

Data, Information & Interpretation

The Contours, The Disruption & The Responsibility

The Contours

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- Data centric decision making
 - ❖ Data centric warfare

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- Loss of situational awareness
- Missing
 - ❖ Big picture
 - ❖ Small picture
- Economics
 - ❖ Too much data
 - ❖ Loss of perspective and Understanding

The Disruption

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 - ❖ Human bodies become data generators
- New approach to:
 - ❖ fight disease
 - ❖ fight poverty
- New socio-political & Socio-Economic trajectory
 - ❖ As profound as possibly domestication of fire, animals
 - ❖ The horse gets a stirrup, the ships can survive high seas

The Responsibility

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 - ❖ But inexorable increase in complexity
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 - ❖ The digital footprints-eternal self
 - ❖ Living in a glass house-are we ready?

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 - ❖ End of privacy
 - ❖ The digital footprints-eternal self
 - ❖ Living in a glass house-are we ready?
- One who controls 'Big Data' controls the nations/world
 - ❖ Tools of change
 - ❖ Losing control over our destinies?

The Data Deluge

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- A MRI:
 - ❖ typical 1 mb/image at current machine resolution
 - ❖ would be 1 pb at light microscopy resolution
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 - ❖ at neural level, electron microscope-this goes to a zb level
- Entire humanity has generated some 1.8 zb of data!

The Data Deluge-Current

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- In 1986 (-3 yrs to the internet), 6% of world's data was digital
 - ❖ Today >99% of text, video, pictures in digital world
- Today a small vendor has more information at his beck and call than what a head of the state could have a few decades ago

The Data-Eternal

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- What we search, post are digital footprints like tattoos-inked for eternity
 - ❖ Google, Twitter, Instagram, Amazon, YouTube,
 - ❖ we are tattooing ourselves-our lives, our preferences, our faith, our proclivities-in far more comprehensive manner
 - ❖ These would outlast our mortal bodies

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 - ❖ Now mapping services are available for under USD 10k
- Possibility of turning a species to another real

Interesting, Emergent Applications

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 - ◎ New generation of sensors,
 - ▶ networkable
 - ▶ small
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- Collate:
 - ❖ advances in data storage and retrieval
 - ❖ advanced servers
 - ❖ higher data rates
- Analysis:
 - ❖ ability to draw inference, test and model large data sets
 - ❖ birth of Big Data
 - ❖ Yesterday's data mines and mining techniques?

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- Reduce health care costs



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- Permits doctors to change dosage/medicines
- Ensures compliance

Life Logging

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- Gordon Bell has logged > 1 Lakh photos, quarter million emails
 - ❖ Went paperless as experiment
 - ❖ Logs conversations, keystrokes, location, TV watching, real time heart beat, cholesterol
 - ❖ Wears SenseCam which clicks a picture every few minutes

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- Video

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- Sociologists having unprecedented data in real time to decipher world's **emotional core**

Hospital Data

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- Intensive care for premature babies
 - ❖ Millions of measurements
 - ❖ Record one number on paper per hour
 - ❖ Analysis of full data led to detection a day in advance before symptoms of an infection emerged
 - ◎ A 24 hour leap to react!

Data & Crime

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- With increasing medical, banking, personal data available on line
 - ❖ Economic offenses are tip of the iceberg
 - ❖ Physical violence possible

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- Eradication of polio
 - ❖ Tracking vaccine delivery-
 - ◎ GIS, tracking
- Earthquake monitor-using laptop accelerometers
 - ❖ Quake catcher network (in 67 countries)
 - ❖ Detect and warn:
 - ◎ 8.8 magnitude earthquake in Chile (2010)
 - ◎ 6.3 magnitude earthquake in Christchurch, NZ (2011)

...and we haven't yet
talked of Google Glass!

Data-New Oil

Opening a Different Line

The Toaster Project

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- A simple toaster had over 400 (sub)components
- Needed:
 - ❖ Copper
 - ❖ Iron
 - ❖ Spring
 - ❖ Nickel
 - ❖ Mica
 - ❖ Plastic

The Complexity

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- Forced to compromise soon
 - ❖ Could not use 15th century smelting technology
 - ❖ Had to scavenge for plastic as getting it made from crude was not agreed to by BP
 - ❖ Ni came from commemorative coins-melted and drawn as wire
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- Realisation: without shortcuts one lifetime can be easily spent
- Conclusion: The crude toaster worked on battery but perished when connected to mains!

...and
this was a
humble toaster,
invented in 1893

The Lesson:

Incredible Complexity

which exists *already*

...and we haven't started looking at

stock exchanges, logistics

let alone

Big Data

Complexity!

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 - ❖ Many are much...much more complex than a *'Electric Toaster'*
- An economy like NY or London offers 10 Bn different products
- This is the underlying complexity which surrounds us
- Now these are the products on sale...think again of the Electric Toaster & think of the supply chains feeding the factories

The Path

Planned...
Vs
...Evolution

Biological Evolution

Biological Evolution

- *Variation, Selection, Repeat*
 - ❖ What it does:
 - Searches for and keeps refining the fit
 - Iterative
 - ❖ What it does not:
 - Does not look for the perfection
 - Blind: No foresight
 - Unlike a formula...not deterministic

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 - ❖ What it does not:
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 - Unlike a formula...not deterministic
- Black swans...beyond statistical determination

The Experts

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- Seminal work of Philip Tetlock

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- Leading experts could not agree even on basic issues which can be existential!

The Lesson:
We are far more blinder
than
we think we are

So What of Forecasting

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 - ❖ Slide rule
 - ❖ Sewing machine
 - ❖ VHS system
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Despite the best of number crunching

Missing the Big Picture

Despite the top mathematicians

Despite the best planners

Despite the most ferocious secret police

...USSR is to be found in history books

Whereas in 1950s several Western Experts concluded that
the communism, despite its cruel ways was more effective
than capitalism to run economy.

Politics

Palchinsky

The Engineer Martyred for '*Publishing Detailed Statistics*'

Palchinsky Principles

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Palchinsky Principles

- Seek out new ideas and try new things:
Variation
- While trying-do at a level where failures are survivable: ***Survivability***
- Seek feedback and learn, correcting as we go along: ***Selection***

Missing the Small Picture

Network

Terraforming?

Rules Causing Ruin

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- Rules to analyse and to control can spiral matters out of control
 - ❖ Case of Piper Alpha
 - ❖ Case of Financial Meltdown

Situational Awareness

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Situational Awareness

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 - ❖ Largest and the oldest oil rig in the North Sea
- A backup pump dismantled
 - ❖ Maintenance could not be completed by one shift
 - ❖ Note given to control room-NOT to use the pump
 - ❖ Primary pump develops a problem
 - ❖ Quick decision needed, note not found and this dismantled pump started
 - ❖ Gas leaked and explosion happened

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 - ❖ This continued to flow as the other platforms didn't have authority to shut the production
- As Piper Alpha was designed for oil not for gas, safety walls were weak and control was next to the offending pump
- 157 people died and changed the texture of Oil & Gas industry in the UK
 - ❖ Parallels were also drawn with Deep Horizon accident

Tight Coupling

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- Insurers has reinsurance
 - ❖ they were packaged and resold
 - ❖ The USD 1.6 Bn ended up being a almost USD 16 Bn claim
 - ❖ This was known as LMX spiral and happened in 1988
 - ❖ Still unspooling happening

The Data Delusion

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- Financial Regulators and Institutions told themselves that sophisticated tools were diluting the risk by spreading it to people best able to cope with it
- Historical data suggested that packaged reinsurance contracts were very safe
- Overlooked:
 - ❖ It is dangerous to have complexity and tight coupling together in a system

Credit Meltdown

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- Caused due to USD 4.8 Bn loan to Exxon
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 - ❖ EBRD had surplus cash and wanted to invest in low risk venture
 - ❖ And JPM wanted to free its locked capital

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 - ❖ And JPM wanted to free its locked capital
- Regulators agreed

Simply Put

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- So banks found a way to insure a gamble and raised their stakes

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- Rating agency practice...

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 - ❖ Underlying weakness was lost
- When insurer held many such risky instruments, its rating went down, reducing rating of all such instruments insured by it
- Banks which held these instruments were required by law to shed poor rated instruments
 - ❖ So, in frenzy all sold together

Lessons

Lessons

- Director of Financial Stability at Bank of England
 - ❖ Talks of creating a 'heat map' of financial system
 - ❖ To work like an electrical grid
 - ❖ Highlighting critical links, overstressed nodes and unexpected interactions

Data Centric Warfare

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- Story of Robert McNamara

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- Fetish for big picture

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Data Centric Warfare

- Story of Robert McNamara
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- Iraq invasion

Thanks

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