

WARDLEY MAPPING

Maps as models

A P Moore

SPEAKER



Alastair Moore
Head of Analytics and Machine Learning

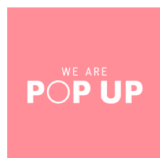
Senior Teaching Fellow
UCL School of Management

Senior Teaching Fellow
MBA Programme,
Peking University

Co-Founder
Satalia.com



Co-Founder
WeArePopUp.com



Partner
AMAAMS LLP



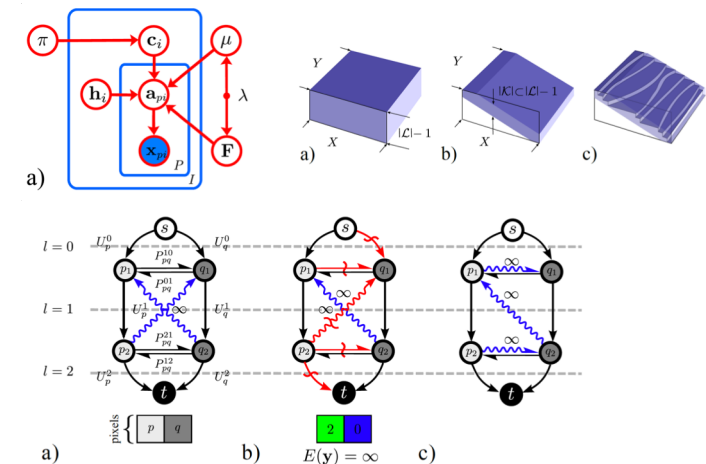
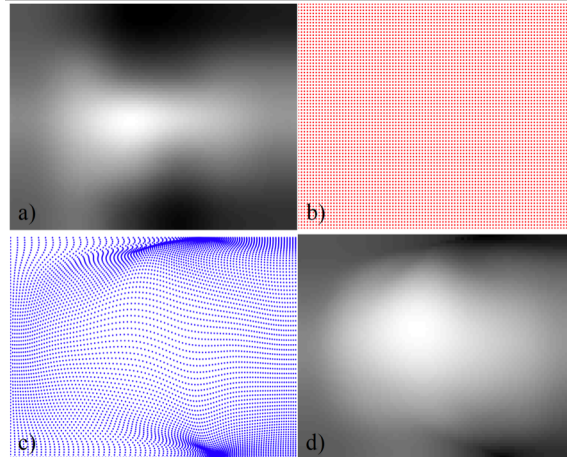
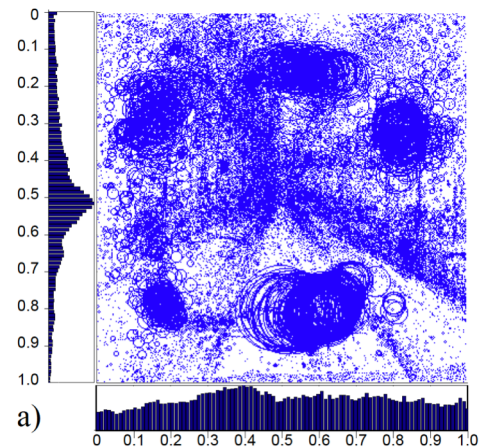
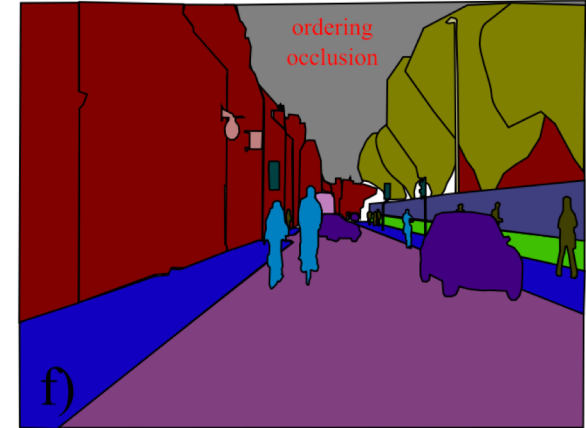
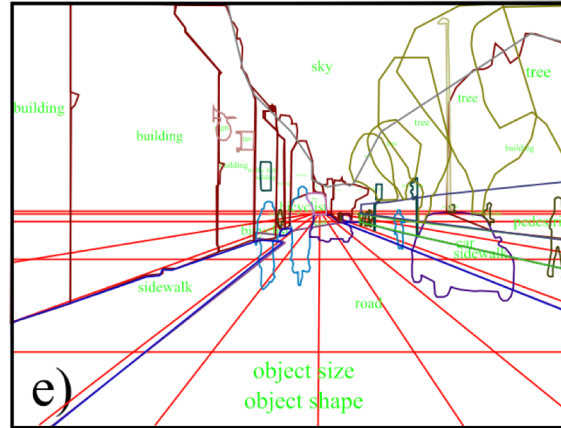
Mishcon de Reya

UCL
SCHOOL OF
MANAGEMENT



BIMBA
国家发展研究院

MY BACKGROUND



OUTLINE

- My background
- The Art and Science of Cartography
- Spaces
 - Projections
 - Kernels
 - Embeddings & Manifolds
- Data Structures
 - Graphs
- Abstraction and Patterns
 - Stocks and Flows
 - Capital
 - X flows, Y flows
- Simple models
- Maps as models
- Maps as interfaces and modes of communication
- Computational strategy

My experience of mapping

Random thoughts I have on mapping

Limited progress!

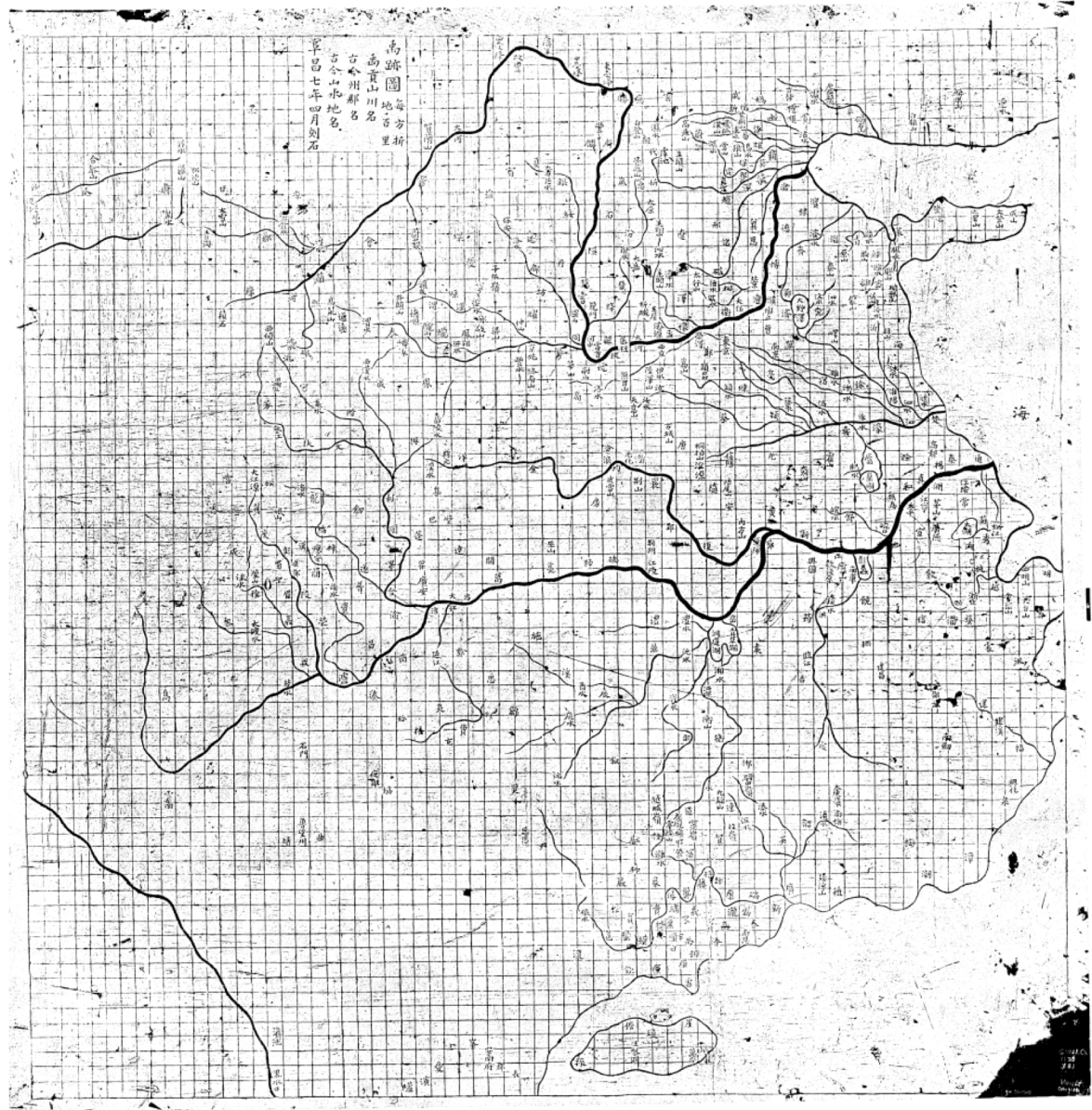
ART & SCIENCE

MAPS

MEASUREMENT & METRICS

The Yu Ju Tu, carved in stone probably in the 11th century.

The cartographic use of a grid system dates at least back to the Han dynasty in the second in the **second century AD**, when the polymath Zhang Heng is said to have introduced it.



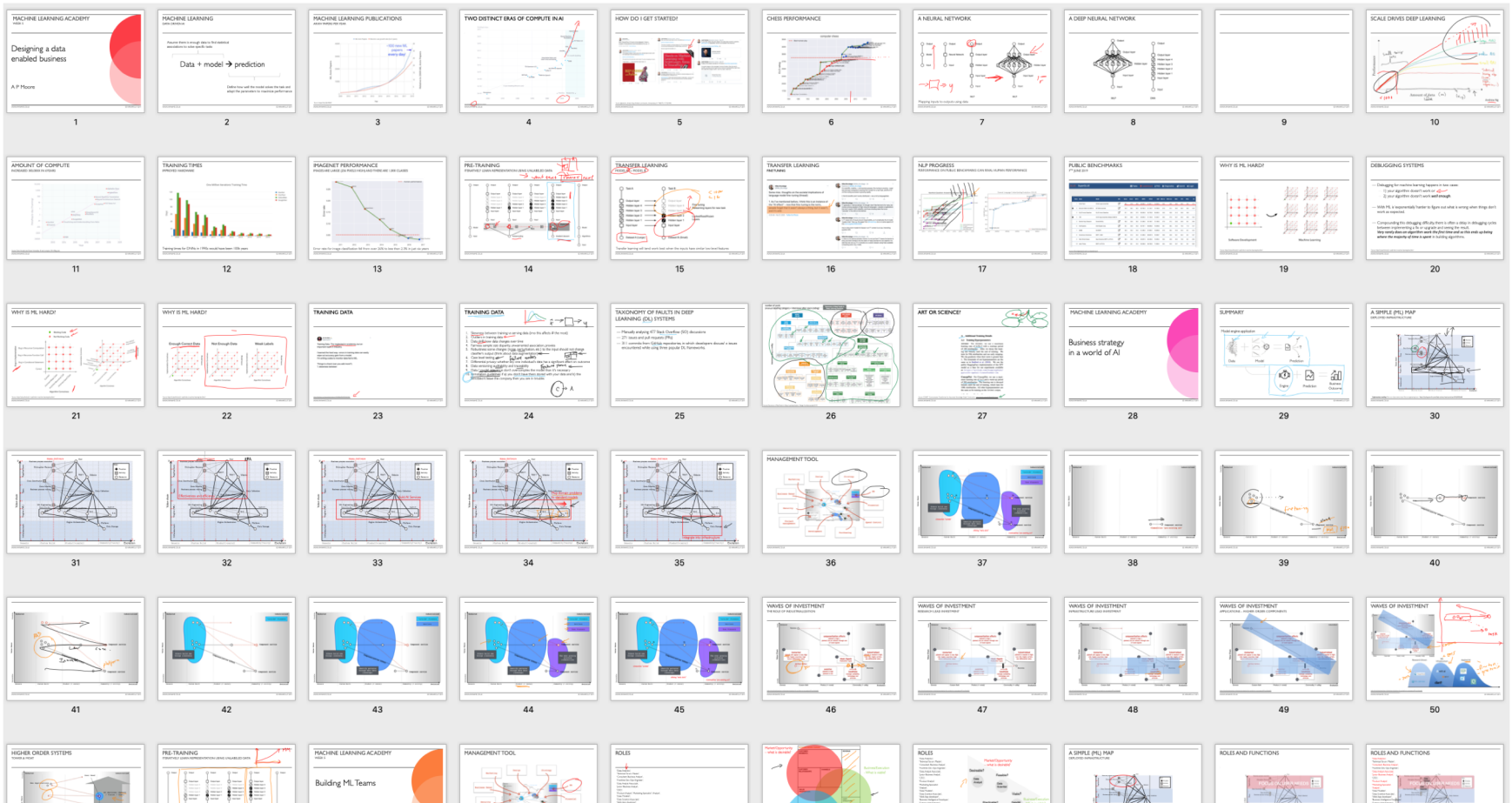
MAPS

SIMPLE AS POSSIBLE, BUT NOT SIMPLER

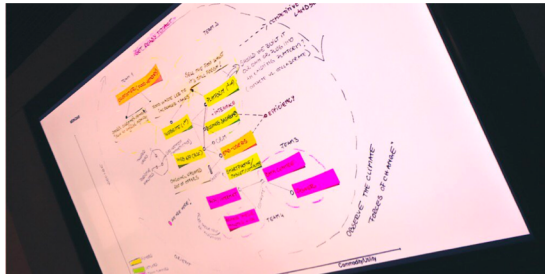
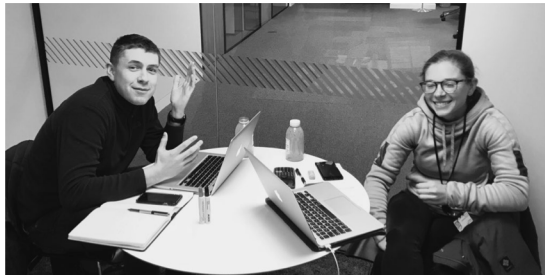
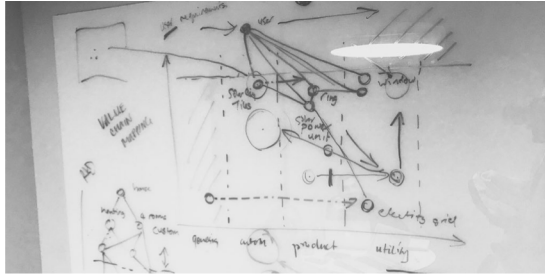


TEACHING

DESIGNING DATA ENABLED BUSINESSES

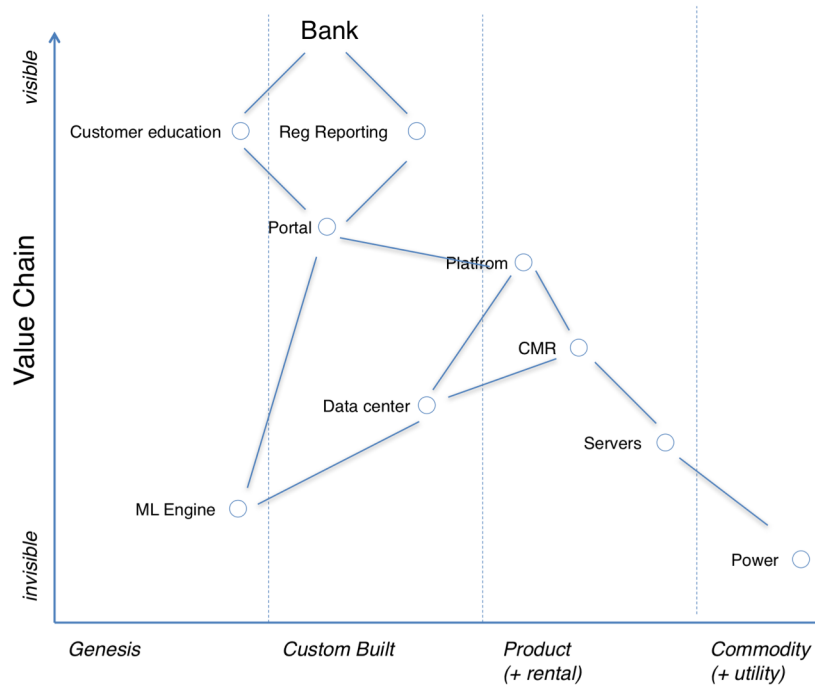


TEACHING

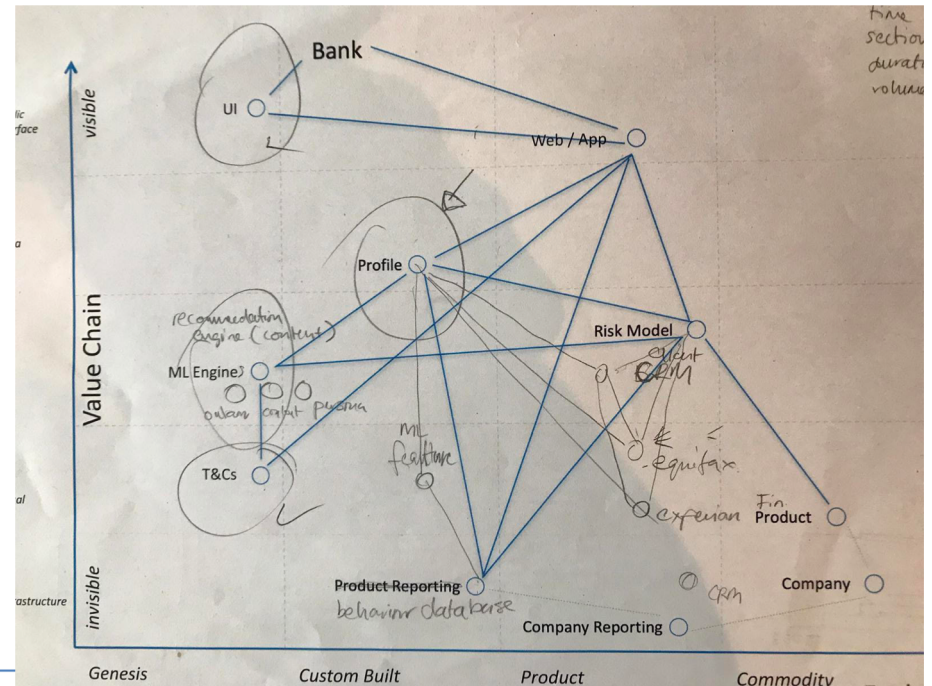


ITERATION & COMMUNICATION

V2

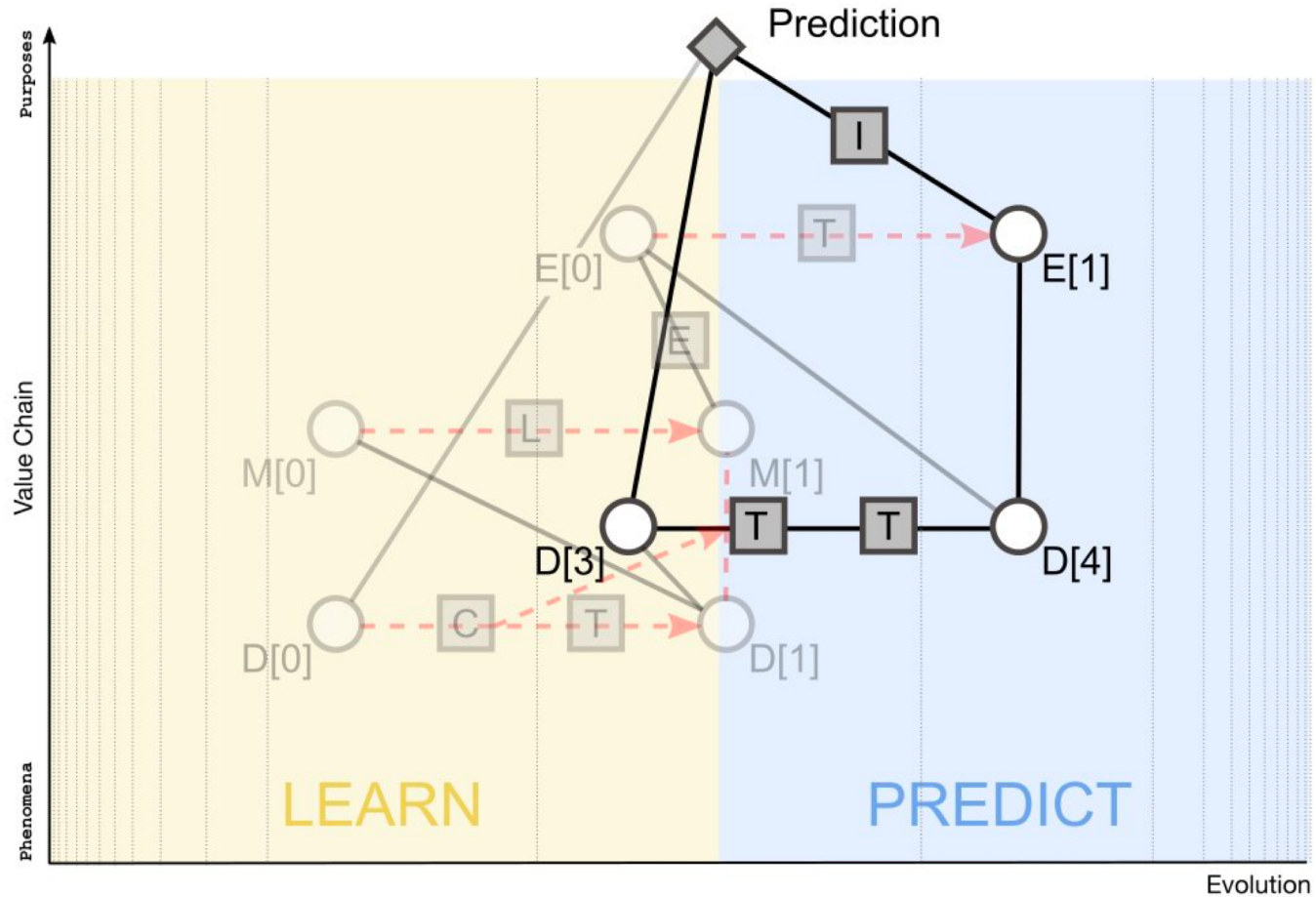


V4

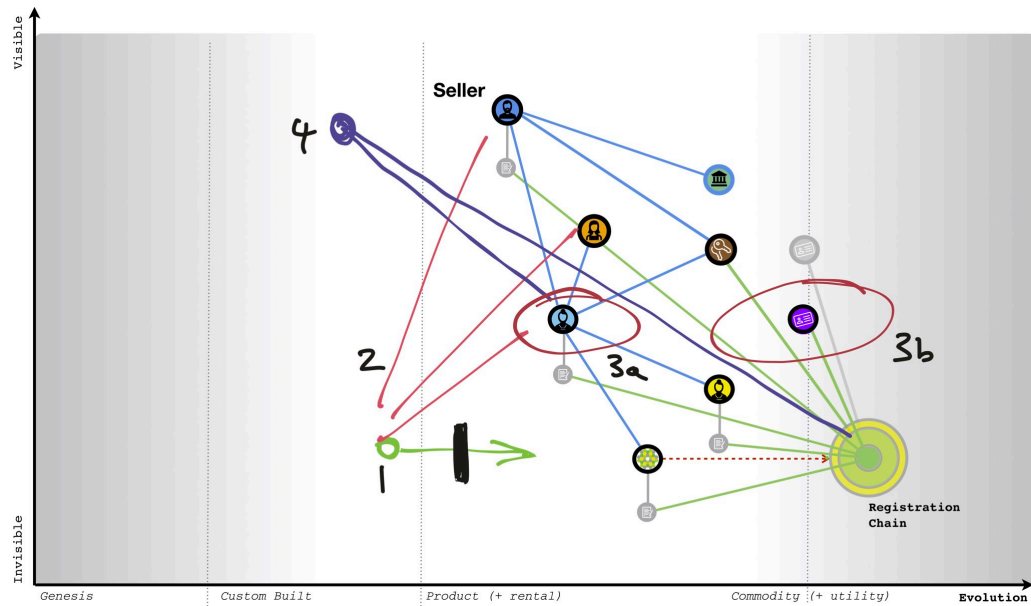


FLOWS OF INFORMATION

MACHINE LEARNING LOOPS



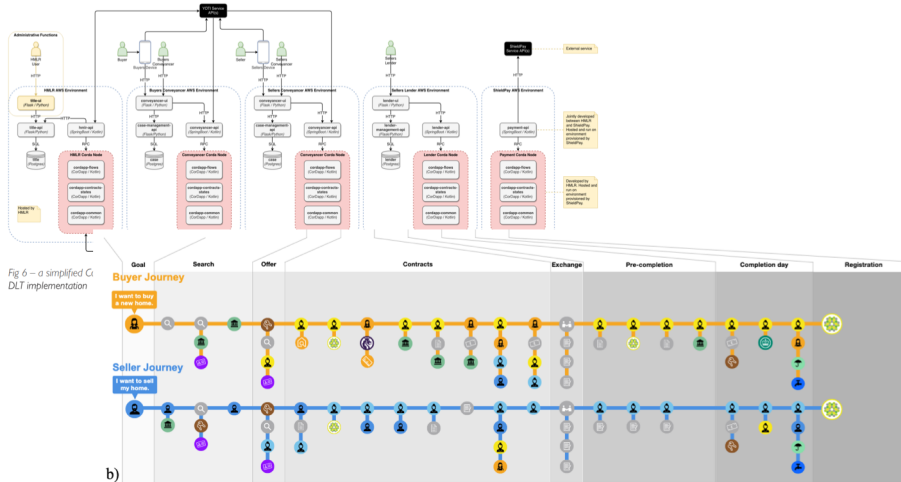
STRATEGY



Towards a distributed ledger of
residential title deeds in the UK
July 2020

Mishcon de Reya

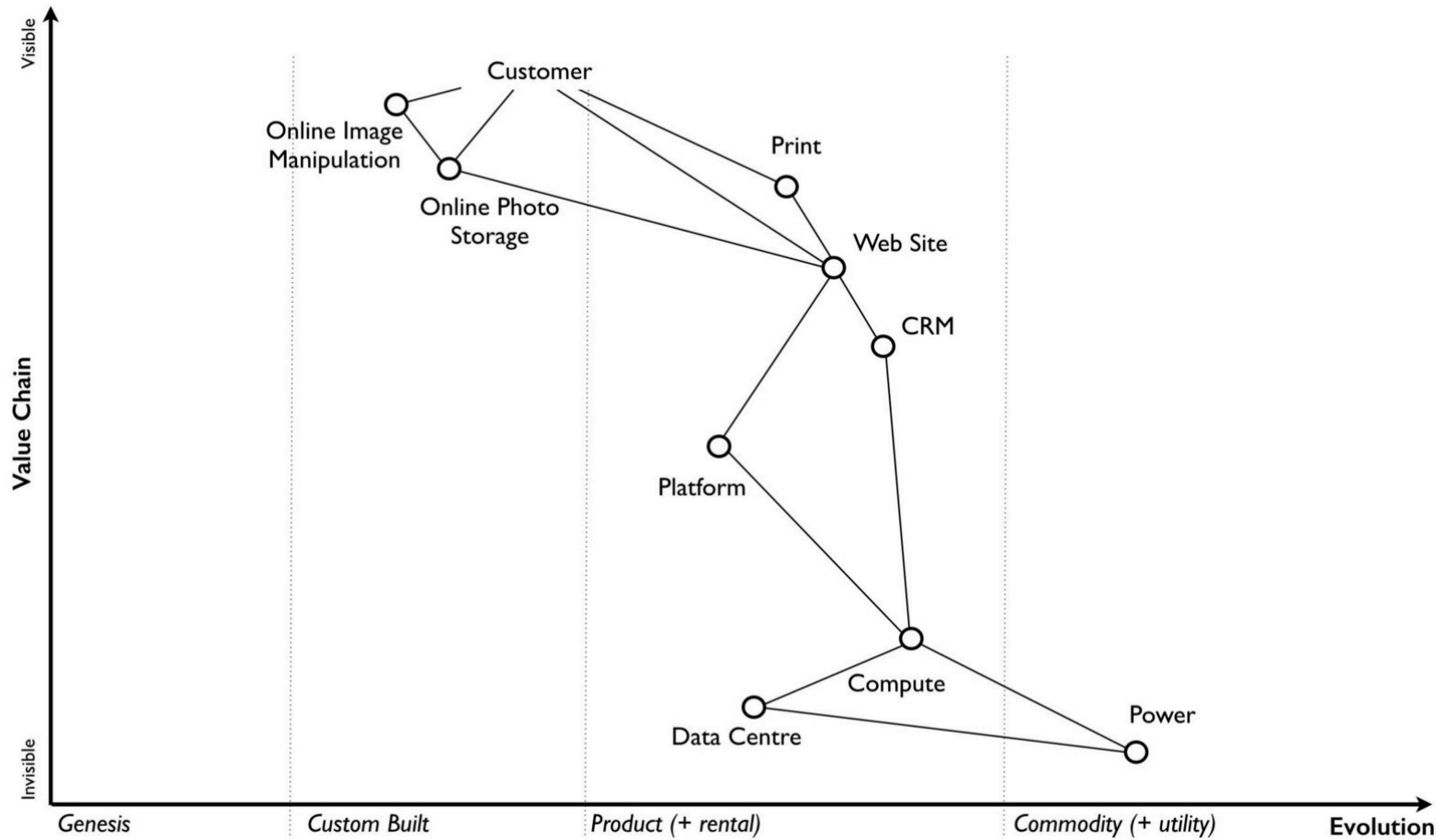
It's business. But it's personal.
mishcon.com



Source: <https://www.mishcon.com/upload/files/HMLR%20White%20Paper.pdf>

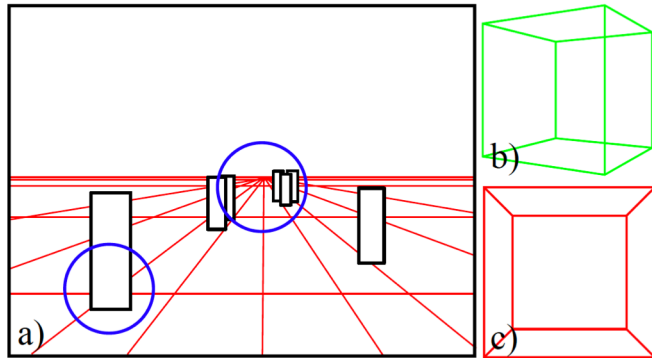
MAPS AS MODELS

MAPS AS MODELS



SPACES

PROJECTIONS



Robinson



Plate Carrée



Winkel Tripel



Eckert IV



Mollweide



Mercator



Wagner VII



Interrupted Mollweide



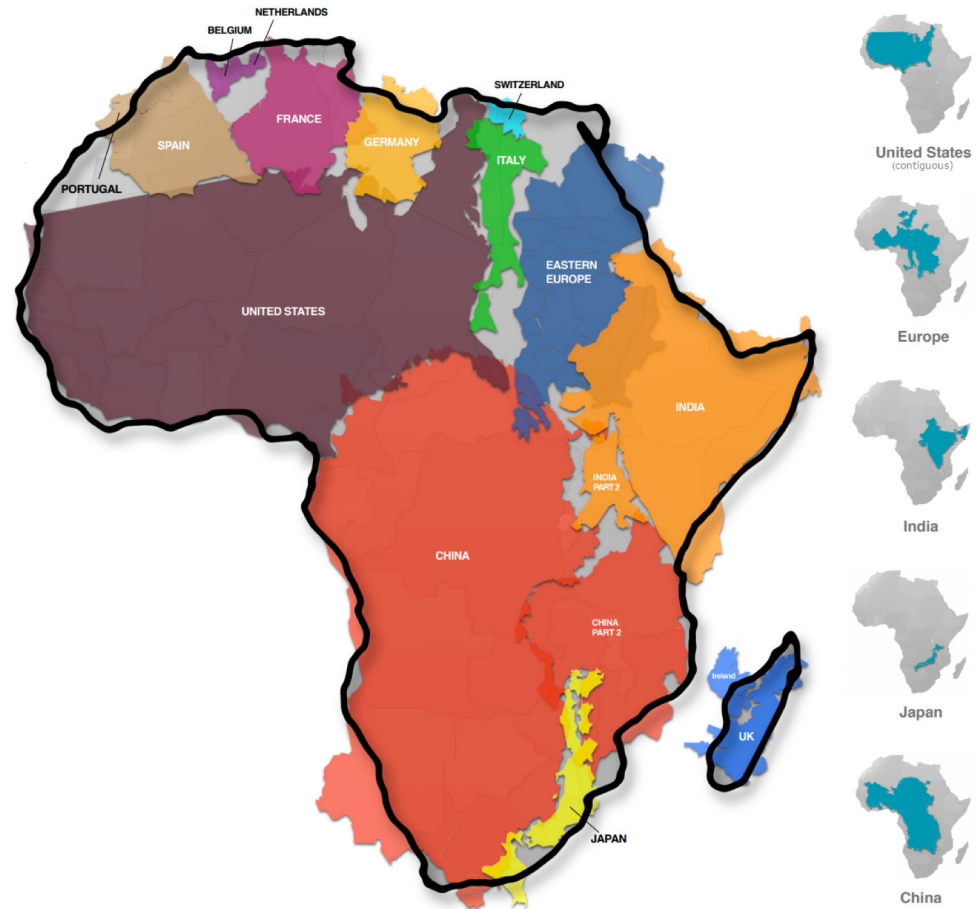
Goode Homolosine

PROJECTIONS

REPRESENTATIONS AND BIASES



Mercator



DECOMPOSITION

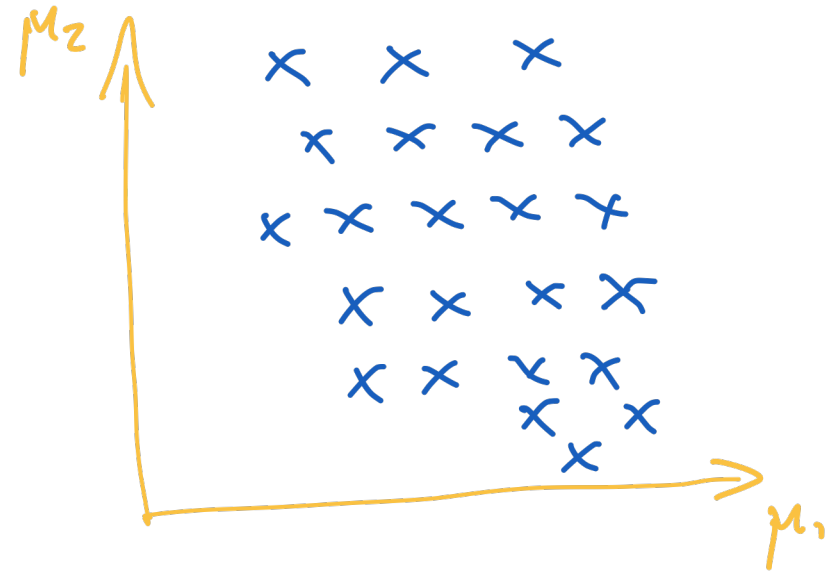
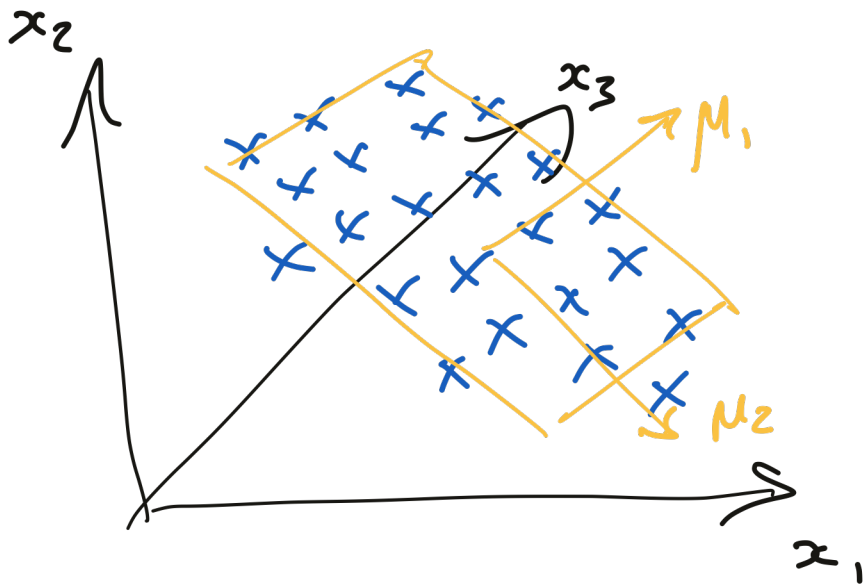
PROJECTION METHODS

Model requirements

Decomposition

$x \in [-\infty, \infty]$

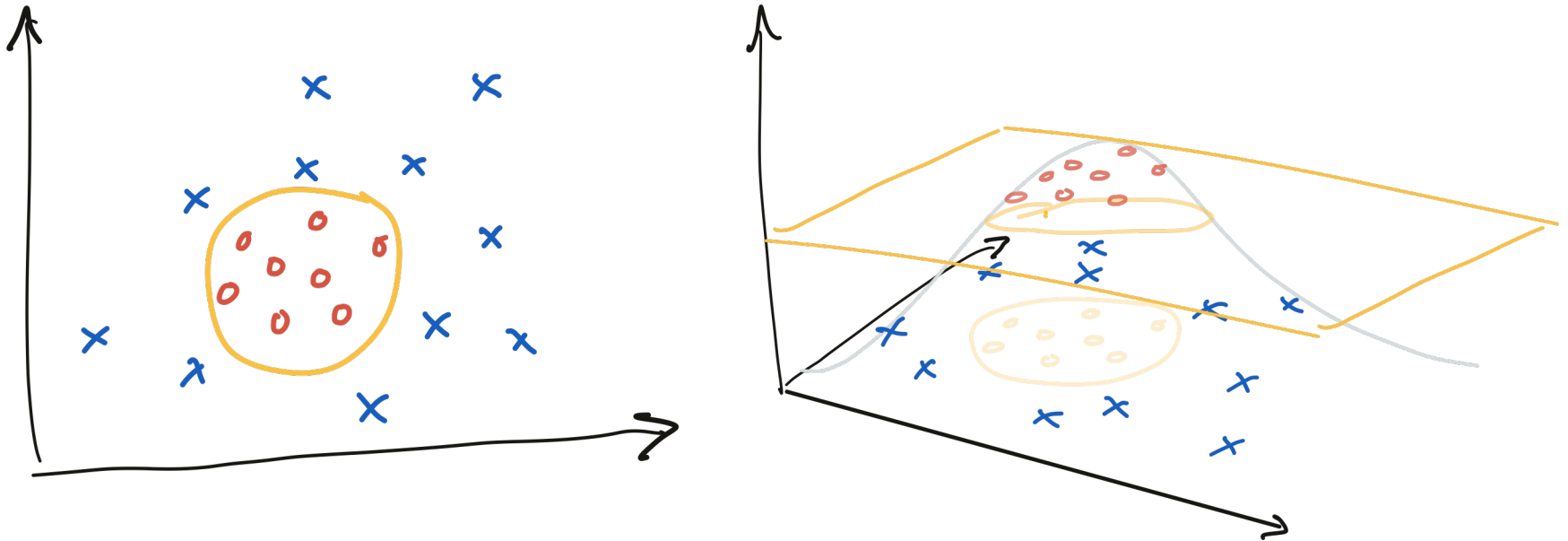
$y \in [-\infty, \infty]$



Dimensionality reduction

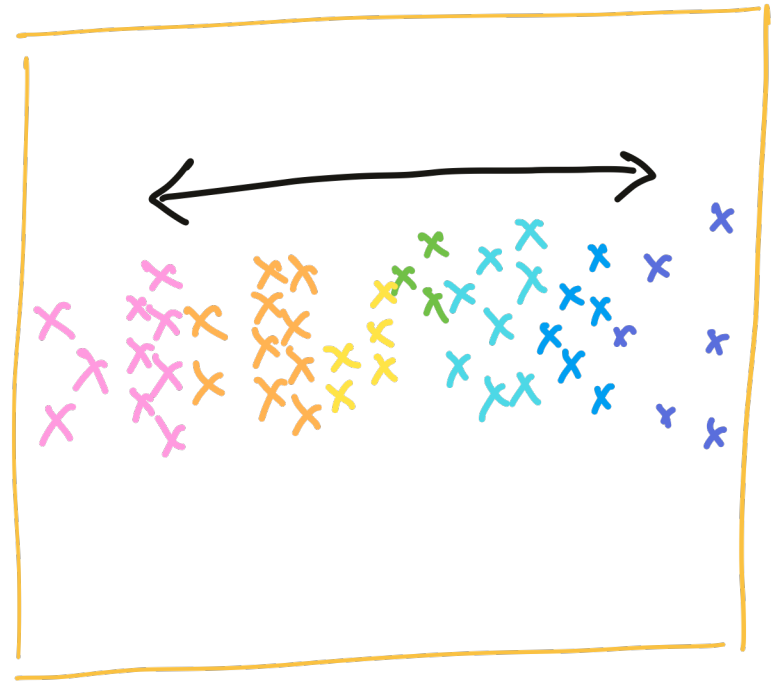
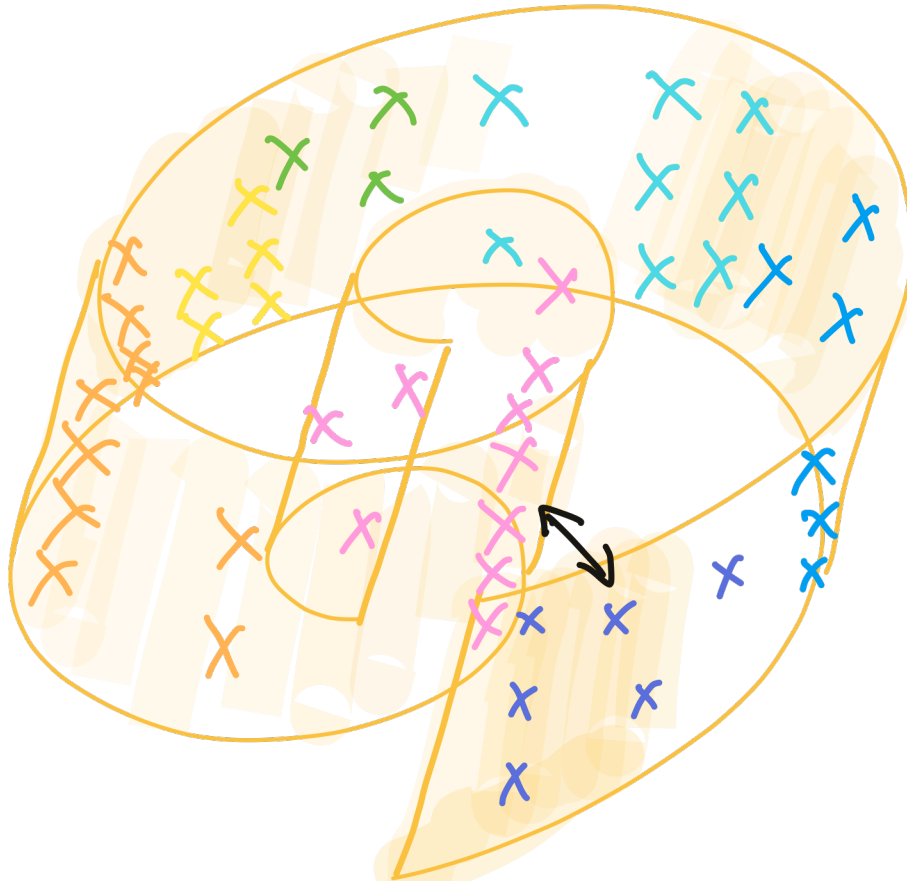
DECOMPOSITION

KERNEL METHODS



DECOMPOSITION

MANIFOLD AND EMBEDDINGS

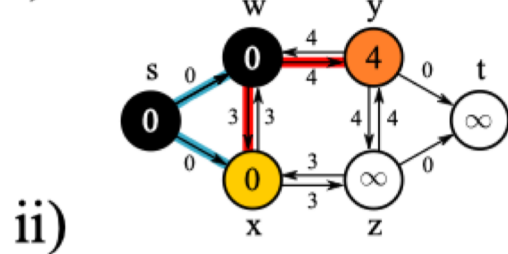
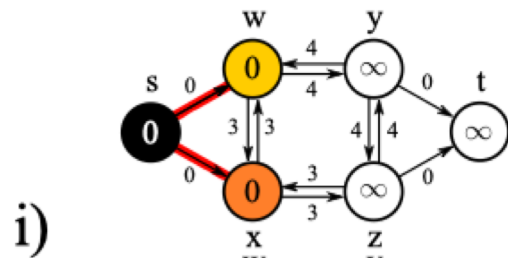
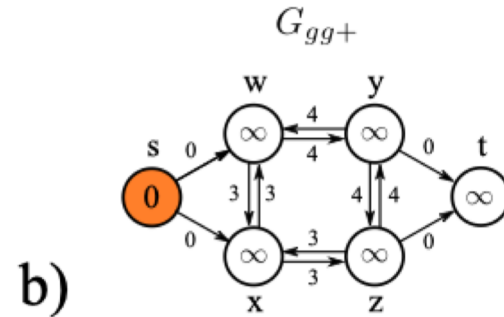
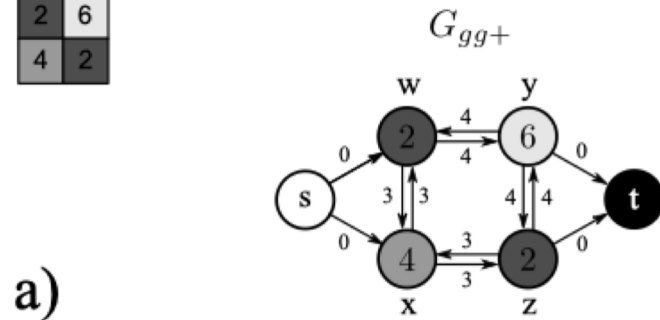


DATA STRUCTURES

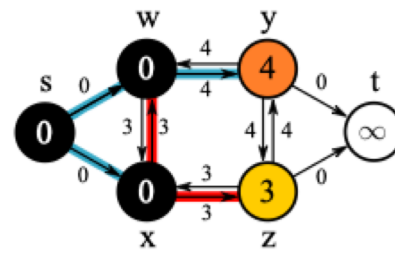
GRAPHS

STOCKS, FLOWS, **WEIGHTS, PATHS, CUTS, CLIQUES, COLORINGS, DUALS...**

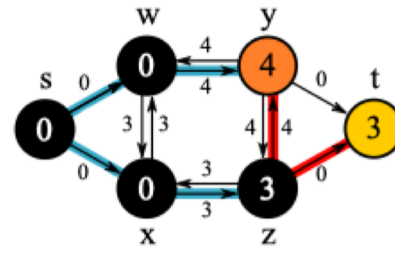
2	6
4	2



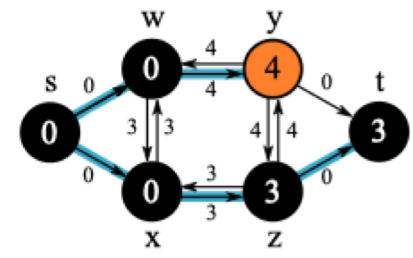
iii)



iv)



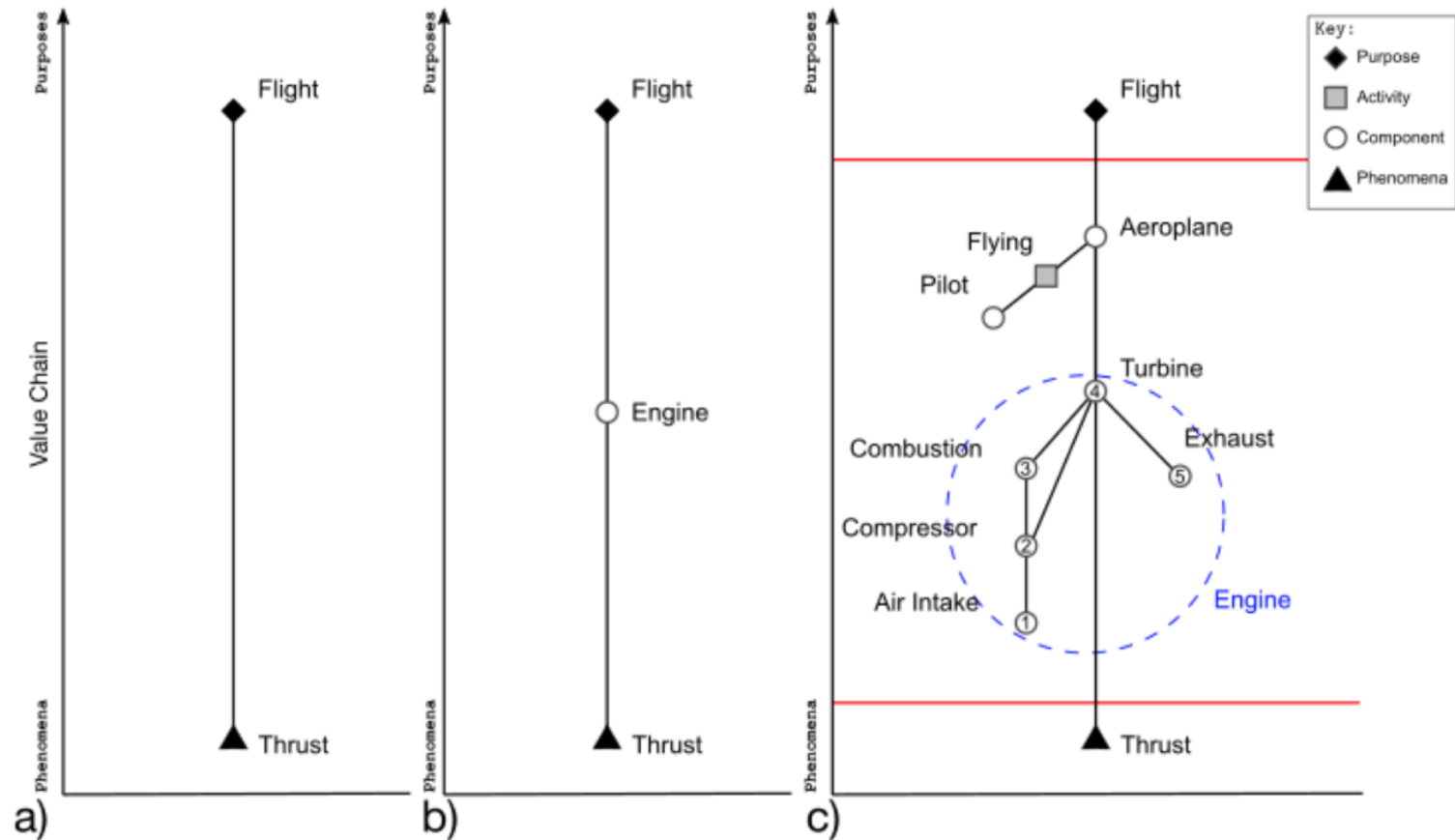
v)



SOME COMMENTS

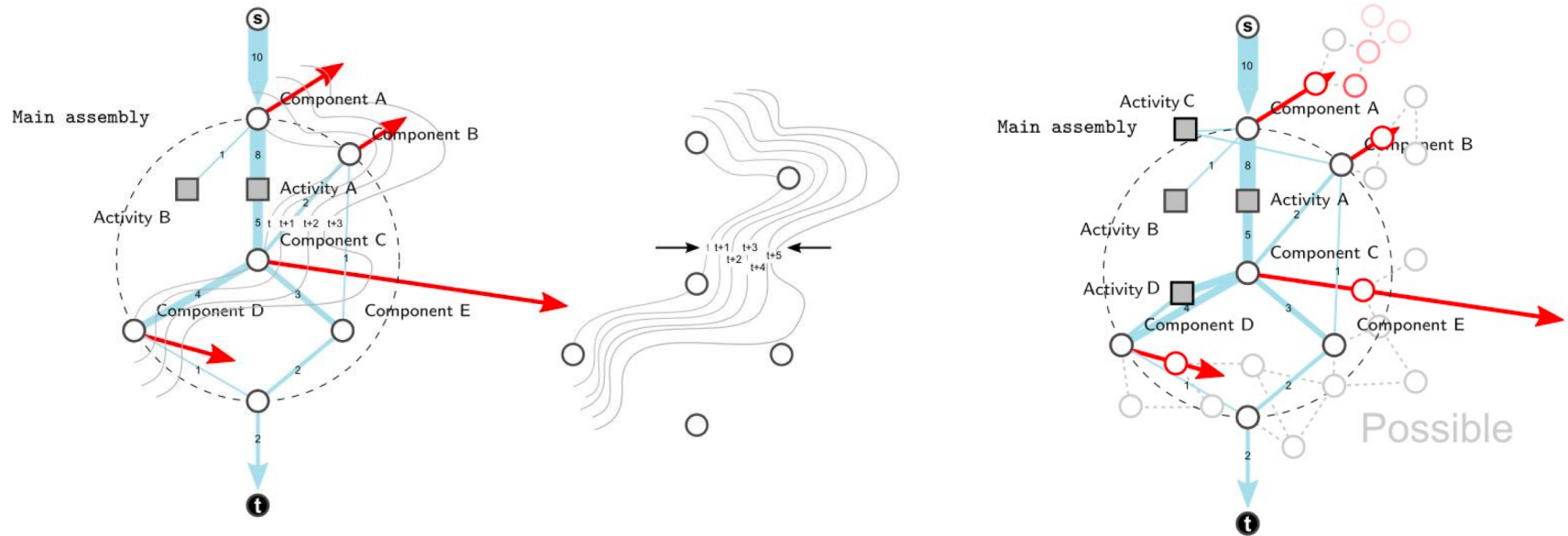
PURPOSES-PRINCIPLES-PHENOMENA

MAIN ASSEMBLY

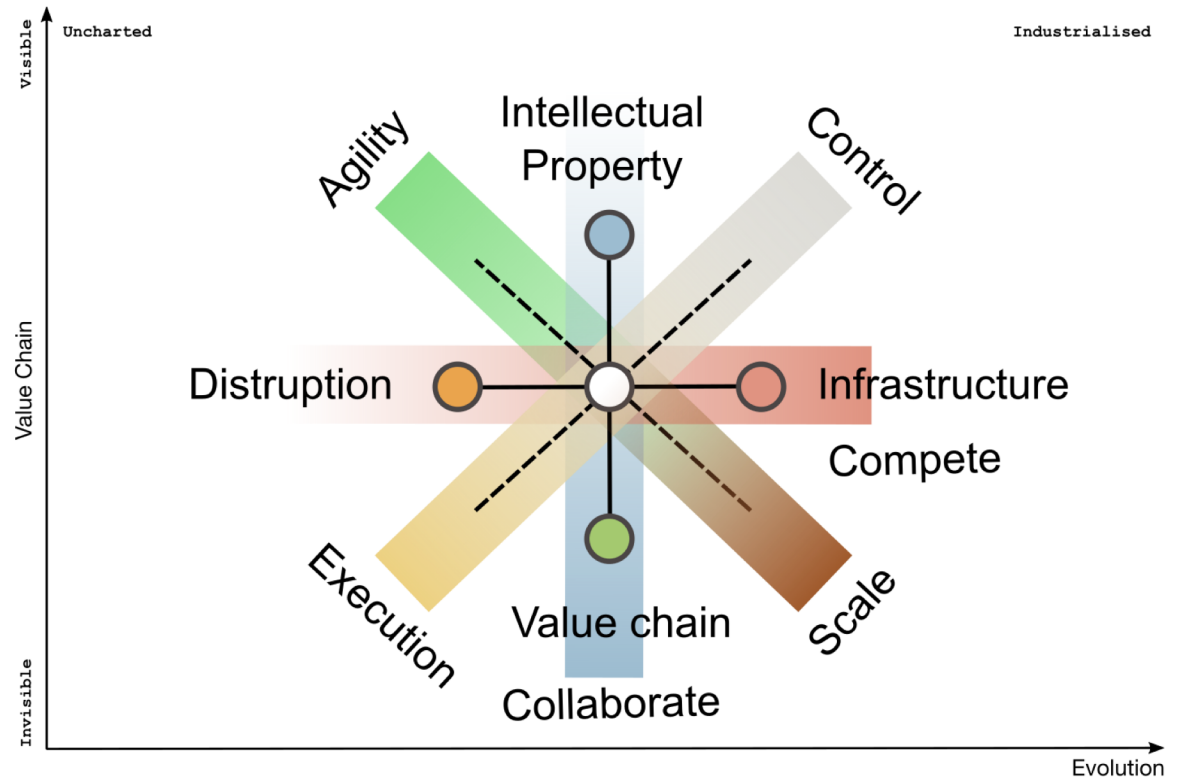
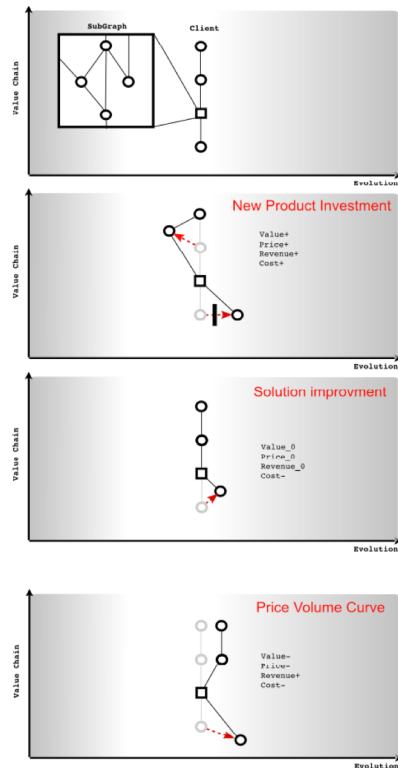


Original Source: Arthur, W. Brian, The Structure of Invention, Research Policy

ADJACENT POSSIBLE

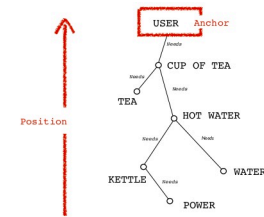


MOVE MAKING MINIMIZATION AND INVESTMENT FIELDS

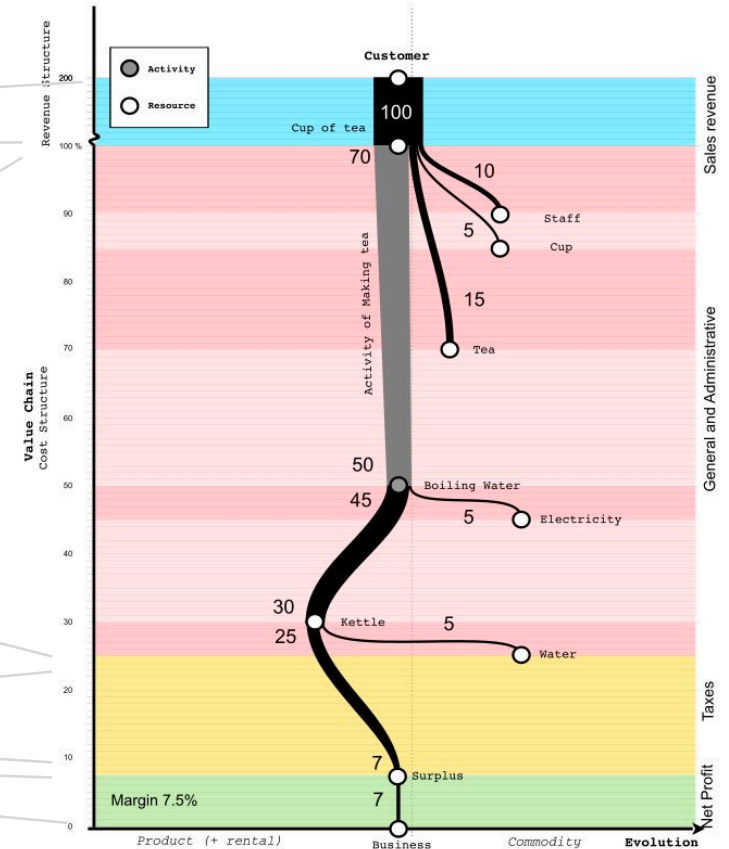


FLOWS

(AND BALANCE SHEETS)

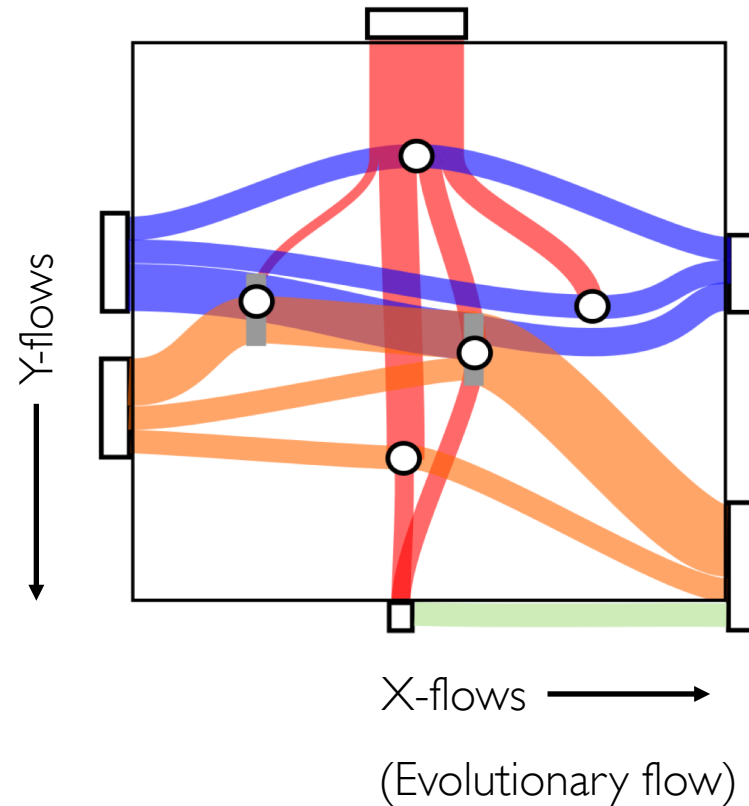
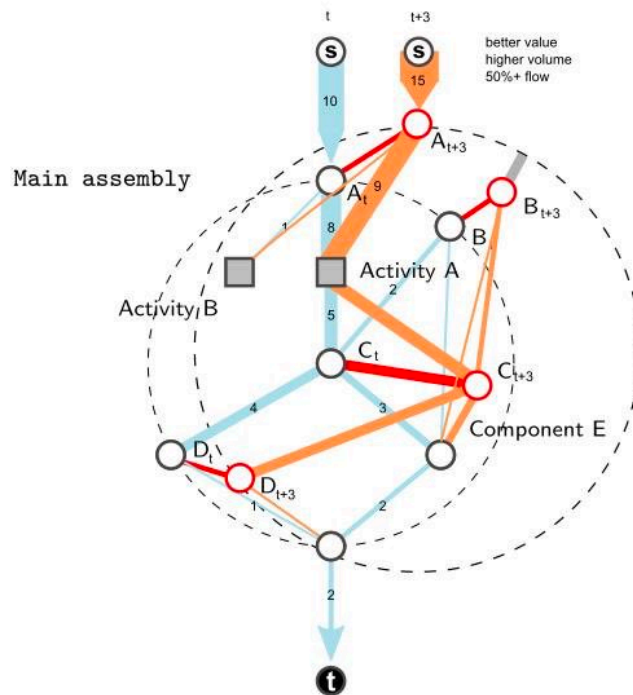


	A	B	C	D	E	F
1 Cup of tea		Unit cost				
2						
3 Revenue structure						
4						
5 Sales Revenue						
6 Cup of tea		1.00				
7 Total Sales Revenue [J]			1.00			1.00
8						
9 Cost of Sales						
10 N/A		0.00				
11 Total Cost of Sales [K]			0.00			
12						
13 Gross Profit [L=J-K]						1.00
14						
15 Cost structure [Operating Expenses]						
16						
17 Sales and Marketing						
18 N/A		0.00				
19 Total Sales and Marketing Expenses [M]			0.00			
20						
21 Research and Development						
22 N/A		0.00				
23 Total Research and Development Expenses [N]			0.00			
24						
25 General and Administrative						
26 Staff		0.10				1.00
27 Cup		0.05				0.90
28 Tea		0.15				0.85
29 Hot water		0.20				0.70
30 Electricity		0.05				0.50
31 Kettle		0.15				0.45
32 Water		0.05				0.30
33						
34 Total General and Administrative Expenses [O]		0.75				0.75
35						
36 Total Operating Expenses [P=M+N+O]						0.75
37						
38 Income from Operations [Q=L-P]						0.25
39						
40 Other Income [R]						0.00
41						
42 Taxes						
43 Sales tax		0.18				0.25
44 Total Taxes [S]		0.18				0.18
45						
46 Net Profit [T=Q+R-S]						0.07
47						
48 Gross Margin [U/I]						100%
49 Return on sales [V/J]						7.5%



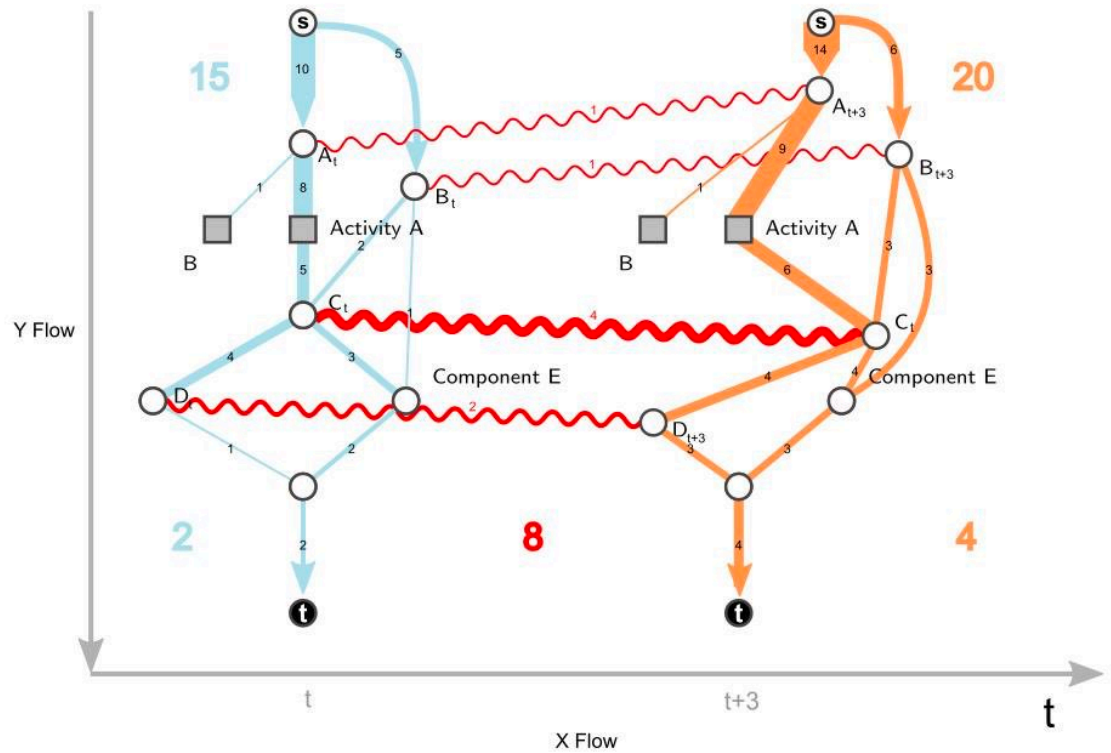
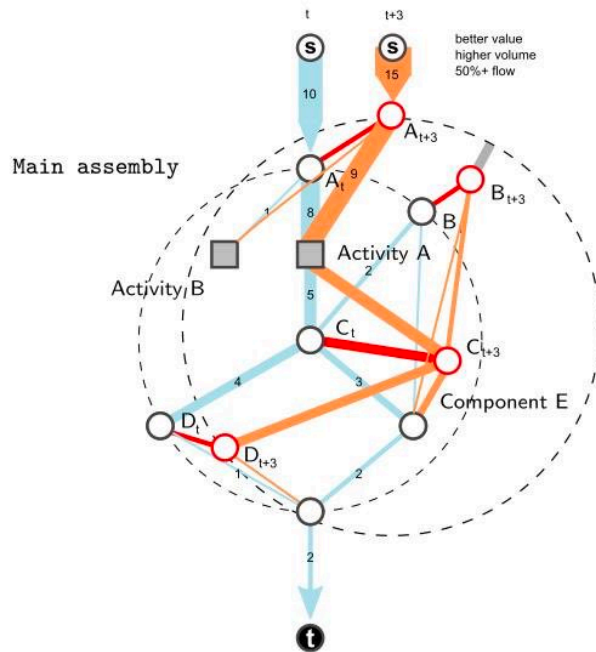
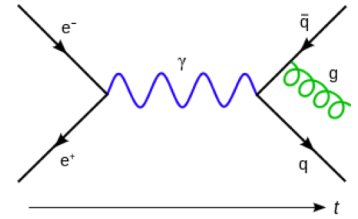
EXPLOITATION VS EXPLORATION

X AND Y CAPITAL FLOWS



EXPLOITATION VS EXPLORATION

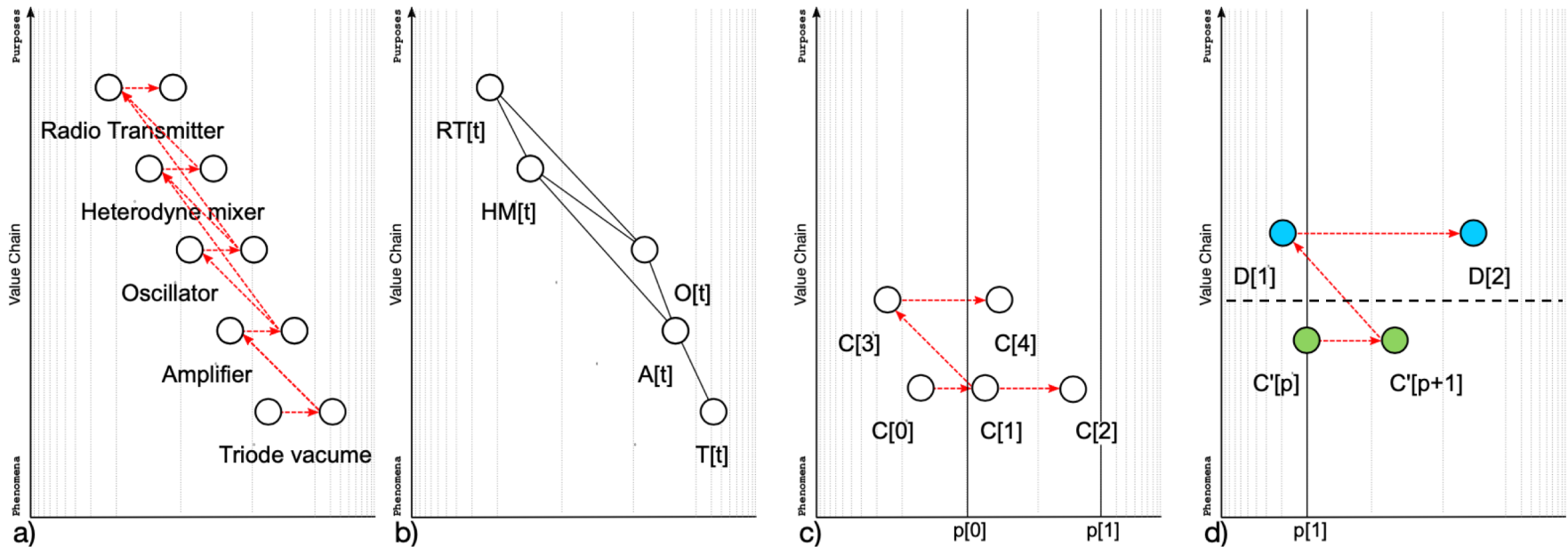
X AND Y CAPITAL FLOWS



PATTERNS

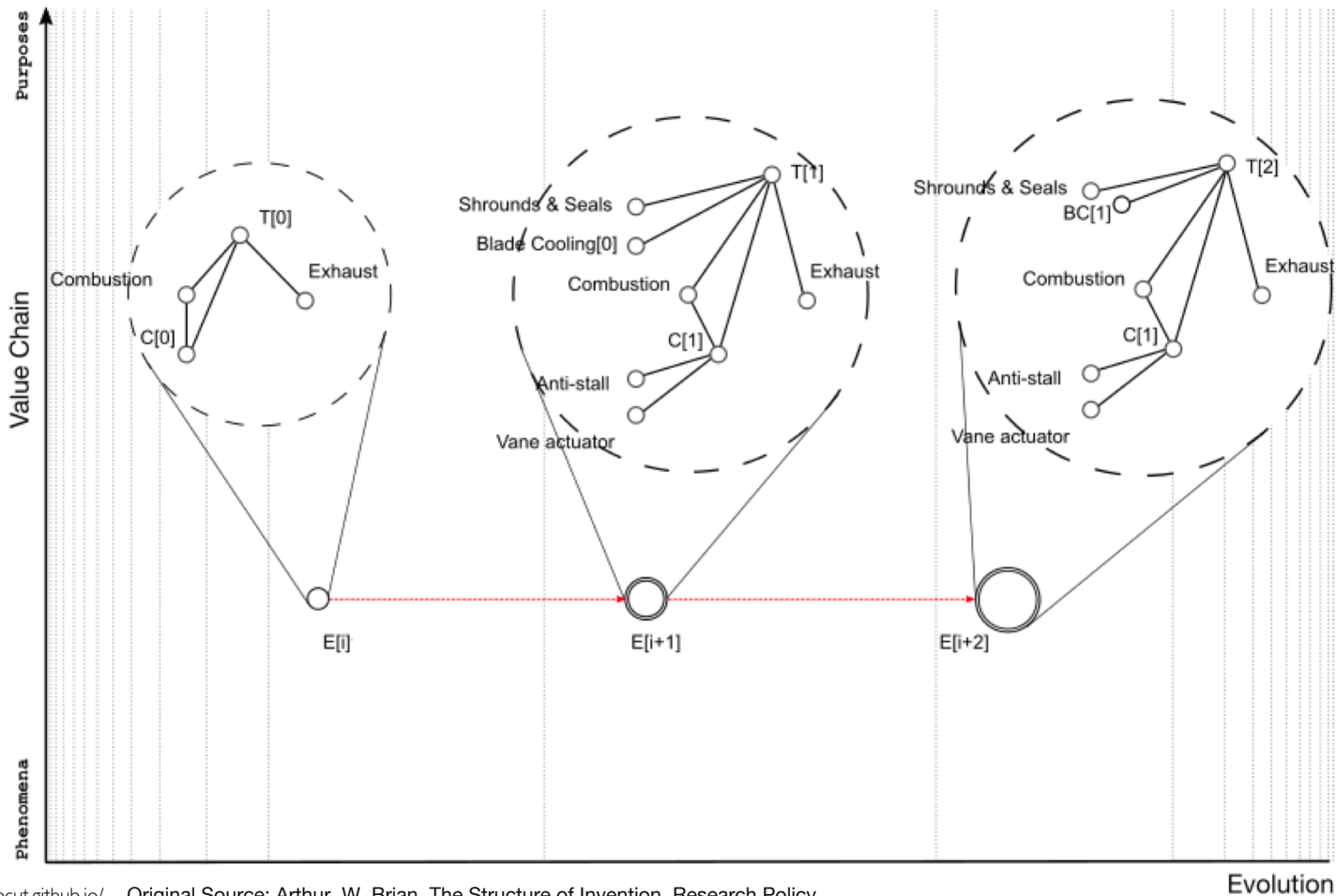
PATTERNS

COMPONENT PHASE TRANSITIONS



PATTERNS

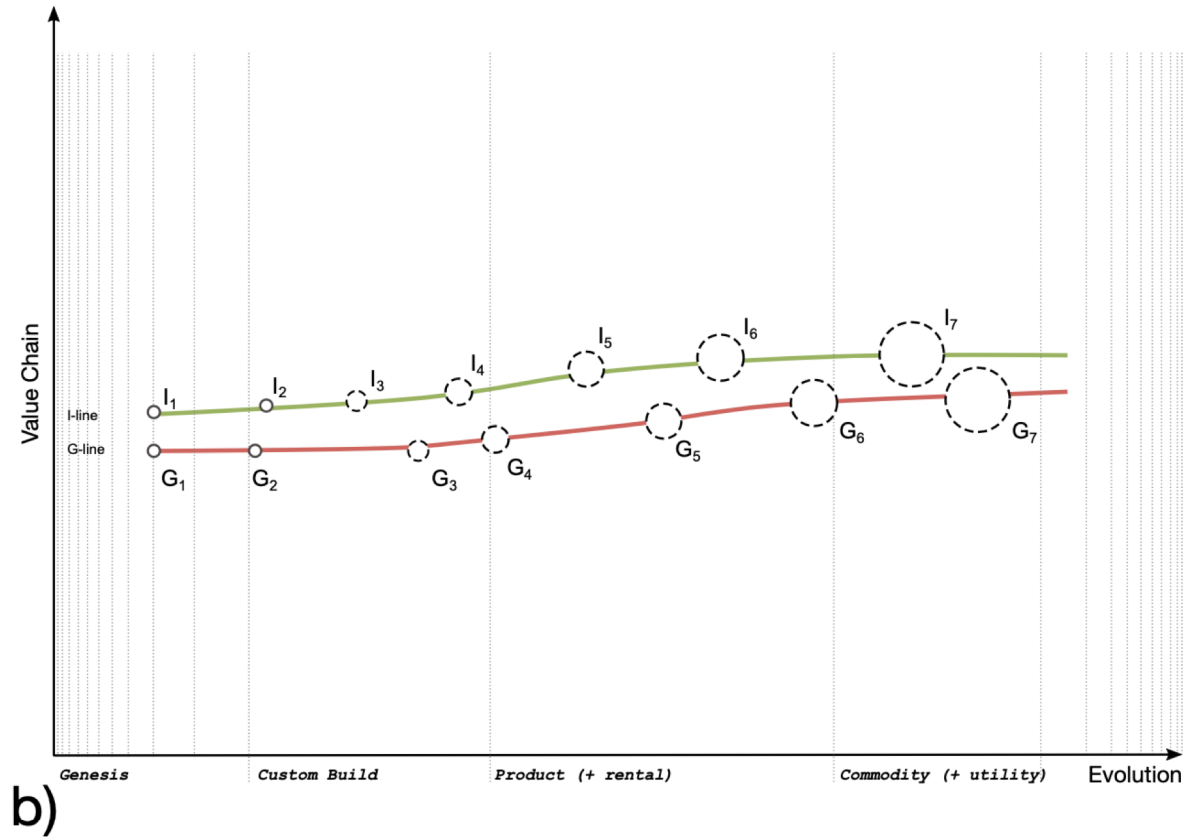
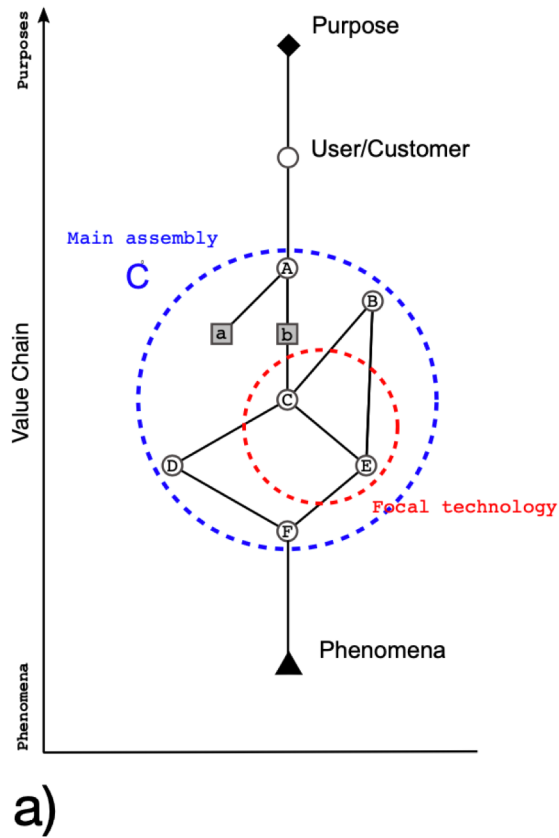
STRUCTURAL DEEPENING

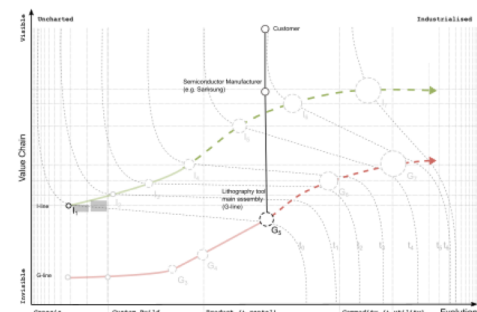
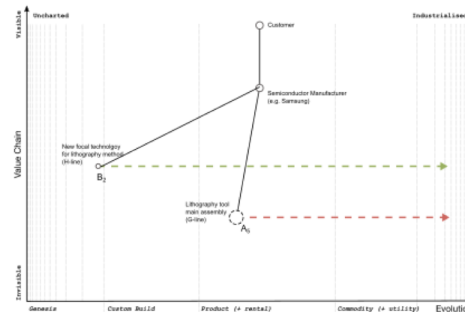
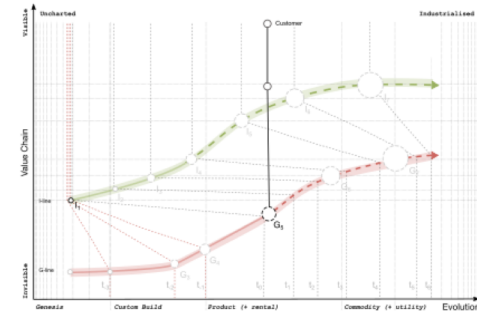
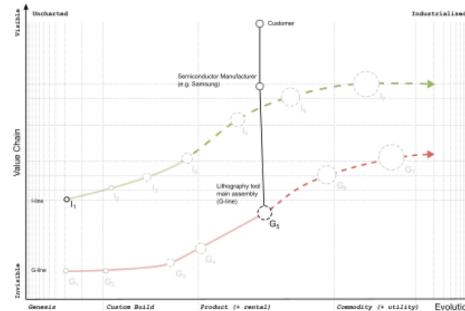
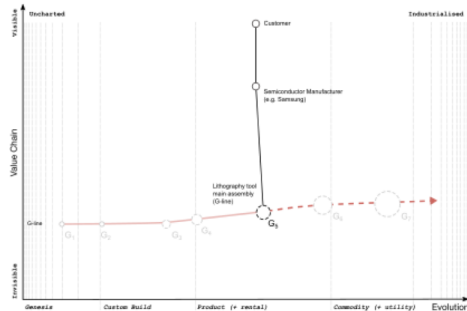
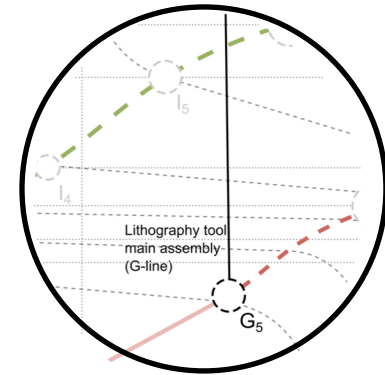
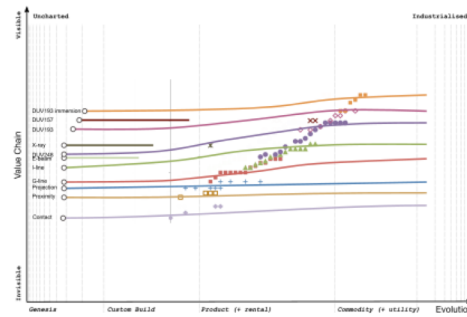
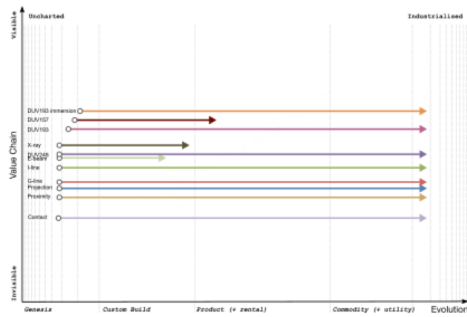


Source: <https://latticecut.github.io/> Original Source: Arthur, W. Brian, The Structure of Invention, Research Policy

EVOLUTION OF THE MAIN ASSEMBLY

CO-EVOLUTION CURVES

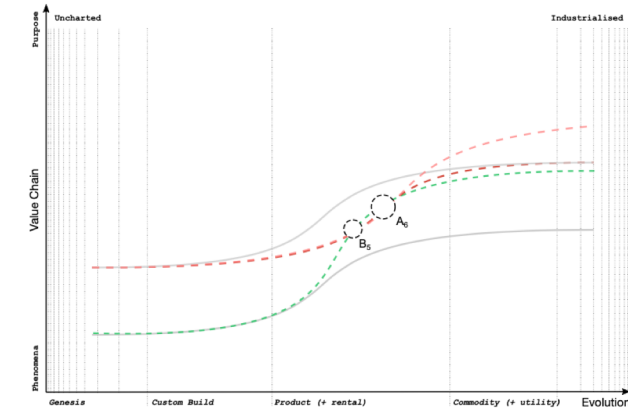




Original source: Adner, R. and Kapoor, R., Innovation ecosystems and the pace of substitution: Re-examining technology S-curves, Strategic Management Journal

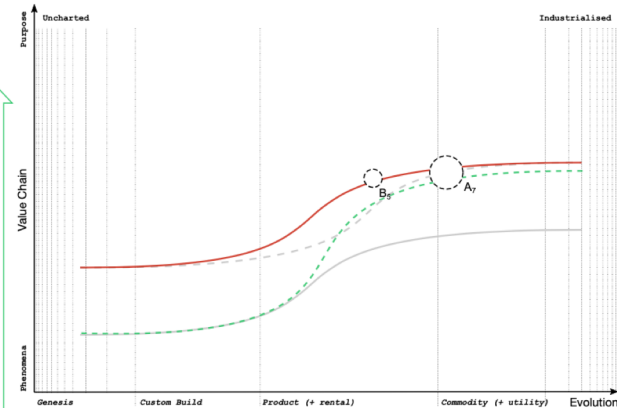
CO-EVOLUTION CURVES

Robust Coexistence



a)

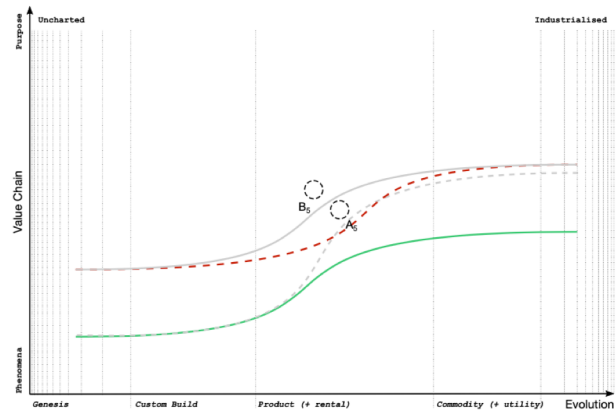
Robust Resilience



b)

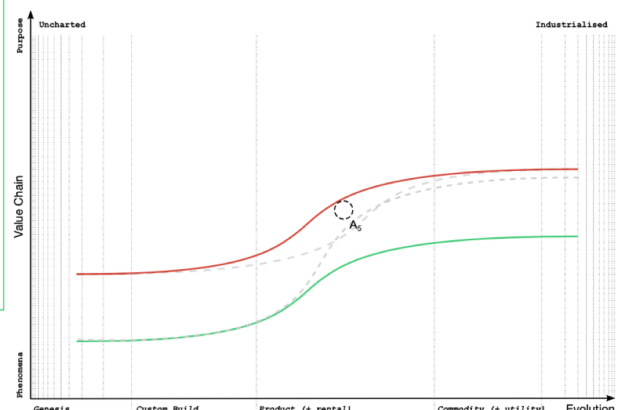
Extension Opportunity

Emergence Challenge



c)

Creative Destruction



d)

Resilience Illusion

Original source: Adner, R. and Kapoor, R., Innovation ecosystems and the pace of substitution: Re-examining technology S-curves, Strategic Management Journal

SIMPLE MODELS

SIMPLE MODELS

THE EVOLUTION OF TECHNOLOGY WITHIN A SIMPLE COMPUTER MODEL

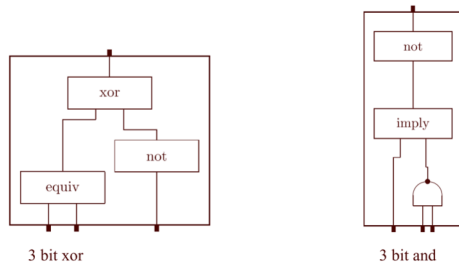
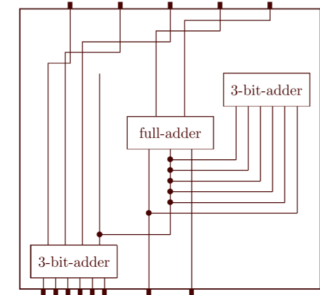
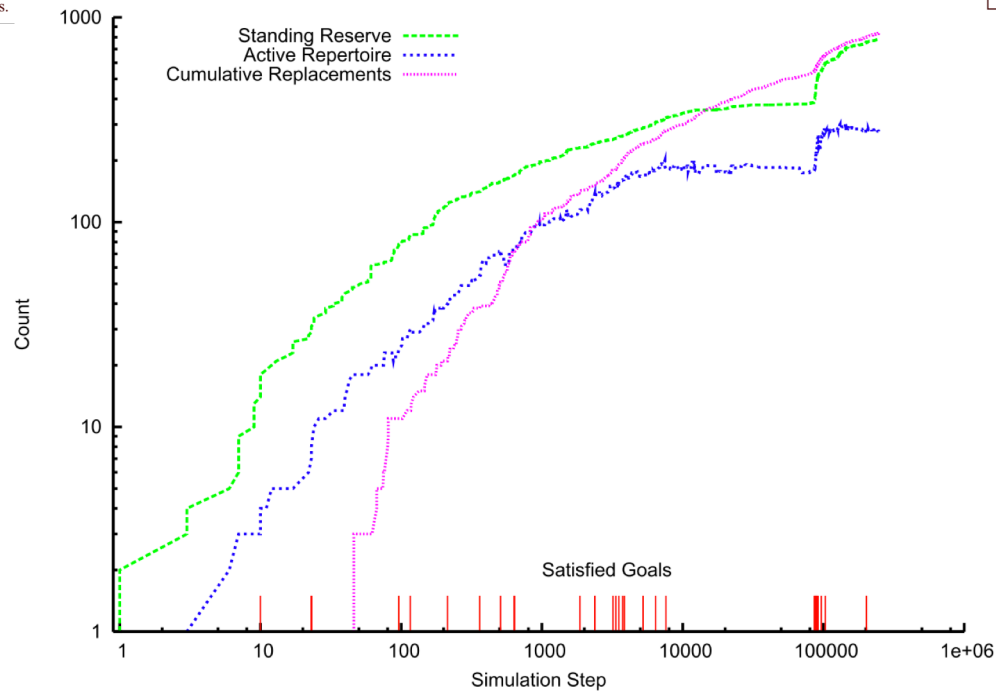
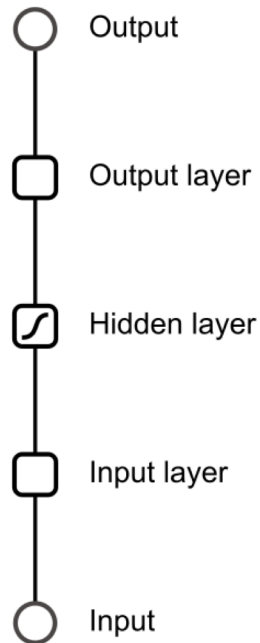
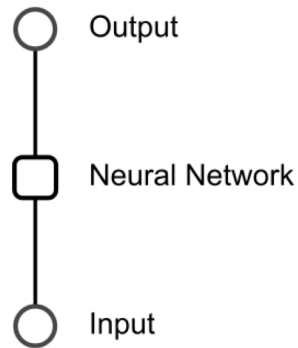
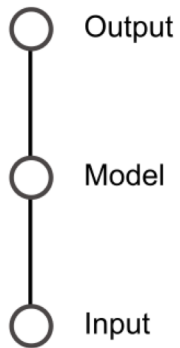


Figure 1: two circuits "invented" for simple goals.

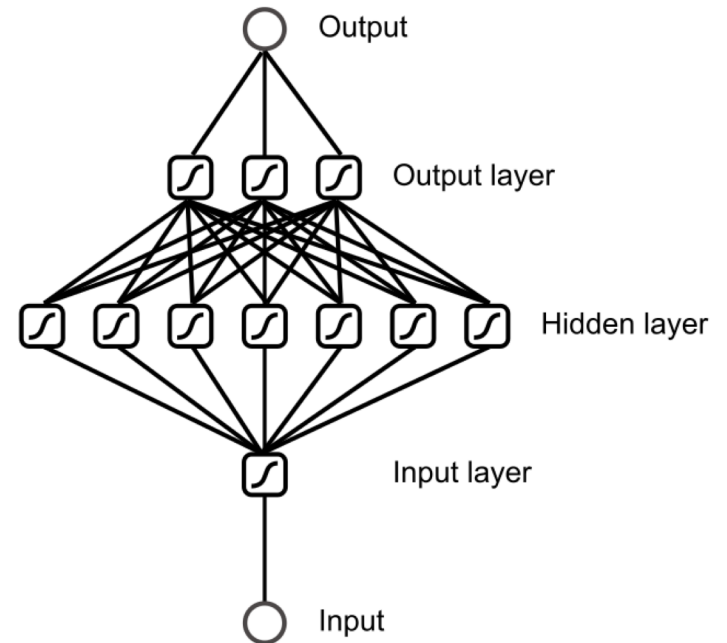


Source: W Brian Arthur and Wolfgang Polak. The Evolution of Technology within a Simple Computer Model. Technical report.

A NEURAL NETWORK



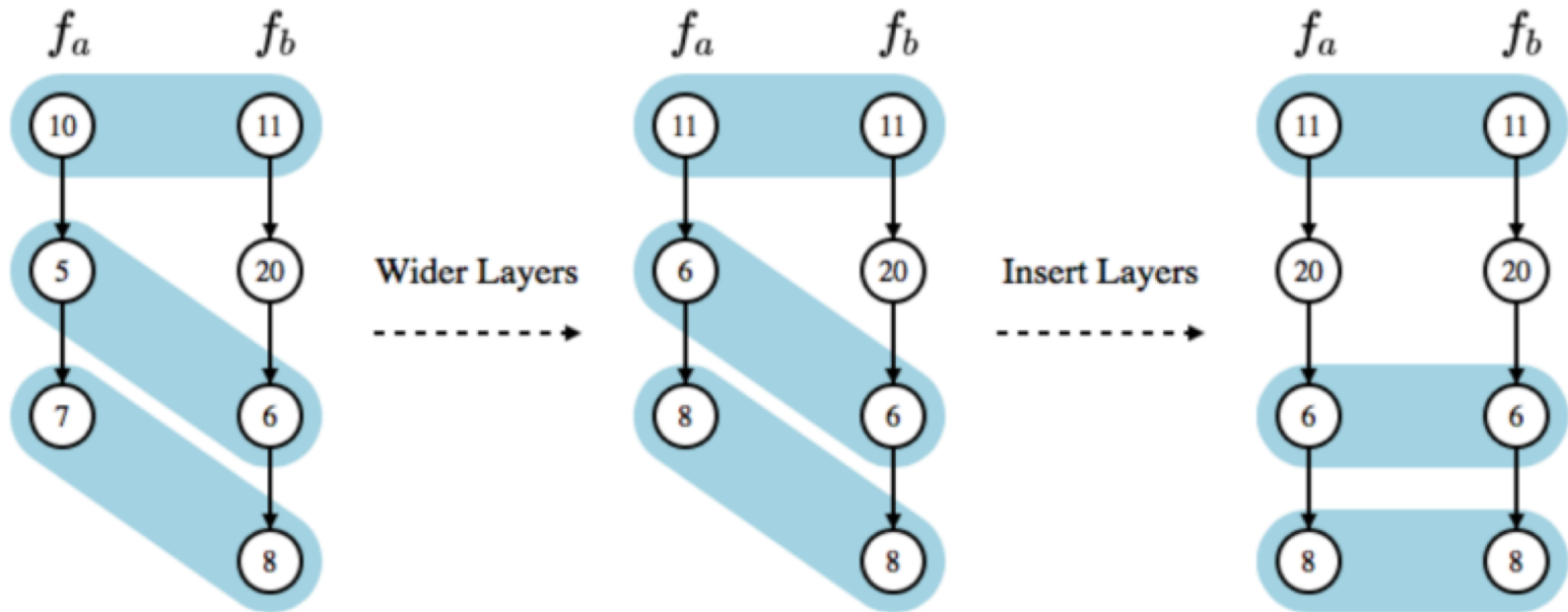
MLP



MLP

NEURAL NETWORK MODELS

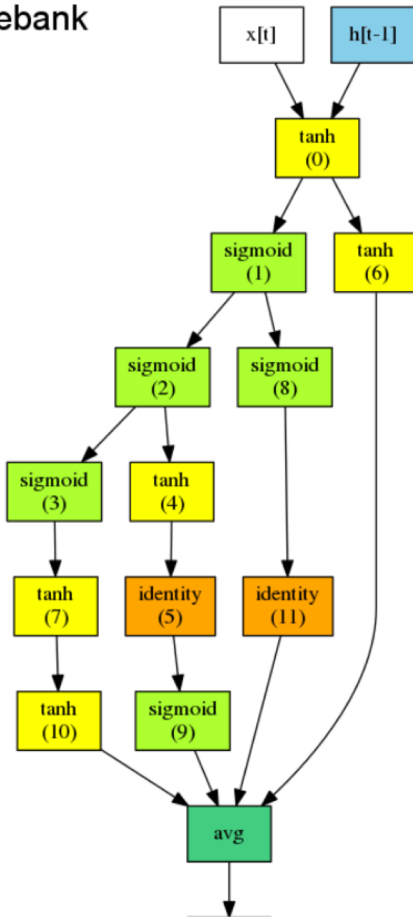
EVOLVING TECHNOLOGY COMPONENTS (NEURAL ARCHITECTURE SEARCH)



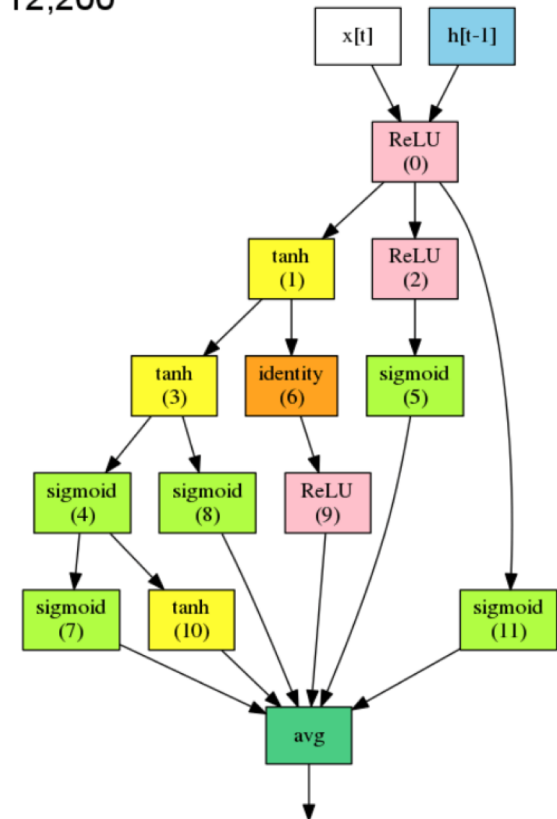
NEURAL NETWORK MODELS

EVOLVING TECHNOLOGY COMPONENTS (NEURAL ARCHITECTURE SEARCH)

Penn Treebank
step: 50

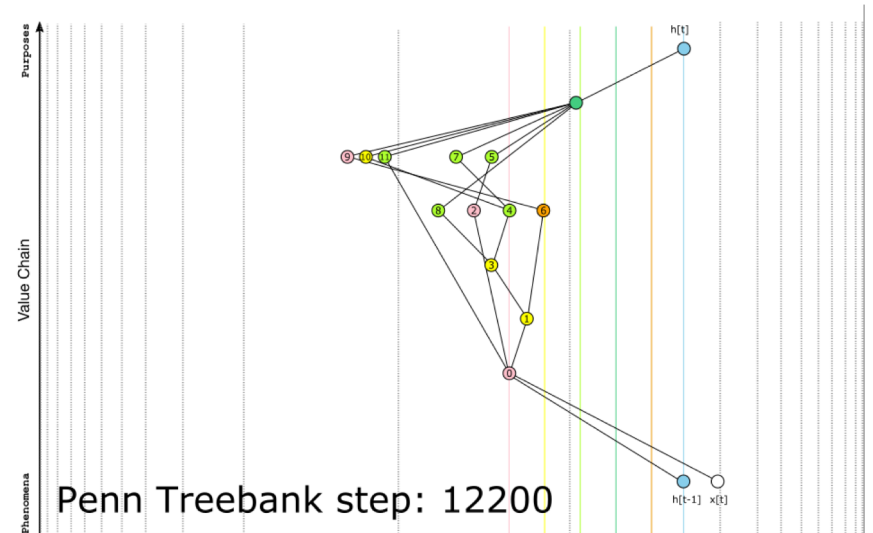
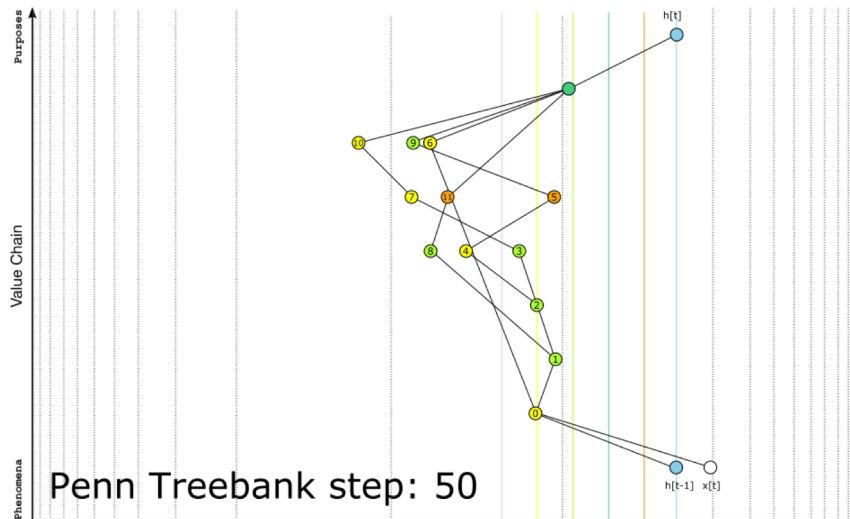


Penn Treebank
step: 12,200



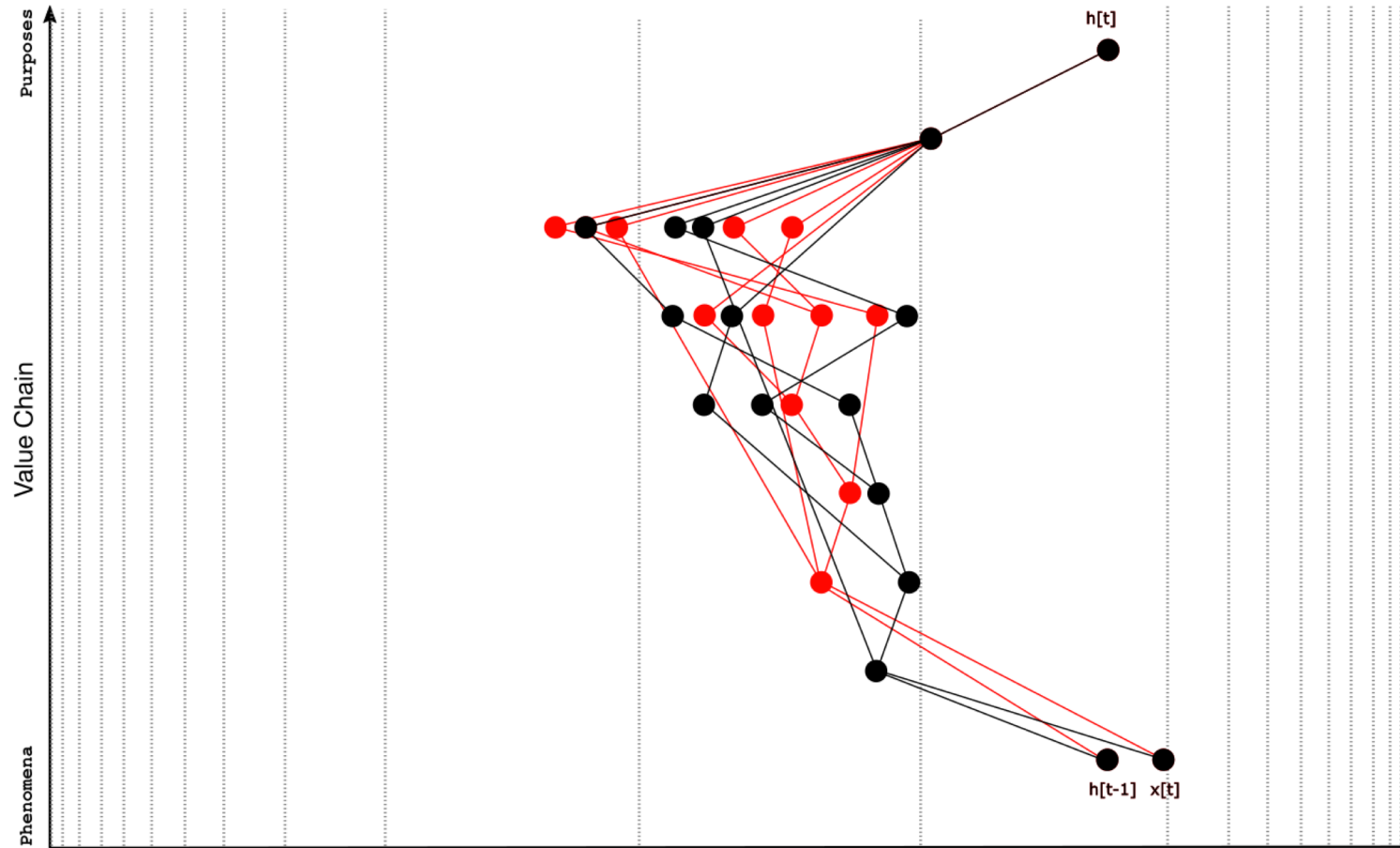
NEURAL NETWORK MODELS

EVOLVING TECHNOLOGY COMPONENTS (NEURAL ARCHITECTURE SEARCH)



NEURAL NETWORK MODELS

EVOLVING TECHNOLOGY COMPONENTS (NEURAL ARCHITECTURE SEARCH)



CHARTING THE FUTURE

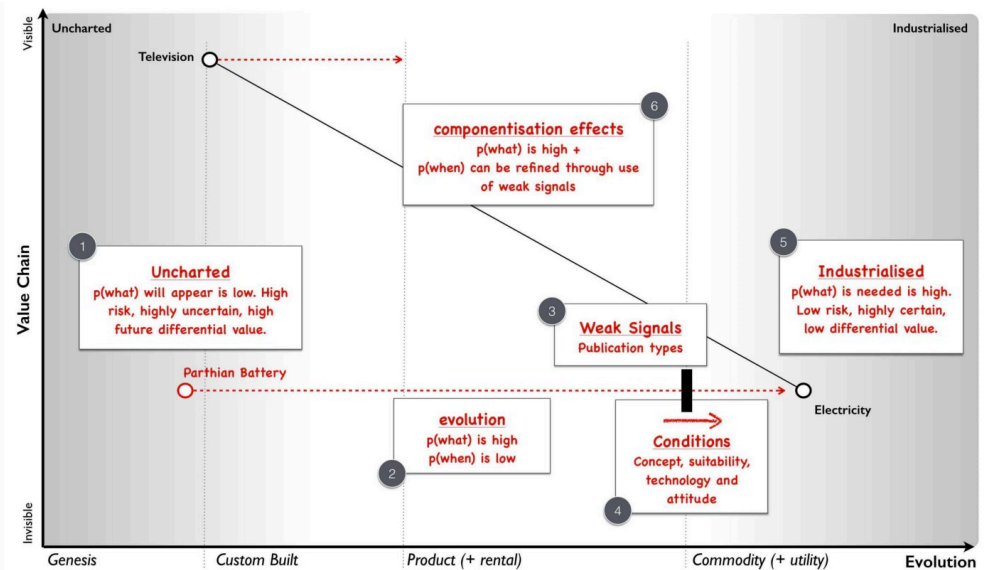
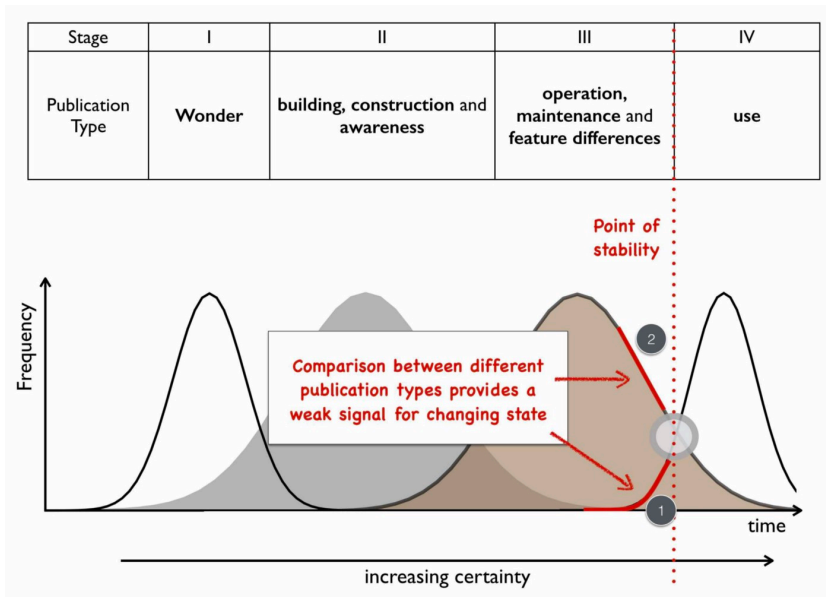
SYSTEMATIC LITERATURE REVIEWS

- Domain specific taxonomies
- Evolution of the main assembly

CHARTING THE FUTURE (CHAPTER 9)

A DOCUMENT AS A POINT ESTIMATE OF A VECTOR FIELD

- Simon's original slides
- Documents as a measurement process on beliefs of states of the world

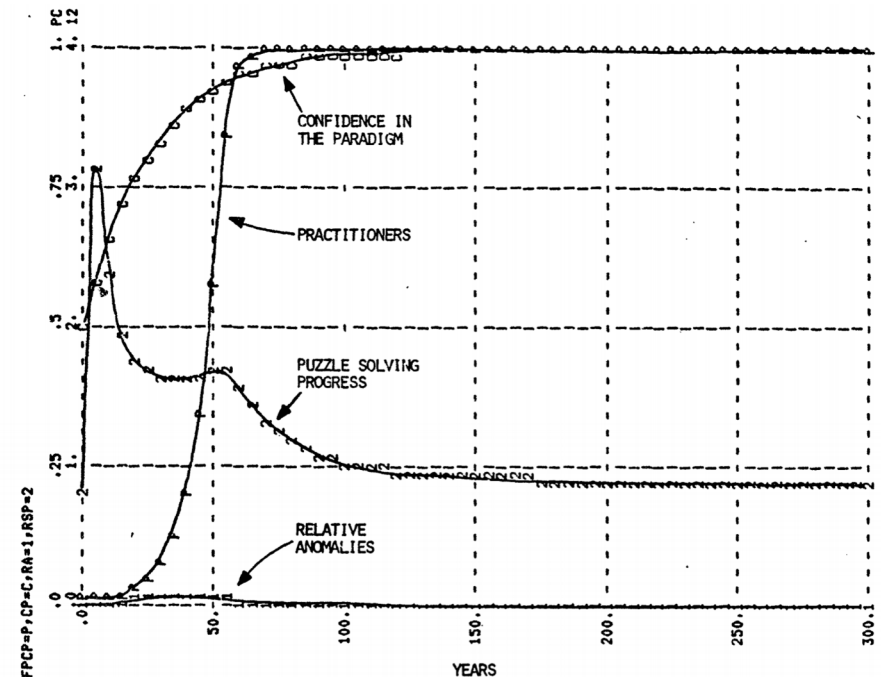
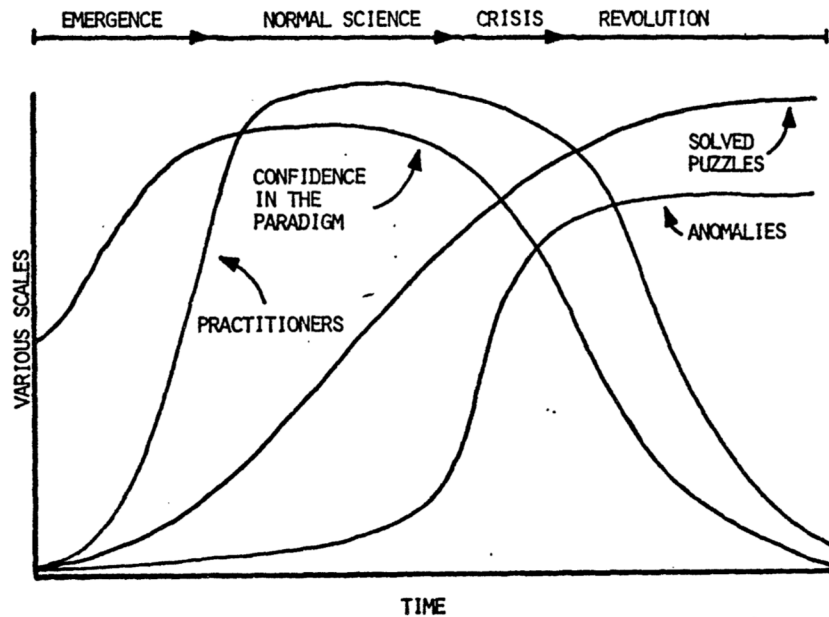


THE GROWTH OF KNOWLEDGE

WP 1326-82

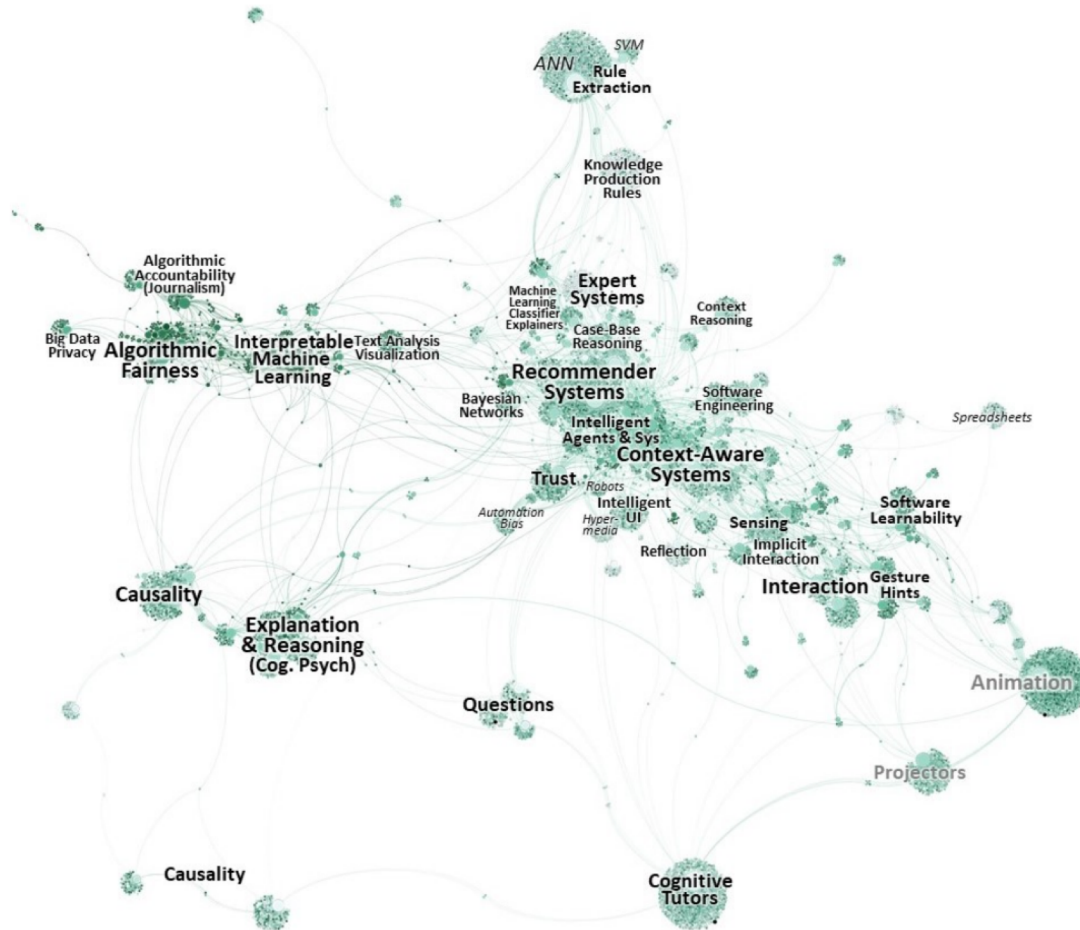
THE GROWTH OF KNOWLEDGE
Testing a Theory of Scientific Revolutions
With a Formal Model

John D. Sterman
Assistant Professor



CITATION NETWORKS

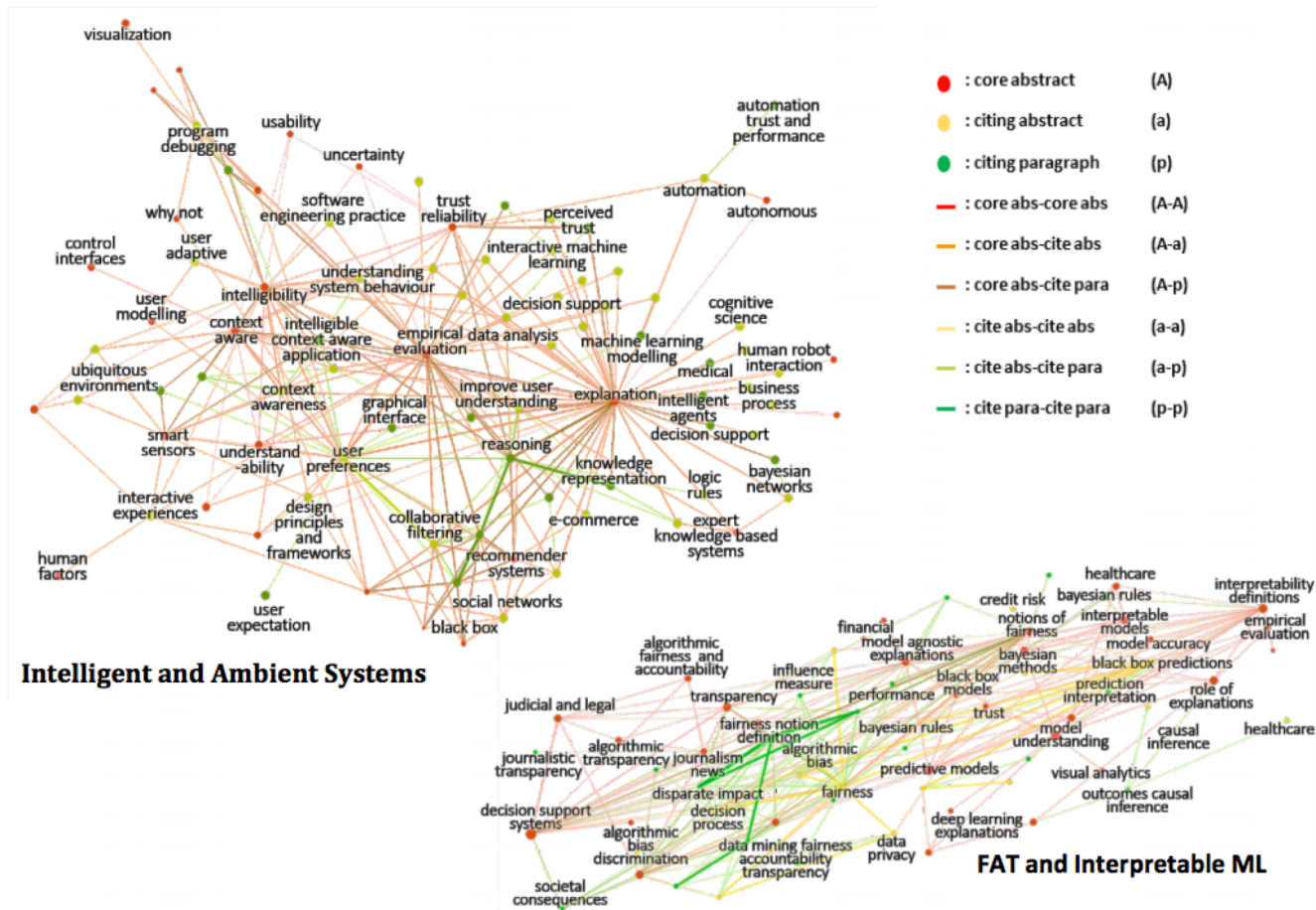
12,412 PAPERS CITING 289 CORE PAPERS ON EXPLANATIONS



Source: Trends and Trajectories for Explainable, Accountable and Intelligent Systems: An HCI Research Agenda 2019

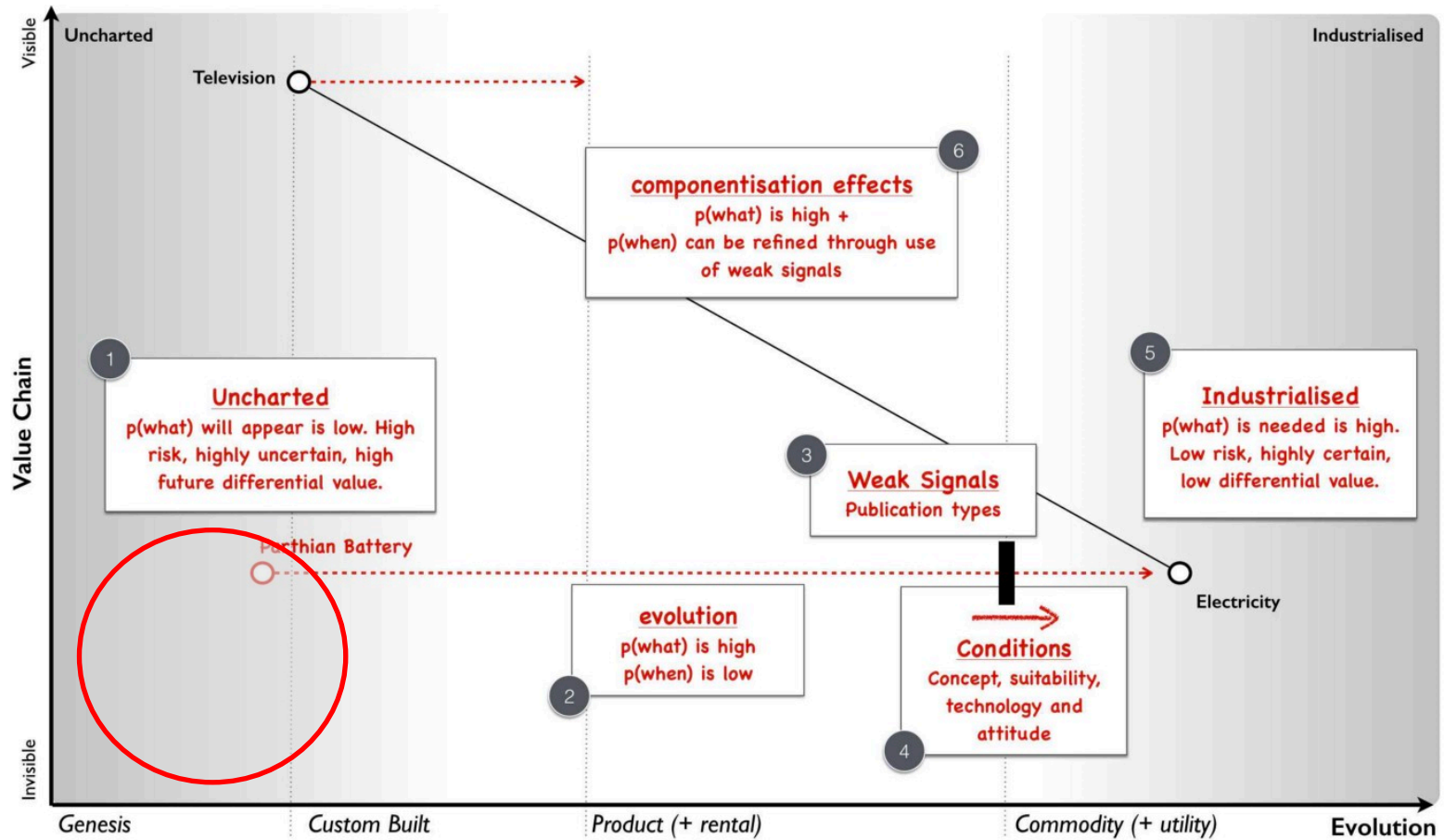
TOPIC NETWORKS

2 KEY SUBNETWORKS OF CORE AND CITING PAPERS



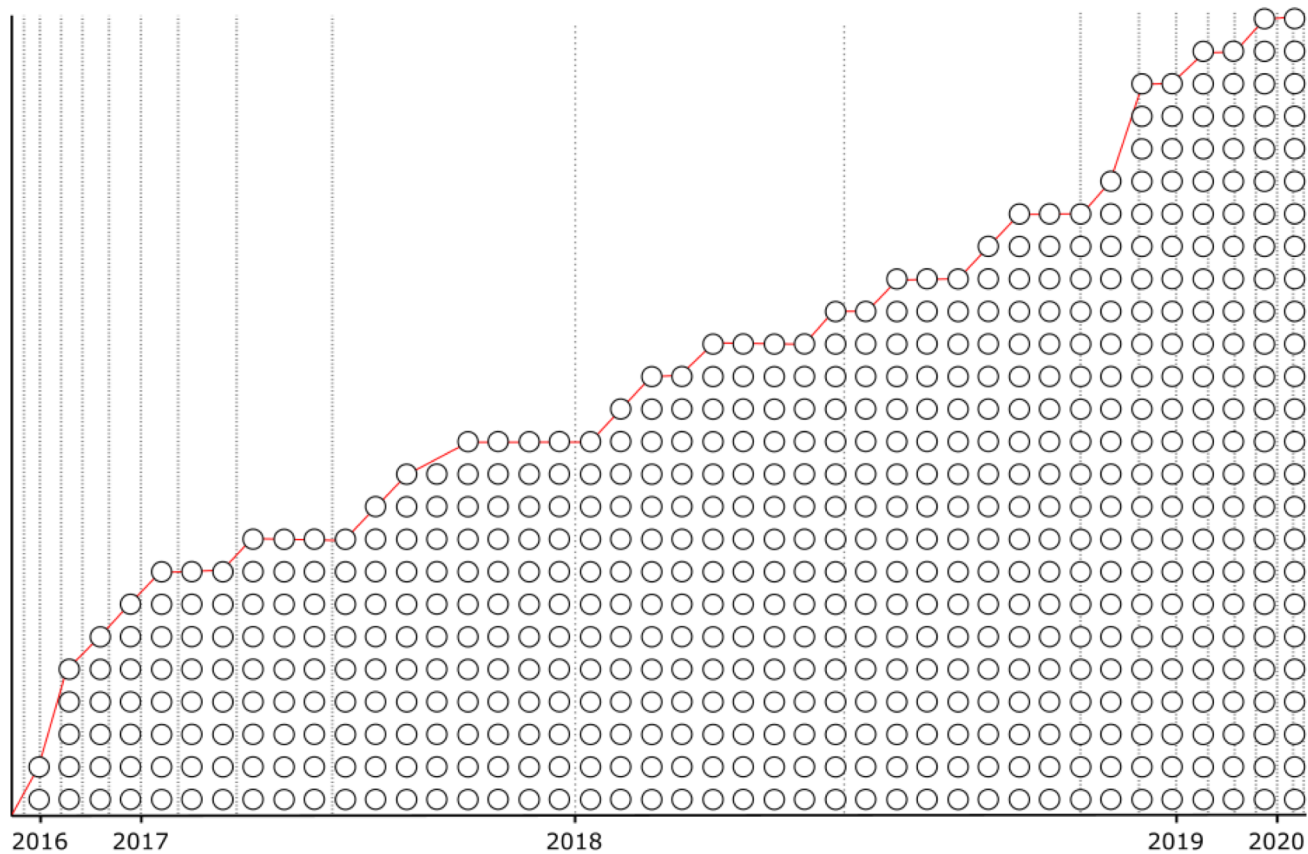
Source: Trends and Trajectories for Explainable, Accountable and Intelligible Systems: An HCI Research Agenda 2019

CHARTING THE FUTURE



STANDING CORPUS

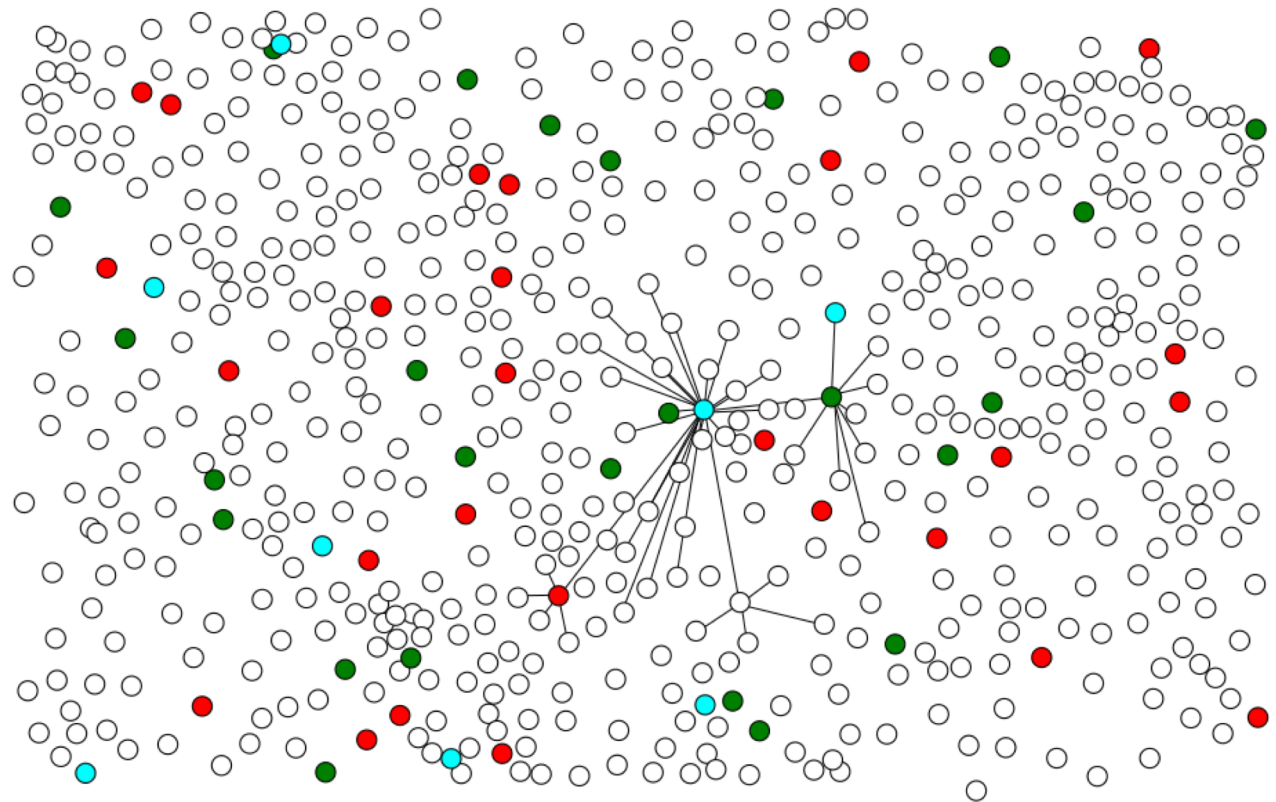
LOG, LINEAR, LOG



CITATION EMBEDDING

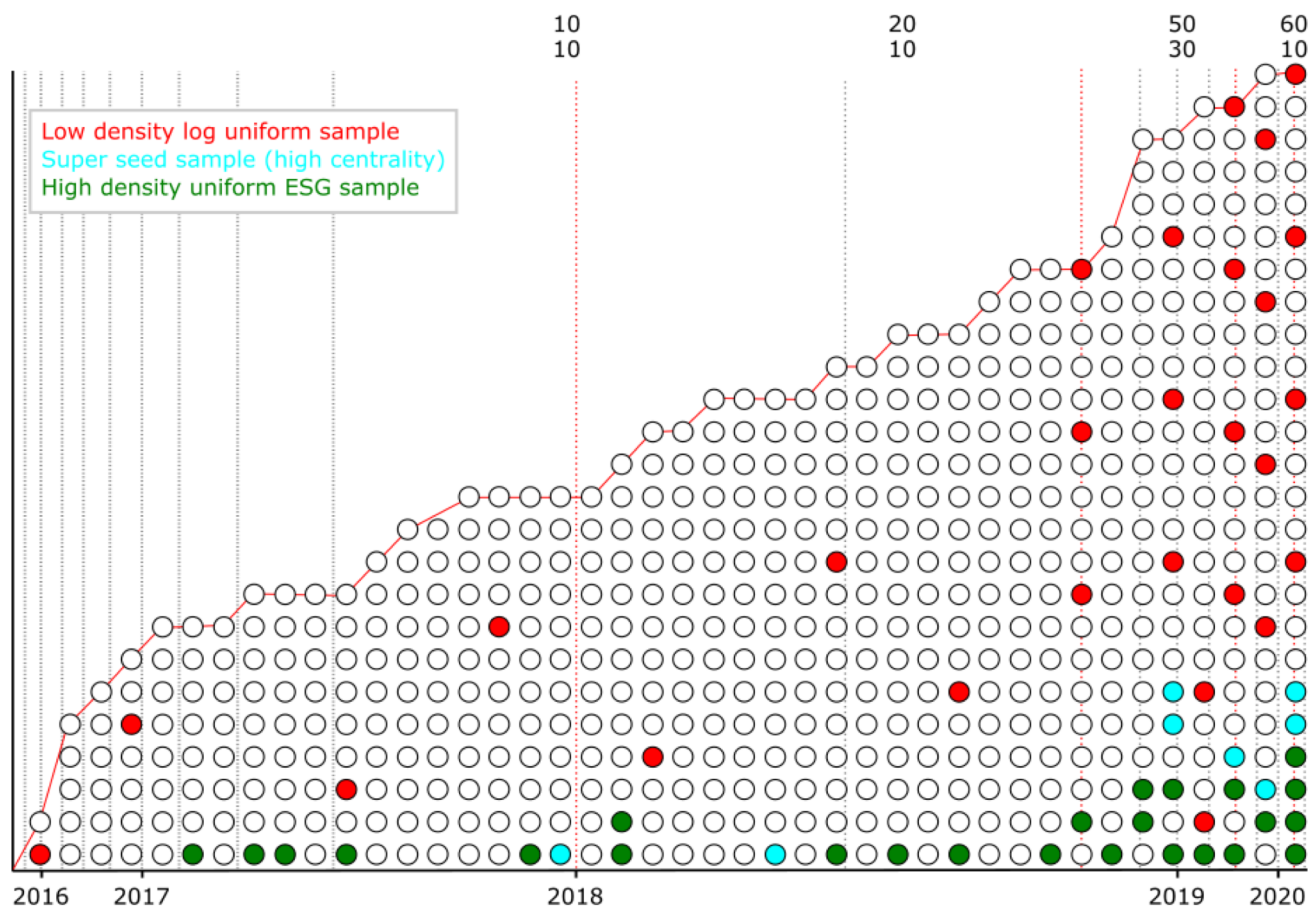
UMAP?

Sample type	Deg
Log	4.5
Seed	8.9
Uniform ESG	4.7

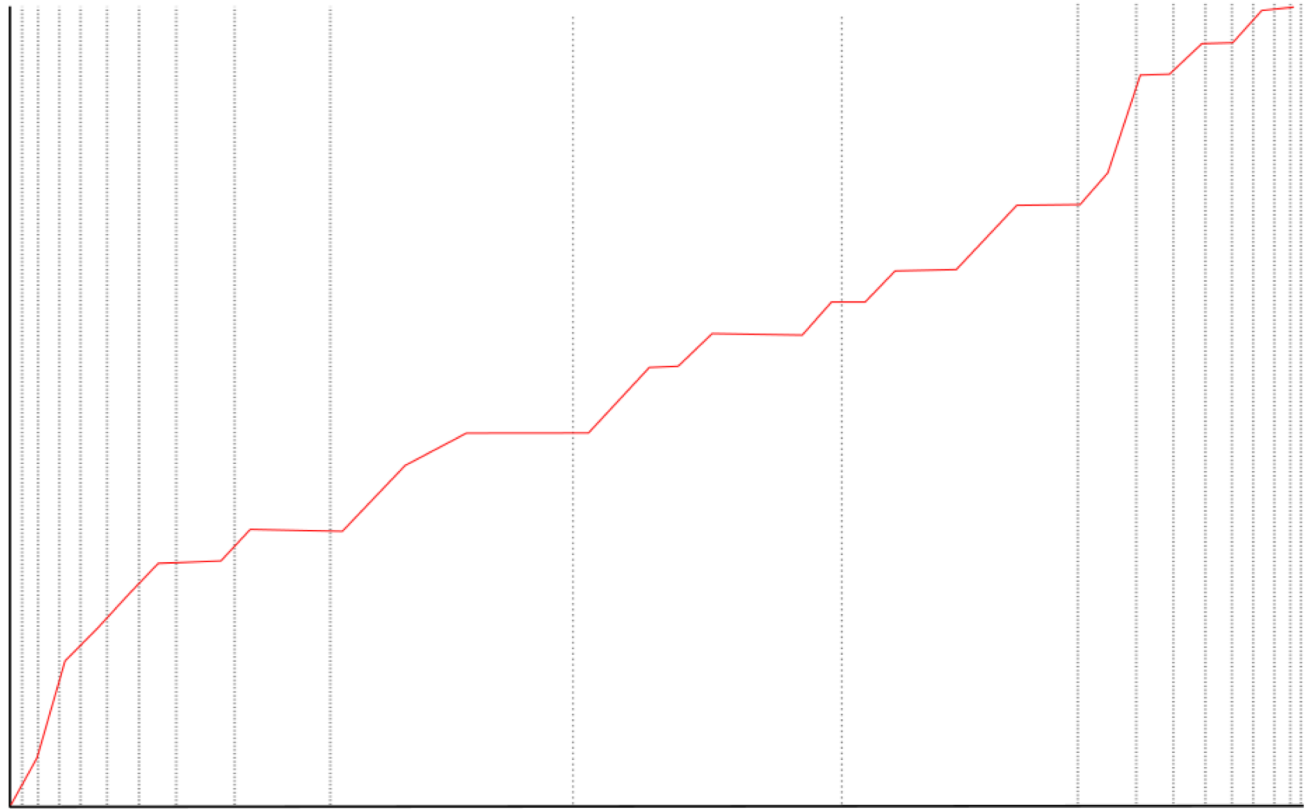
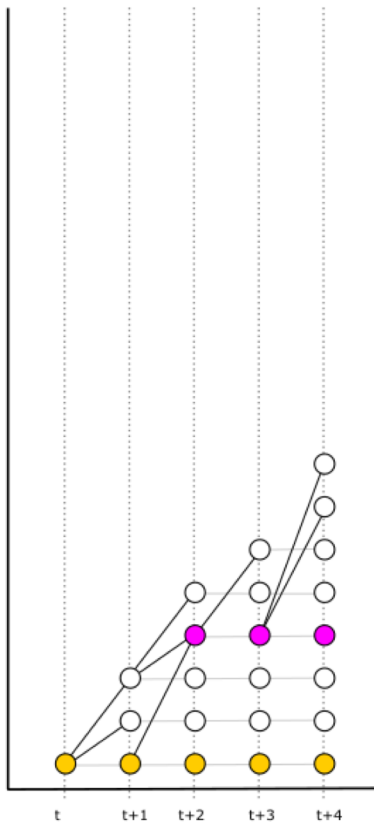


CORPUS SAMPLE METHODOLOGY

~#500 ~50 TRAIN ~10 TEST

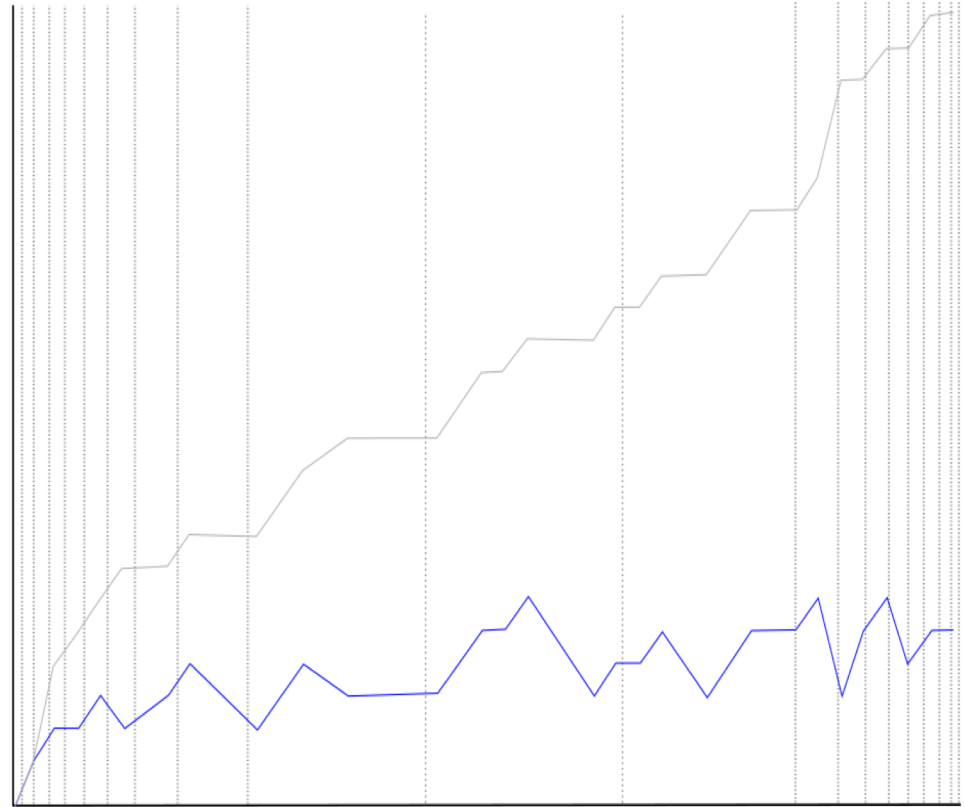
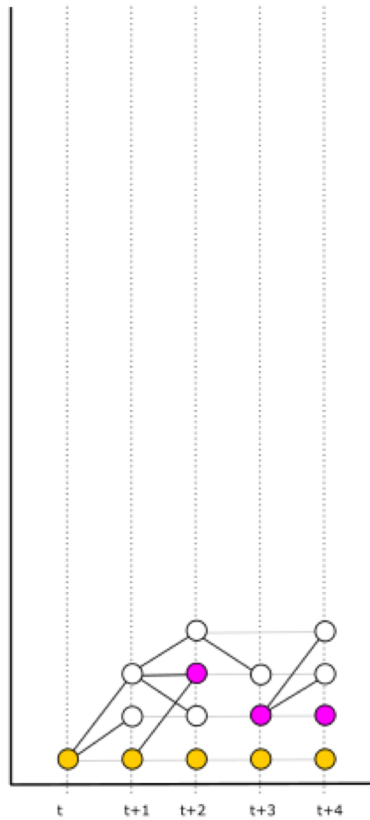
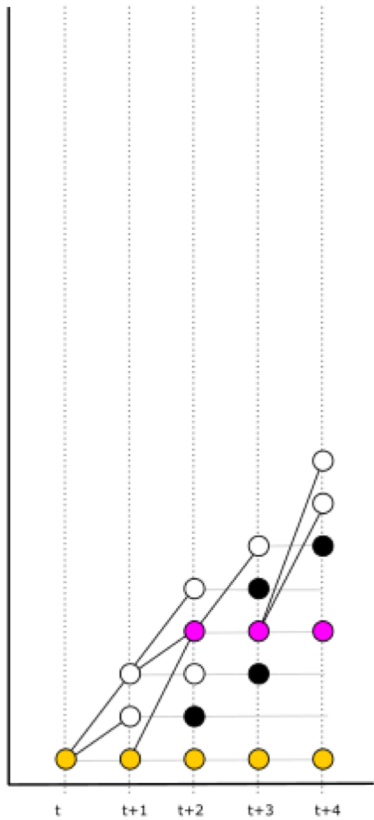


STANDING CORPUS CITATION PATHS



ACTIVE CORPUS

CITATION PATHS (PATH DECAY)

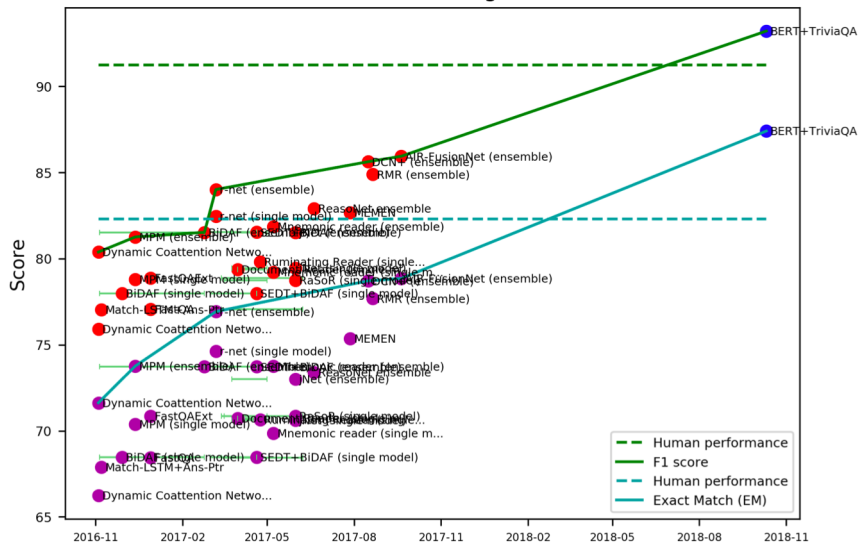


LANGUAGE MODELS

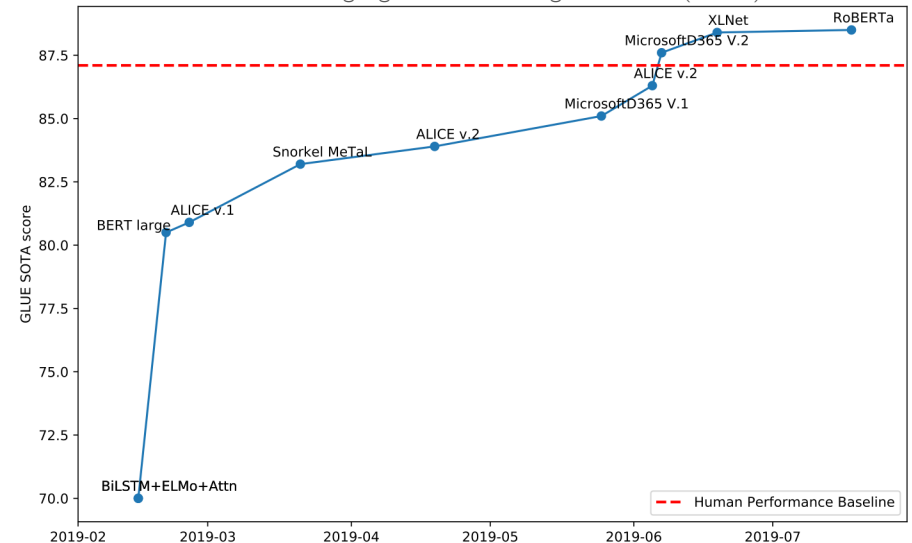
NLP PROGRESS

PERFORMANCE ON PUBLIC BENCHMARKS CAN RIVAL HUMAN PERFORMANCE

Stanford Question Answering Dataset (SQuAD)

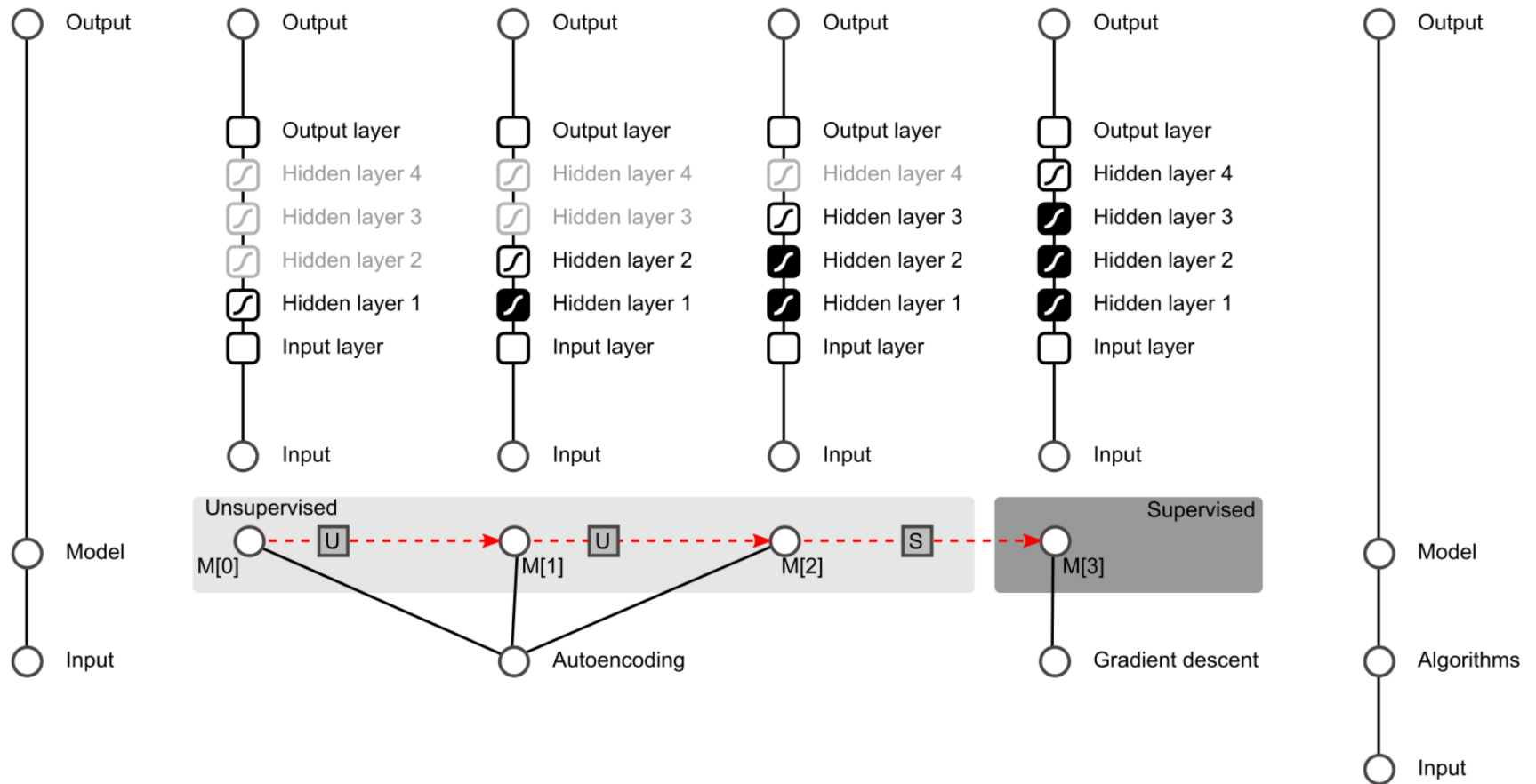


General Language Understanding Evaluation (GLUE)



PRE-TRAINING MASSIVE MODELS

ITERATIVELY LEARN REPRESENTATION USING UNLABELED DATA

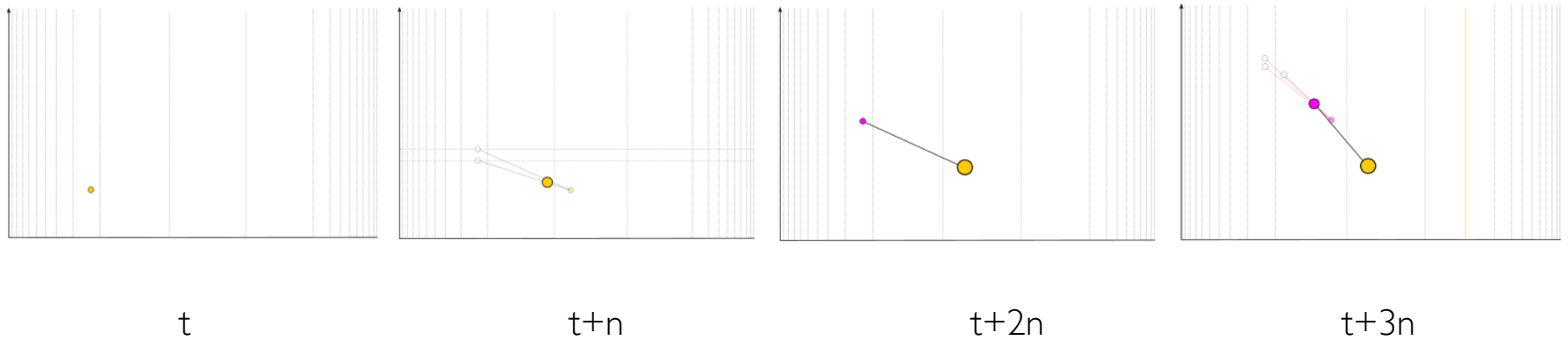


CORPUS ANALYSIS

	<p data-bbox="602 525 937 545"><u>Blockchain Name</u> Identifiers_arg Date Created</p> <p data-bbox="1240 506 1362 525">Security_Privacy_arg</p> <p data-bbox="1193 525 1296 545">Miscellaneous</p> <p data-bbox="86 549 1881 571">33 Blockchaining was first introduced with the creation of Bitcoin back in 2008. It is used to create a decentralized system in order to keep data more secure. A blockchain uses public and</p> <p data-bbox="931 582 1052 601">Security_Privacy_arg</p> <p data-bbox="873 601 975 621">Miscellaneous</p> <p data-bbox="112 625 1738 646">private keys in order to verify transactions that form a block. A block is made up of a hash, several transactions and the hash of the previous block, and a nonce. Blockchains use the</p> <p data-bbox="202 658 324 676">Security_Privacy_arg</p> <p data-bbox="227 676 274 696">SHA2</p> <p data-bbox="421 676 467 696">SHA2</p> <p data-bbox="537 676 639 696">Miscellaneous</p> <p data-bbox="112 701 1812 722">256 bit secure hashing algorithm (SHA-256) [4] hash algorithm in order to create hashes based on the data that is contained within that blockchain. Transactions are objects that have several</p> <p data-bbox="382 733 484 753">Miscellaneous</p> <p data-bbox="490 733 593 753">Miscellaneous</p> <p data-bbox="598 733 701 753">Miscellaneous</p> <p data-bbox="761 733 863 753">Miscellaneous</p> <p data-bbox="908 733 1010 753">Miscellaneous</p> <p data-bbox="1174 733 1257 753">Consensus</p> <p data-bbox="1572 733 1675 753">Miscellaneous</p> <p data-bbox="112 758 1881 801">different properties that include sender key, receiver key, time stamp, and signature. The blockchain also uses a consensus algorithm that verifies the validity of a blockchain. The following sections will further explain the elements of a block on a blockchain.</p> <p data-bbox="86 829 504 851">35 SUBSECTION: A. Hashes and Previous Hashes</p> <p data-bbox="220 891 322 911">Miscellaneous</p> <p data-bbox="459 891 506 911">SHA2</p> <p data-bbox="556 886 716 905">Miscellaneous Relationship</p> <p data-bbox="768 891 871 911">Miscellaneous</p> <p data-bbox="86 915 1812 936">37 The blockchain hashing function uses SHA-256 algorithm in order to create hashes for the blocks on the chain. The 256 symbolizes the amount of bits that the algorithm produces for the hash [3].</p> <p data-bbox="1503 948 1605 968">Miscellaneous</p> <p data-bbox="112 972 1835 993">Hashing is beneficial to the blockchain because it can make for searching for a block much quicker and easier. The hashes are unique to each block by incorporating a nonce into the hashing algorithm.</p> <p data-bbox="86 1022 1831 1043">39 The hashes of the previous block of the blockchain are stored in each block. This makes it so that the blockchain is always in consecutive order of which the blocks have been pushed to the</p> <p data-bbox="421 1055 523 1075">Miscellaneous</p> <p data-bbox="112 1079 1835 1122">blockchain. This also protects from replay attacks. Replay attacks are when valid data transmissions are replayed or delayed in order to be used for malicious intent [5]. The hash and previous hash in combination with the nonce makes it so that blocks cannot be repeated.</p>
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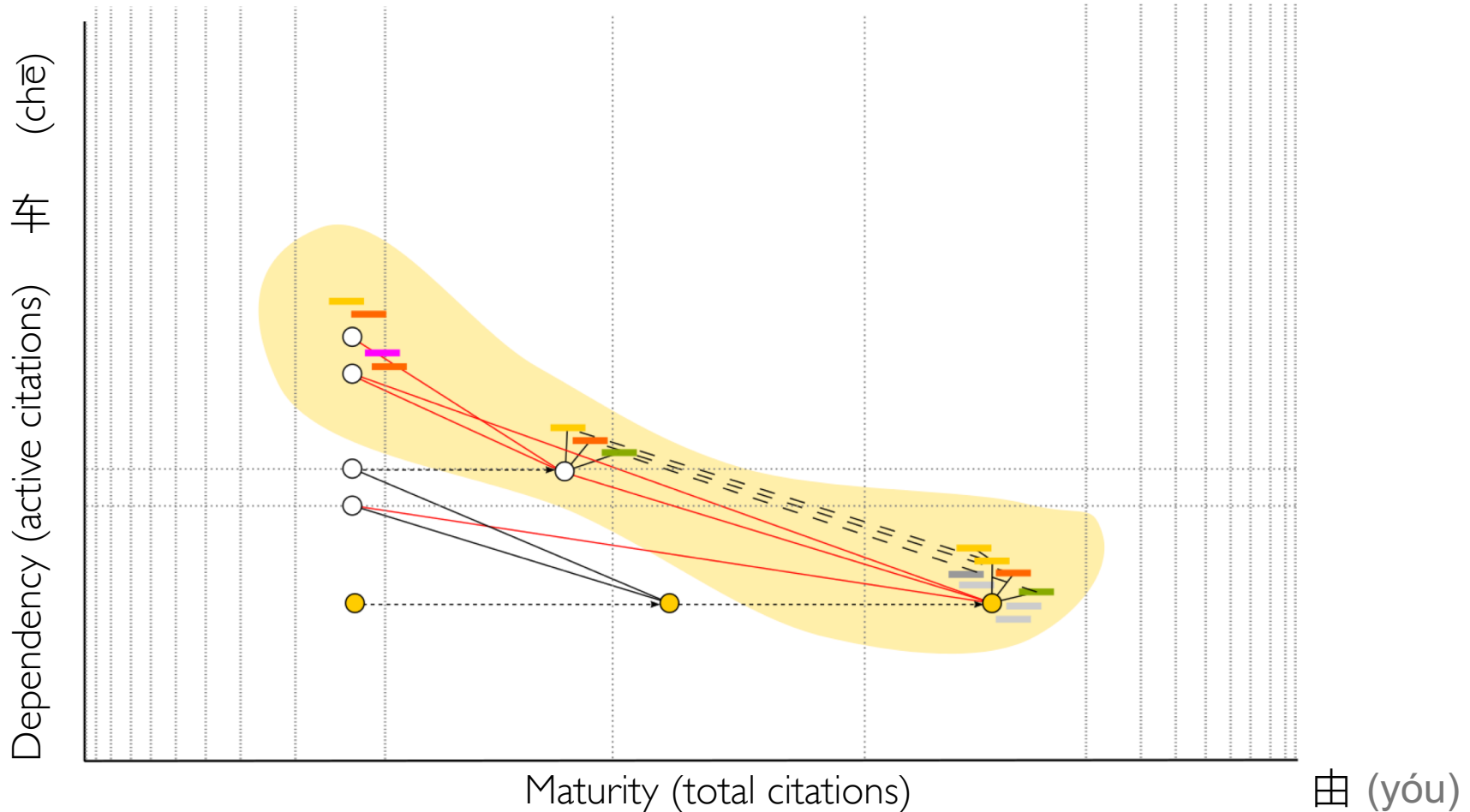
LEARNING TO MAP

LEARNING TAXONOMIES

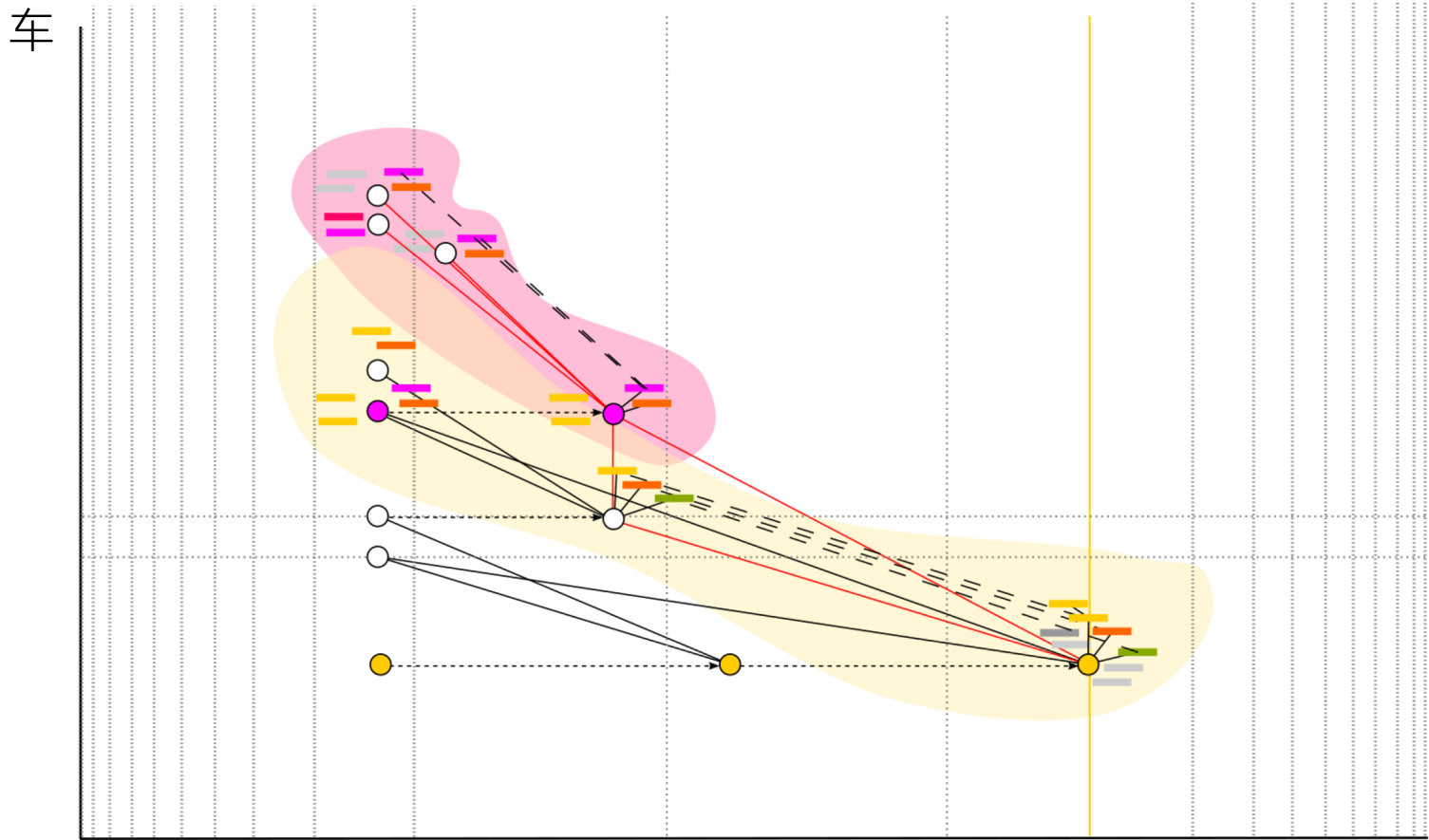


LABEL EVOLUTION ON CITATION GRAPH

轴 (ZHÓU)

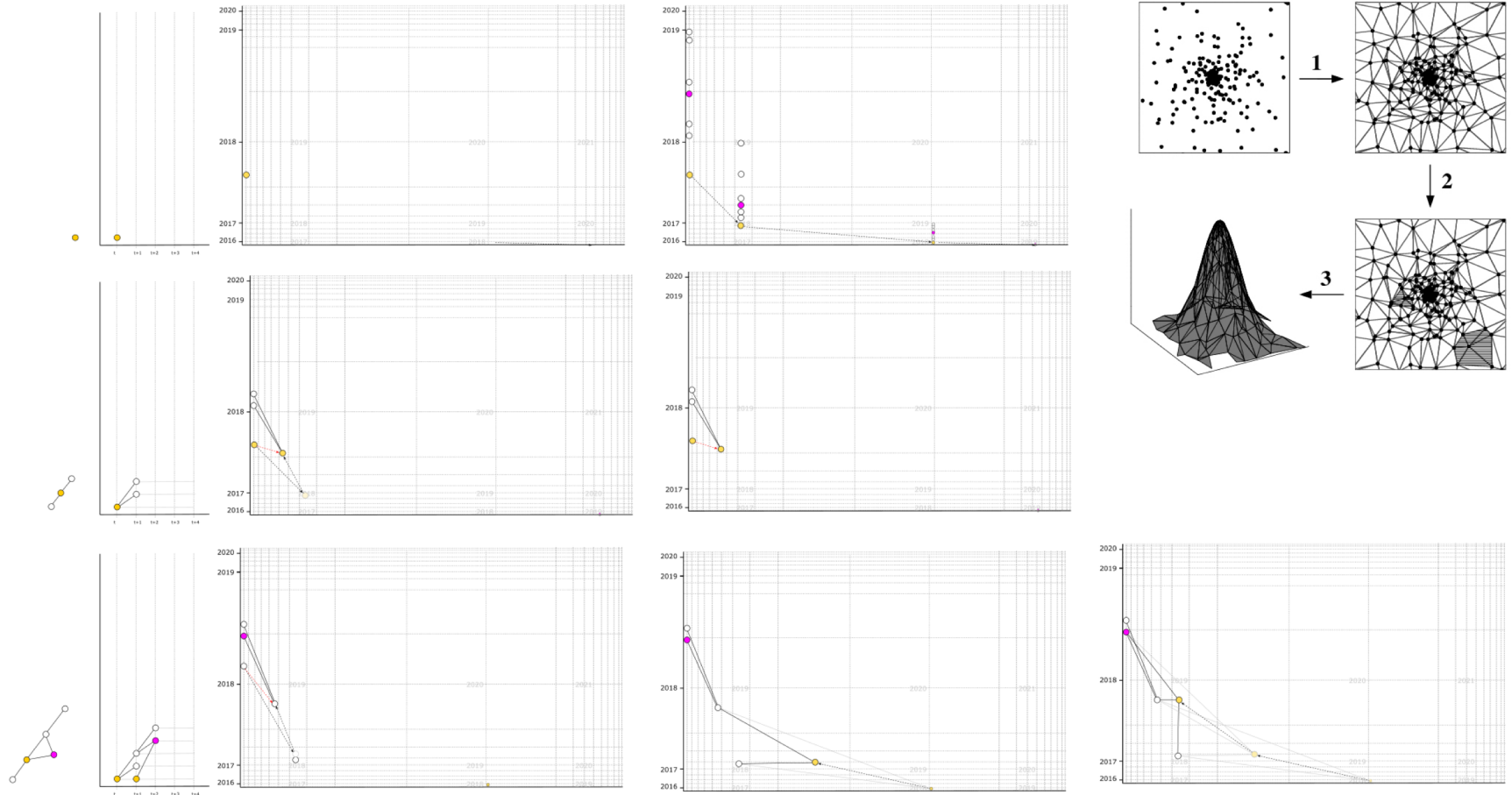


LABEL EVOLUTION ON CITATION GRAPH

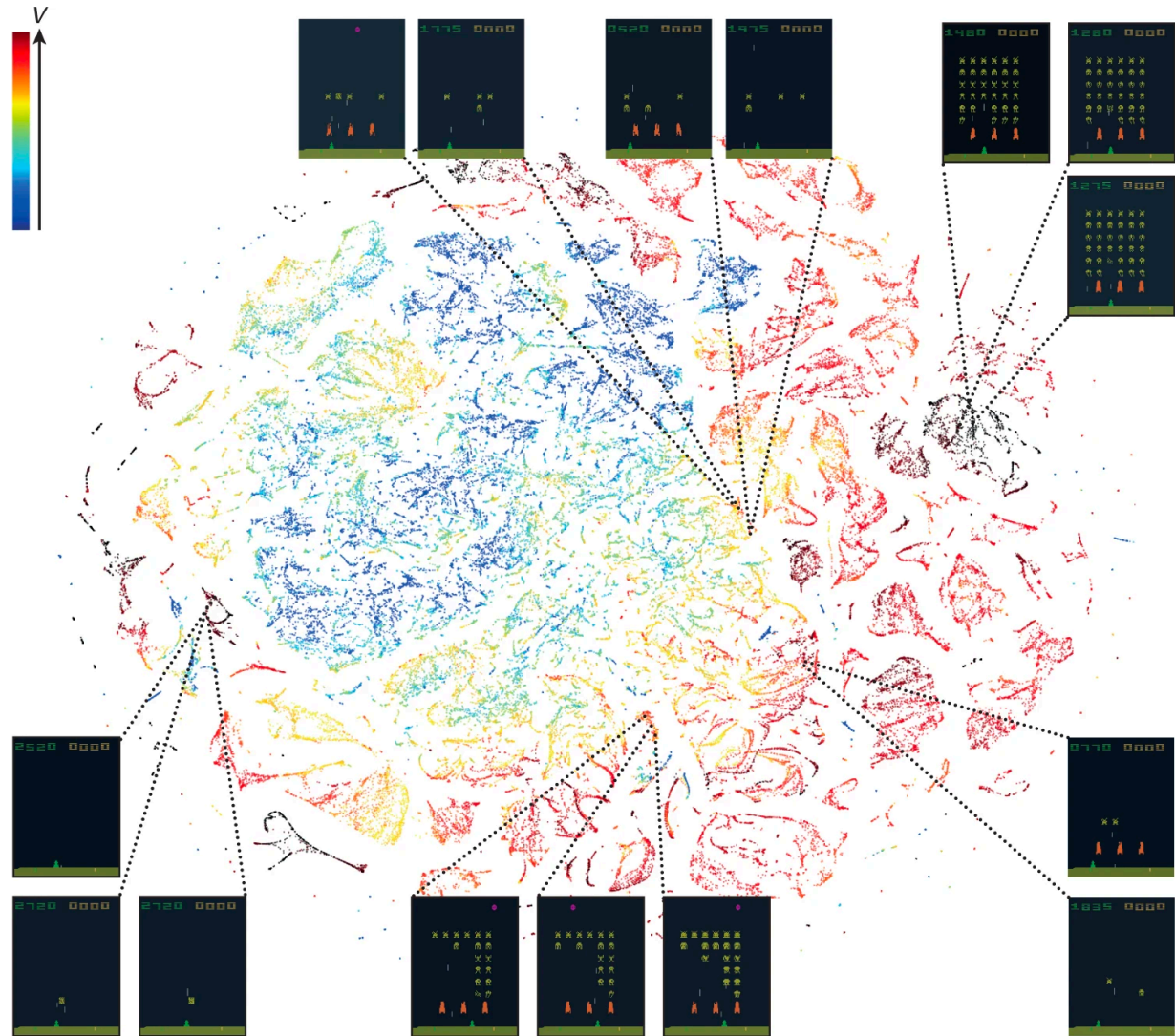


COMPONENT WISE RE-NORMALIZATION

“TIME” IN MULTIPLE AXES



COMPUTATIONAL STRATEGY

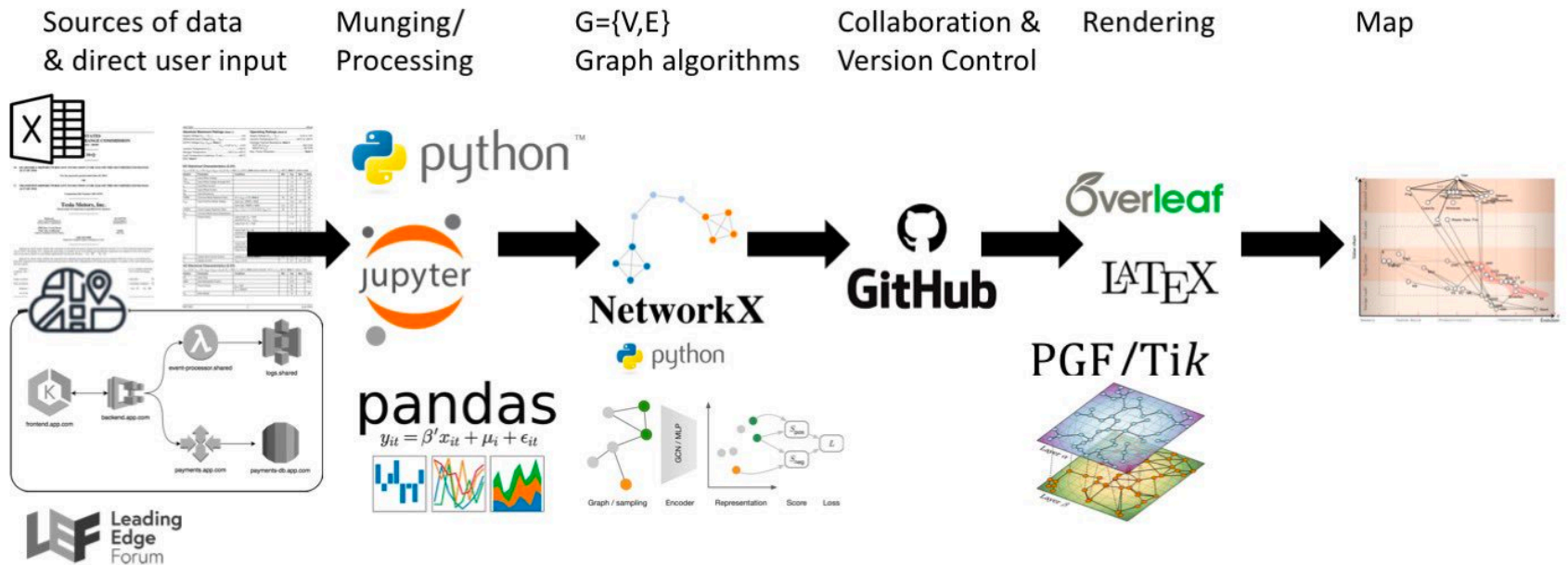


Source: <https://www.nature.com/articles/nature14236>

SUMMARY

- I really like AND use Wardley Maps
 - I getting better with practice, it took me several years
 - I can never UNSEE it!
- Machinery of maps is very versatile and well understood
 - Dependency graph
 - Projections and Embedded spaces (Learnable?)
- Maps are models
- A lot of work to be done!

MAPPING WORKFLOWS



LATEX (TEMPLATES)

latticecut / Wardley_Chapter2_Finding_a_path

<> Code Issues Pull requests Actions Projects Wiki Security Insights Settings

master 1 branch 0 tags

Go to file

Add file

Code

latticecut Updates from Overleaf

0c9e272 on 10 Jun 2019 30 commits

images	Updated README.md	14 months ago
layers	Changed corrupted V and E files	14 months ago
map	Changed corrupted V and E files	14 months ago
pdf	Updates from Overleaf	14 months ago
plates	Initial Overleaf Import	14 months ago
strata	Changed corrupted V and E files	14 months ago
LICENSE.md	Create LICENSE.md	14 months ago
README.md	Updates from Overleaf	14 months ago
Wardley_Chapter2_Finding_a_path...	Updated README.md	14 months ago
main.tex	Finished Fig 11 annotations	14 months ago
preamble.tex	Changed corrupted V and E files	14 months ago
tikz-network.sty	Initial Overleaf Import	14 months ago

README.md

Wardley Map for Chapter 2 "Finding a path"

"it has always been standardisation of components that has enabled creations of greater complexity" - Simon Wardley

This is a Wardley Map for Chapter 2 of Simon Wardley's [online book](https://bit.ly/2z1tpy) on topographical intelligence for business strategy [Wardley2016][1]. Full details can be found here (reading time ~24 mins): <https://bit.ly/2z1tpy>

The first map

Wardley Mapping has proved a useful tool for that can serve as a basis for framing the analysis of technology maturity and helping develop business strategy.

This is an example of visualizing Wardley Maps and Value Chain dependency networks in LaTeX. It aims to provide a simple and easy method to create, visualize and modify Wardley Maps that is consistent with best practise in collaboration, document management and version control. My main motivation is to create a mapping workflow that can work well across teams and document versions etc. In this regard working with GitHub and the Overleaf hosted LaTeX editor has proved successful.

The example is based on the PGF/TikZ languages for producing vector graphics from a geometric/algebraic description. PGF is a lower-level language, while TikZ is a set of higher-level macros that use PGF and an interpreter written in TeX by Till Tantau.

You can find an introductory video to get started using TikZ here: [Basic Drawing Using TikZ](#)

Figure 8

Figure 8 is what a map of a single line of business should look like. Simon created the first map in 2005 and it was for an online photo service.

This has been split out into a single stratum, the Application Layer with two .tex files for nodes (V) and edges (E) respectively.

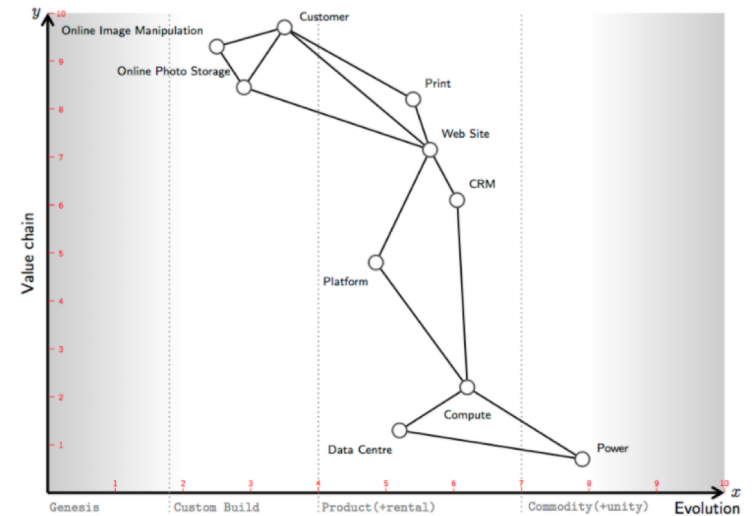


Figure 11

Here we add example annotations using the Fig11_Annotation.tex file over the top of the Map from Figure 8. Comment out as desired.

In practice a lot of the code in this file is just about styling, for example the formatting of the Key, and can be ignored during the normal mapping process. However, I have tried remain faithful to Simon's original style/rendering.

