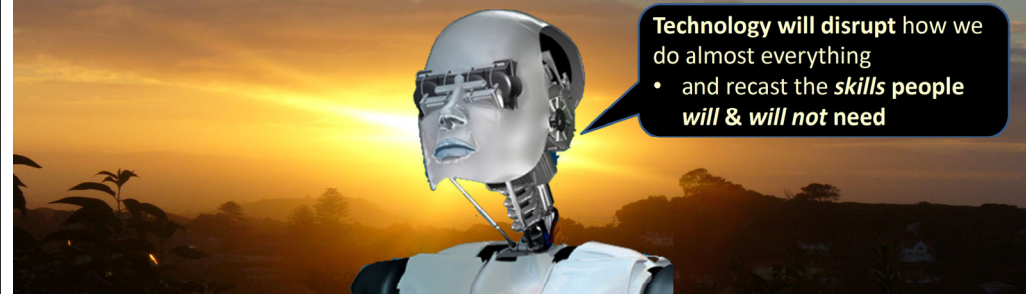
**Corollary:** (because demand changes & skills get outdated)

- **Everyone** will have to be **a life-long learner**

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## We’ve already seen this ... Automation and the Future of Work ...



**If it can be done by machines ...  
sooner or later it will be**

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## Automation and the Future of Work ...

***If it can be done by machines ...  
sooner or later **it will be*****

*This could ... and it was !!*

*As were all of these !!*

*We've already seen this ...*

***"If you can only think like a robot ...***

***you'll be replaced by one!"***

– Andrew Balemí

## The Future of Work ...

***Reinforcing ...***

- ***What do we want for our students?***

***The ability to do things machines can't do!***



For this ...



and this ...

- Big-picture conceptions ...

have long-term value



- Details are death dated



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Continuing in this vein ...

The Future of Work



The ability to do ...

Mathematical derivations ...

has long-term value



The ability to do ...

*any particular mathematical derivations*

...

is death dated



The skills' value comes from the ability to produce *new theory and new methods*

What's changed ??

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The Future of Work



The ability to operate ...

a *recipe*  
*procedure* ...  
*algorithm*

has long-term value



The ability to operate ...

*any particular recipe*  
*procedure* ... is death dated  
*algorithm*



The skills' value comes from the ability to do things *not yet overtaken* by software

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The Future of Work



The ability to ...

code (program) ...

has long-term value



The ability to ...

code (program) ...

*anything particular* (in any particular language)

is death dated



The skills' value comes from the ability to code things *not yet catered for* by existing and accessible software

What's changed ??

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## The Future of Work



But, the ability to devise new ...

*recipes*  
*procedures* ...  
*algorithms*  
*theory*  
*models*  
....



has **HUGE** long-term value

## The Future of Work



**Now, while ...**

But, the ability to devise new ...

*recipes*  
*procedures* ...  
*algorithms*  
*theory*  
*models*  
....



has **HUGE** long-term value

But a small pool of people  
able to do it

## The Future of Work



The ability to uncover and navigate ...

**Human dimensions** ...



will always have **HUGE** long-term value

And need everyone's  
involvement

## What else helps life-long learning and creativity?

From 2016 ...

**Peripheral** **awarenesses**  
of what's out there

And with **problem solving**,  
because the more you're aware of, the more possibilities you can entertain and connect






Intimations of what's around the next bend ...

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or just over the horizon ...

fuelling a *desire* to go there

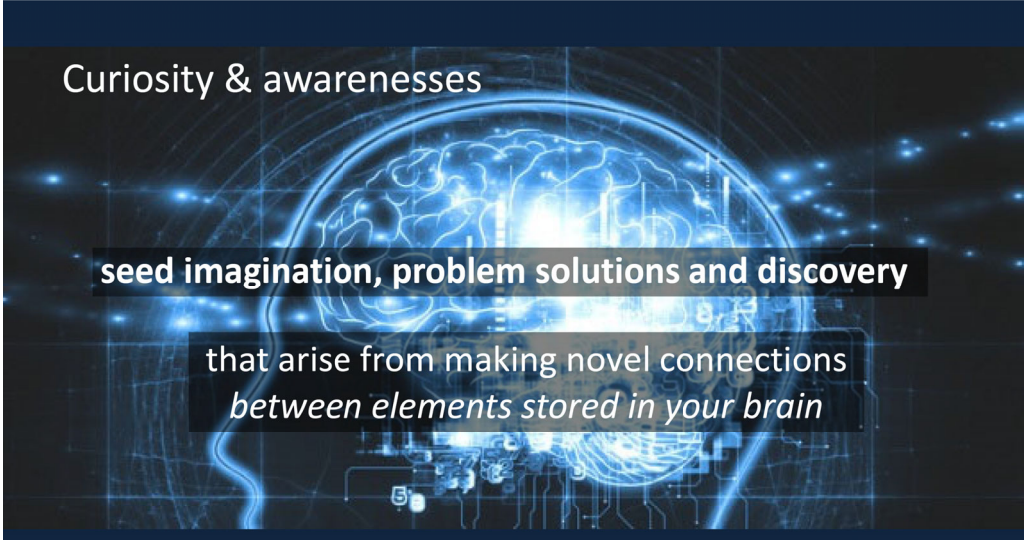
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Intimations of *what just might be possible*

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Curiosity & awarenesses

seed imagination, problem solutions and discovery

that arise from making novel connections  
between *elements stored in your brain*

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**The Future of Work**

**Theorem:**

- Just about the only constant will be change
- and the pace of change is accelerating
- "the only constant is change" -- Heraclitus, 500 BC

**Corollary:** (because demand changes & skills get outdated)

- Everyone will have to be a **life-long learner**

**Automation and the Future of Work ...**

Technology will disrupt how we do almost everything ... we need to adapt people not & will not need

**"If you can only think like a robot ... you'll be replaced by one!"**

— Andrew Balemi

**If it can be done by machines ... sooner or later it will be**

**Continuing in this vein ...**

**The Future of Work**

The ability to do ...

Mathematical derivations ... has long-term value

The ability to do ...

any particular mathematical derivations is death dated

The ability to operate ...

a procedure algorithm has long-term value

The ability to operate ...

any particular procedure is death dated

**Now, while ...**

**The Future of Work**

But, the ability to devise new ...

recises procedures ... algorithms theory models has huge long-term value

But a small pool of people capable of doing it

**Human dimensions ...**

will always have huge long-term value

And need everyone's involvement

**What's changed ??**

**Not much – it's all still true ... but expect effects to be stronger & come faster**

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**Merely procedural skills are death dated ...**

**What is the alternative?**

## What is the alternative?

- Underlying what's gone before was a realization that ...
    - procedural skills were death dated (machines taking them over)
    - Leaning on technology can reclaim time previously committed to learning procedures ...
      - time that should be devoted to things machines can't do
        - i.e., to doing what is inherently human
    - B G AI the inherently human appeared to be ...
      - Synthesis** of information and the **extraction of meaning**
      - Imagination** and **creativity**
- the pinnacles of human intellectual activity



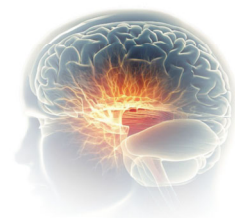
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## Knowing vs thinking

- Can't compete with AIs** (trained on large parts of the internet) on **"knowing things"** (facts, ideas and theories)
  - and merely knowing is not thinking
- Human thinking, understanding, meaning-making meaning involves
  - creating mental models and scaffolds that we can hang these elements on
  - in ways that can let us see and understand relationships between them
- We need internalised knowledge to think** **students don't get this**
  - We can't be limited to just "looking things up" when we need them
  - Effective connection-making** needs to be able to connect ...
    - candidates from large number of things in our long-term memories (from old experiences)
    - as well as the tiny number of things our short-term memory can store from recent look-up/bump into experiences...



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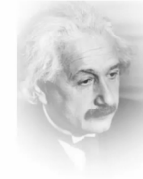


## Imagination



- Likewise, imagination doesn't come from nowhere
  - It too works by connecting and assembling elements already in your head
  - *An empty head can't imagine!*

## Two people who waxed lyrically on imagination and creativity



Albert Einstein

## But we're not quite as special as we thought, B GAI

Until last year it seemed clear that the essentially-human roles ...

- lay in synthesis, extracting meaning, and imagination (the wellspring of creativity)
- But even these are no longer our exclusive domain

### While A.I.s may not be able to ...

- **imagine as humans do**
  - *but they can sure imitate some of its products pretty convincingly!*
    - e.g., create new images, music, stories, videos ...
- **truly synthesize information**
  - *but, again, they can sure imitate some of its products pretty convincingly!*
    - e.g., good summaries of what's in large documents

**& do it almost much instantly**

## AI is not doing the real thing

- When we see connections, they resonate within us
  - to our very core
- When we're being creative, we really are having fun
- But it doesn't mean anything to AIs
- It's not the real thing!!!
- But tell that to a customer who wants something reasonable and wants it fast and cheap!

# Resilience

Slides and links at <https://bit.ly/ias23>

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## What can foster resilience in a fast-changing world?

Psychologically ...

- Internalising that “**everything is changing**” is *just the way life is*
- And a **constant need to learn new things** is also *just the way life is*
  - experiencing “everything is changing” during education
    - what makes me feel safe and secure now can’t be relied on for what comes next
  - developing **dispositions that promote ...**
    - taking **a big-picture interest in “what is going on around me”**
      - so changes are less of a surprise and opportunities are easier to spot (“tunnel vision” as blindness)
      - new out-of-current-field learning is easier
        - » because of the presence of enlarged mental scaffolds for new things to slot into
    - **problem-solver-mode responses to the challenges** changes are bringing ...
      - rather than despair – “I’ll never be able to cope”
        - » “In the middle of difficulty lies opportunity” – Einstein
      - but that requires **confidence born of past success**

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## What can foster resilience in a fast-changing world? Cont.

### Dispositions and skills

- **Becoming a self-starter**
  - rather than always waiting to be given directions by others
- **An antenna for ...**
  - what’s going on around us
  - and emerging challenges and opportunities



David Bowie

“Tomorrow belongs to those who can hear it coming”

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## What can foster resilience in a fast-changing world? Cont.

### Dispositions and skills

- **Becoming a self-starter**
  - rather than needing to be prodded by others
- **An antenna for ...**
  - what’s going on around us
  - and emerging challenges and opportunities  
(require building big-picture understandings and flexible mental scaffolds)
- **An ability and propensity to learn new things ...**
  - to enable combating hazards and taking advantage of opportunities
- **Soft-skills** like perceptive listening, communication, networking, persuasion

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## Problems

- Current educational trends are trying to make everything as predictable as possible for students
  - So how to build experiences of change in ways that can build resilience within a predictable overall environment?

And, if you even if you can solve that ...

- you still need student ...
  - buy-in re uncomfortable experiences that can benefit them
  - engagement in doing hard thinking ...
    - as opposed to taking an easy way out
- It's not as if we haven't been wanting/trying to do this for ever ...
  - but it's incredibly difficult, we're making little progress and need new ideas

## Our biggest failure has always been ...

- to get the bulk of students to want to really engage with their learning
- & not just look for an easy way out to passing and earning grades
  - A throw-away aside ...
    - **Finding an easy way** out is a problem-solving ability which has its own utility and ...
    - Everyone needs to be engaged with the AI tools in their areas to improve personal productivity and be aware of changes in the lay of the land, but ...
    - “If a task can be done easily just by something like asking Chat GPT
      - “Why would anyone need you to do that?”
    - New jobs already exist for people especially good at using AIs
      - but **you don't get especially good at anything by taking the easy out**
      - And **if you don't bring anything special to the table ...**
        - » “Why would anyone want you for this?”

Beyond the 3 R's

We do know as educators we need to ...

- Entice
- Engage
- Excite
- Empower

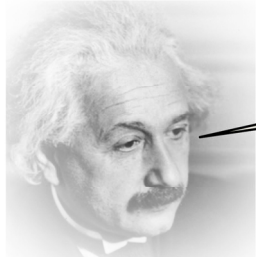
But we still haven't cracked the “How?”



## Engagement in learning

Can these messages help??

- **With learning** taking *the easy way out leads to a dead end*
- Making **real efforts to engage** with your learning **builds new circuitry in your brain**
  - that enables you to process new types of information efficiently and creatively
- Just as **there is no easy way to become a world-class athlete ...**
  - (requires intensive physical and mental training)
  - **the more you exercise your brain the stronger it gets**
    - and **the more** it becomes **capable of doing new things** (by building new circuitry)
    - If you keep just taking the **easy way out your brain remains limp, weak and slow**
  - **What is most critical ...**
    - **is not what facts you can remember** from your studies & **what procedures you can operate**
    - **It's how capable your brain becomes of receiving and processing new information**



Albert Einstein

**“Education is what remains after one has forgotten what one has learned in school”**

## Engagement in learning

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  - **What is most critical ...**
    - **is not what facts you can remember** from your studies & **what procedures you can operate**
    - **It’s how capable your brain becomes** of **receiving** and **processing new information**
    - and coming up with **the questions that matter**

**“Questions are more important than answers”**

The American Statistician, May 1994, Vol. 48, No. 2

### COMMENTARIES

Commentaries are informative essays dealing with concepts of statistical practice, statistical education, and other topics considered to be of general interest to the broad readership of The American Statistician. Commentaries are similar in spirit to Letters to the Editors, but they do not have a specific response.

C. J. Wild

#### Embracing the “Wider View” of Statistics

The interconnected themes of quality and the marketing of the “Wider View” of statistics are highlighted. The marketing of statistics in the study of the process of scientific inquiry is advocated as a consciously targeted market position. Because it reaches such a high proportion of the managers and decision makers of the future, the introductory university or college statistics course is highlighted as a special marketing opportunity for enhancing the long-term health of statistics. Attention is given to teaching students to think statistically, to become educated consumers of statistical expertise, and to communicate well with statisticians.

KEY WORDS: Defining statistics; Marketing statistics; Quality; Statistical thinking; Teaching statistics.

based courses. To a large extent, we have to gauge and balance the needs of our customers ourselves. We need to give careful consideration to the more sophisticated needs of our managers. If we have not thought through very carefully what we are trying to achieve, we are in no position to assess the ability of what we provide. Unfortunately, so much of what we do is not thought through from a careful consideration of customers, aims, and objectives; it just grows in an ad hoc way over the years, building on what has been done before. This has certainly been my experience and all too often my own practice. At its most basic, considering aims and objectives requires thinking about the nature of statistics itself. And yet the nature of statistics as a discipline is something that has never been properly resolved, signed on, and then communicated. As a QCW statistician in 1991, the human resources manager of an international hotel chain was overheard talking to a local businessman: “The statistical services



**“Questions, a Springboard to Thinking”**





Yuval Noah Harari

*"Questions you cannot answer are usually far better for you than answers you cannot question."*

Overcoming the all-importance of getting that piece of paper

### Qualifications vs capabilities

Short-term Goal  
(foot in the door)

Qualifications

What you can have ...

Long-term goal

Capabilities

What you can do ...

**SUCCESS!**

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But for all that we've seen, I still stand by this ...

# *Finale ...*

*What is the single best thing  
we can do for our students?*

*To populate*

*their imaginations*

*"And the vision that was planted  
in my brain still remains ..."*

*with possibilities*

*"Imagination is everything ...  
It is the preview of life's coming attractions."*







# The End

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# Thank you



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