

# **Big Data, Analytics & Data Visualization – Dispelling the Myths and Discovering New Opportunities**

Professor Olivera Marjanovic, PhD

Leader of the RG “Analytics in Human Complex Systems”

Women in Engineering and IT (WiEIT) Champion

School of Professional Practice & Leadership

Faculty of Engineering and IT

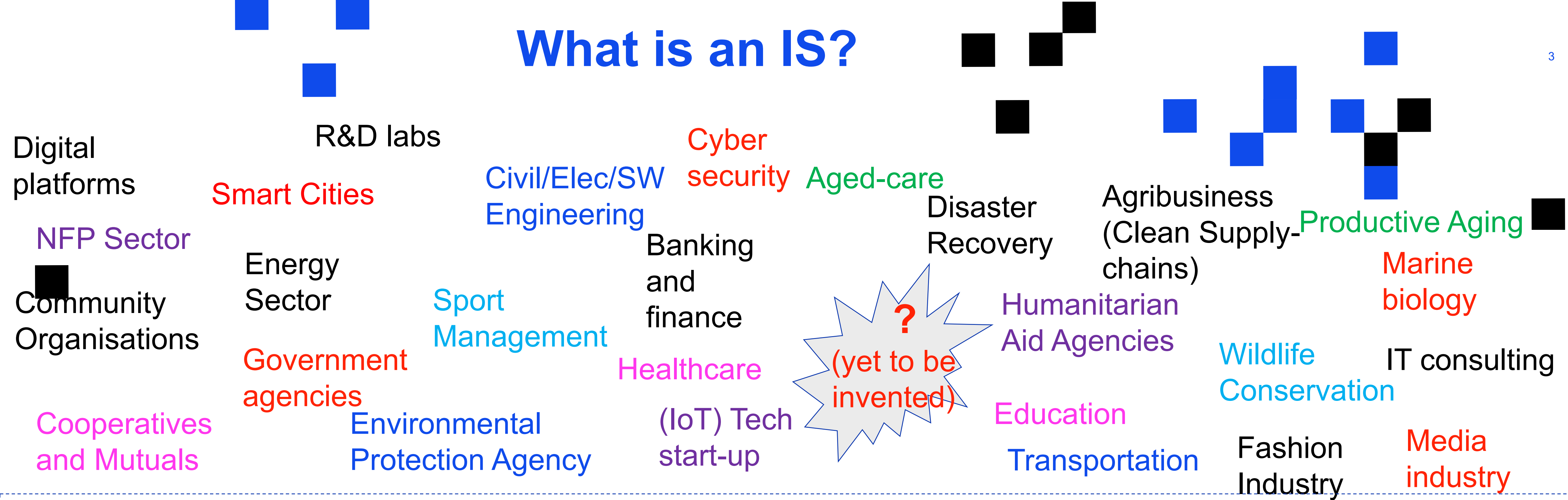
University of Technology Sydney

[olivera.marjanovic@uts.edu.au](mailto:olivera.marjanovic@uts.edu.au)

## Presentation Outline

- Fundamental concepts: Big data, Business Intelligence & Analytics
- Making sense of the current Big data confusion and hype
- Three different perspectives (business, data science & IT) of BI&A
- Emerging trends – Data Visualization and Visual Analytics
- Our current research: Visual Atlas of Australian Cooperatives
- Beyond Business Analytics: Analytics in Human Complex Systems

# What is an IS?



**Societal context**

**Industry context**

**ORG CONTEXT**

<b>IT</b> (Hardware and Software)	<b>Data</b> (management, modeling, quality, visualization, ethics)	<b>Processes</b> (Business and Other)	<b>People</b> Human and Social capital (knowledge/ skills/creativity/ethics Change/humanity)	<b>Services</b> (to customers/patients/ citizens/constituents/ other stakeholders)
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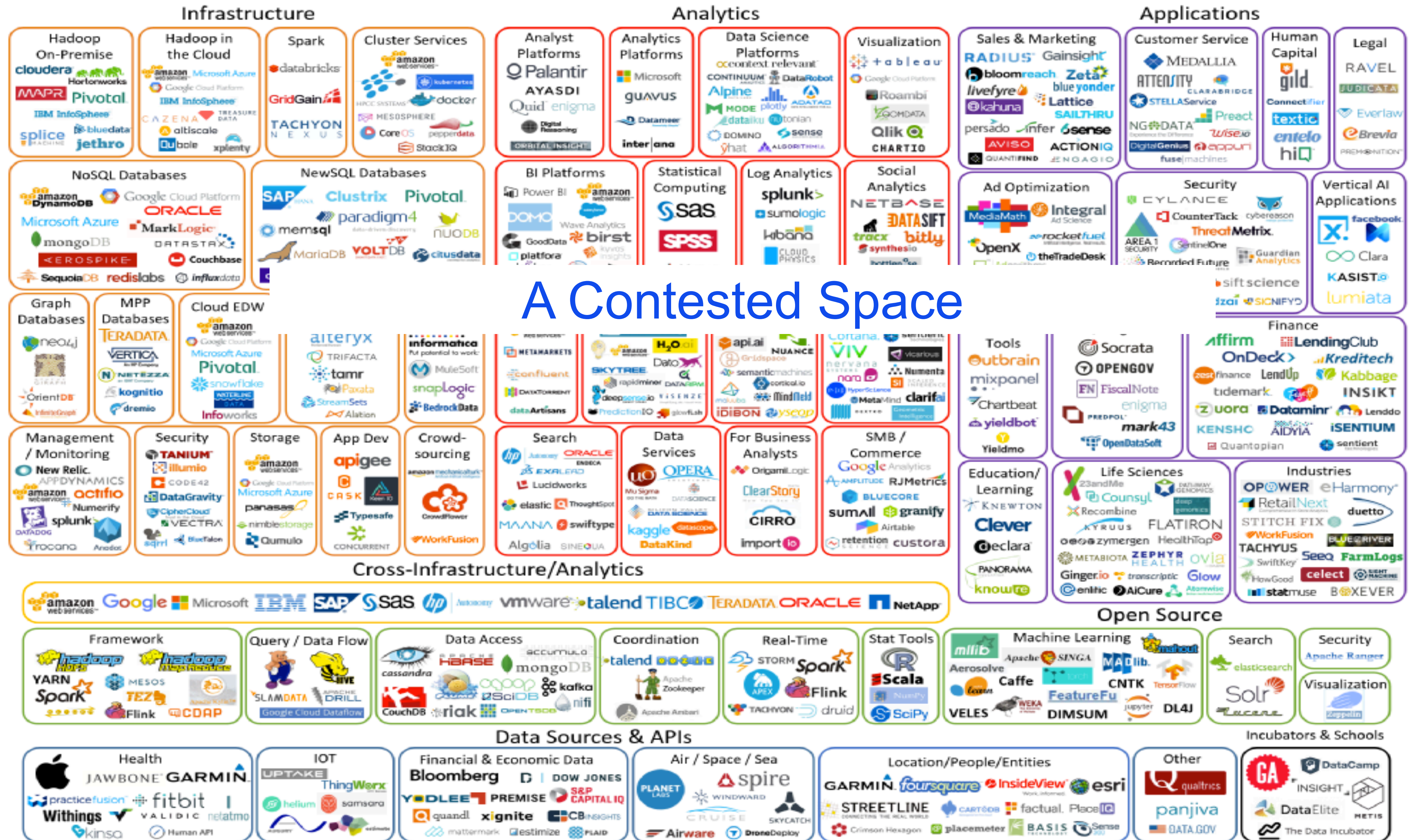


## Big Data Phenomenon





# Big Data Landscape





## The reality of Big Data

19 September, 2013

### Gartner On Big Data: Everyone's Doing It, No One Knows Why

The same enterprises that seem most confused about Big Data seem to be the ones launching Big Data projects. What gives?

The gravitational pull of Big Data is now so strong that even people who haven't a clue as to what it's all about report that they're running Big Data projects.

Strange, but true.

According to a recent Gartner report, 64% of enterprises surveyed indicate

## FINANCIAL TIMES

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March 28, 2014 11:38 am

### Big data: are we making a big mistake?

By Tim Harford

Big data is a vague term for a massive phenomenon that has rapidly become an obsession with entrepreneurs, scientists, governments and the media

## Big Data is a Big Confusion

AUGUST 8, 2012 by [Josh Sternberg](#)



We're in the era of Big Data, but we may as well call it the era of Big I Have No Clue.

7 May 2014 | By Sharon Everitt



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A lack of big data know-how has created a backlog that gives way to a flood of demands for business intelligence (BI), a report has predicted. As a result, data center managers could be swamped by requests for resources in the near future, it warned.



## What is (are) “Big Data”?

Big Data: Key **defining** characteristics:

- Volume
- Velocity
- Variety

“The 3Vs”

- Veracity

## What is (are) “Big Data”?

Industry practitioners keep inventing additional **Vs**

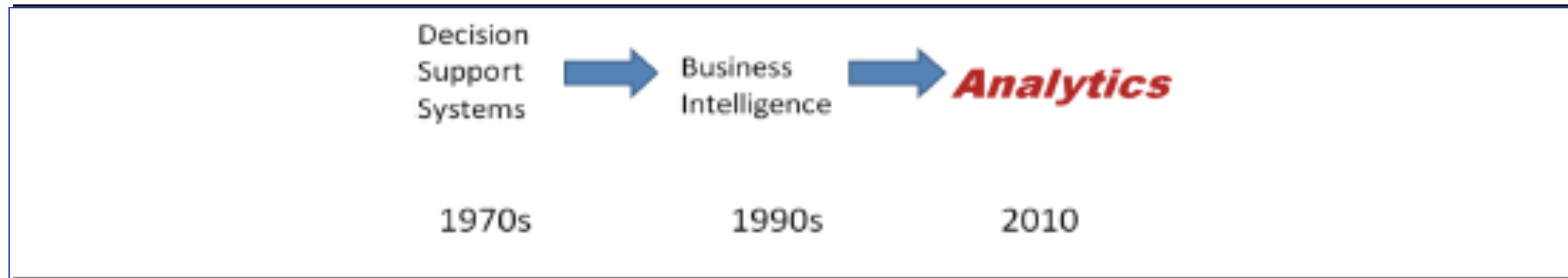
- Variability
- Visualisation
- Value
- Variability
- Venue
- Vocabulary
- Vagueness
- Virility
- Vendible
- Vaticination
- Voracity
- Vanity
- Etc.

“If you can sell it, and sell it as Big Data, then it ‘is’ Big Data.”

“Big Data provides the sort of visionary and predictive powers only previously obtainable through ritual sacrifice, magic potions and the casting of spells”



## A long history of Business Intelligence and Analytics



Watson (2014)

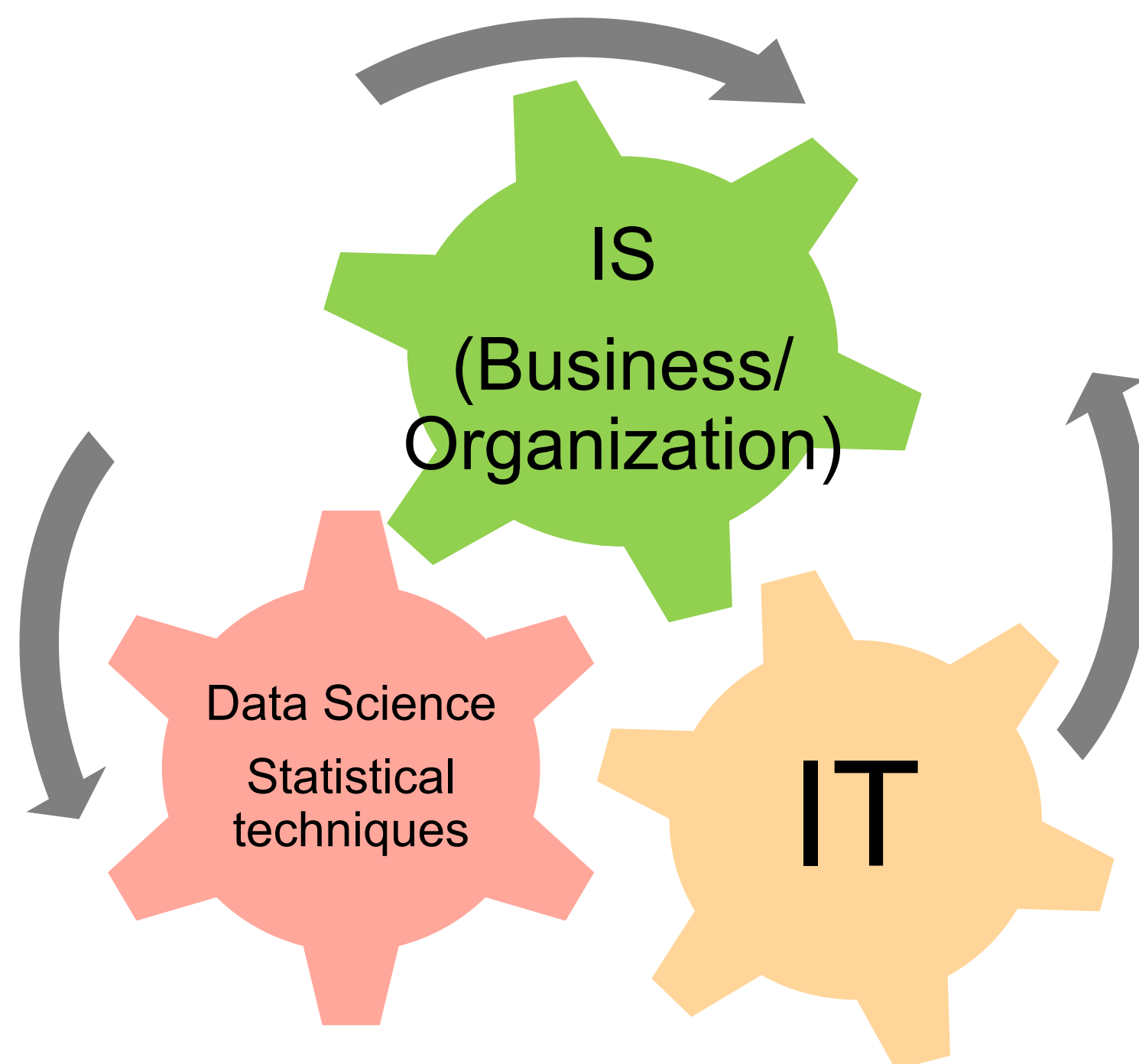
# Evolution of Business Analytics

Davenport (2018)





## Business Analytics: Different perspectives



MIT 's survey ("Big Data, Analytics, and the Path from Insights to Value") of 3000+ executives from 108 countries across 30 industries confirms that **the biggest challenges in adopting analytics are managerial and cultural** (MIT Sloan and IBM, 2014)

## From Data to Insight to Action

### Important Questions to ask:

What kind of data?

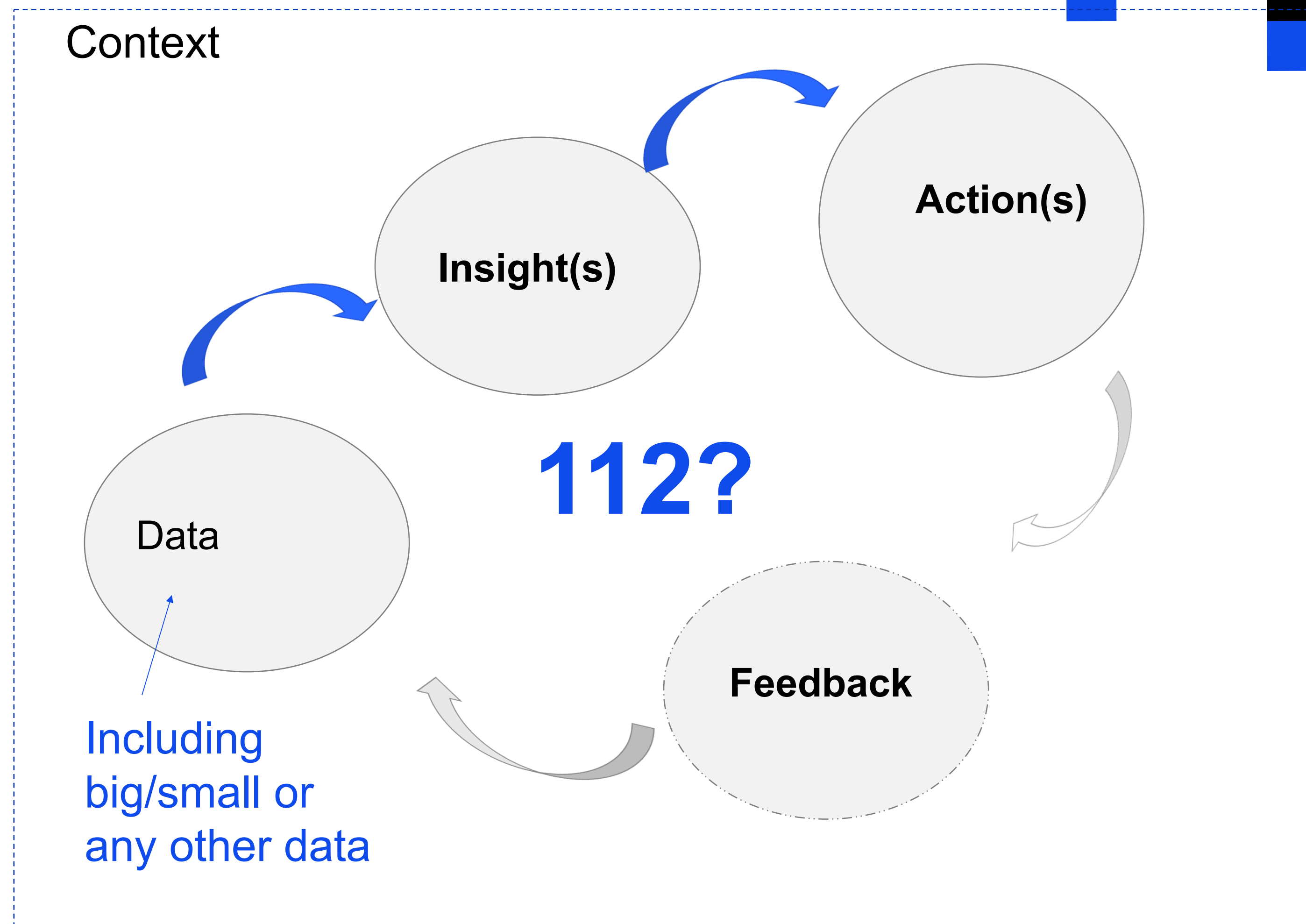
From where?

Captured how?

In which context?

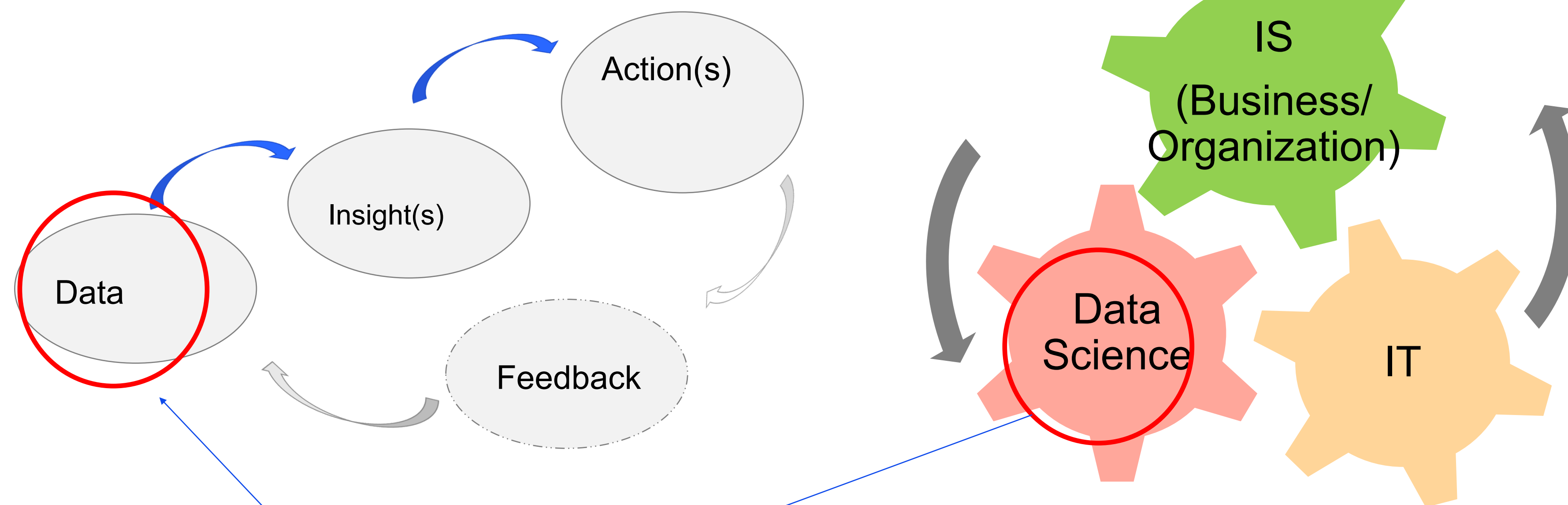
For what purpose?

To address what problem?



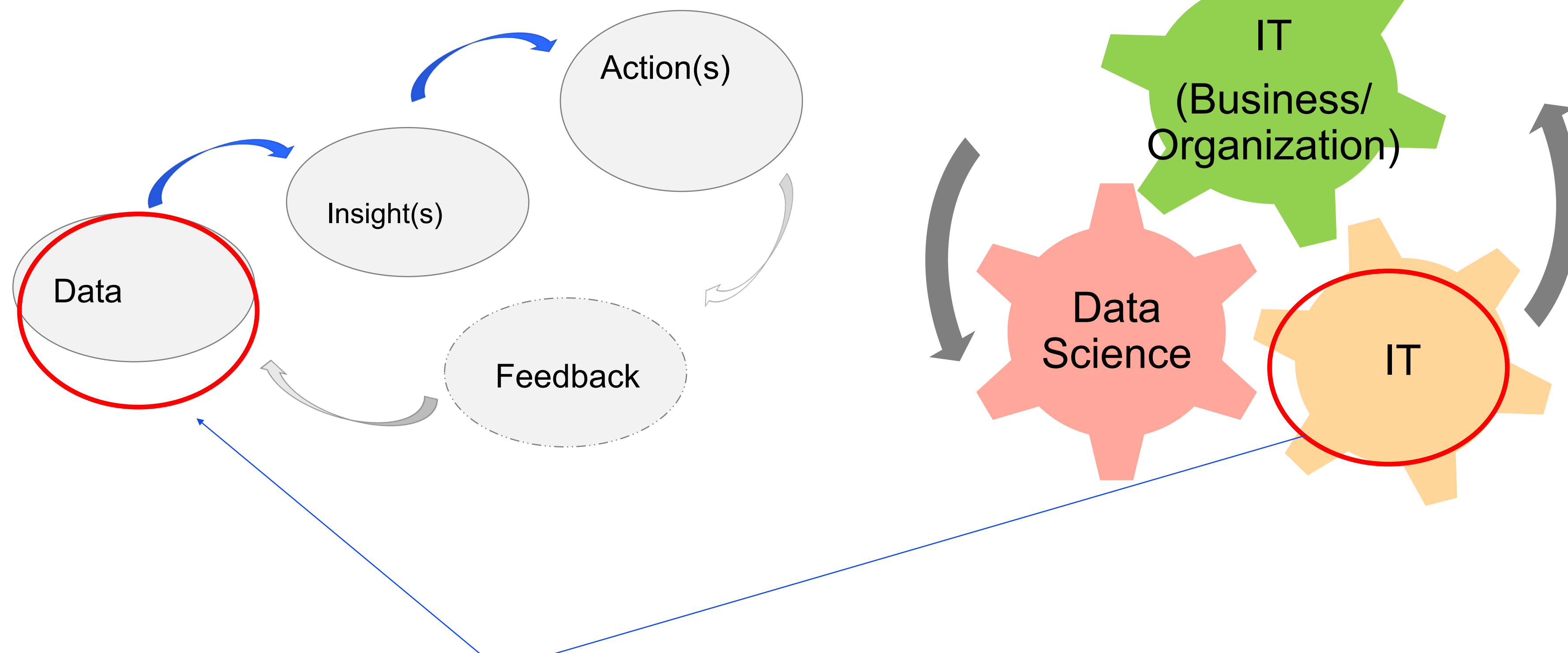


## The Data Science Perspective



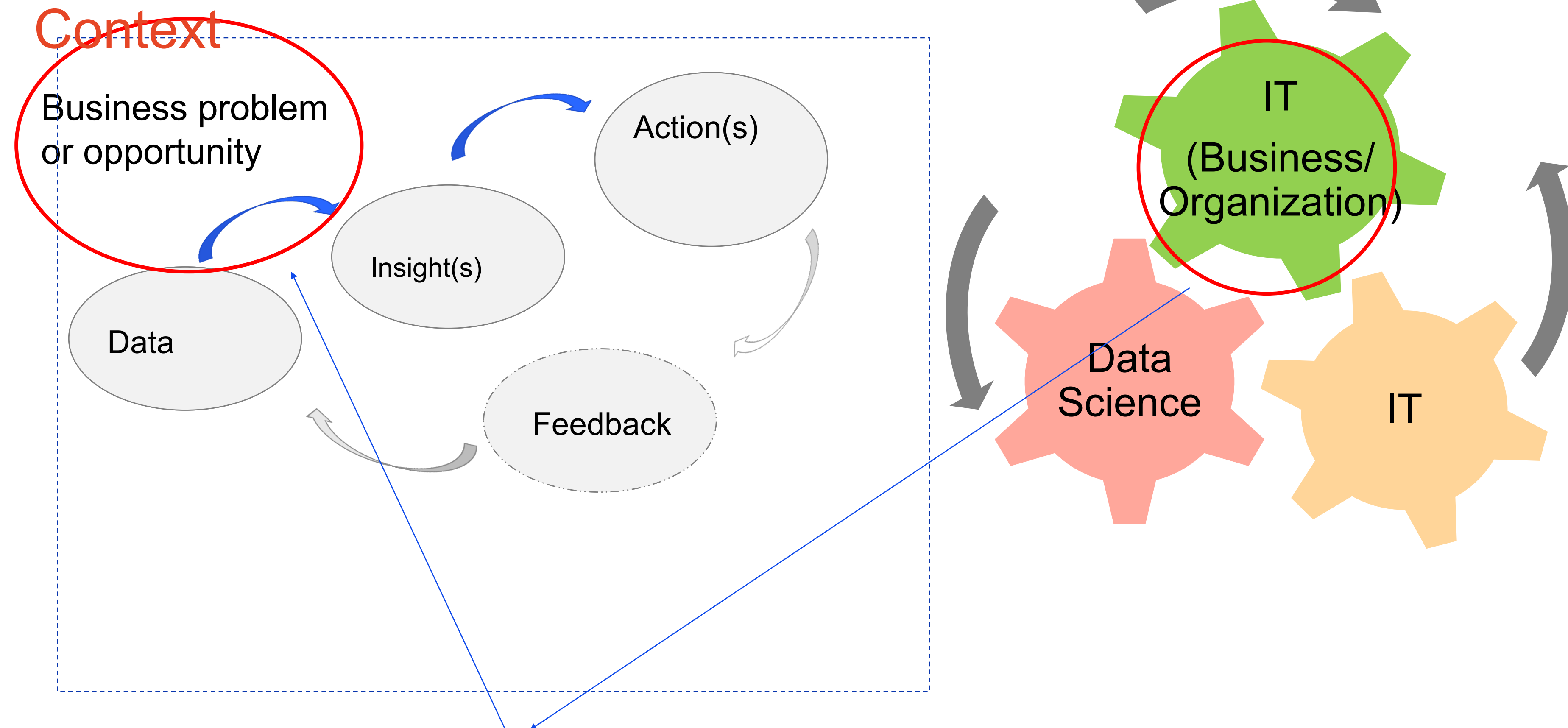
**Data science:** Data first; Business context not considered (e.g. business processes); Strong focus on numerical data; Very sophisticated knowledge of statistical methods; Limited domain knowledge; Provide information to decision makers

## The IT Perspective



**IT:** Data first; Business context not considered (e.g. business processes); Strong focus on data administration, storage, (warehouses/ data marts, hadoop-based technologies), data integration, transformation & load; speed of access; algorithms; structured and unstructured data; Set environment for data science; Provide information to decision makers

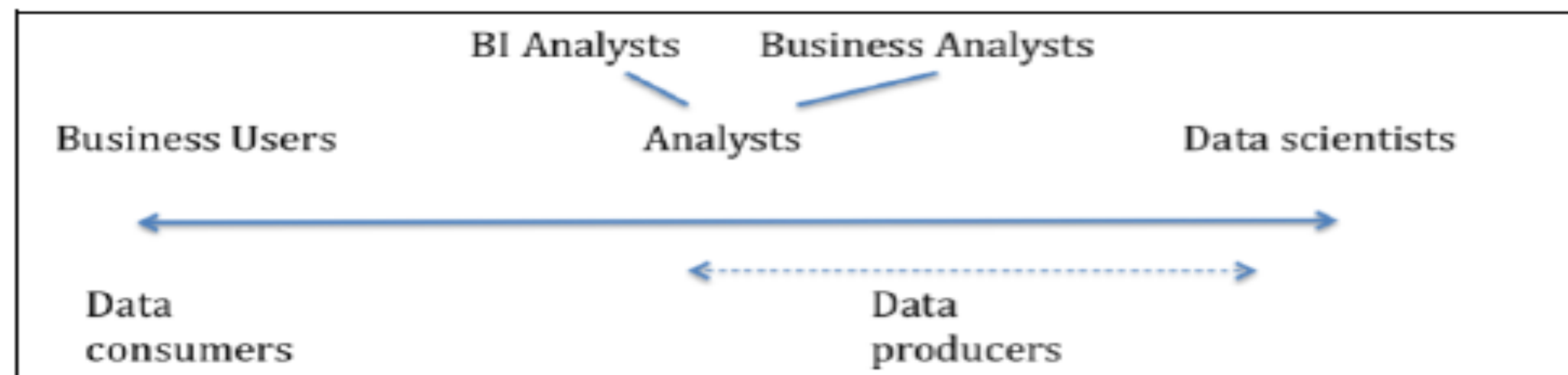
## The Information Systems (IS) perspective



**Org/Business:** Concern with Context; Starts from Business problem and/or opportunity; Domain knowledge; Responsible for decisions, actions and consequences; Challenges with defining and collecting effective feedback (more than numerical data; Should consider wider societal context (but often does not)



## Business Analytics: Different roles



(Watson, 2014)

←-----→

**Latest update: Business Users of Visual Analytics as Data producers ("Citizen scientists")**

# The Emergence of Visual Analytics (VA)

- (Mainstream) Business Intelligence & Analytics:
  - numerical data,
  - focus on finding answering to given (business questions) questions
  - "Traditional" approaches to visualisation – pie charts, graphs etc.
- Rapidly growing: Visual Analytics (VA)
  - Visual data of different kind (numbers, qual data, sound, pictures etc.)
  - Focus on finding relevant questions
  - Does not require knowledge and experience in "deep-analytics" & even statistics
  - Story-telling with data

The largest international survey conducted by TDWI: the greatest barriers to organizational adoption of visual analytics are lack of skilled personnel and training (TDWI, 2013, pp.5).

# The Emergence of Data Visualisation & Visual Analytics (VA)

Data visualisation



Answer the given question(s)

Visual data exploration



Formulate new question(s)

Data-driven story-telling

The greatest barriers to organizational adoption of visual analytics are lack of skilled personnel and training (TDWI, 2017)



**VA makes it easier for humans to observe patterns in large volumes of data (HBR, 2016)**



Smolan and Erwitte (2012), *The Human Face of Big Data*, Against All Odds Productions;

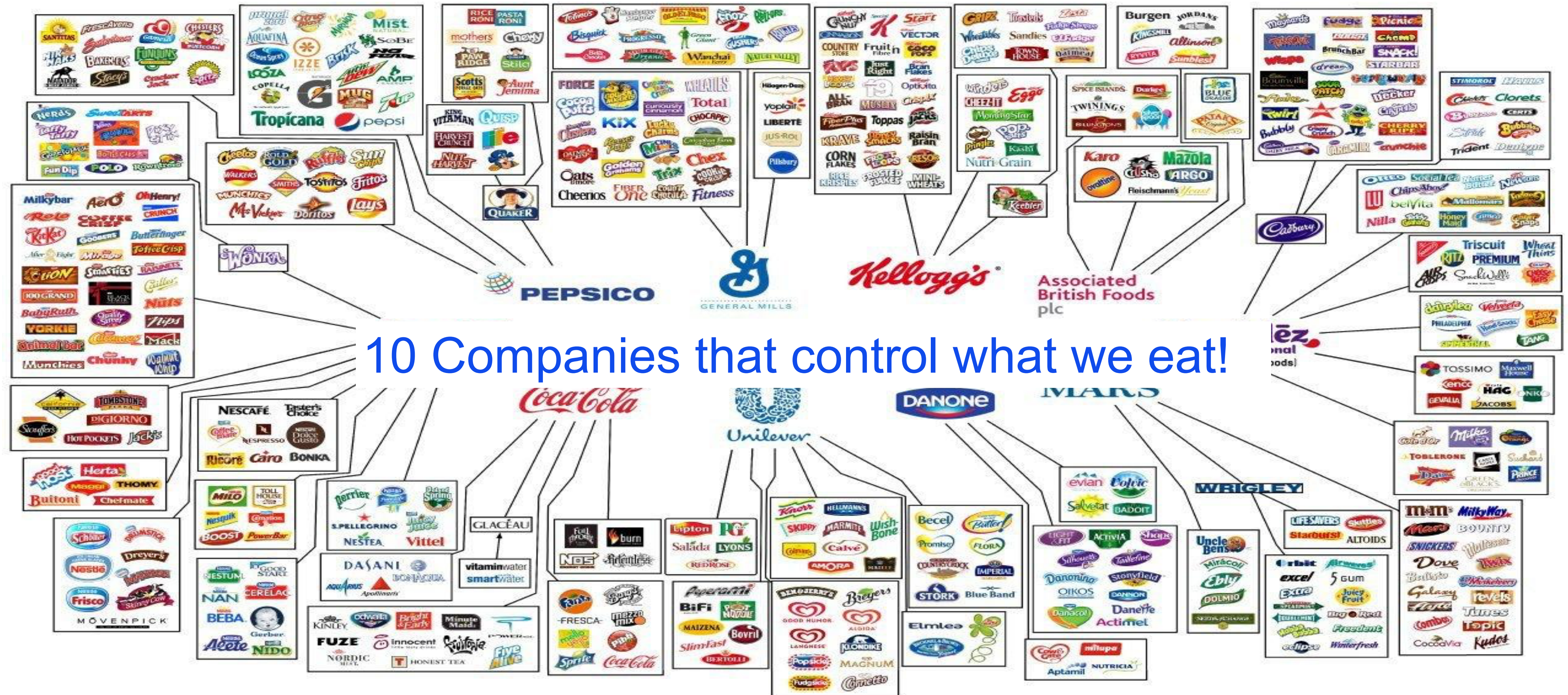


VA - ... we visualise data to ... see what could not be seen before” (HBR, 2016)












**VA - ... we visualise data to ... see what could not be seen before” (HBR, 2016)**





VA- we visualise data to prompt people (decision-makers) to take action

Origin	Airline	Flight No.	Scheduled	Estimated <span>▼</span>	<div>Flight Listing Status</div>
Singapore	 Qantas	QF6 9W4006, AY5003, EK5006, FJ5321, MU8455, PG4537, UL3376	09:50	08:59	<div>Arrived</div> <span>&gt;</span>
Kuala Lumpur	 AirAsia X	D7222	09:50	09:17	<div>Arrived</div> <span>&gt;</span>
Auckland	 Virgin Australia	VA143 AB880, AZ4211, EY6516, NZ7901, SQ6357, VA143	09:45	09:28	<div>Arrived</div> <span>&gt;</span>
Singapore	 Singapore Airlines	SQ231 LX4184, TK9320, VA5509, VS7231	10:25	09:37	<div>Arrived</div> <span>&gt;</span>
Kuala Lumpur	 Malaysia Airlines	MH141 KL4119, UL2341	10:00	09:54	<div>Arrived</div> <span>&gt;</span>
Kuala Lumpur	 Malaysia Airlines	MH123 KL4105, UL2323	10:00	09:54	<div>Arrived</div> <span>&gt;</span>
Port Vila	 Air Vanuatu	NF10 QF376	09:55	09:56	<div>Arrived</div> <span>&gt;</span>



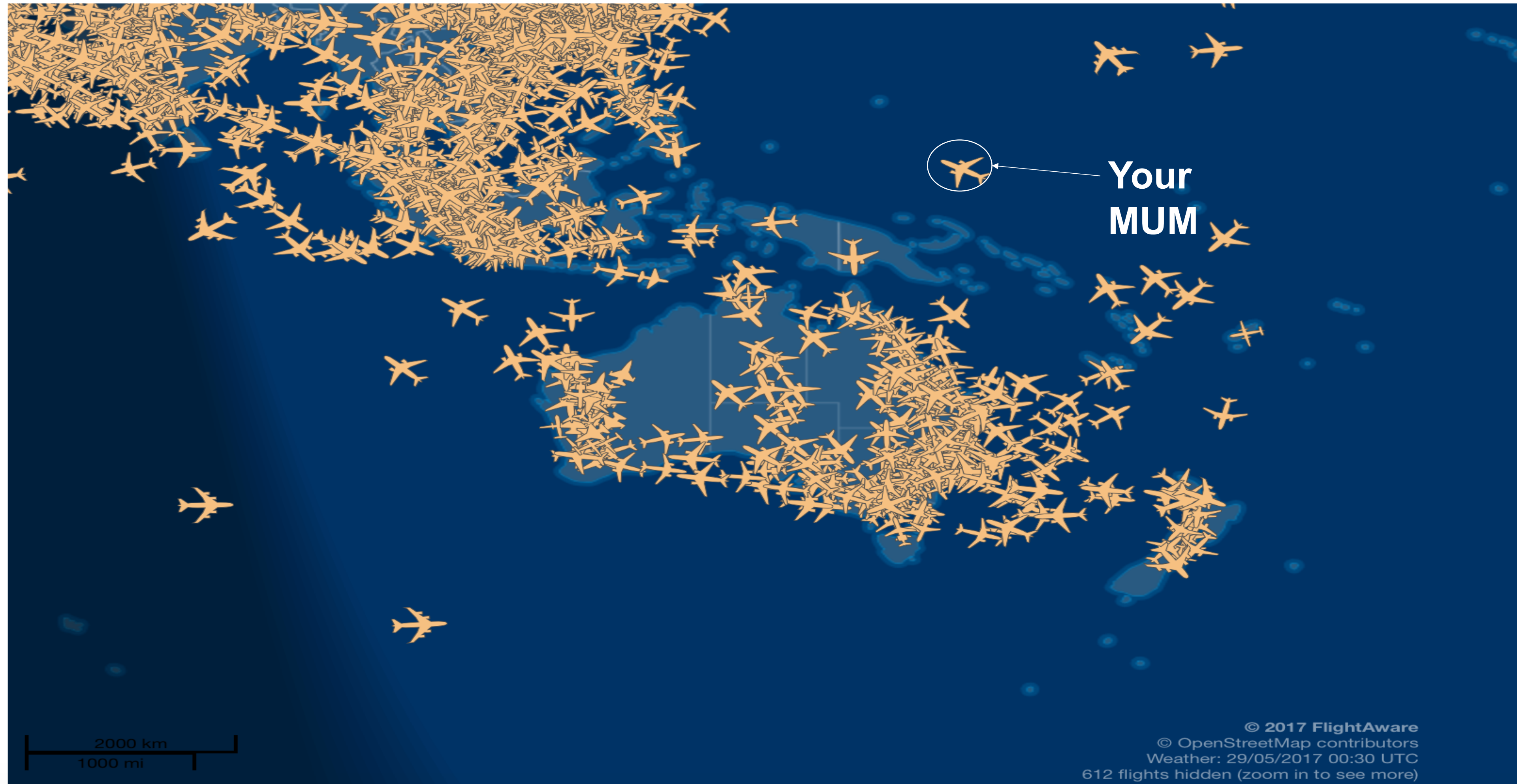


VA- we visualise data to move people to feel ...” (HBR, 2016)



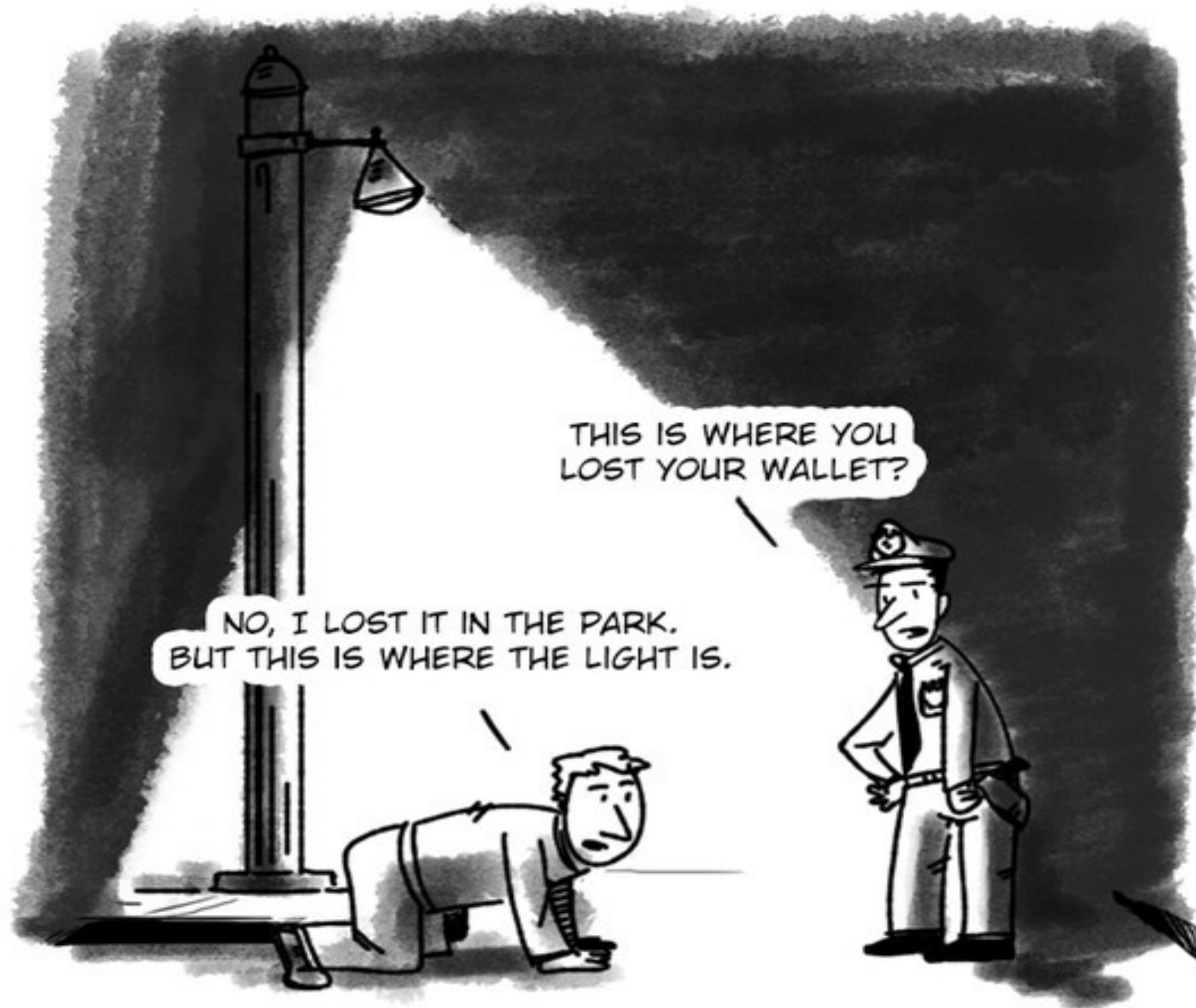


VA- we visualise data to move people to feel ..." (HBR, 2016)





## Important: What kind of data?



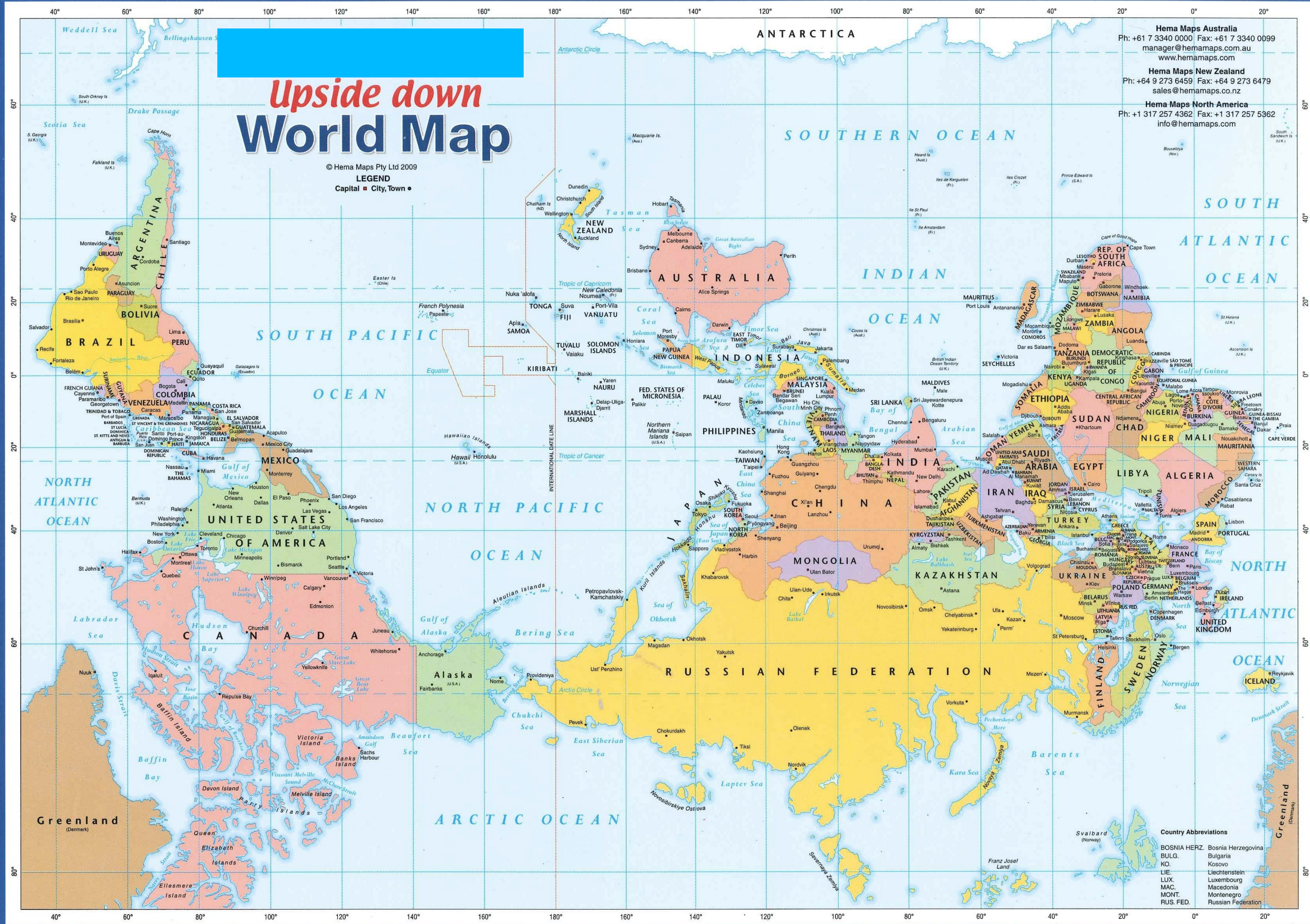


# Visual Ethics

Visualisations influence people much more than numbers







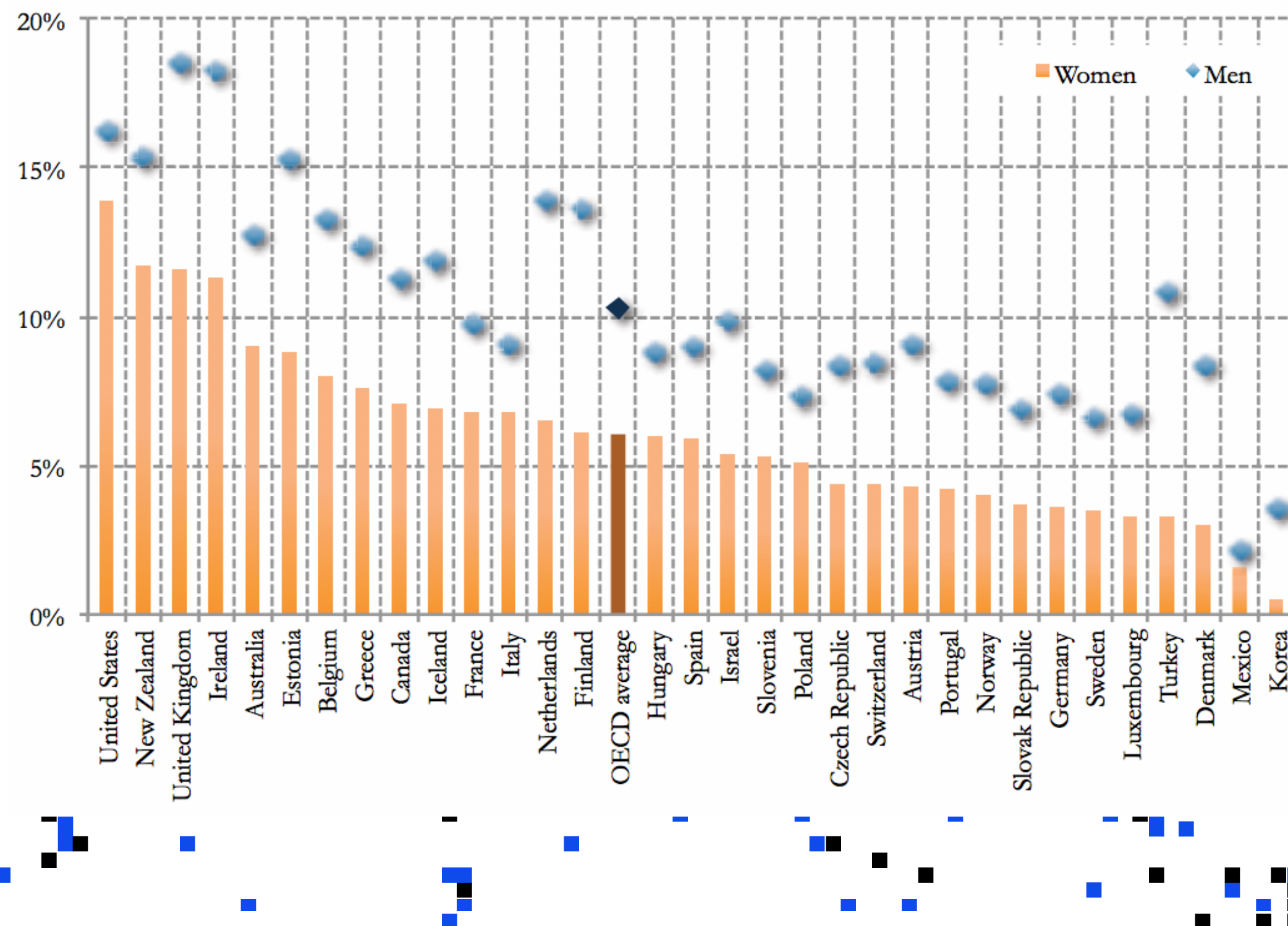


# Example: Visual Ethics

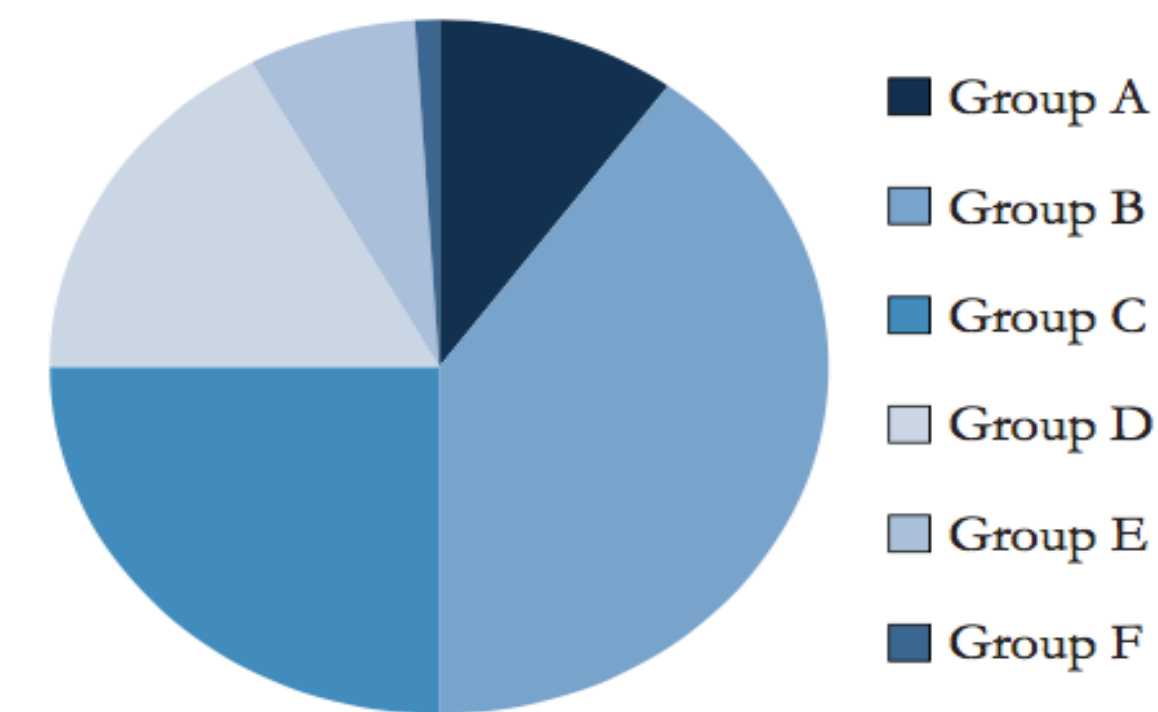
- Different forms of data visualization have the power to distort information and influence people much more than numbers

## An Unbalanced Chart

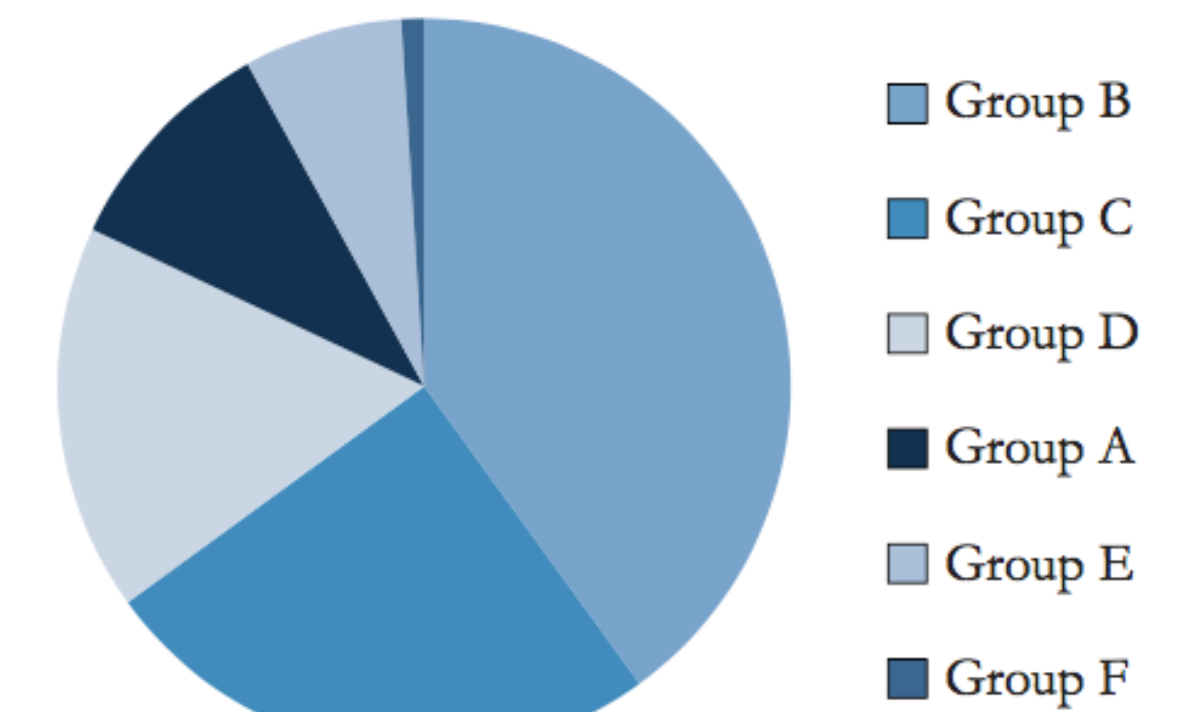
Percentage of Employed Who Are Senior Managers,  
by Sex, 2008



A Pie Chart

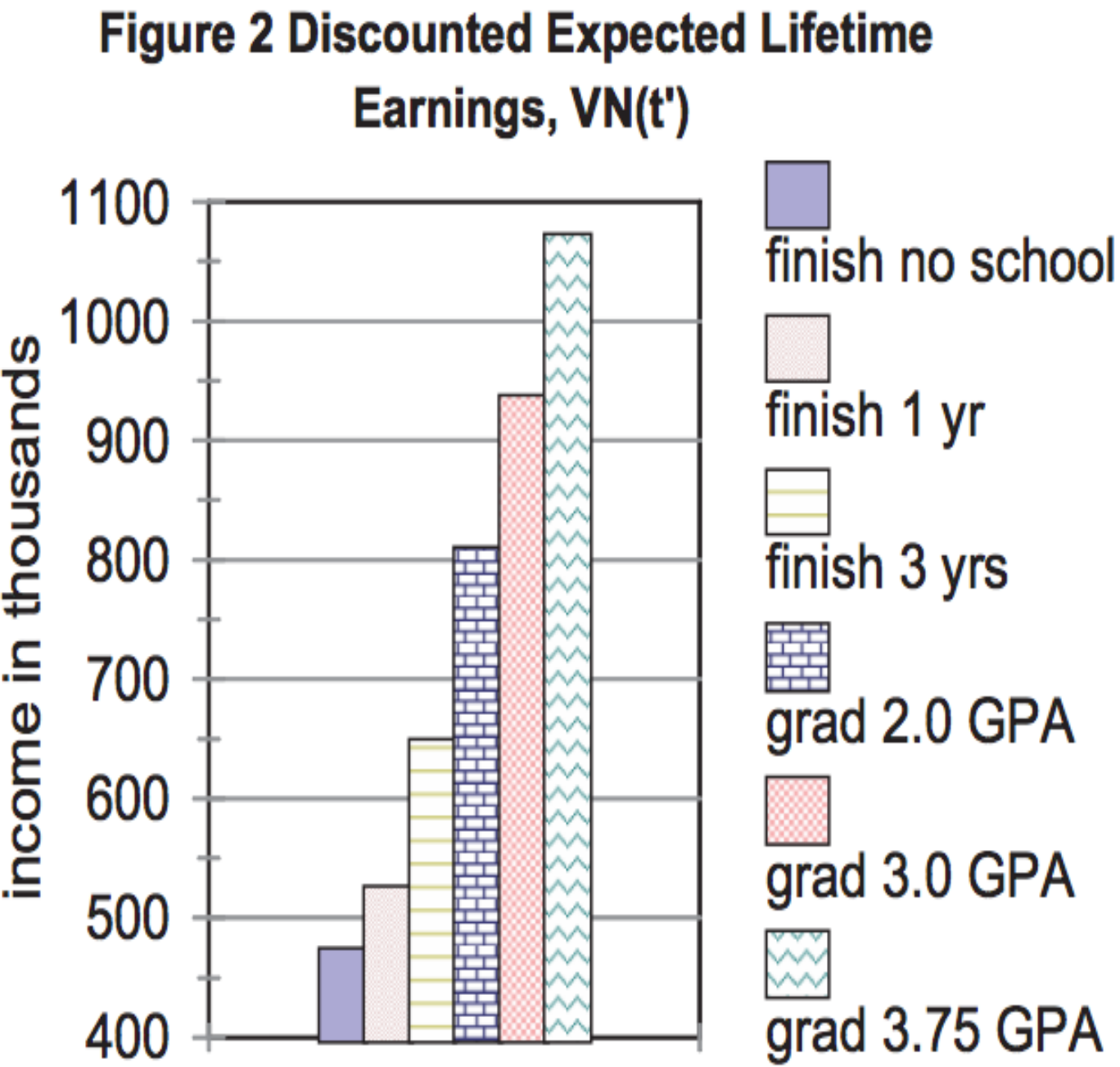


B: A Pie Chart, Rotated



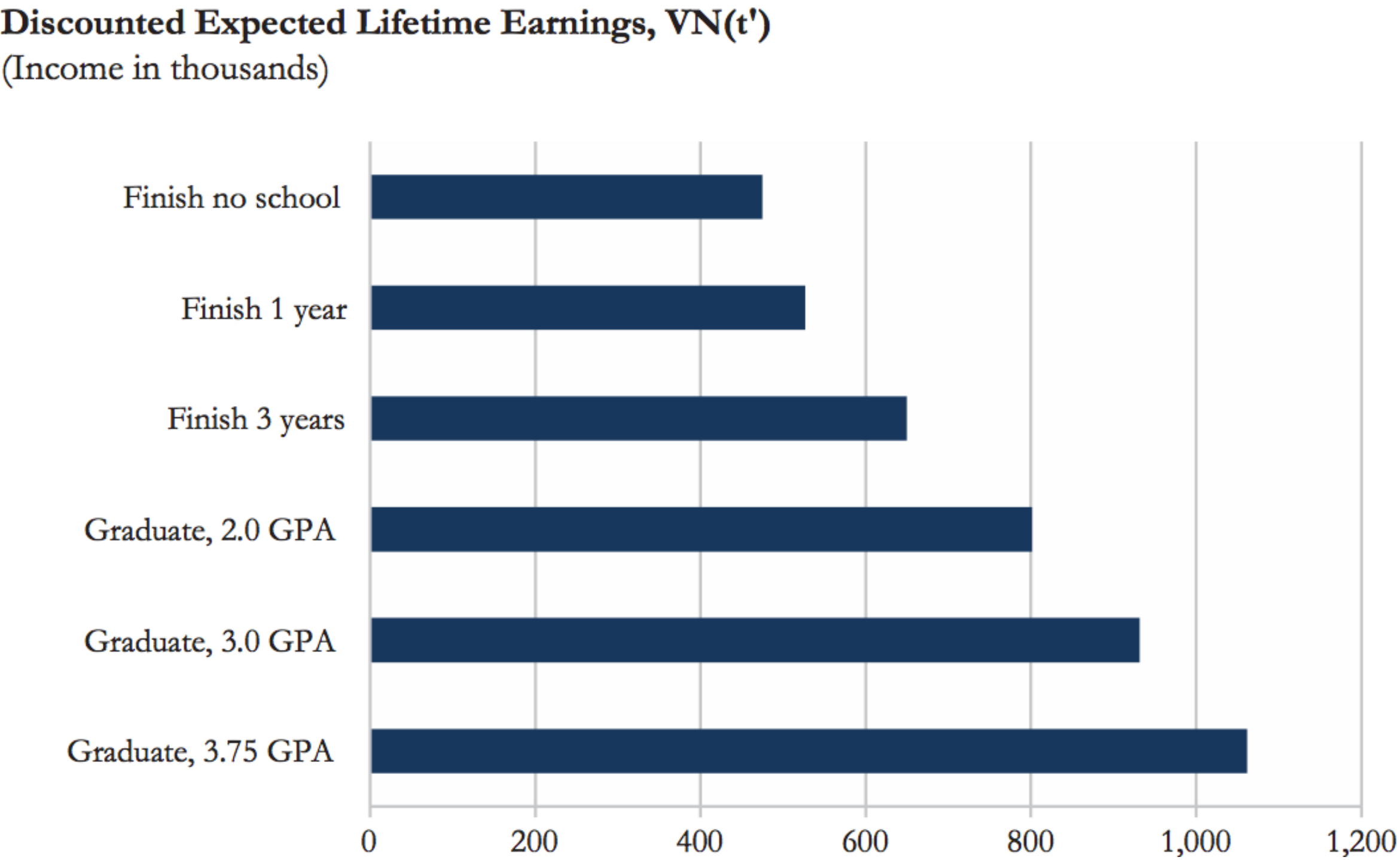
# Example: Visual Ethics

## The Basic Column Chart



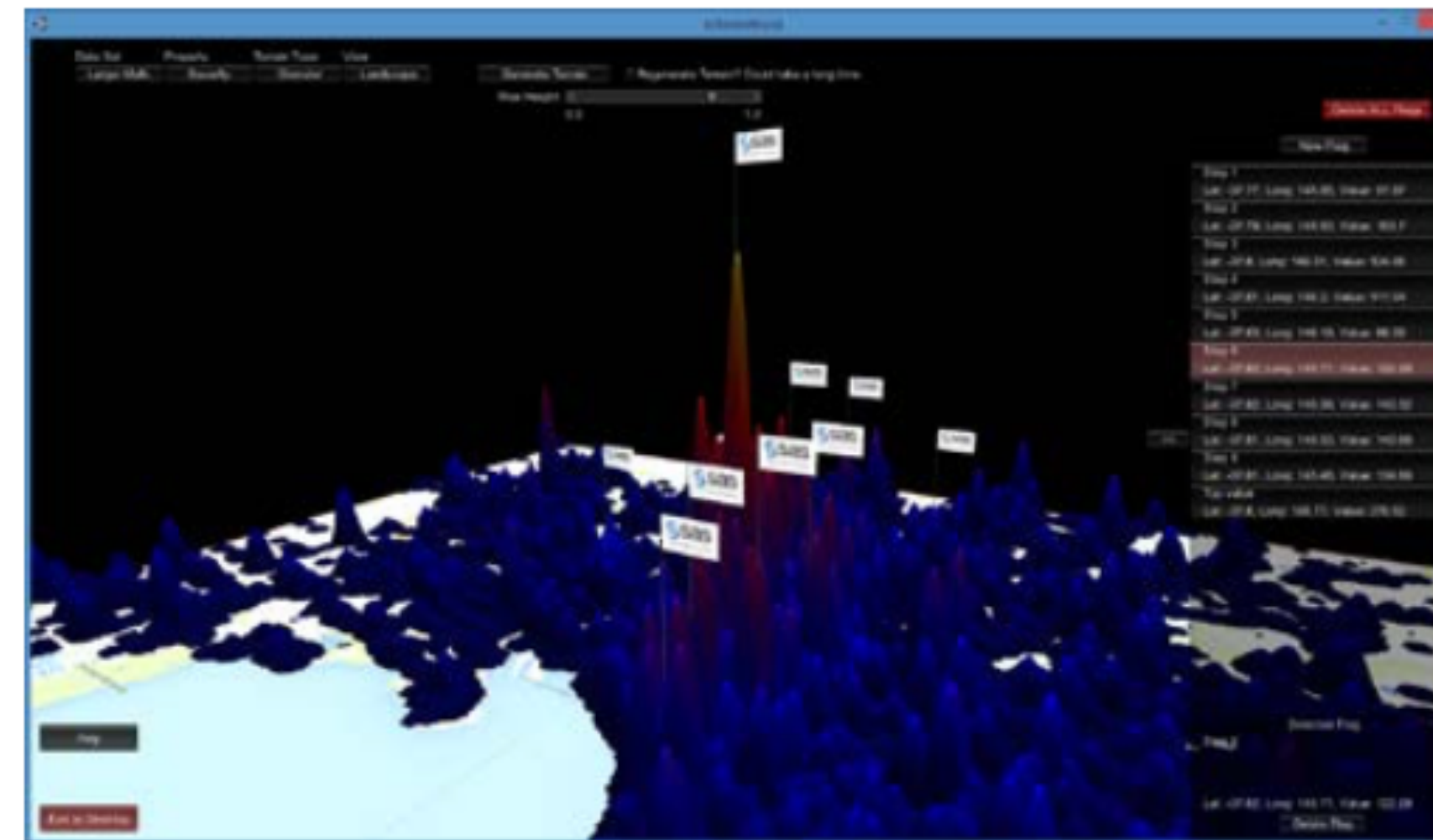
Source: Stinebrickner and Stinebrickner (2013).

## The Revised Column Chart

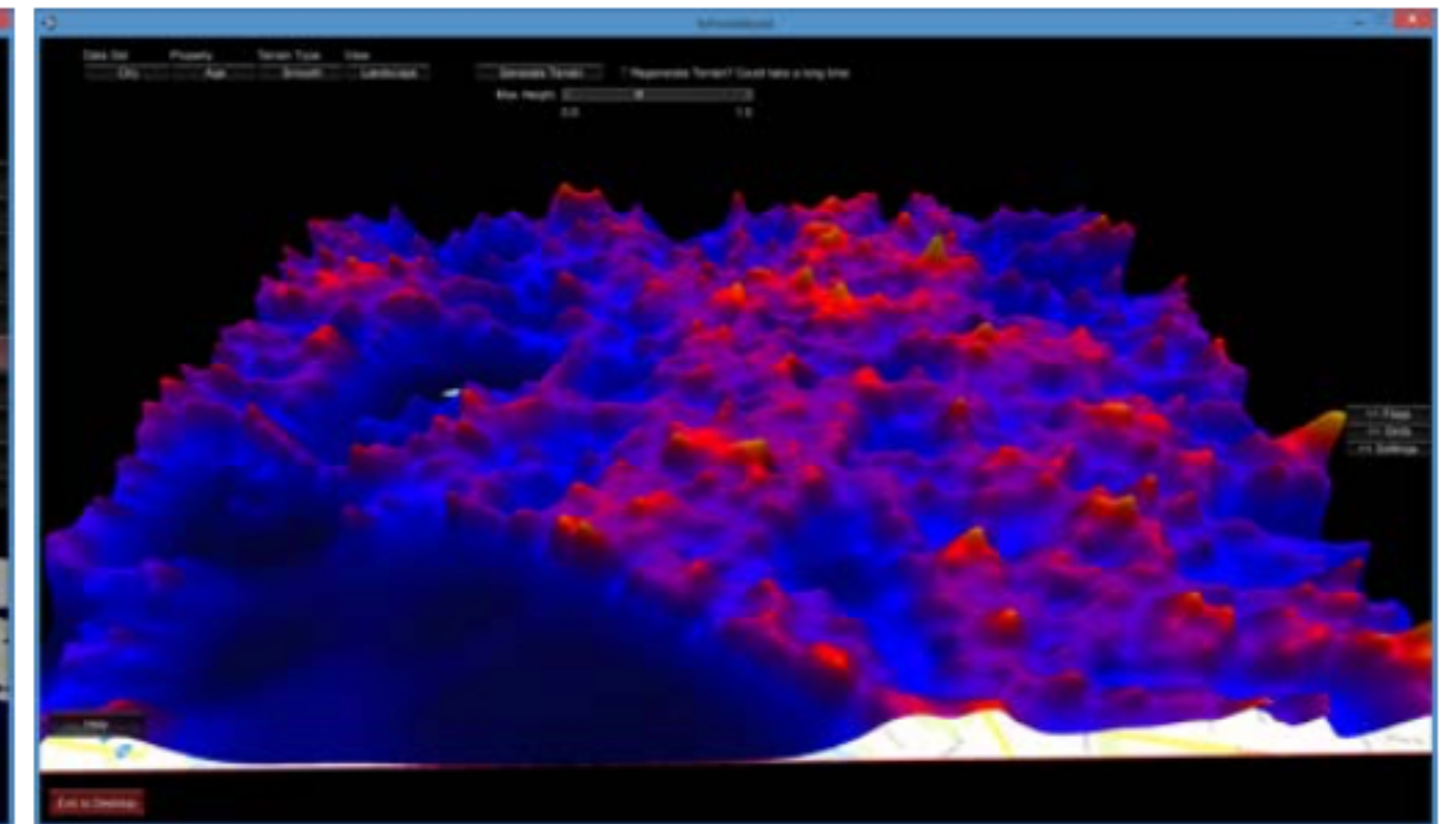


(Schwabish, 2014)



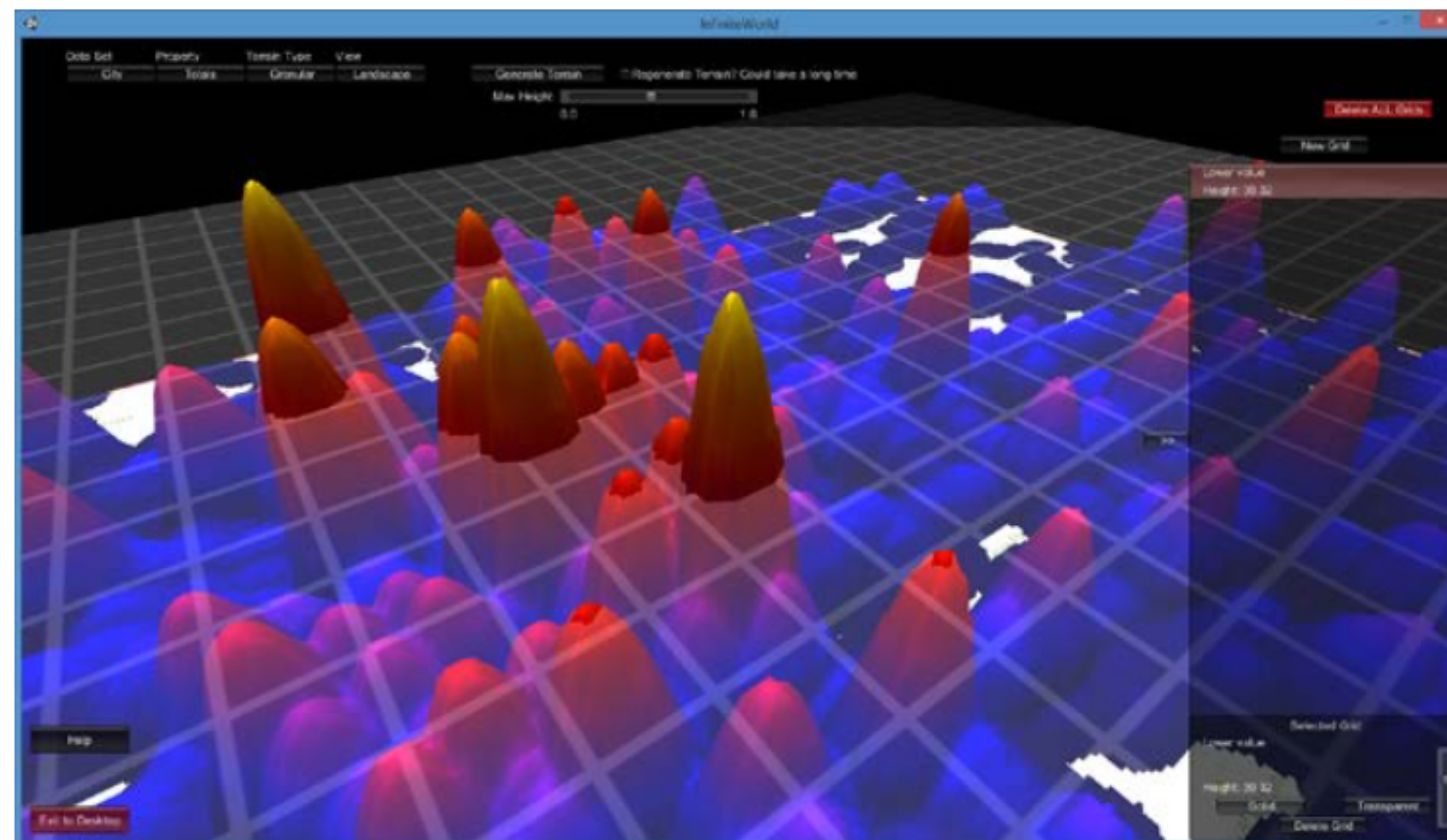


**(a) Total number of accidents (granular + flags)**



**(b) Age of people in accidents (smooth)**

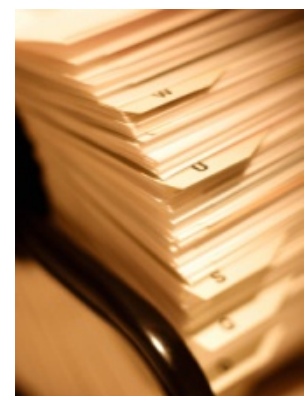
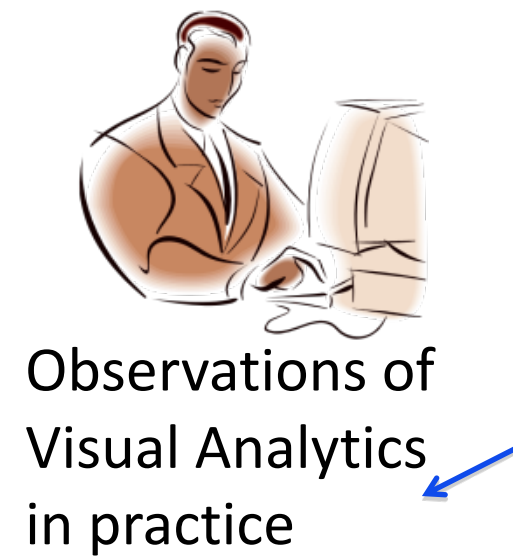
3D is not necessarily better (easier to comprehend) than 2D!



**(c) Navigation, measuring and comparing of data terrain features (grids)**



# Organisational Challenges of VA



Published  
industry  
Case studies



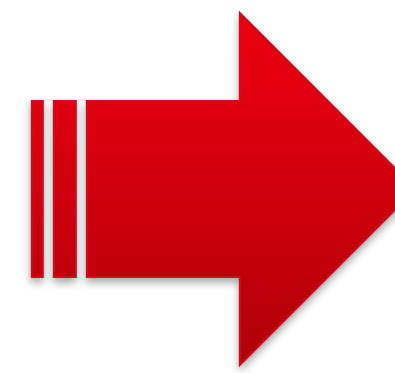
Interviews with  
industry  
practitioners



- How do practitioners use VA?
  - who is using VA?
  - for what purpose?
  - what kind of decisions do they make?
- What are the current challenges?
- What are the new opportunities?
- What are the required skills?

Industry practices

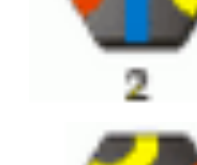
## Patterns



Organisational silos



Different sources of data



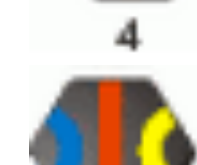
Data quality issues



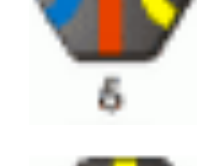
Collaboration to bring in different perspectives



Need to combine and reconcile different  
insights in order to propose an action



Need to use storytelling to communicate the  
findings and intended action.

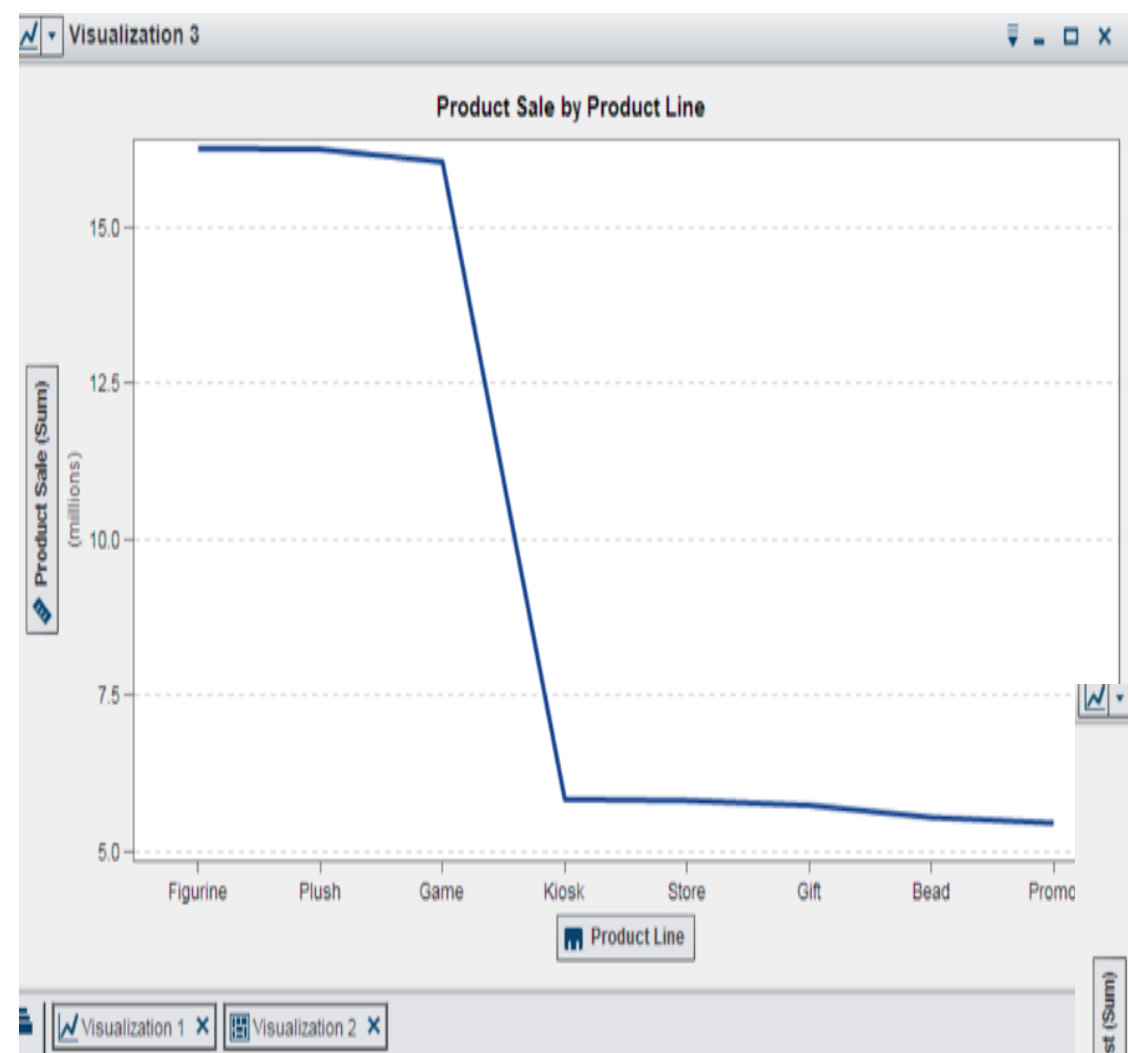


Marjanovic: VA of the Future, Au Gov OLT grant (2014-2016)

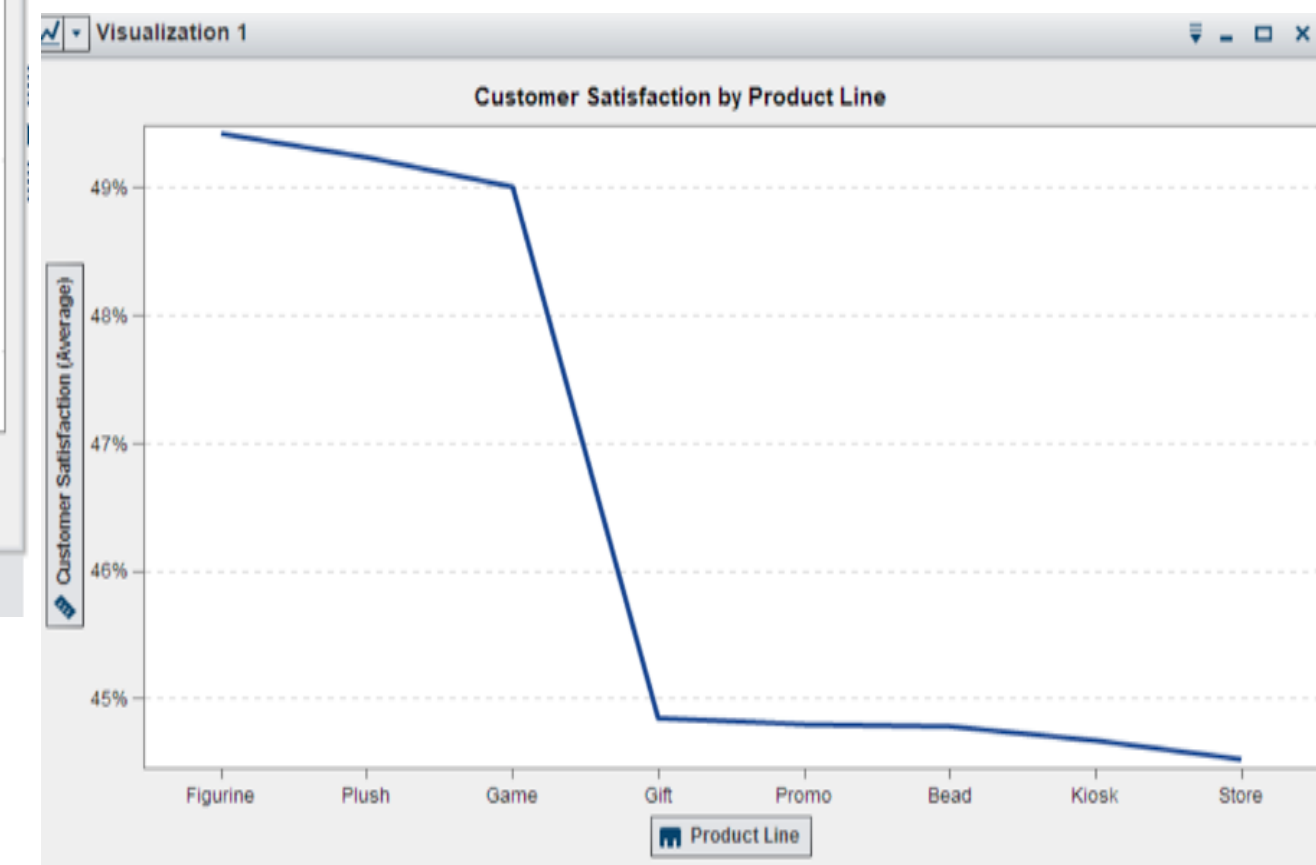
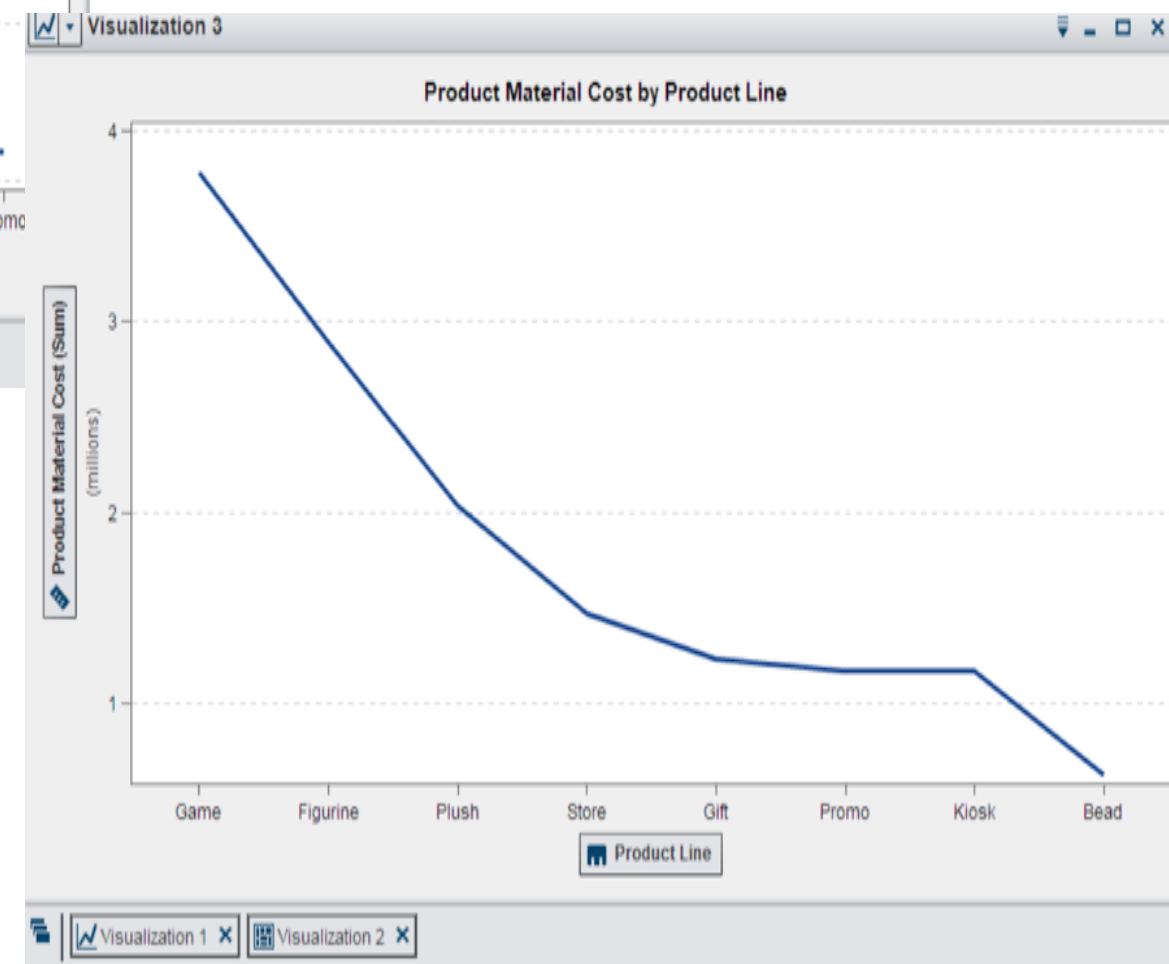


# An example: Collaborative VA brings to the surface some important organisational issues...

An interesting experiment: Three groups of students: sales, finance and customer services.



Which products should the company produce next year, in order to maximize its profit?



Functional silos, different perspectives, incomplete data, different interpretations

Marjanovic, (2015) ACIS'2015

# A major shift:

Visualization as a process (verb) rather than an outcome (noun)

Initial designer



VA skills



Main designer



Domain knowledge  
Context knowledge

**Visualising data**



**Visualising through data**

Marjanovic (2015) QC Re-Imagine Education USA



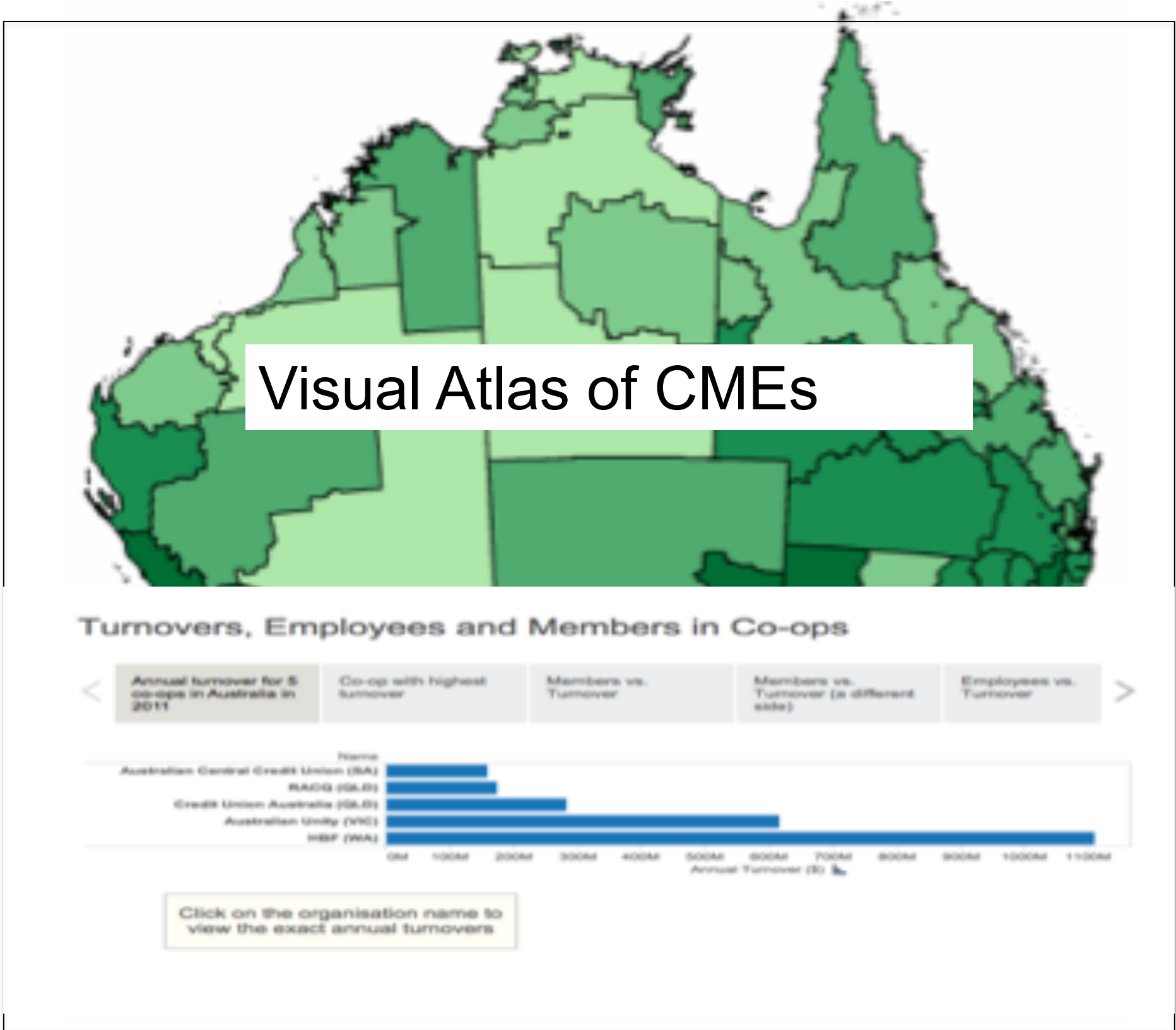
An example: Visual Atlas of Australian Cooperatives

Business Council  
of Cooperatives  
& Mutuels

Policy  
Makers

State & federal  
Governments

University  
Educators



Researchers

CMEs

Members

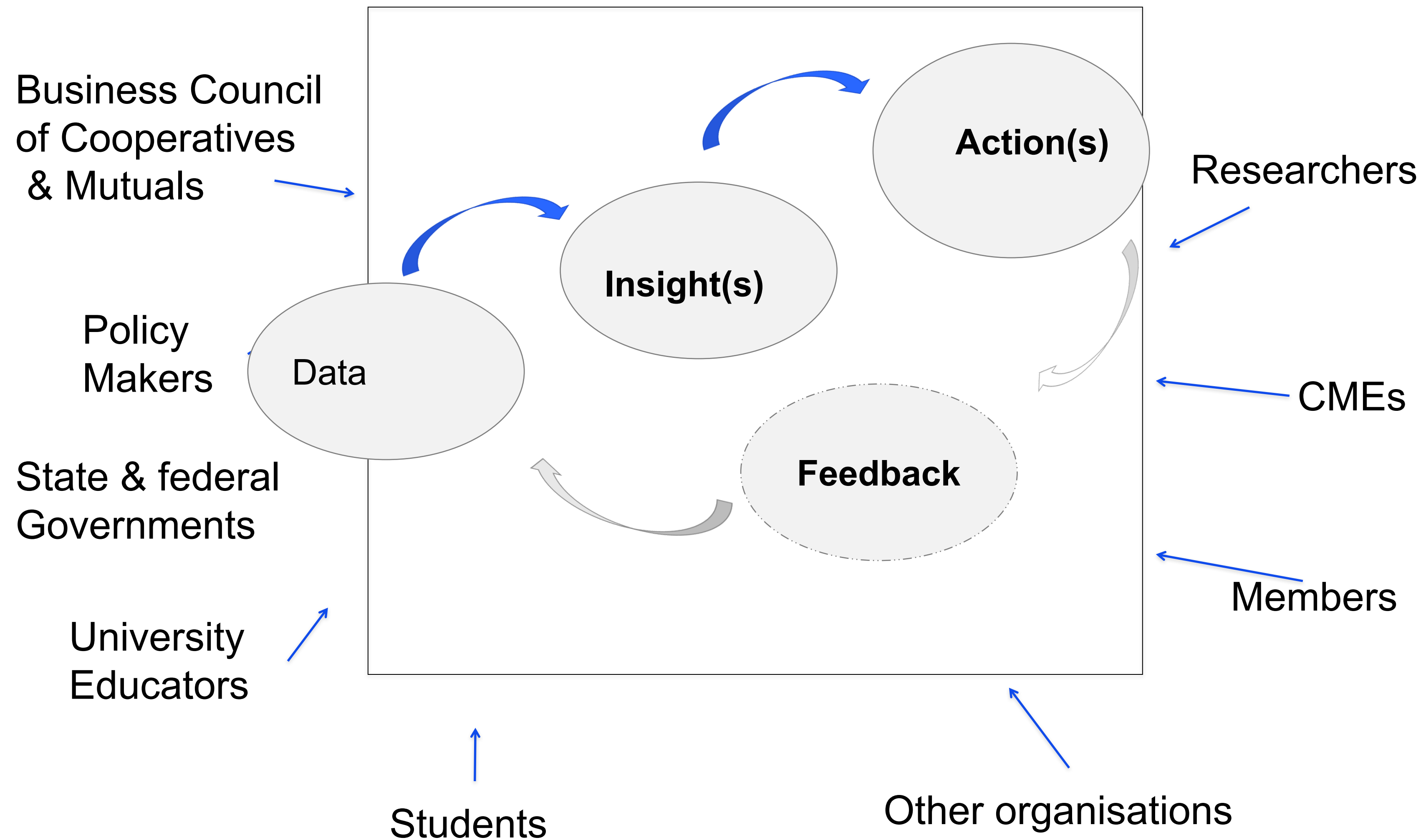
Students

Other organisations

Patmore, Marjanovic, Belnave  
ARC-DP (2017-2019)

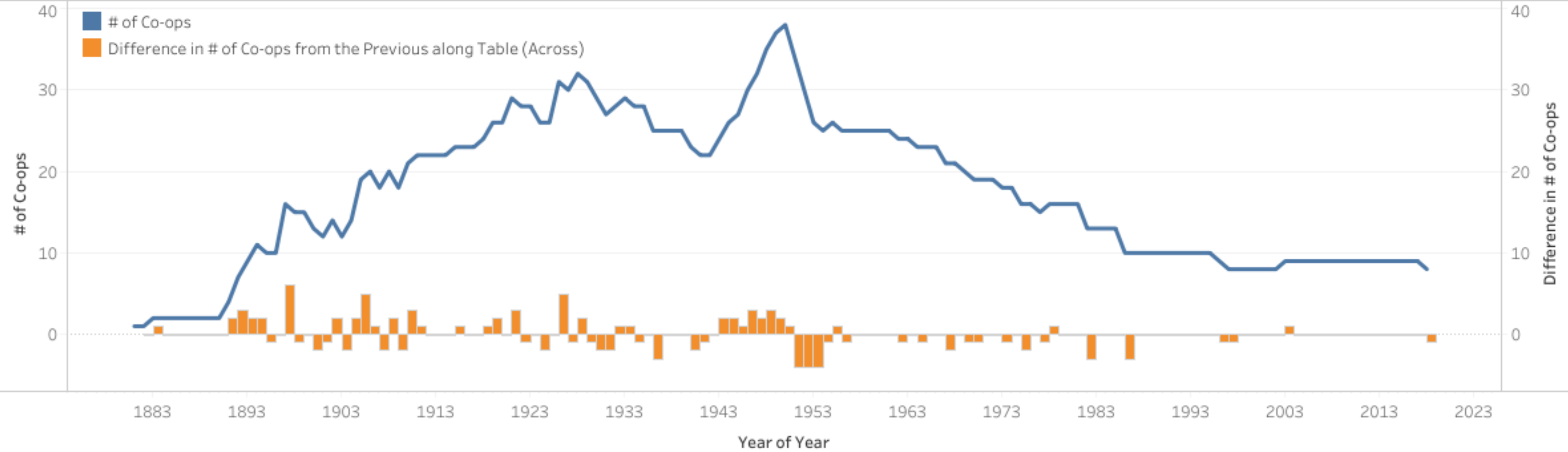


## Visual Atlas of Australian Cooperatives





Overview of Australian Co-ops



Displays	Year of Founding	Year of Last Presence	Age	# of Branches	# of Types
Agriculture Fishing Co-op	1,946	2,018	73	6	1
Agriculture Marketing	1,891	1,996	106	8	1
Agriculture Production	1,881	2,018	138	64	1
Agriculture Supply	1,892	2,018	103	21	1

Year of Year  
1827 to 2018

Revive ?  
All

State  
NSW

Location  
All

Type Name  
Multiple values

Display  
Type Name

Last Updated:  
30/05/2018

Important considerations: Visual Ethics, “Performative aspects of data”

Please note: These are static screen-shots and as such do not represent dynamic aspects of Visual Atlas



# Visual Atlas of Australian Co-ops

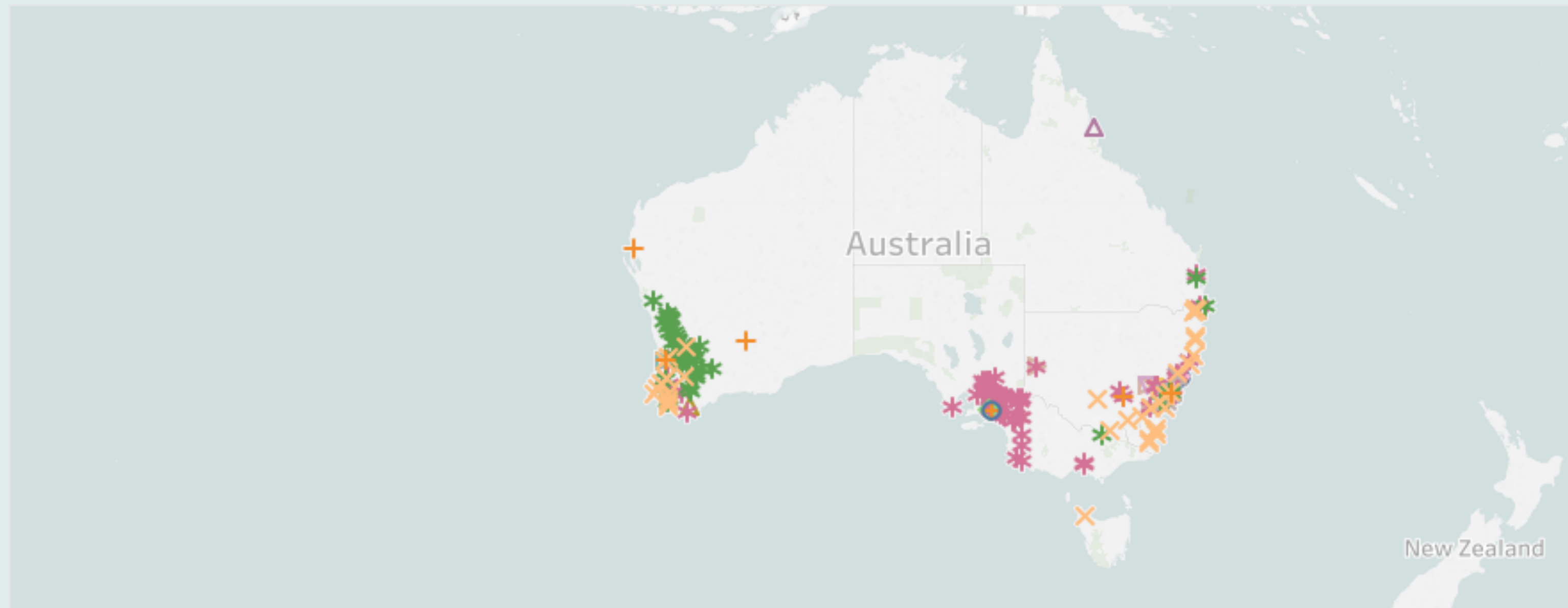
## 1936

### Type Name

- Agricultural Wh.. ▶ Co-operative Fe.
- Agriculture ○ Co-operative Ge.
- Agriculture Fish.. □ Co-operative Ne.
- + Agriculture Mar.. + Co-operative Tr..
- ✕ Agriculture Pro.. ✕ Community Co..
- \* Agriculture Sup.. \* Consumer Co-o..
- ◇ Co-operative Au.. ◇ Consumer Co-o..
- △ Co-operative Co.. △ Financial Co-op ..
- ▽ Co-operative Co.. ▽ Financial Co-op ..
- ◁ Co-operative Co.. ◁ Financial Co-op..

### Displays

- Agricultural Wholesale
- Agriculture
- Agriculture Fishing Co-op
- Agriculture Marketing
- Agriculture Production
- Agriculture Supply
- Co-operative Auxiliary
- Co-operative Community
- Co-operative Community Advancement
- Co-operative Community Society
- Co-operative Federation
- Co-operative General
- Co-operative Newspaper
- Co-operative Transport

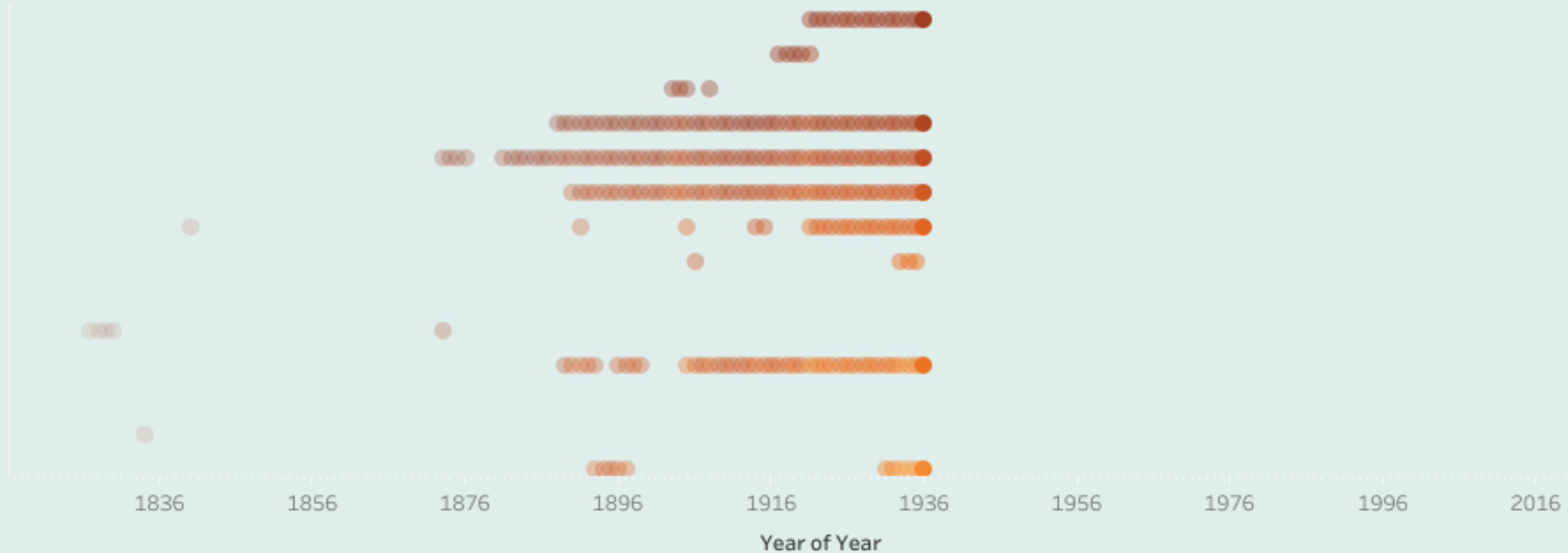


Time Machine  
1936  
☒ Show history

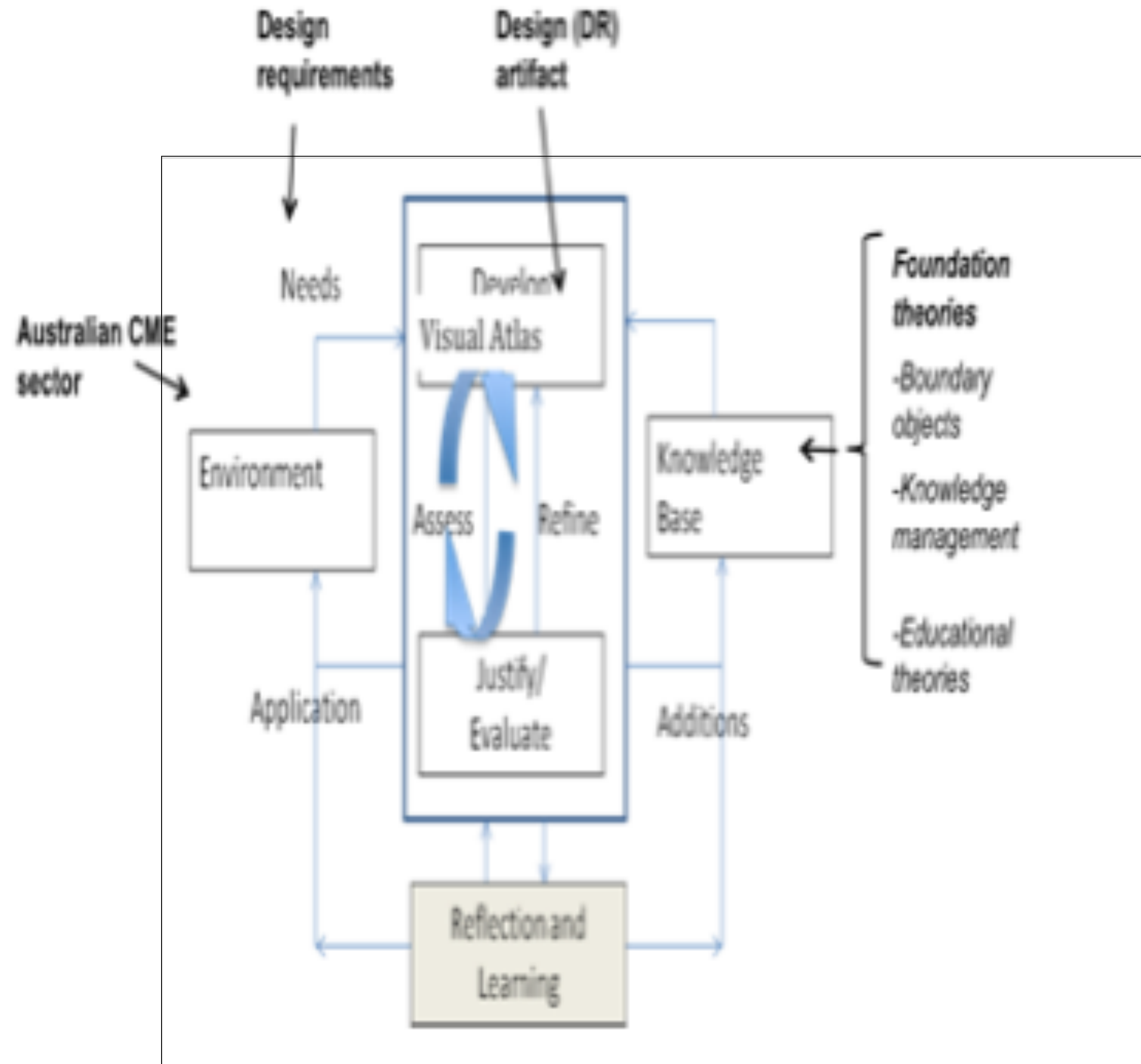
- Revive ?  
All
- HQ or Not  
All
- State  
All
- Type Name  
All

Display  
Type Name

Last Updated:  
30/05/2018





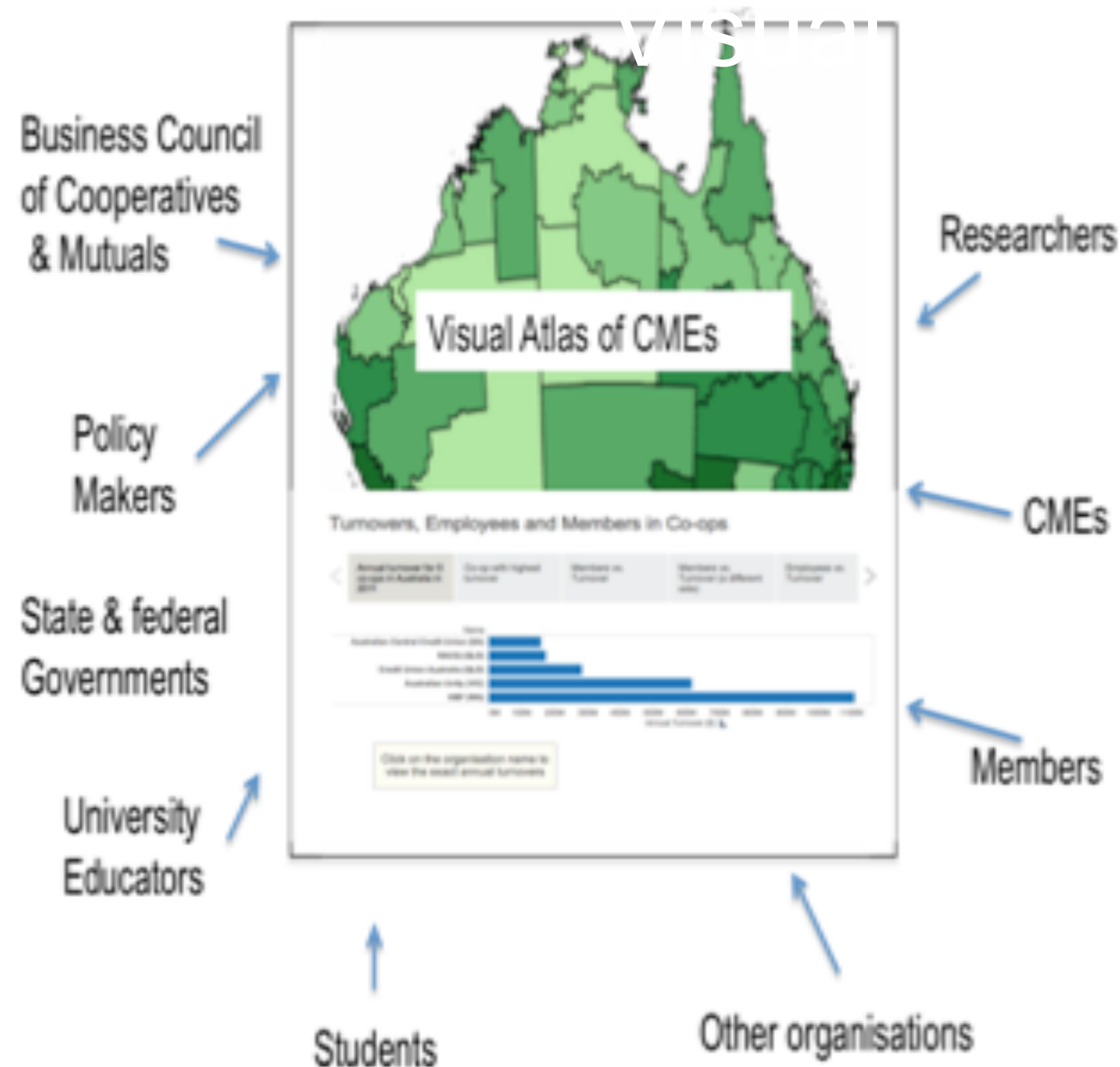


### Design research artifacts:

- A very comprehensive high quality data set collected by historians
- A “Visual Atlas” infrastructure ready for future opportunities
- a method of empowering practitioners to engage in ongoing data exploration through secondary design
- a collection of data visualization stories

## Interesting research challenges (so far):

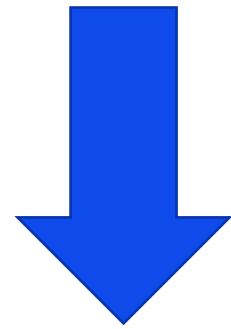
- VA Tool -> VA Infrastructure
- Participatory co-design
- Transfer of skills from Primary to “Secondary” designers
- Visual storytelling
- Knowledge-sharing processes through collaborative sense-making
- Design of data-driven services
- Visual boundary objects
- Open data ethics and datafication effects
- Visual ethics
- Participatory data quality
- Visual Atlas as “pattern” for future VA infrastructures
- Visual Atlas as a “living data environment”
- Visualisation of conceptual phenomena (e..g. visualisation of impact)
- Visual Atlas as a Human Complex System





## Beyond Visual Atlas

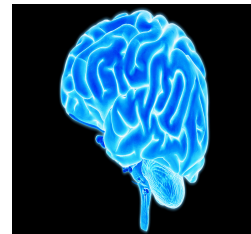
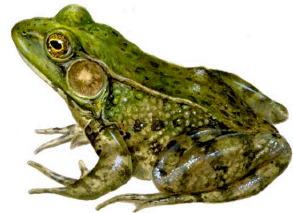
■ Business Analytics (Data-driven)



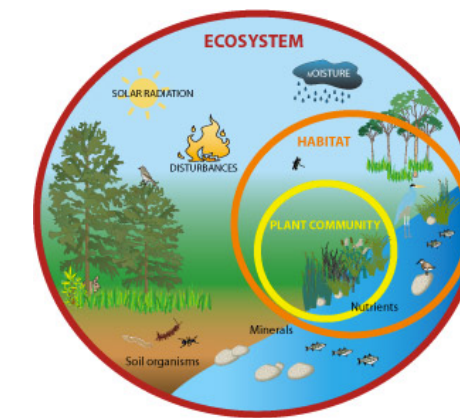
## Analytics in Human Complex Systems (Requires “Thinking in Systems”\*)



Engineering  
Systems



Living systems



Human Complex  
Systems

Example: Datafication effects of MySchool Marjanovic and Cecez-Kecmanovic (2017)

<https://www.sciencedirect.com/science/article/abs/pii/S0963868717302482>



# Think Clouds, not Clocks

*Karl Popper, the great philosopher,  
said all problems  
are either clouds or clocks..*

One of the problems we have as  
a culture is we take clouds &  
pretend they are clocks .



# Towards data humanism...



Thank you!

Thank you!

