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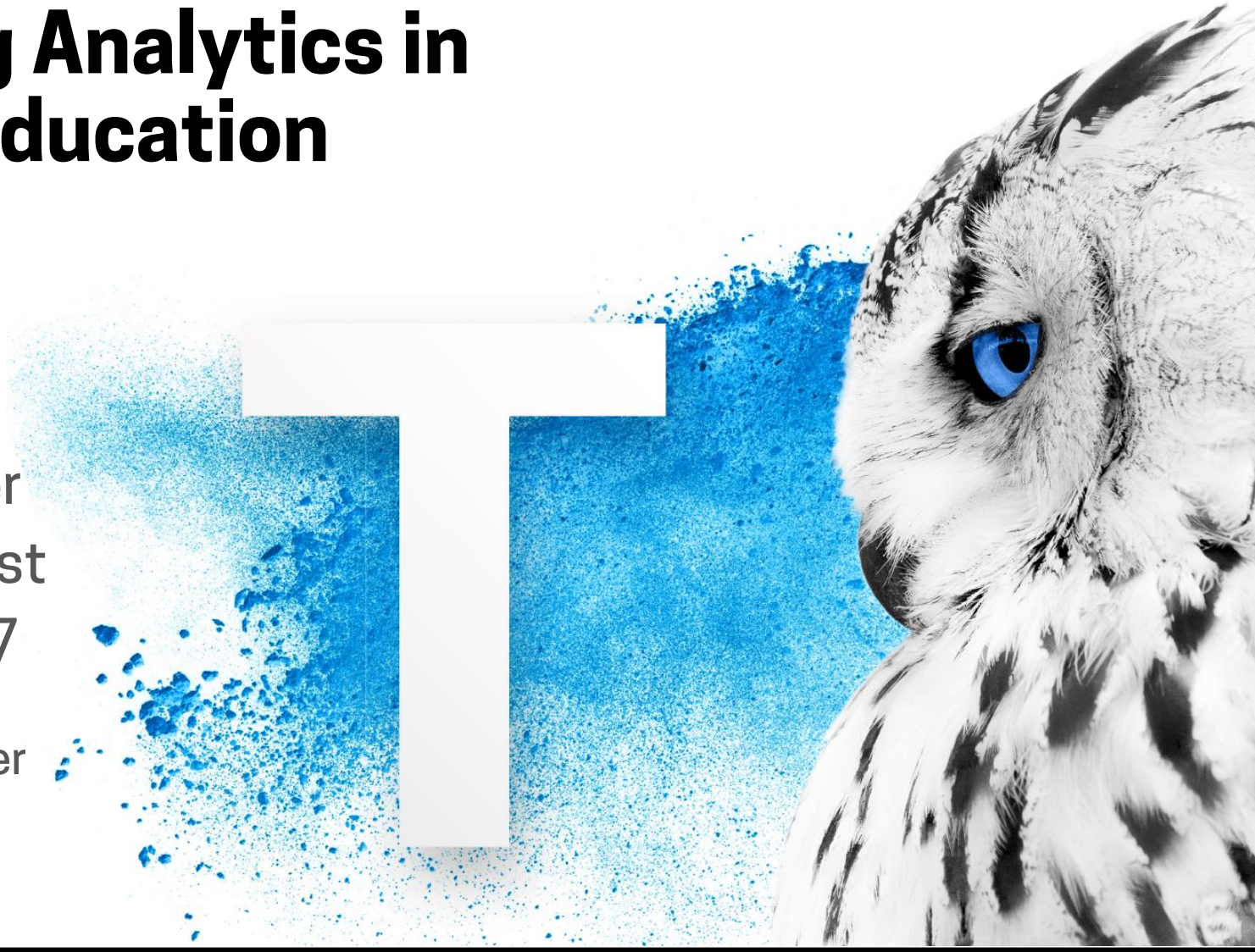
Learning Analytics in Higher Education

Adam Cooper
Data Scientist
July 4th 2017

@adam_r_cooper



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How did I get here?

- SFC Teacher of Chemistry
- FCoT Head Teaching and Learning Technology Centre
- Tribal Software Architect
- Cetis
  - Centre for Educational Technology and Interoperability Standards
  - Reader in eLearning
  - Learning Analytics Community Exchange Project
- Tribal Data Scientist

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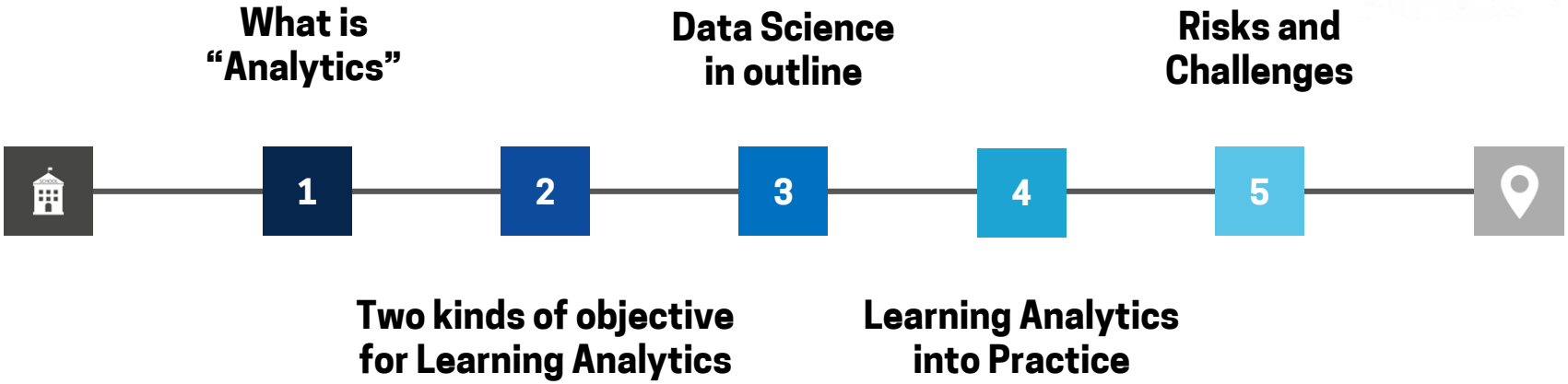
Journey of This Talk



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What Problems?

- Managing learning… by convention, anecdote, hear-say
- Traits, behaviour, and outcomes have complex inter-relationships
- Jumping to conclusions from data, finding patterns where none exist

A principled approach to learning analytics can help.

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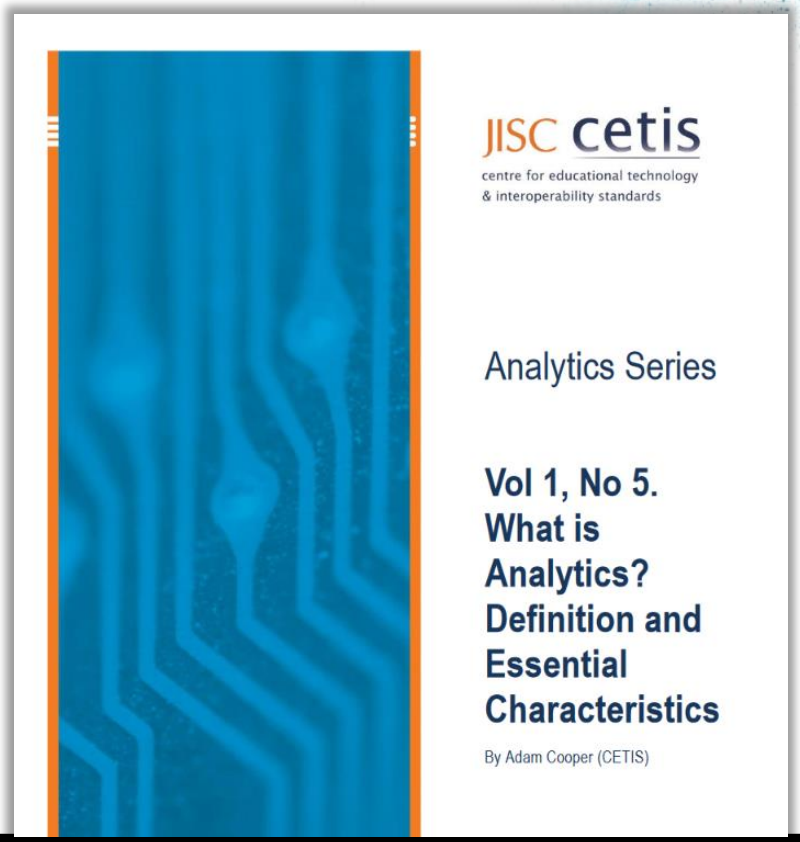
What do I Mean: “Analytics”

“Analytics is the process of developing actionable insights through problem definition and the application of statistical models and analysis against existing and/or simulated future data.”



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What do I Mean: "Analytics"

"Analytics is the process of developing actionable insights through problem definition and the application of statistical models and analysis against existing and/or simulated future data."

make a difference

that is targeted

defensible and qualified

Not everything described as "analytics" is as purposeful as this.
Ask yourself: "does this matter?"

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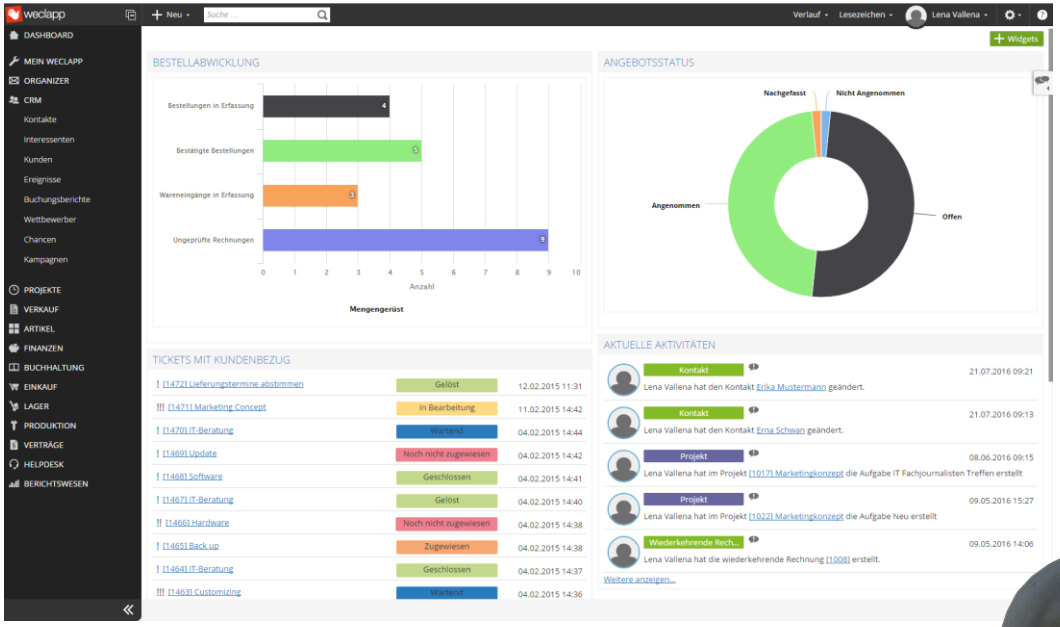

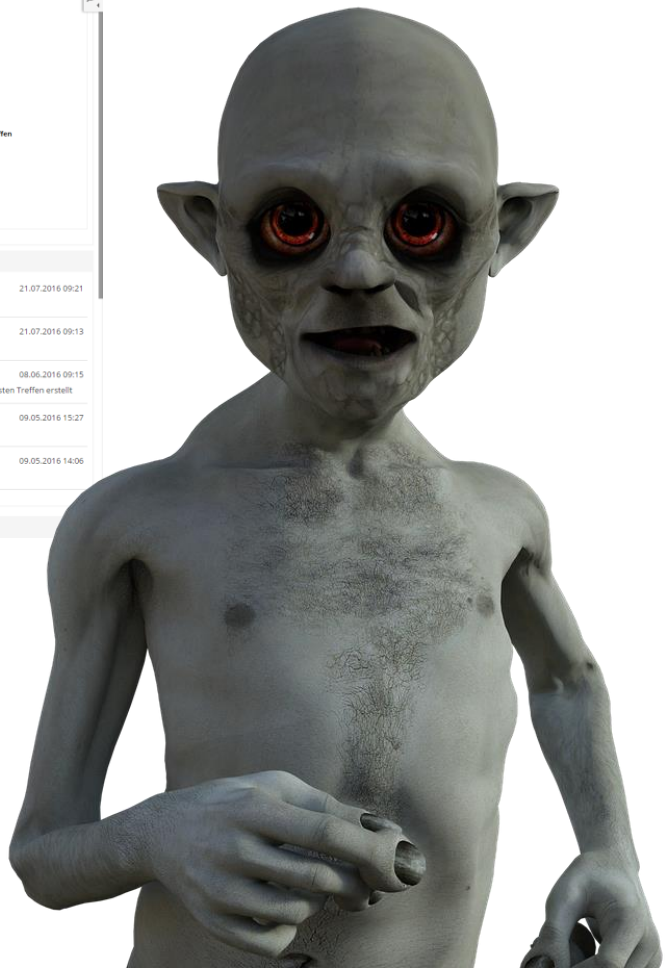

ACME CORPORATION

Learning Analytics Solution

Ask yourself: “does this matter?”

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Journey of This Talk

What is
"Analytics"

1 2 3 4 5

Two kinds of objective
for Learning Analytics

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Defining "Learning Analytics"

SOLAR
SOCIETY for LEARNING ANALYTICS RESEARCH

"Learning analytics is the measurement, collection, analysis and reporting of data about learners and their contexts, for purposes of understanding and optimizing learning and the environments in which it occurs."

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Institutional

Two Kinds of Objective for Learning Analytics

Organisational

- Patterns at institutional, unit, course level
- Strategic or tactical response

e.g. investigate why accommodation type correlates with module/year re-take risk

Individual

- Applying patterns to estimate risk or guide learning journeys
- Personal response (SR?)

e.g. as a tool for routine personal tutor engagement

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So you want some examples?

Policies

Analytical Review (UK Government Department for Education)
Capacity enablers and barriers for learning analytics
Code of practice for learning analytics
Education governance: the role of data – Organisation for Economic Co-operation and Development
Educause – Understanding and managing the risks of analytics in higher education: a guide
Enhancing teaching and learning through learning analytics and educational data mining (US Department of Education)
Ethical use of student data policy – The Open University
Evaluation of policy frameworks for addressing ethical considerations in learning analytics

Practices

Arizona State University
Ceibal
Course Signals: Purdue University
Dunchurch Infant School
Effective learning analytics pilots –Jisc
Further education learning technology action group: FELTAG
Georgia State University
Nottingham Trent University
Student Dashboard
PAR Framework
PredictED– Dublin City University
Progress and Course Engagement (RioPACE) – Rio Salado College
Student retention and learning analytics: A snapshot of Australian practices and a framework for advancement

Tools

ASSISTments
Bettermarks
Civitas Learning
Cognitive Tutor software
Conexus Vokal
Degree Compass (Desire2Learn)
Digital Assess – adaptive comparative judgement
FFT Aspire
itslearning
Khan Academy analytics
Learning Analytics Processor
Metacog
Open Essayist
OU Analyse
Schoolzilla
Skillaware
SNAPP

#laepanalytics

13

Original slide by R Ferguson et al, Open University

LAEP Inventory http://cloudworks.ac.uk/cloudscape/view/2959

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Journey of This Talk

What is "Analytics"

Data Science in outline

1 2 3 4 5

Two kinds of objective for Learning Analytics

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A Very Quick Example of "Data Mining"

Presuming we have:

- Clear purpose/targets
- Clean data
- A measure of "goodness in practice"

Purpose:

- Finding hidden patterns
- Building a predictive model
- Evaluating its likely performance

- … and for the following example, objective outcomes of interest

a classification problem

The images which immediately follow are from www.r2d3.us

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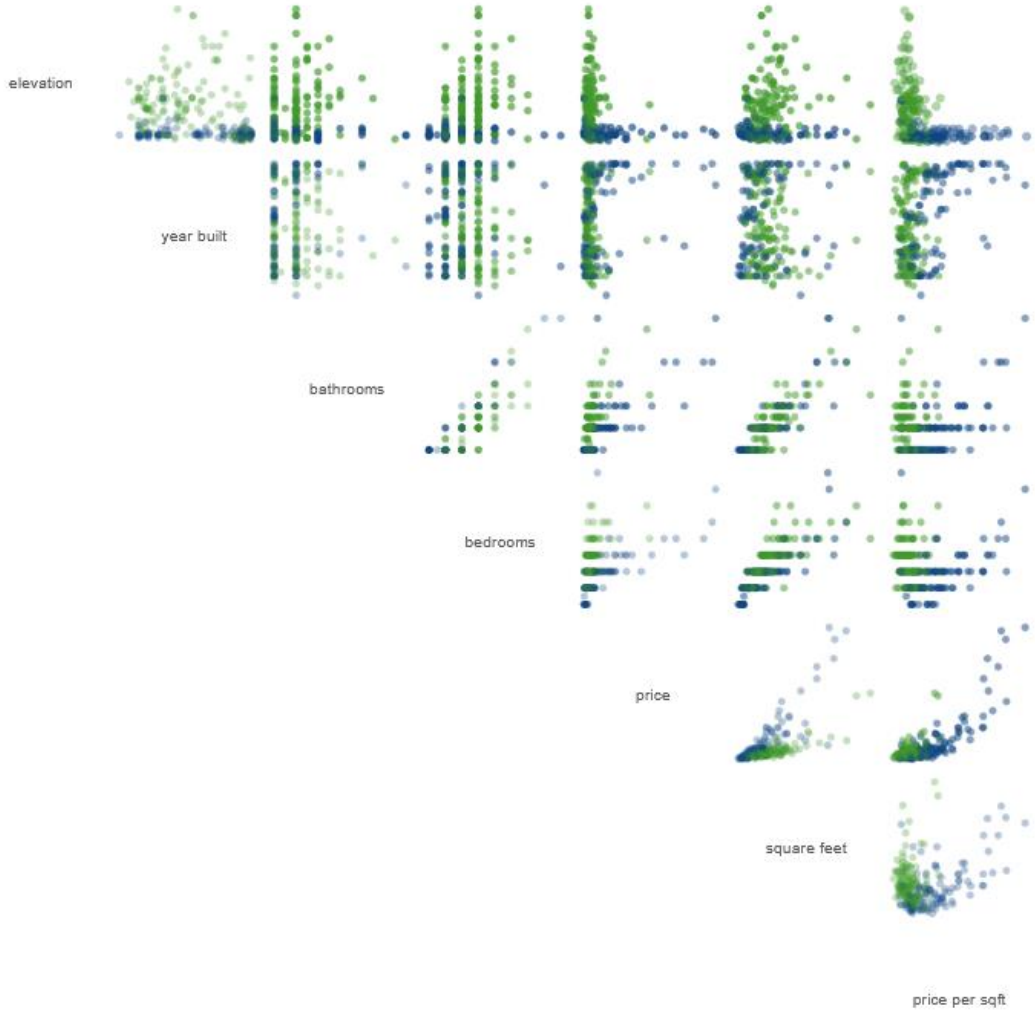
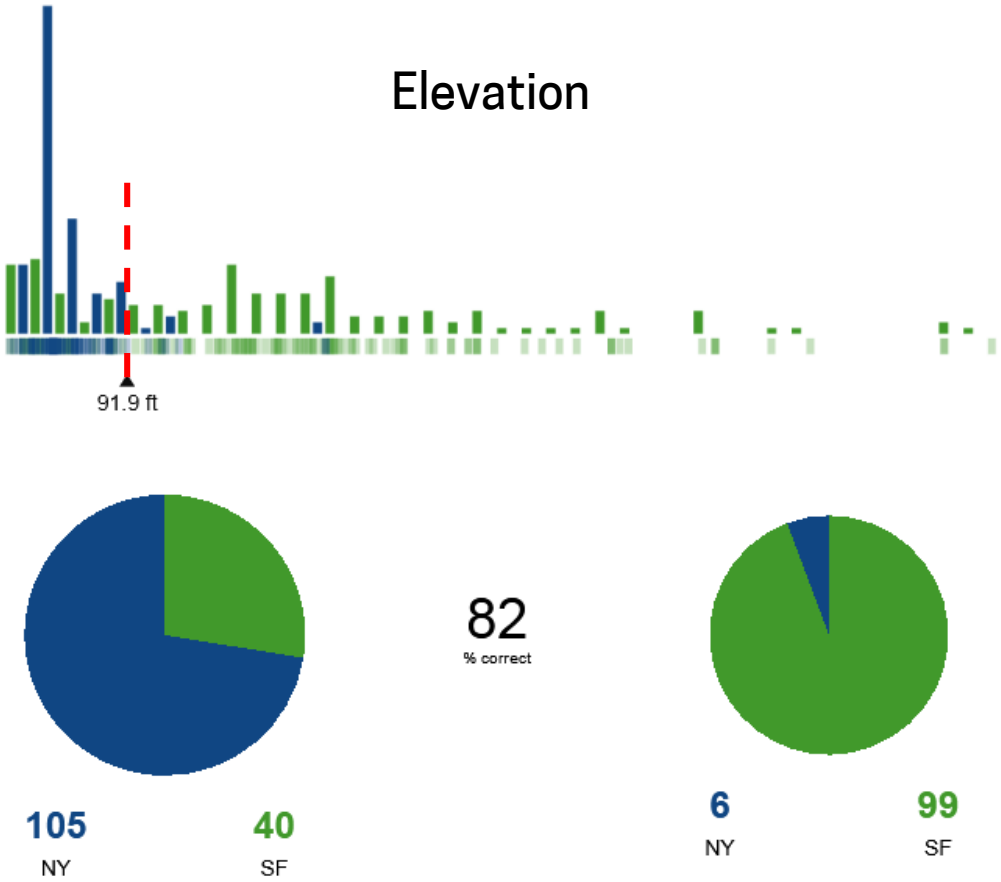
Example - Building a Decision Tree



Can we build a predictive model to decide, from 7 attributes of a house, whether it is in San Francisco or New York?

Aim is to find a set of binary splits which best separate SF from NY houses



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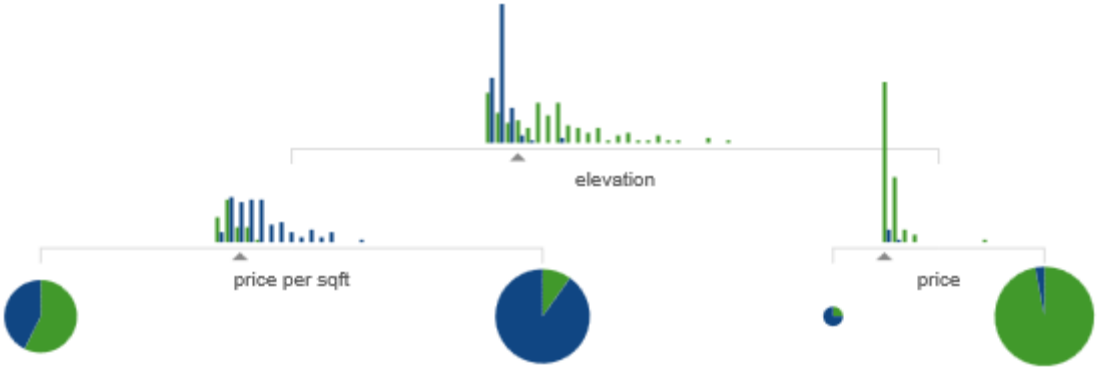

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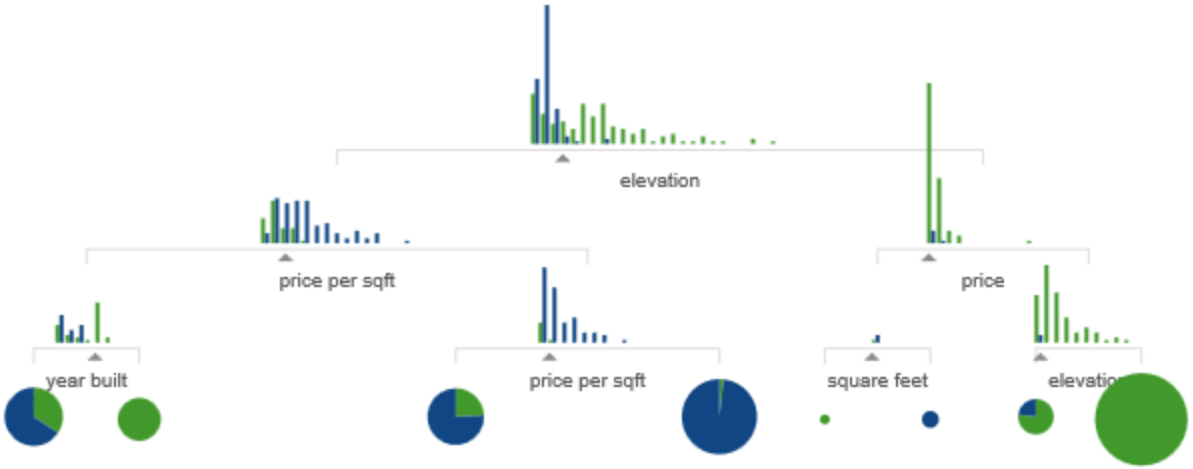
elevation
price per sqft
price
year built
price per sqft
square feet

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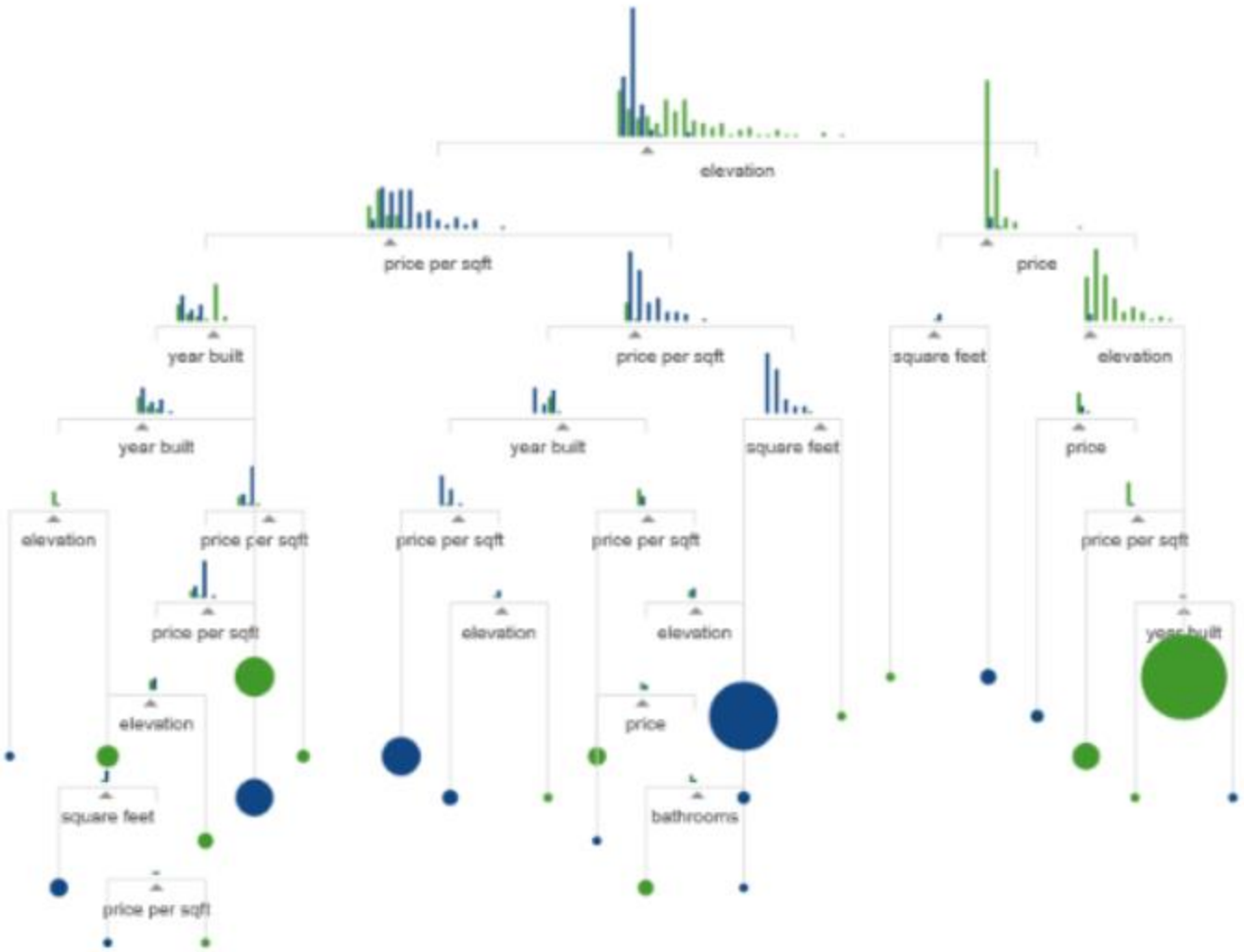

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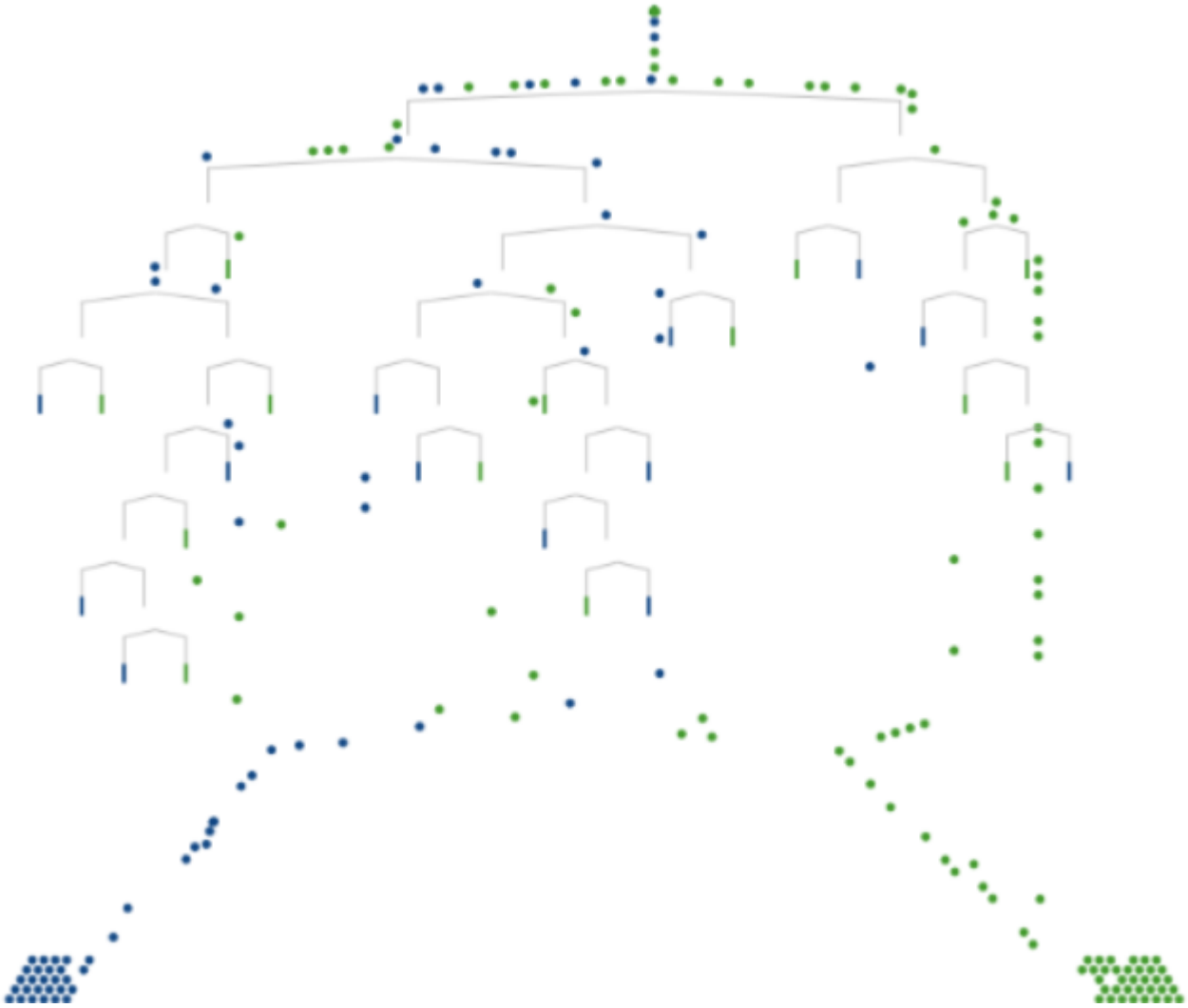
Using the Tree to Classify Houses



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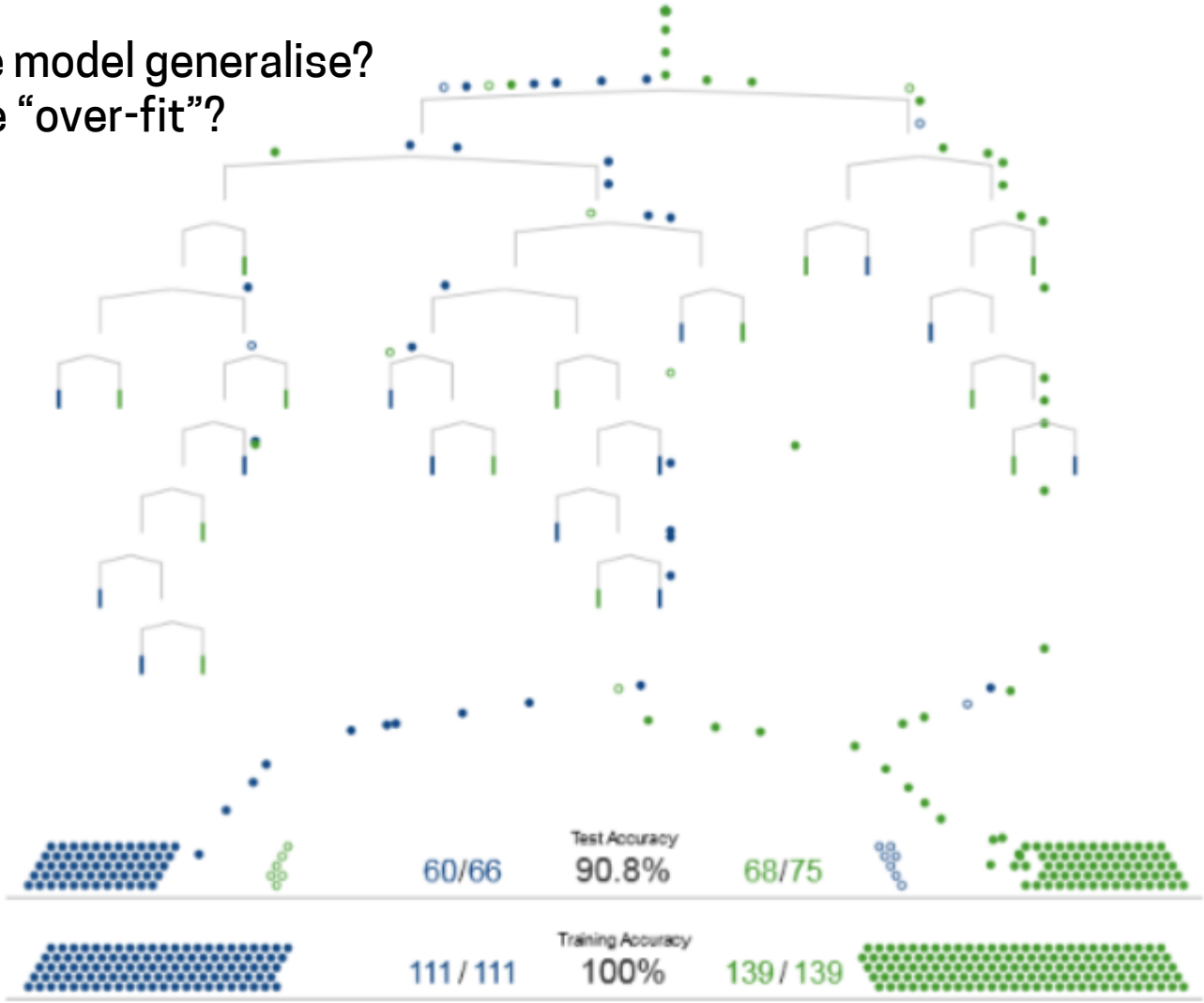
Using “Holdout Data” to Evaluate the Tree

Does the model generalise?
Or did we “over-fit”?



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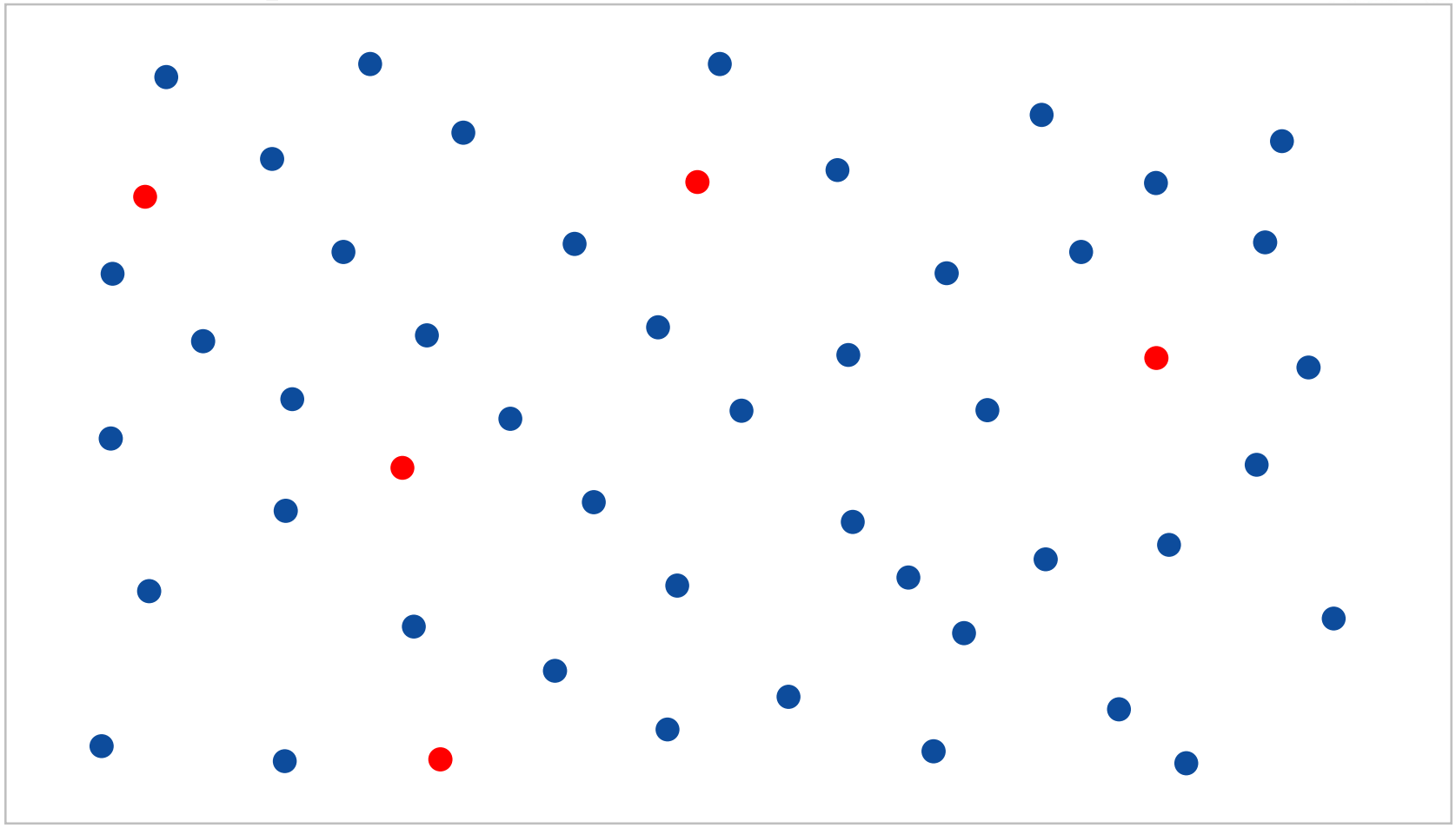
Accuracy is Treacherous!



"All dots are blue" is 90% accurate.

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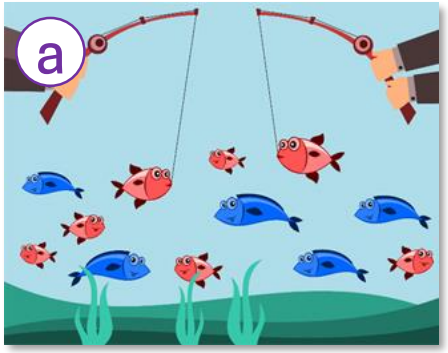
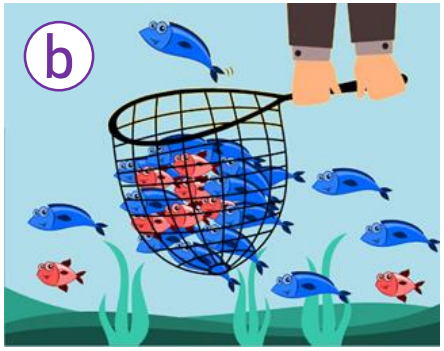
Metaphor: To build a model to catch red fish



Using a rod and special bait that red fish like we only catch red fish. This is **HIGH PRECISON**.

But how can we catch **more** of the red fish?



Using a new large fishing net and the special bait we now catch most of the red fish. This is **HIGH RECALL**.

But now we have lots of Blue fish too. So we have **LOW PRECISON**

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Key Points

- We need historical data
- More complex models require more data
  - More attributes
  - Bushier trees
- Allow the pattern to emerge
- Evaluation should be in-context
- A model <u>will</u> be imperfect but it <u>may</u> still be useful
  - I prefer “estimating risk” over “prediction”
- Models that can be inspected, with attributes that are meaningful, support trust and actionable insight
- + part of a process …

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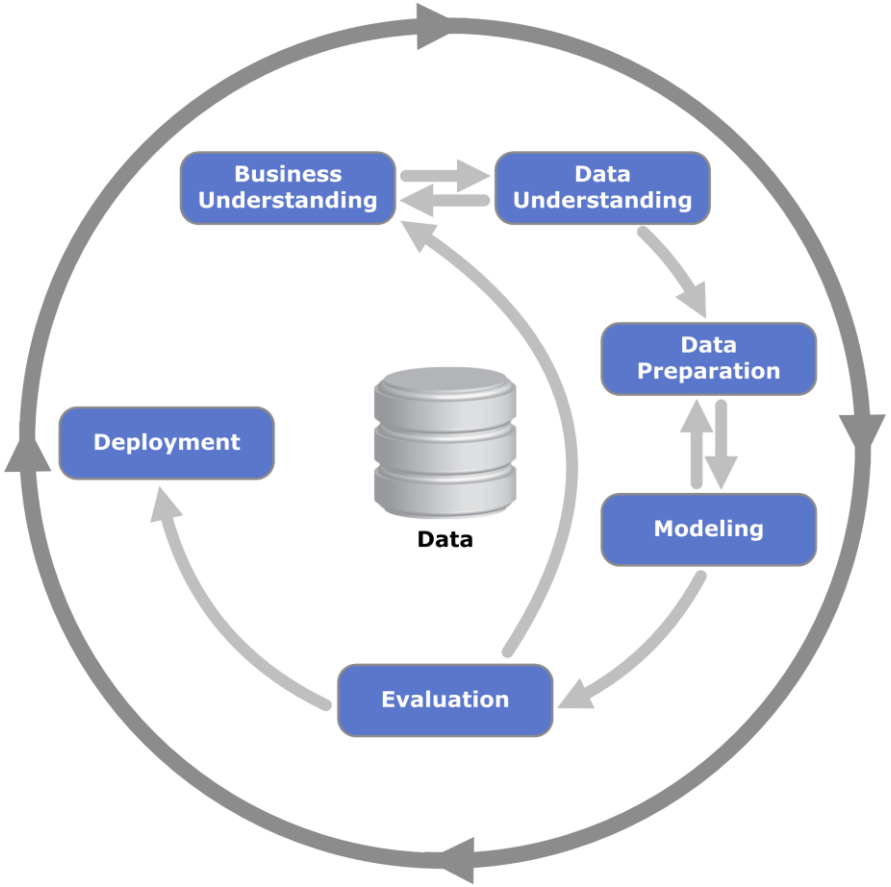
Data Science as Contextualised Process



Caveat:
technology perspective

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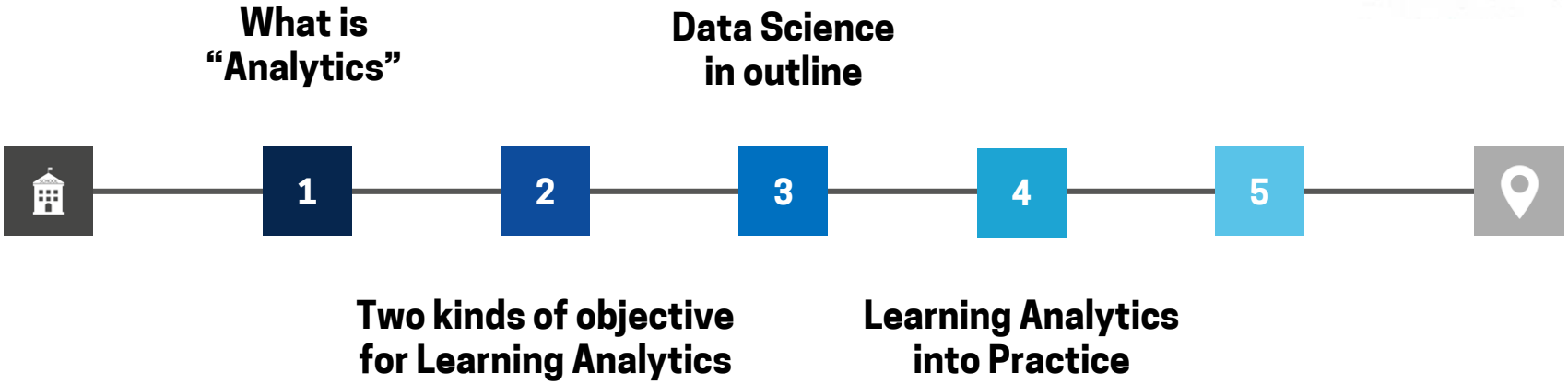
Journey of This Talk



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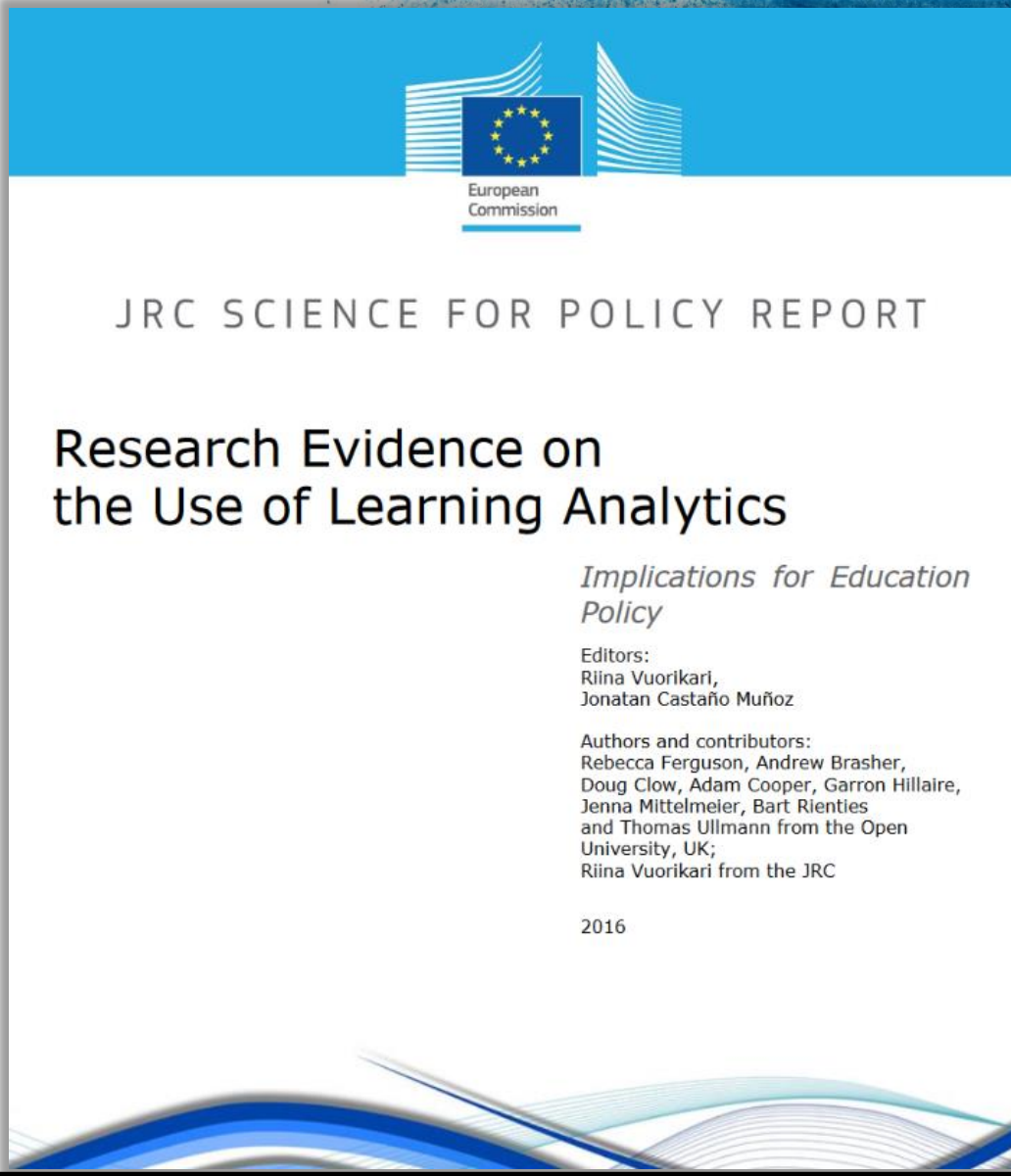
The implications and opportunities of learning analytics for European educational policy (LAEP)

RQ1: What is the current international state of the art in the implementation of learning analytics for education and training in both formal and informal settings?

RQ2: What are the prospects for the implementation of learning analytics for education and training in both formal and informal settings in the next 10–15 years?

RQ3: What is the potential for European policy to be used to guide and support the take-up and adaptation of learning analytics to enhance education in Europe?



European Commission

JRC SCIENCE FOR POLICY REPORT

Research Evidence on the Use of Learning Analytics

Implications for Education Policy

Editors:
Riina Vuorikari,
Jonatan Castaño Muñoz

Authors and contributors:
Rebecca Ferguson, Andrew Brasher, Doug Clow, Adam Cooper, Garron Hillaire, Jenna Mittelmeier, Bart Rienties and Thomas Ullmann from the Open University, UK;
Riina Vuorikari from the JRC

2016

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Implementation and Complexity

ROMA: Rapid Outcome Mapping Approach

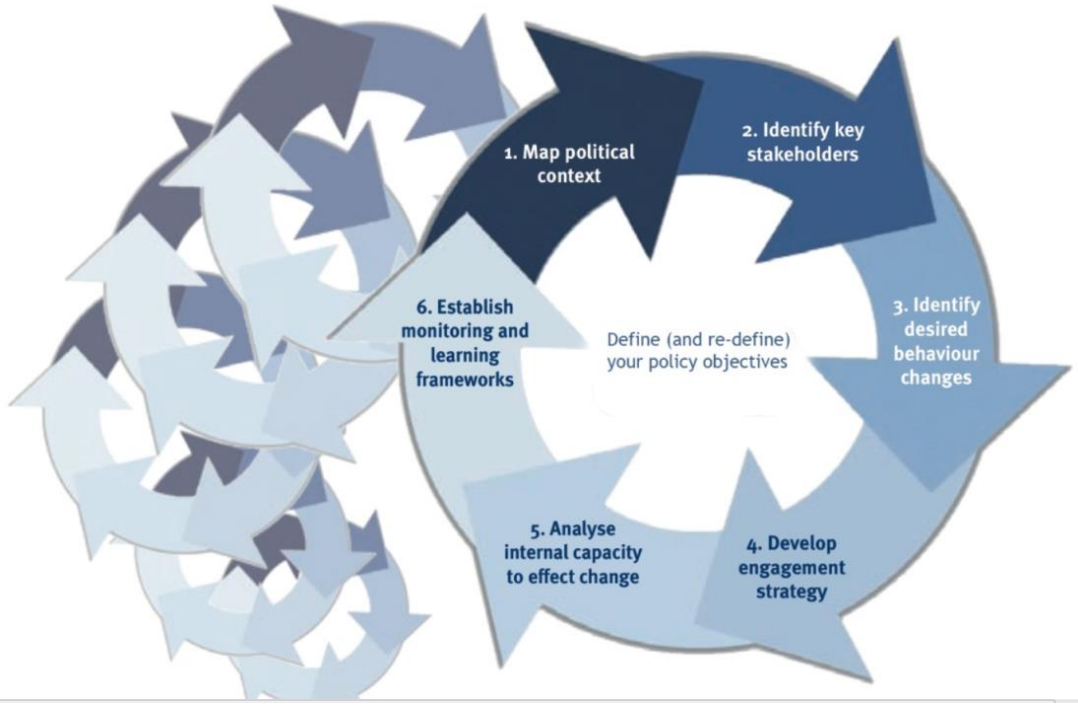

Diagram from: Ferguson, Rebecca; Macfadyen, Leah P.; Clow, Doug; Tynan, Belinda; Alexander, Shirley and Dawson, Shane (2015). Setting learning analytics in context: overcoming the barriers to large-scale adoption. Journal of Learning Analytics, 1(3) pp. 120–144.

LAK17 Workshop

LA Policy: Developing an Institutional Policy for Learning Analytics using the RAPID Outcome Mapping Approach

"… develop an understanding of organisational operation for learning analytics … engage in a strategic planning process for this"

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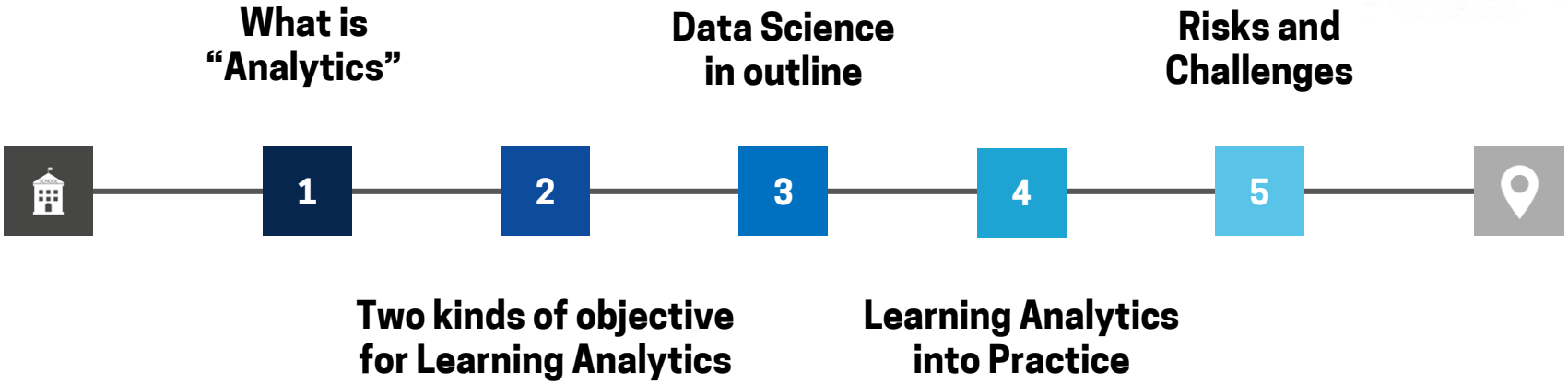
Journey of This Talk



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BE PRAGMATIC – BE PATIENT

Learn to Use the Tool

Image from http://www.kunsan.af.mil

A tool you cannot cut yourself on is unlikely to be useful

- Good technique
  - Learn by doing
- Knowing when to use and when not to use
  - Tools have limitations
  - Not “LA everywhere”
- Wear goggles!

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Don’t underestimate the effort required to access and prepare suitable data.

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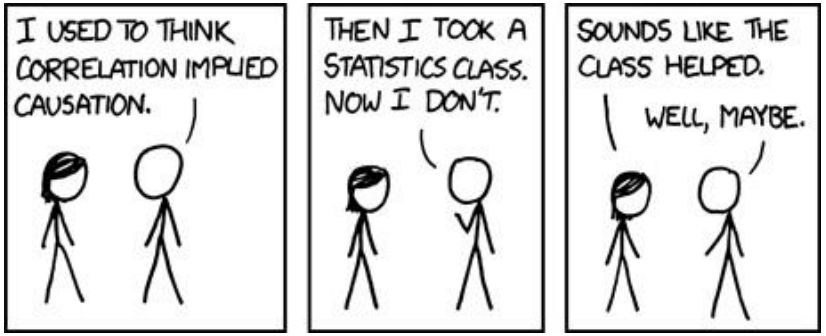
Correlation is not Causation



Successful students might be more likely to XXX, but making all students XXX will not necessarily make them successful.

XXX = “use the VLE”, “attend classes”, “live in halls”, “be female”

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So…

How could learning analytics “reshape the educational landscape”?

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Believable Progress or Dystopia

- LA as mediated evidence
- Focus on student support
- Addresses all students
- Evolves by participative design
- Challenges presumption and supposition
- Deployed within its limitations
- Embedded into professional practice
- Valued by all

- LA as proof/answers
- Managerial focus
- Driven by cost/benefit
- Acquired as a “solution”
- Used as a defensive weapon of the elite
- Used without care for validity
- Imposed as administrative requirement
- Discredited

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More likely than dystopia

- Over-optimism over realistic expectation
- Embracing hype over informed application
- Hasty implementation over pragmatic learning-by-doing
- Failure to embrace complexity of change

⇒disenchantment, “it didn’t work”, rejection by staff or students, …

Reshaping landscapes takes planning and time!

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Reading List #1

- Cetis Analytics Series - http://publications.cetis.org.uk/c/analytics
- JRC Science for Policy Report "Research Evidence on the Use of Learning Analytics" - https://is.gd/LAEP_report
  - LAEP Inventory http://cloudworks.ac.uk/cloudscape/view/2959
- ROMA Framework Paper
  Ferguson, Rebecca; Macfadyen, Leah P.; Clow, Doug; Tynan, Belinda; Alexander, Shirley and Dawson, Shane (2015). Setting learning analytics in context: overcoming the barriers to large-scale adoption. Journal of Learning Analytics, 1(3) pp. 120–144.
- Jisc Code of Practice for Learning Analytics
  https://www.jisc.ac.uk/guides/code-of-practice-for-learning-analytics
- For the technically-minded, the R2D3 visual introduction to machine learning - http://www.r2d3.us

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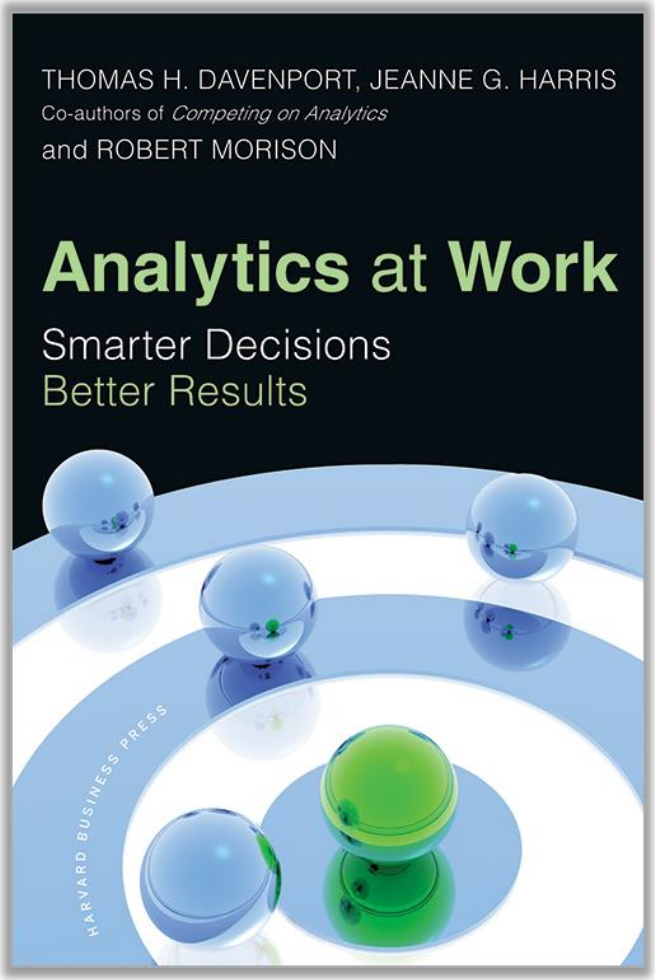
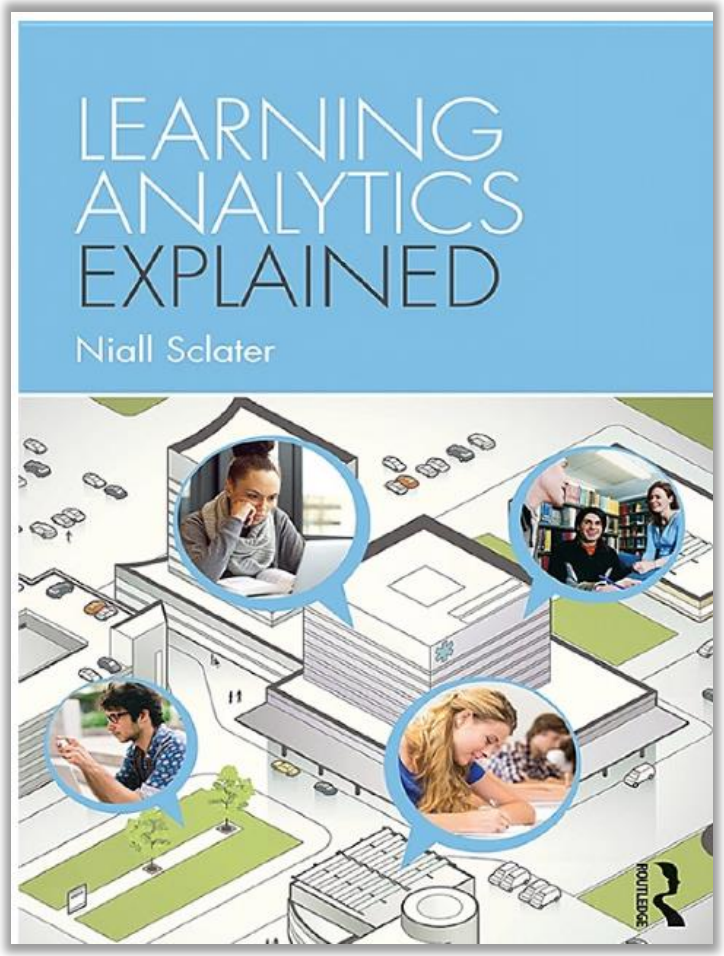
Reading List #2





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Reading List #3

LACE

ABOUT LACE | COMMUNITY | SECTORS | PUBLICATIONS | OUTCOMES | EVENTS

FEATURED

Cross-cultural studies of LA policies will help implementations

MAY 15, 2017

Join us exploring national and regional LA policies!

NOVEMBER 18, 2016

Interviews from the Institutional Readiness Day for Learning Analytics

DECEMBER 1, 2015

Associate Prof. Dr. Hendrik Drachsler at LACE & UoC conference on Learning Analytics

NOVEMBER 5, 2015

Pro Vice-Chancelor Innovation and Education Prof. Dr. Belinda Tynan at LACE & SOLAR flare, 09 October 2015

OCTOBER 9, 2015

http://www.laceproject.eu/

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This presentation was given at the Open Forum Event
"Technology in Learning: Reshaping the Educational Landscape"
on July 4th 2017 in Manchester, UK

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