Artificiële Intelligentie

Keuzevak Demistifying AI & HC Data 05 oktober 2022

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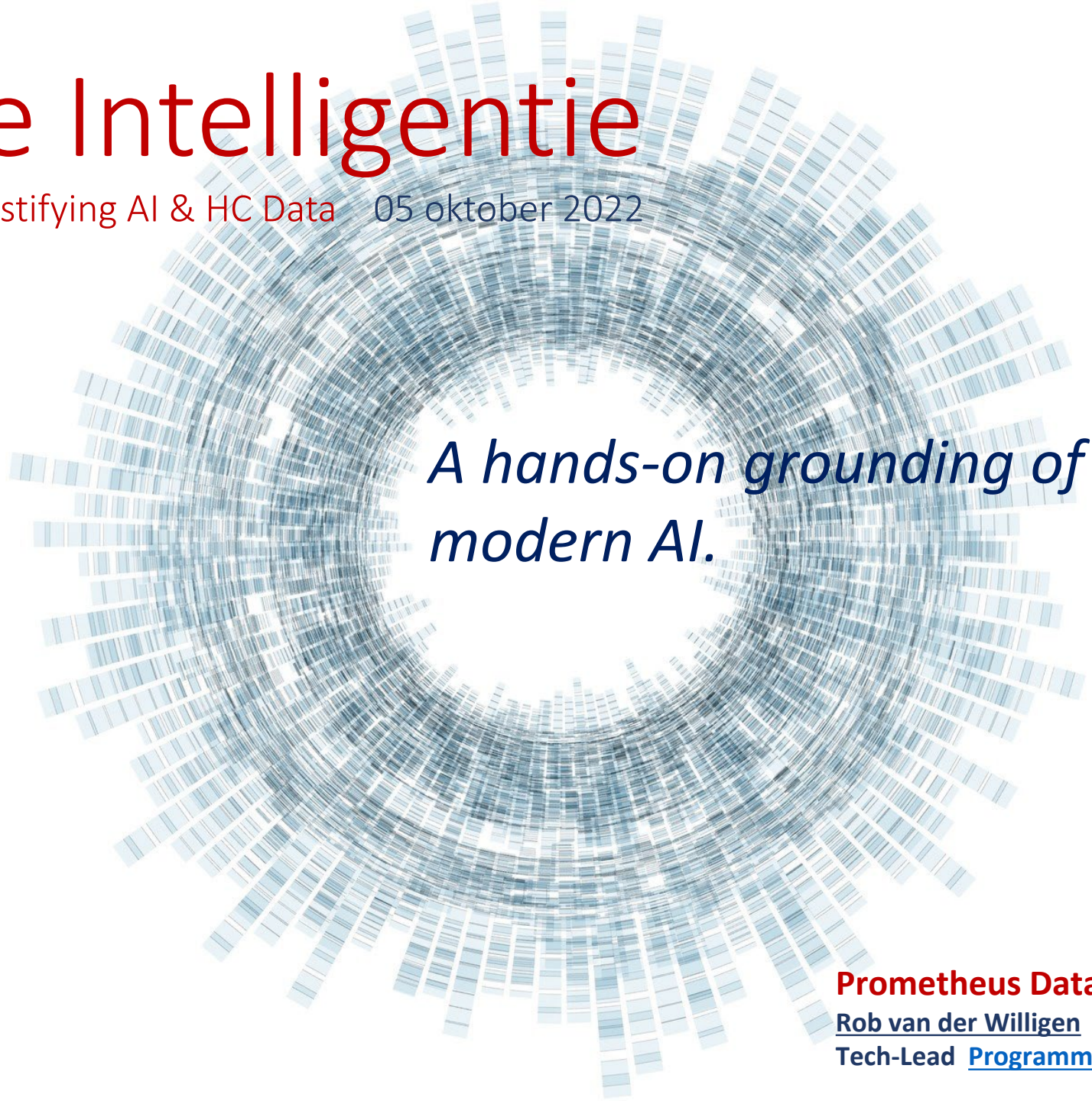
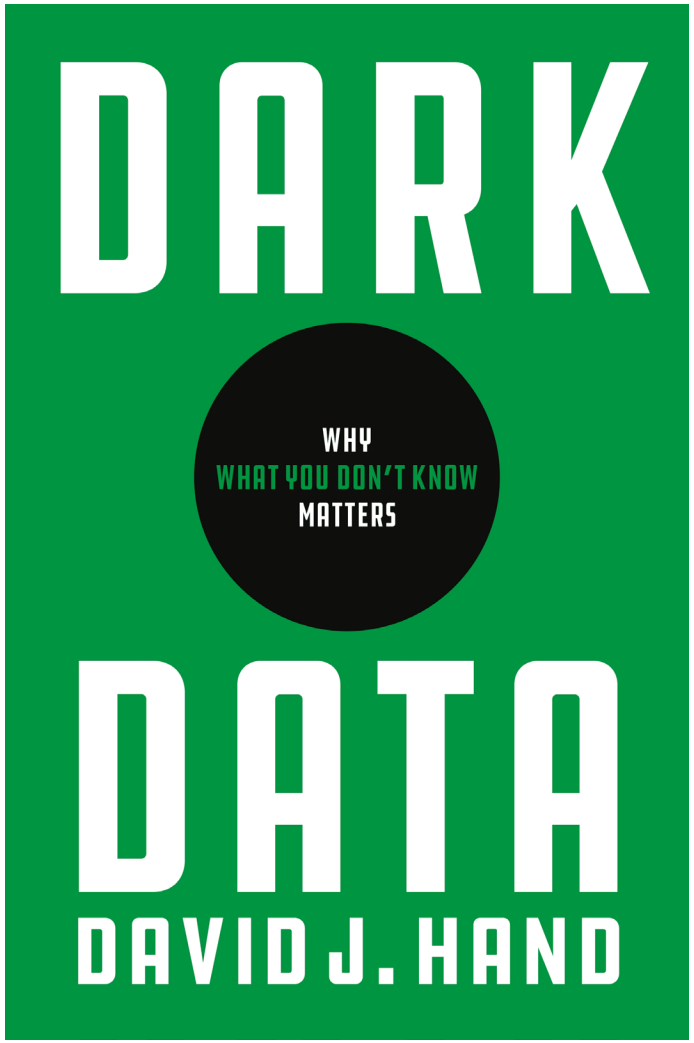


A hands-on grounding of modern AI.

Prometheus Data-Lab (Wijnhaven 103)

Rob van der Willigen

Tech-Lead Programma AI & Ethics

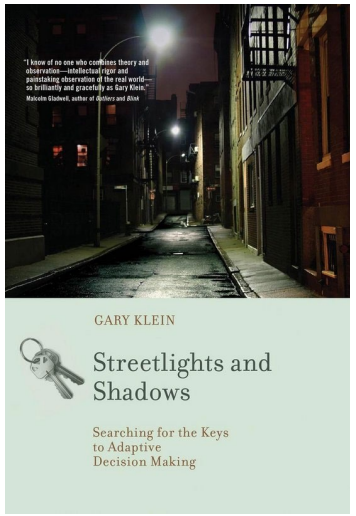

DARK
WHY
WHAT YOU DON'T KNOW
MATTERS
DATA
DAVID J. HAND


De
computer
zegt
[NEE]


WRR
Green
Red
Black
Blue
Hoe
mensen
keuzes
maken
DE PSYCHOLOGIE VAN
HET BESLISSEN
W.L. Tiemeijer
amsterdam university press

Algorthms

> As people become more dependent on algorithms, their judgment may erode, making them dependent even more on the algorithms.
> That process sets up a vicious cycle.
> People get passive and less vigilant when algorithms make the decisions.



– Gary Klein

Streetlights and Shadows

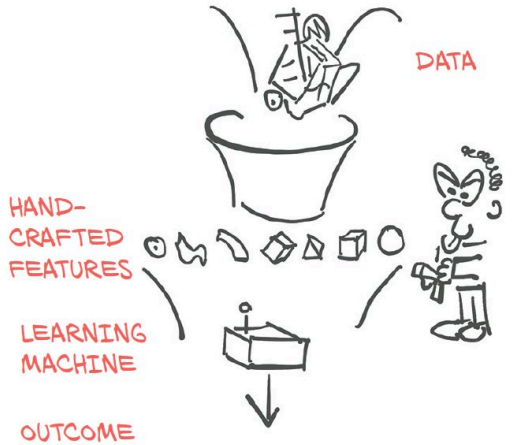
CONTEXT

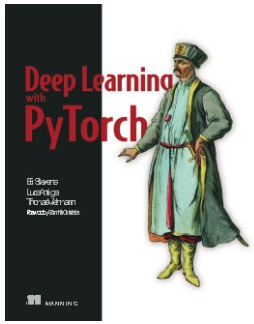
- Prerequisites: basics in linear algebra, probability, and analysis of algorithms.
- Workload: homework assignments
- GitHub: Start a ML repository at GitHub

DATA PRODUCTS

What is a Data Product?

Why should AI-specialists care?





Lecture 06

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- Basic definitions and concepts of Machine Learning (ML) PART04a: DATA SCIENCE
- How to get from ML concepts & Models to Python code.

- ➔ DATA SCIENCE vs DATA PRODUCTS ➔

https://pt.slideshare.net/uxpin/designing-meaningful-data-products-72206752

https://www.slideshare.net/inovex/what-are-data-products-and-why-are-they-different-from-other-products

https://hbr.org/2018/10/how-to-build-great-data-products

https://towardsdatascience.com/designing-data-products-b6b93edf3d23

https://www.mindtheproduct.com/fundamentals-building-better-data-products/

https://queirozf.com/entries/11-types-of-data-products-with-examples

{02}
DATA SCIENCE vs DATA PRODUCTS

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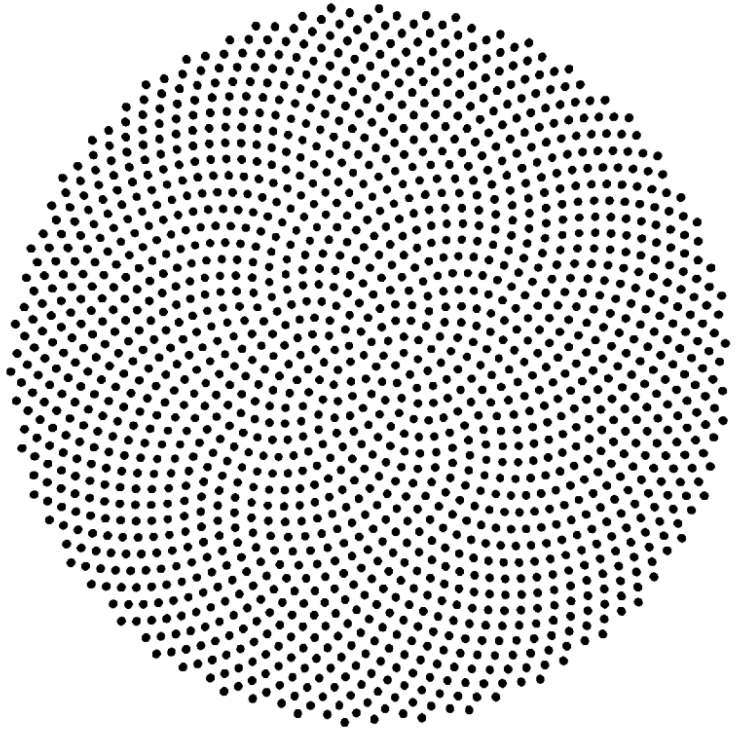

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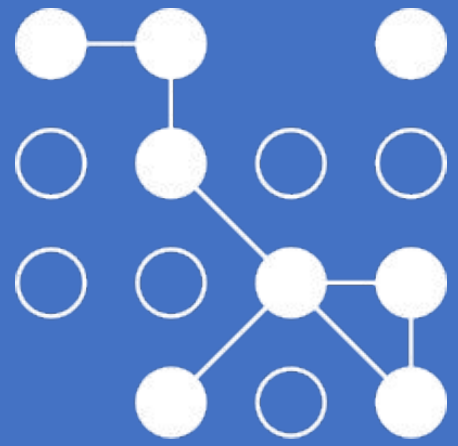
DATA SCIENCE

\+

HUMAN FACTORS

=

DATA PRODUCT



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Data Deluge: to much data

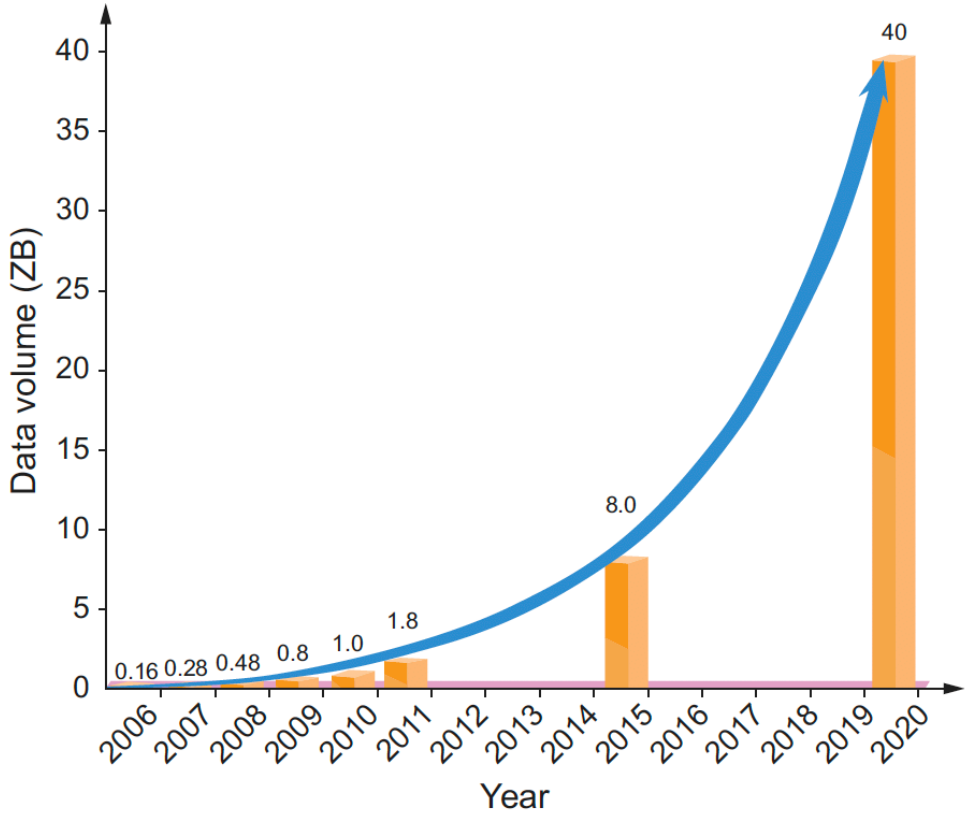
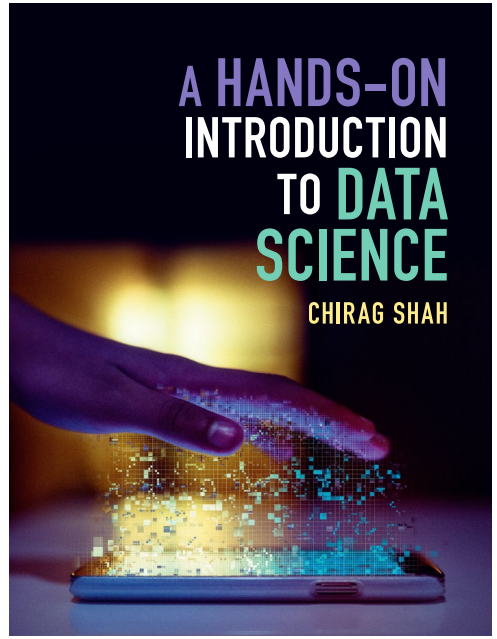


Figure 1.1 Increase of data volume in last 15 years. (Source: IDC's Digital Universe Study, December 2012.[5])



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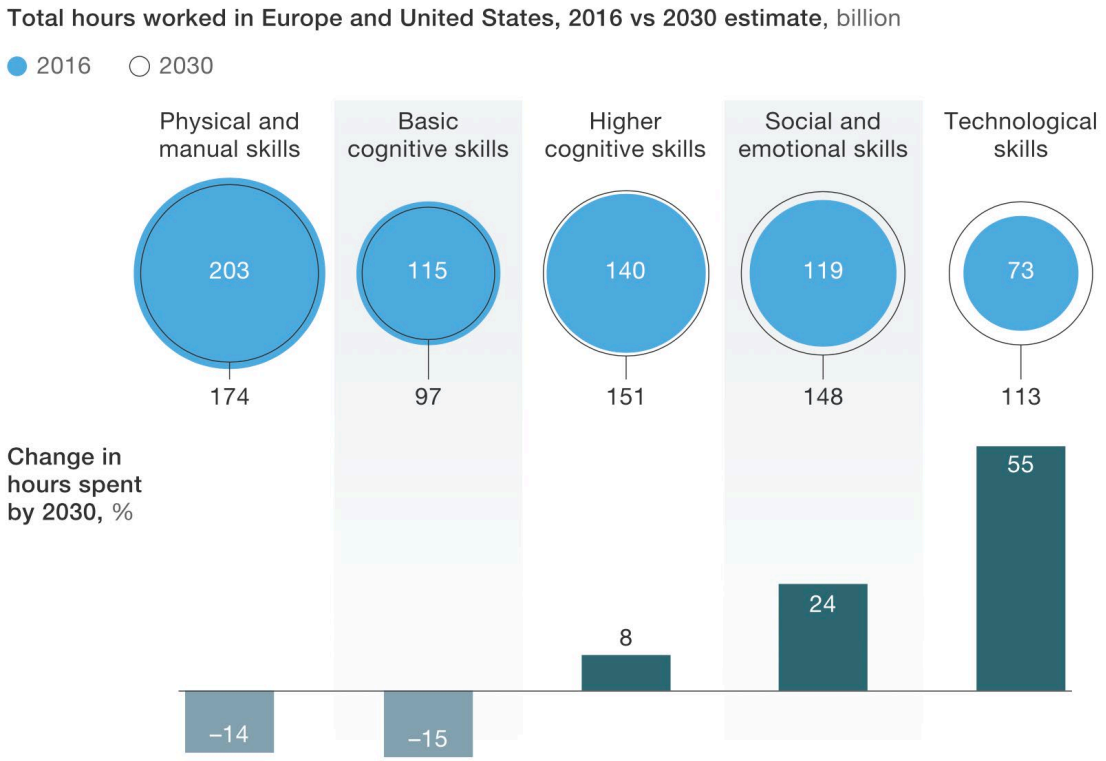
Wy do we need Data Science in higher education:

Automation and artificial intelligence will accelerate the shift in workforce skills



https://www.mckinsey.com/featured-insights/future-of-work/skill-shift-automation-and-the-future-of-the-workforce#

{02}
Data Science

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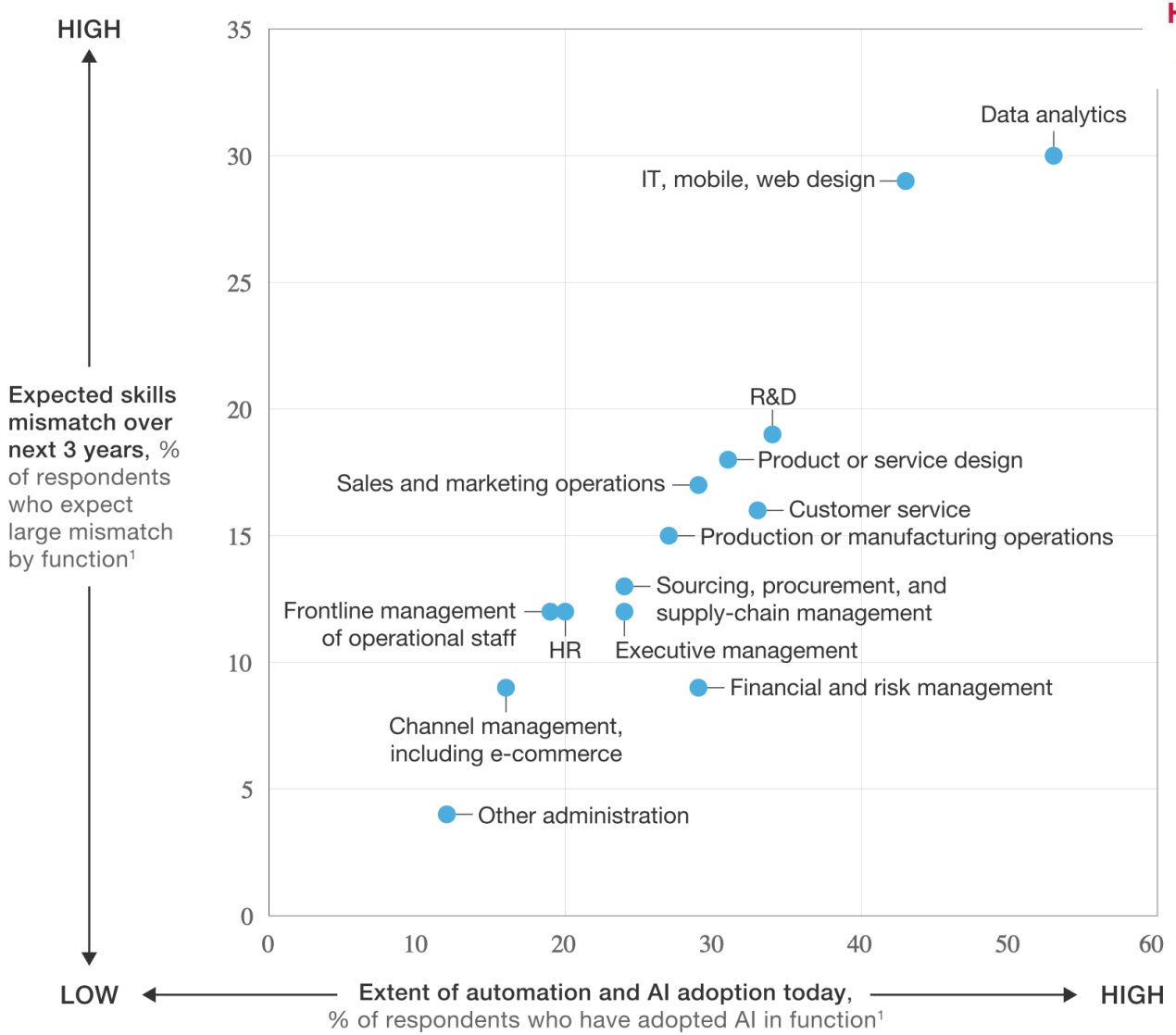
Wy do we need Data Science in
higher education:

Skills mismatch vs automation and artificial intelligence (AI) adoption



https://www.mckinsey.com/featured-insights/future-of-work/skill-shift-automation-and-the-future-of-the-workforce#

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DATA SCIENCE (ANALYTICS) VERSUS DATA ENGINEERING (PROBLEM SOLVING)

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DATA SCIENCE
focuses on **Analytics**

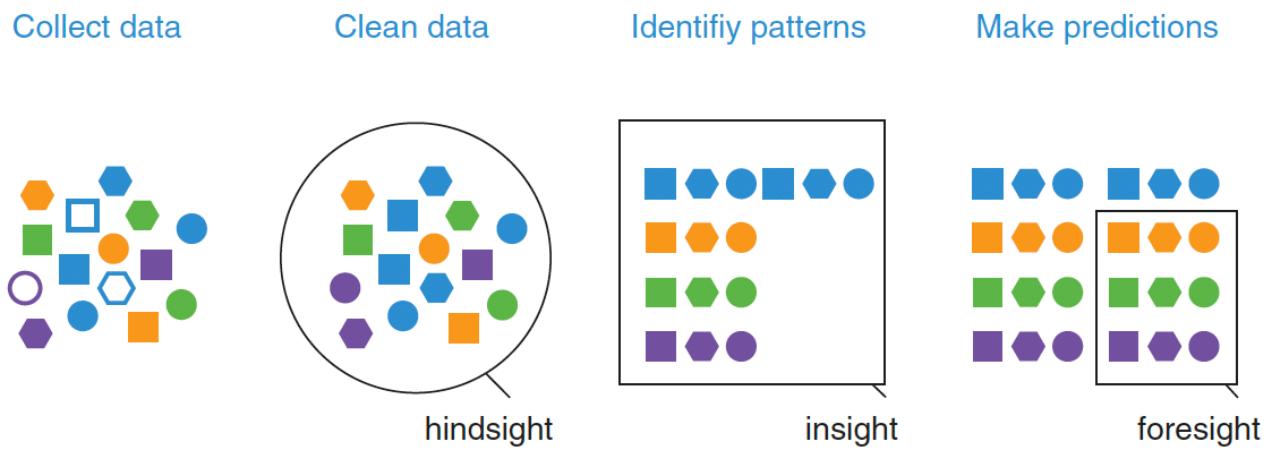
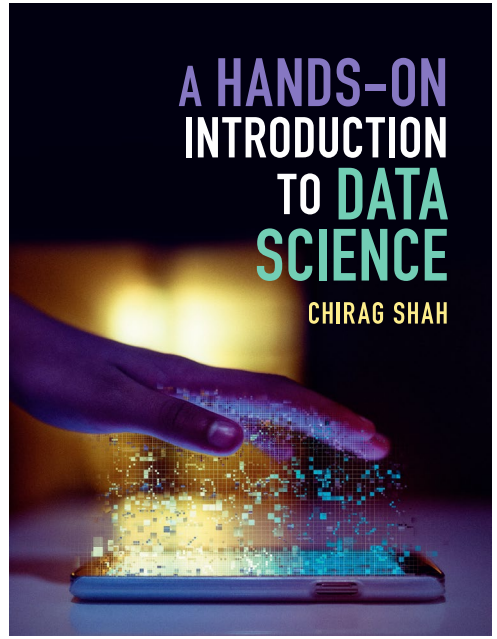


Figure 3.11 Process of predictive analytics.[7]



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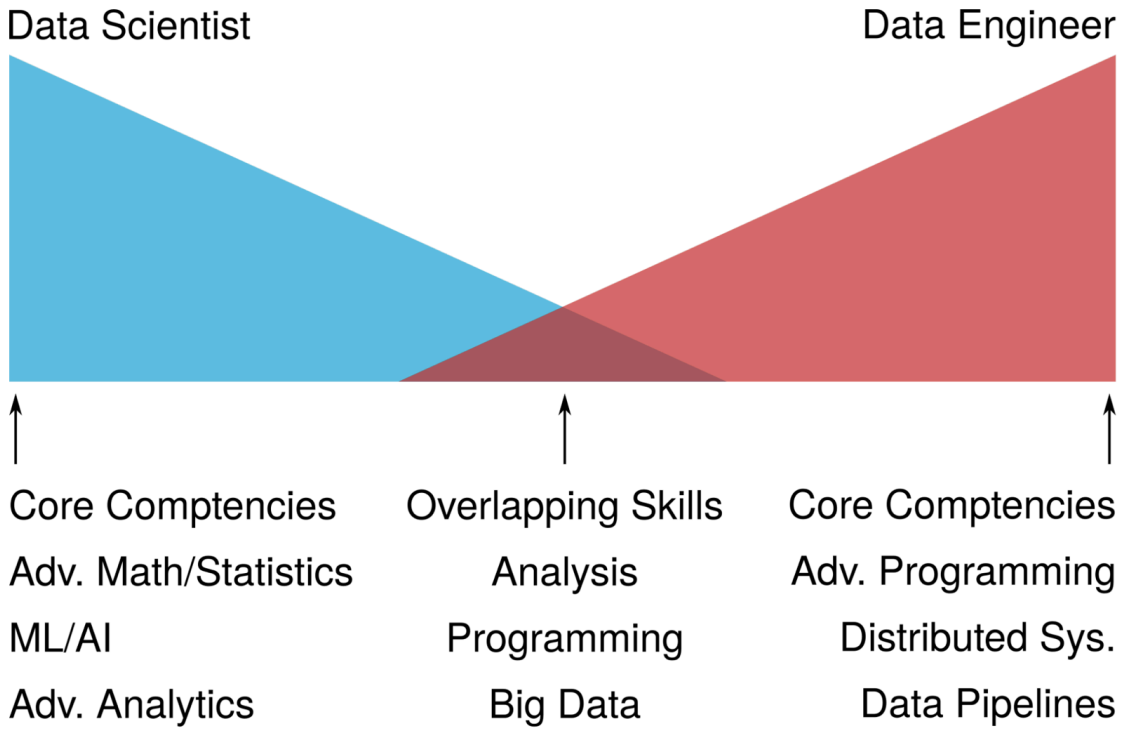
DATA ENGINEERING focuses on **Problem Solving**

Data engineers build and maintain data pipelines

Data pipelines encompass the journey and processes that data undergoes within a company.

Data engineers are responsible for creating those pipelines.



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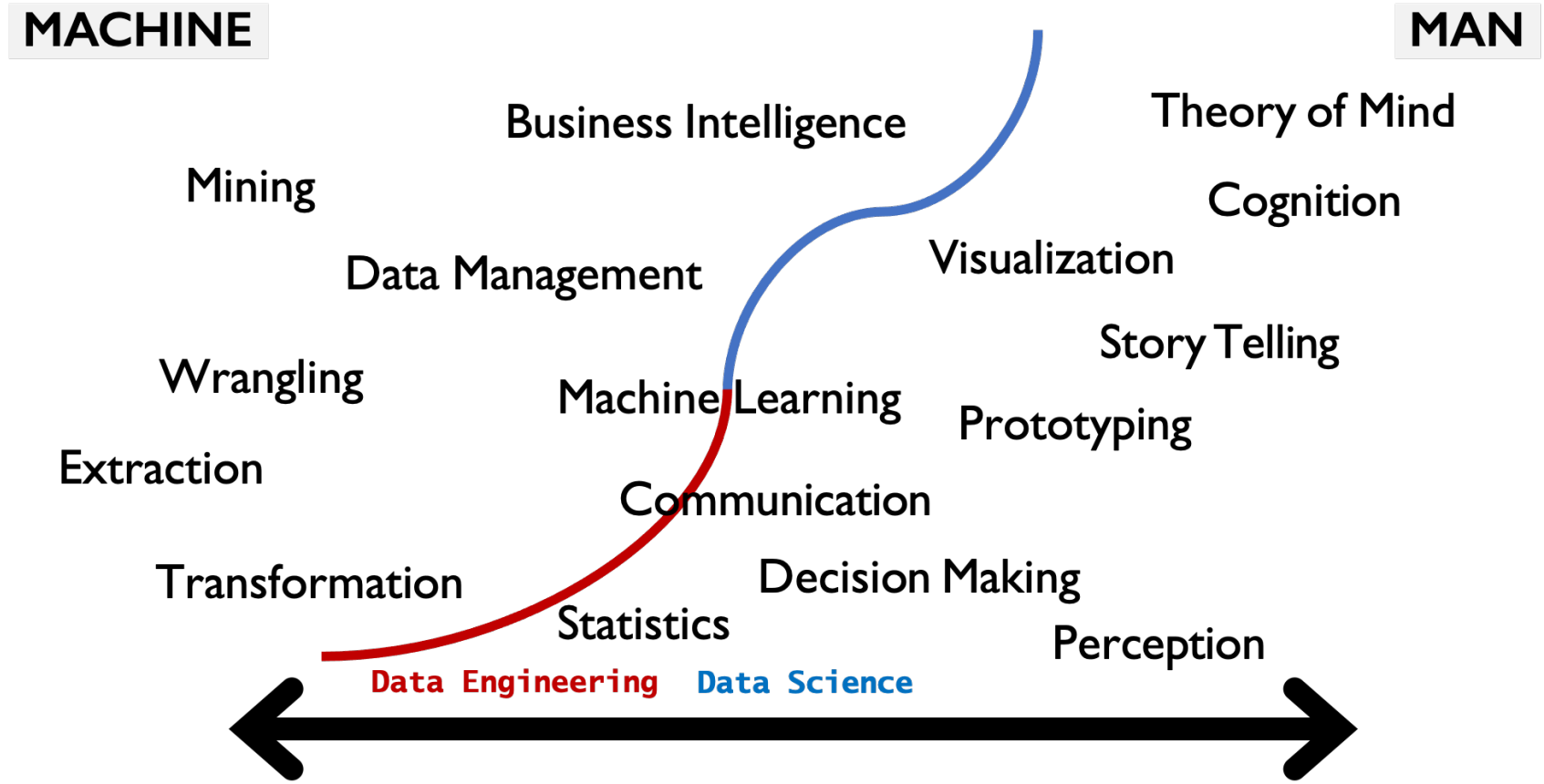

Inspired by Daniel Keim, "Visual Analytics: Definition, Process, and Challenges"

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To make sense of the world

> “Sense-making is the way that humans **choose between multiple possible explanations** of sensory input.”

– Dave Snowden

https://doi.org/10.14236/JHI.V13I1.578

Informatics in Primary Care 2005;13:45–53
© 2005 PHCSG, British Computer Society

Conference papers

Multi-ontology sense making: a new simplicity in decision making

David J Snowden
Founder, Cynefin Centre for Organizational Complexity, UK

Imagine organising a birthday party for a group of young children. Would you agree a set of learning objectives with their parents in advance of the party? Would those objectives be aligned with the mission statement for education in the society to which you belong? Would you create a project plan for the party with clear milestones associated with empirical measures of achievement? Would you start the party with a motivational video so that the children did not waste time in play not aligned with the learning objectives? Would you use PowerPoint to demonstrate to the children that their pocket money is linked to achievement of the empirical measures at each milestone? Would you conduct an after-action review at the end of the party, update your best practice database and revise standard operating procedures for party management?

No! Instead, like most parents, you would create barriers to prevent certain types of behaviour, you would use attractors (party games, a football, a videotape) to encourage the formation of beneficial largely self-organising identities; you would disrupt negative patterns early, to prevent the party becoming chaotic, or necessitating the draconian imposition of authority. At the end of the party you would know whether it had been a success, but you could not have defined (in other than the most general terms) what that success would look like in advance.

From The Cynefin Manifesto, www.cynefin.net

Introduction

The purpose of this article is to introduce a new simplicity into acts of decision making and intervention design in organisations. That may seem ironic given the title, with its use of the terms ‘ontology’ and ‘sense making’ which may be unfamiliar to readers; but new ideas often need new or at least unfamiliar language and I make no apology for that (although some readers may wish to skip the remainder of this introduction which may only be relevant to academics wishing to situate my language). New language aside, the basic principles that underlie this paper are very easy to understand and are illustrated by the inset example of the children’s party. Multi-ontology sense making is about understanding when to use both methods of management outlined in the story, both the structured and ordered approach based on planned outcomes and the un-ordered, emergent approach focused on starting conditions expressed as barriers, attractors and identities.

Ontology[a] is derived from the Greek word for being, and it is the branch of metaphysics that concerns itself with the nature of things. In this article I am using it to identify different types of system defined by the relationship, if any, between cause and effect. I will later discuss two contrasting types of ontology (order and un-order), each of which requires a different approach to both diagnosis and intervention. In practice, we need to consider three physical and five human ontologies. The three physical ontologies are order, complexity and chaos; in human systems order divides into visible and hidden forms and we add a fifth state of disorder. These are more fully described elsewhere.[1] Here I will combine complex and chaotic into a single category of un-order and ignore disorder.

[a] Ontology is commonly misused in the IT profession as an elevated version of taxonomy and is in fact closer to onomastics than it is to ontology.

What do these people have in common?

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Alphabet

amazon

PayPal

TESLA

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Big-Tech is build upon data [products]




Alphabet

amazon

PayPal

TESLA

FOURSQUARE

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Data Product a definition:

Products fueled by data and machine learning can be a powerful way to solve users' needs.

Prime examples include:

- Google-search
- Amazon product recommendation
- Tesla?
- Facebook?

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Data Product a definition:

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- Google-search
- Amazon product recommendation
- Tesla?
- Facebook?

Data products types

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Type I

Data as a Service

› Weather data

Type II

Data-enhanced Products

› Autonomous driving

Type III

Data as Insights

› Marketing planning

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Data Product (top- down)taxonomy:

automated decision-making

decision support

algorithms-as-a-service

derived structured data

raw unstructured data

TYPES of DATA PRODUCTS

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Sort items into predefined classes

Estimate a numeric value at a specific time

Predict the behaviour of a value in the future

Sort items into similar groups

Recommend items to users

Generate artificial text

Choose from alternative strategies, acting on feedback

Choose from alternative strategies, acting on existing data

Outlier detection

Estimate the probability of an event happening

Rank items to prioritize human action

https://queirozf.com/entries/11-types-of-data-products-with-examples#1-sort-items-into-predefined-classes

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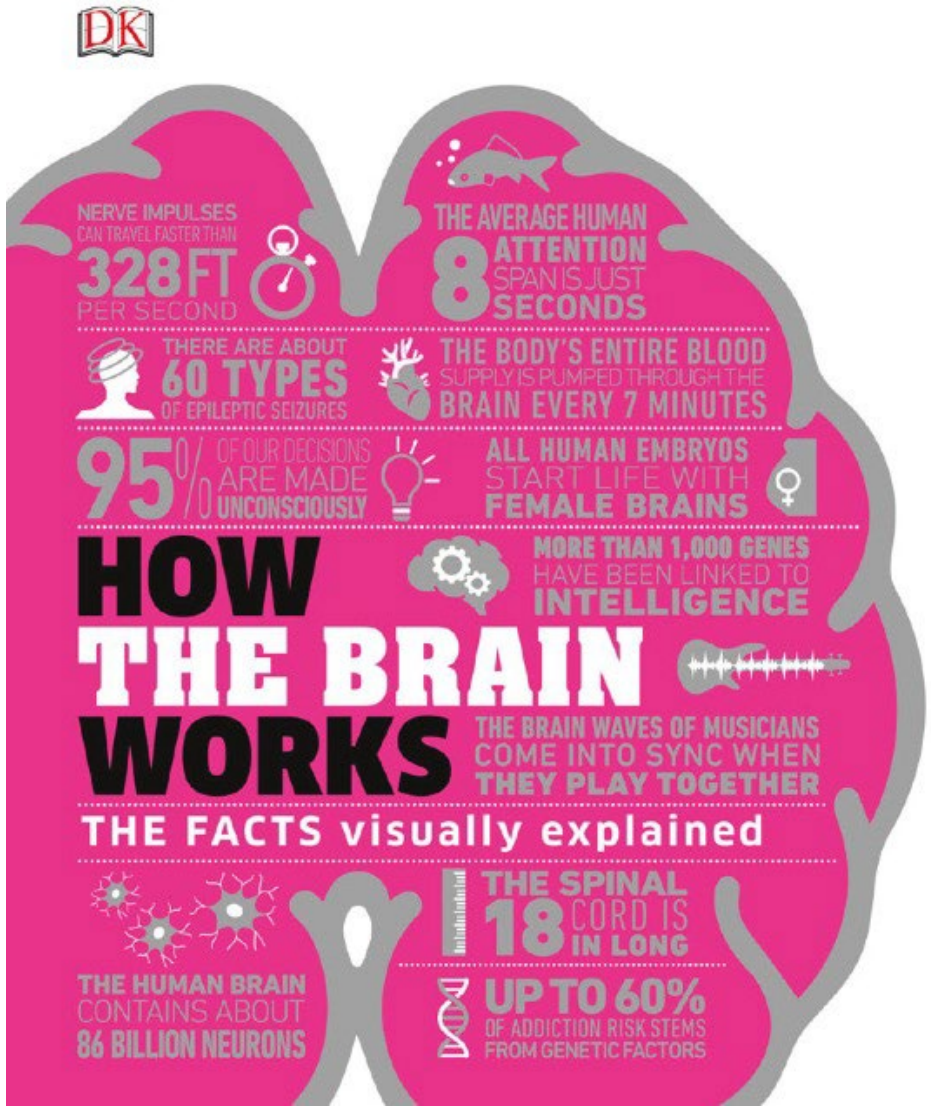

It is a form of interaction

> “The activity of abstracting is basically a form of interaction between people in which they **simplify the complexity** of their own ordinary, everyday interactions […] in an effort to **make meaning** of what they are doing […].”

– Ralph Stacey

Complexity and Organizational Reality

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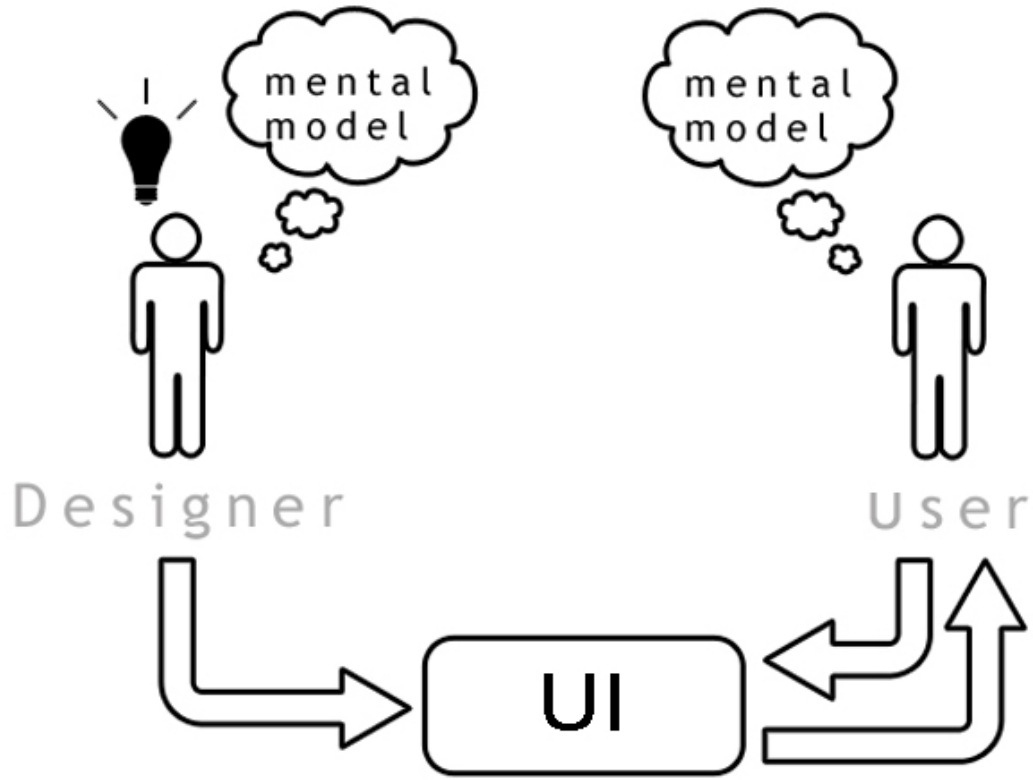

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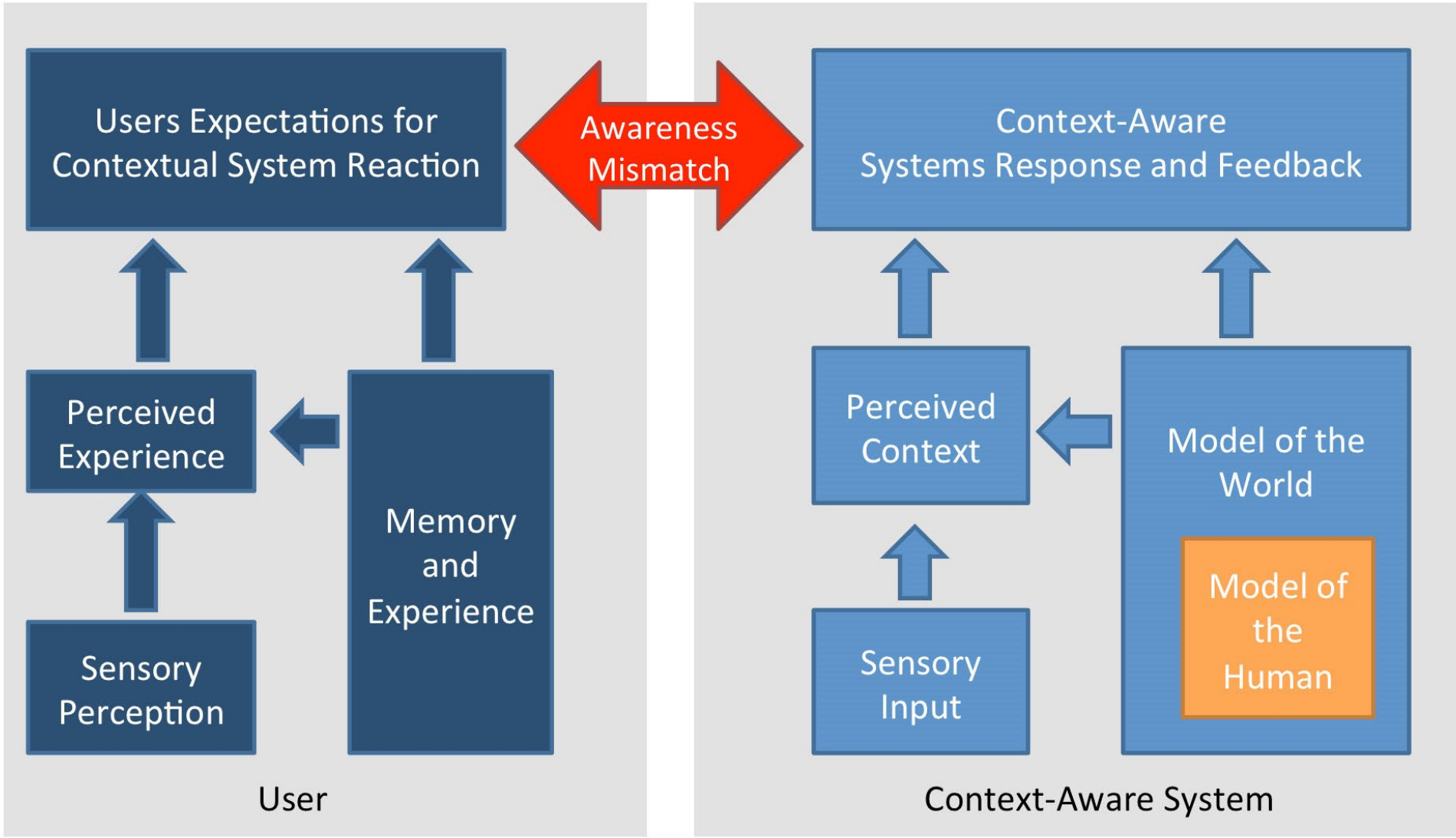

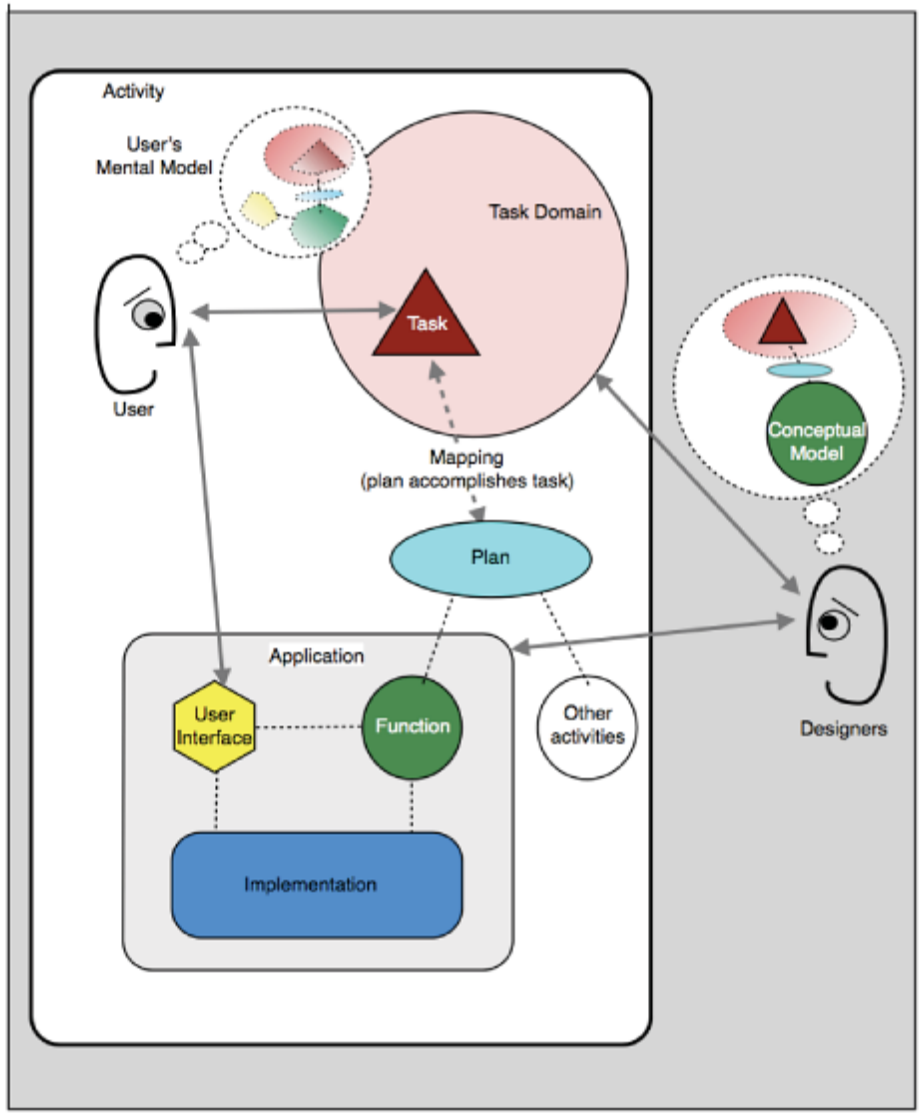

Figure 1.2: Designers' model of a user using an application.

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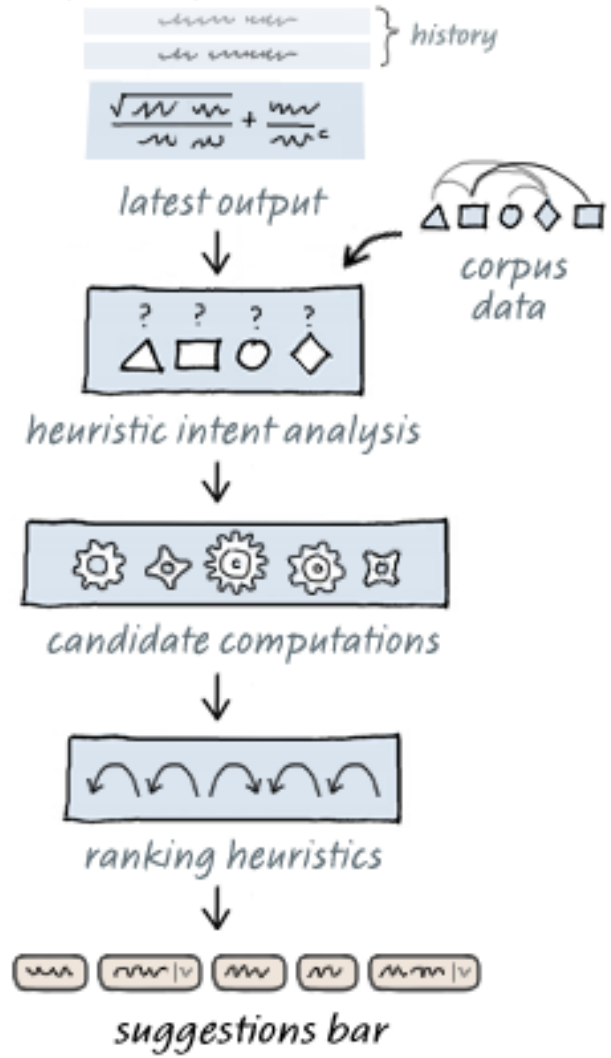
computed predictive interface



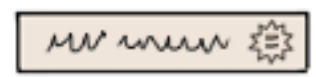
fixed-element interfaces

menus forms wizards

language-based interface

code (Mathematica language)

visual (Wolfram SystemModeler)

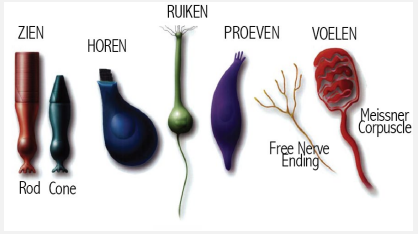


free-form (Wolfram|Alpha)

HUMAN FACTORS
De mens als maatstaf der dingen

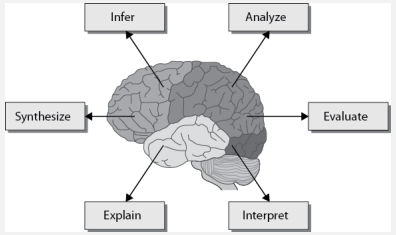
NEUROETHOLOGIE	Neuro-ethologisch perspectief: wat maakt ons humaan?

Gewaarwording & Perceptie



Biologie / neuro-wetenschappen

Cognitie & Semiotiek



Biologie / Neuro-wetenschappen

Gedrag & Communicatie

Biologie / Psychologie

Theory of Mind (ToM)

Psychologie / Sociologie

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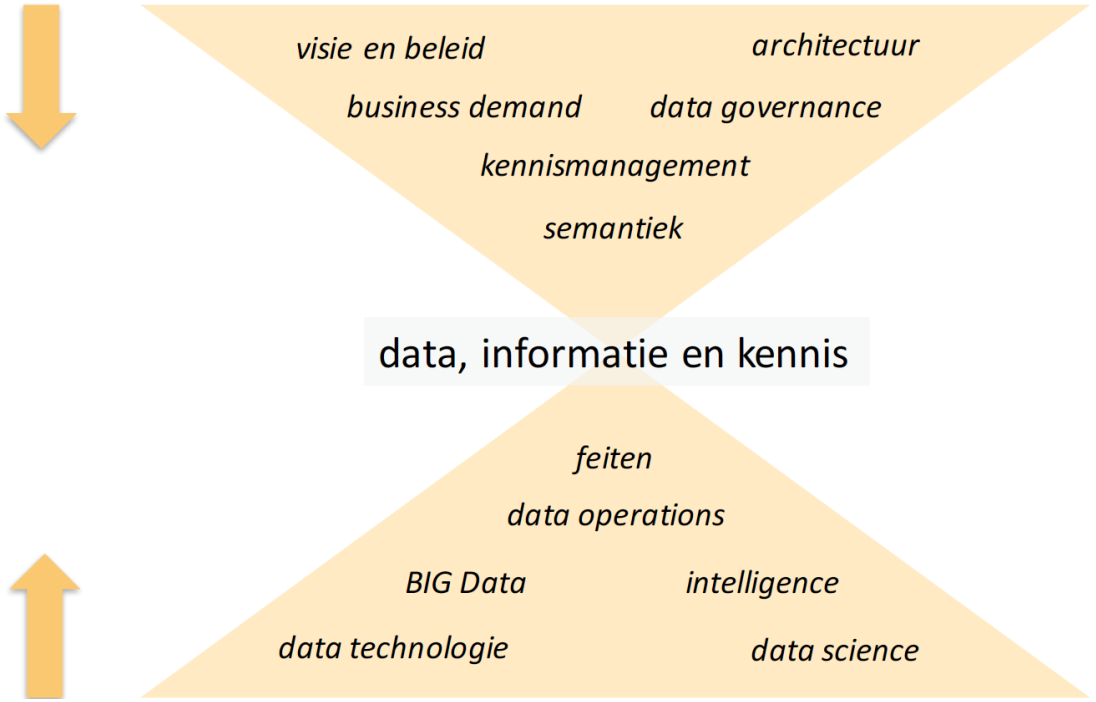
Data / Informatie / kennis

verbindt mensen en vormt zo onze samenleving



Human-Factor benadering gaat over informatieverwerking van fysieke stimuli door ons brein

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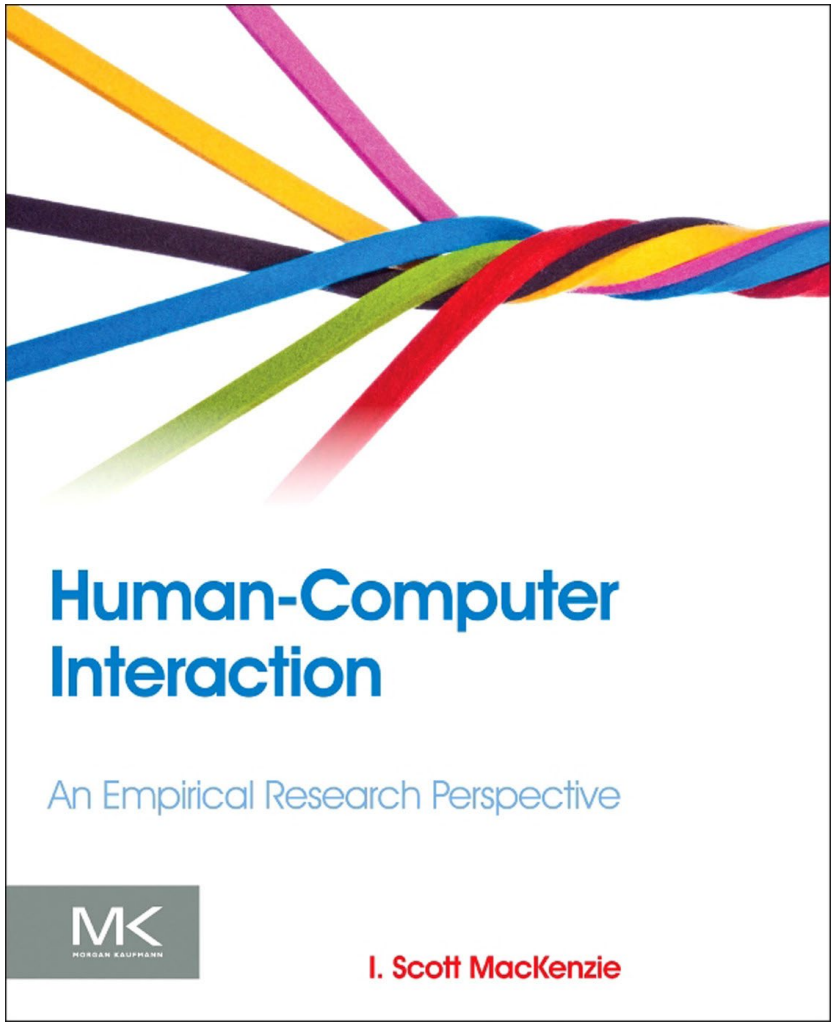
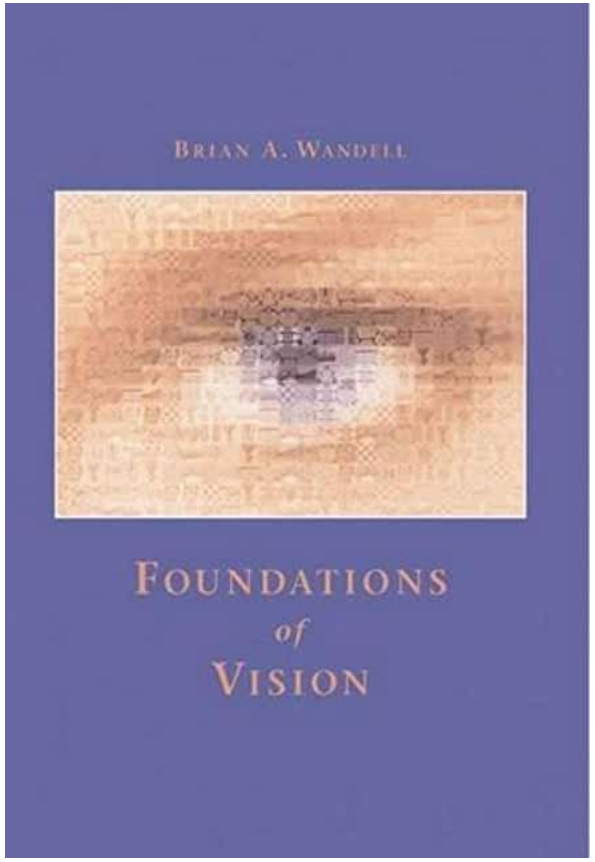


Scale (sec)	Time Units	System	World (theory)
10^7	Months		SOCIAL BAND
10^6	Weeks		
10^5	Days		
10^4	Hours	Task	RATIONAL BAND
10^3	10 min	Task	
10^2	Minutes	Task	
10^1	10 sec	Unit task	COGNITIVE BAND
10^0	1 sec	Operations	
10^{-1}	100 ms	Deliberate act	
10^{-2}	10 ms	Neural circuit	BIOLOGICAL BAND
10^{-3}	1 ms	Neuron	
10^{-4}	100 µs	Organelle	

Informatieverwerking Fysieke Stimuli In Ons Brein



Sensation: [Sensibilisatie]

'…immediate and basic experiences generated as stimuli fall on our sensory systems'

➔ *Verwerken van ruwe data (prikkels of Fysieke stimuli) volgens een vast patroon*

Perception: [Perceptie]

'…interpretation of those sensations, giving them meaning and organization'

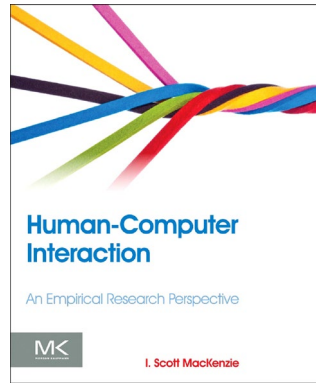
➔ *Gestuurd door "ingebouwde" informatie (niet lerend),*

Cognition: [Cognitie]

'…acquisition, storage, retrieval, and use of information'

➔ *Gestuurd door "verworven" informatie (zelf-lerend)*

M.W. Matlin & H.J. Foley, 1992



Sensatie

[gewaarwording]

Proces waar gestimuleerde receptors een patroon van neurale impulsen creëert

{=> registratie van externe /interne prikkels}

Perceptie

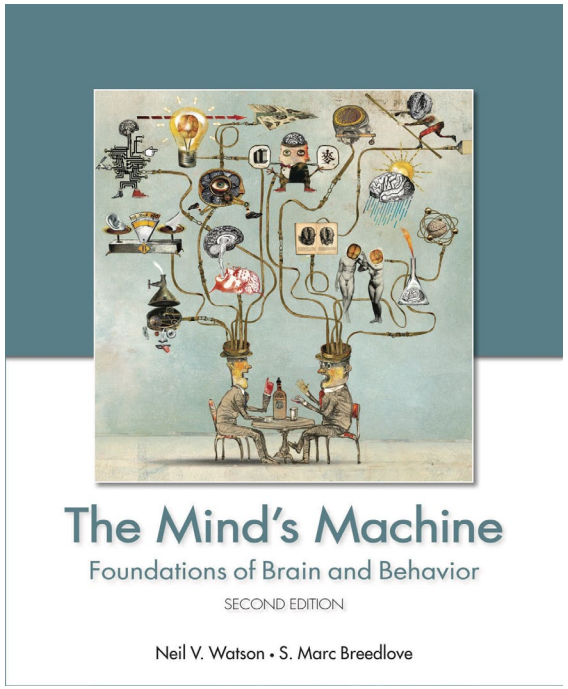
[Waarnemen]

Proces dat de inkomende sensorische patronen bewerkt en er betekenis aan geeft

{=>interpretatie van de geregistreerde prikkels}.

Wordt sterk beïnvloed door herinneringen, motivatie, emotie en andere psychologische processen.

De mens als maatstaf der dingen



Intelligence	Description	Example
Linguistic intelligence	The ability to speak, recognize, and use mechanisms of phonology (speech sounds), syntax (grammar), and semantics (meaning).	Narrators, Orators
Musical intelligence	The ability to create, communicate with, and understand meanings made of sound, understanding of pitch, rhythm.	Musicians, Singers, Composers
Logical-mathematical intelligence	The ability of use and understand relationships in the absence of action or objects. Understanding complex and abstract ideas.	Mathematicians, Scientists
Spatial intelligence	The ability to perceive visual or spatial information, change it, and re-create visual images without reference to the objects, construct 3D images, and to move and rotate them.	Map readers, Astronauts, Physicists
Bodily-Kinesthetic intelligence	The ability to use complete or part of the body to solve problems or fashion products, control over fine and coarse motor skills, and manipulate the objects.	Players, Dancers
Intra-personal intelligence	The ability to distinguish among one's own feelings, intentions, and motivations.	Gautam Buddhha

Cognitie refereert aan ons intellectuele & onderscheidende vermogen van informatie

Onder zuivere intellectuele functies worden verstaan:
oordeelsvermogen, zelfbeleving,
lichaamsbeleving,
logisch redeneren & creatief denken.

BRON: Cognitie- en waarnemingspatroon (H7) Kerstens, J. A. M. (2006). Basisverpleegkunde (3 ed)

Mensen vormen een gefantaseerd “Cognitief” mentaal model van de wereld om hun heen.

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PERCEPTIE versus COGNITIE

We vinden het normaal dat we dingen kunnen zien, horen, ruiken, proeven en voelen.

We kunnen ons een beeld vormen van datgene wat we:

– horen binnen gehoorsafstand;
– zien binnen het gezichtsveld;
– voelen binnen handbereik;
– ruiken binnen reukafstand.

Maar de mens ziet, ruikt en hoort niet alles.
De mens laat ook vaak alleen de signalen toe die hij geselecteerd heeft en die voor hem een bepaalde betekenis hebben.

We kunnen dat onbewust doen.
Dit gebeurt vooral bij niet veranderende signalen (gewoontegetrouw).
We kunnen dat heel bewust doen door:

– naar iets of iemand te kijken, te luisteren;
– iets of iemand te betasten;
– te proeven;
– te lezen;
– te ruiken.

UITVAL VAN COGNITIE

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COGNITIEVE Functies	UITVAL Verschijnselen
bewustzijn	– schommelingen in het bewustzijn zoals wisselingen in helderheid, verlies van aandacht, verminderd concentratievermogen, verhoogde of verlaagde waakzaamheid
geheugen	– niet onthouden van nieuwe informatie, verlies van recent geheugen, desoriëntatie in tijd plaats en persoon
denken	– versneld of vertraagd, onsamenhangend, wanen, achterdocht, verminderd vermogen tot oordelen en kritisch denken
stemming	– angst, radeloosheid, opstandigheid, lusteloosheid, een sombere vijandige of geprikkelde gemoedstoestand, niet kunnen beheersen van gevoelens
waarnemen	– dispercepties, gezichts-, gehoor- en gevoelshallucinaties
psychomotoriek	– onrust, agitatie, agressie, ontbreken van activiteiten, apathie, verstarring
autonome lichaamsfuncties	– versneld hartritme, verhoogde bloeddruk, verhoogde transpiratie, incontinentie

BRON: Cognitie- en waarnemingspatroon (H7) Kerstens, J. A. M. (2006). Basisverpleegkunde (3 ed)

COGNITIE & SEMIOTHIEK

"De menselijke maat"
wordt voor een groot deel bepaald door denken en waarnemen, dus gedragingen die ofwel tot
kennisverwerving leiden of voor het gebruik van kennis nodig zijn.

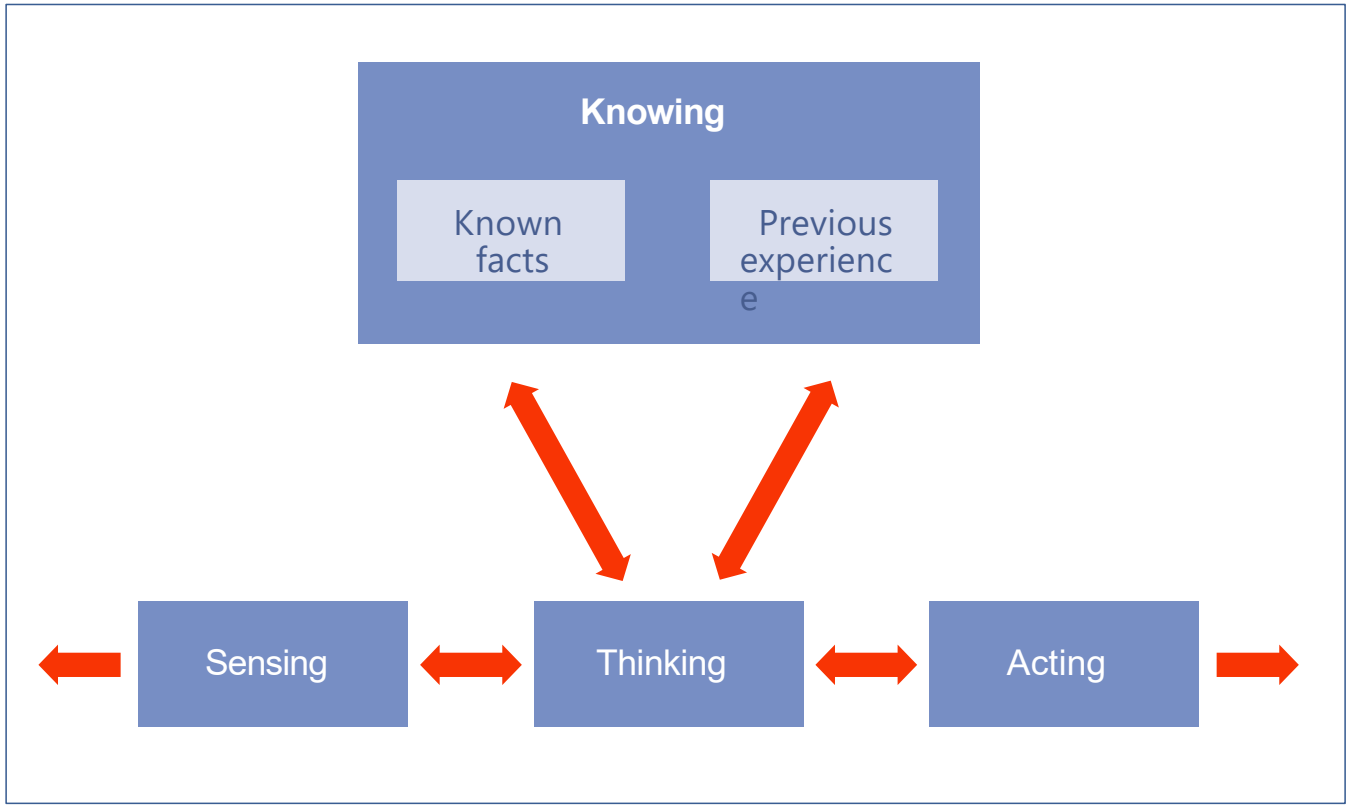

Figure 1: The model of mind

AI is taak automatisering van menselijke cognitie/intelligentie

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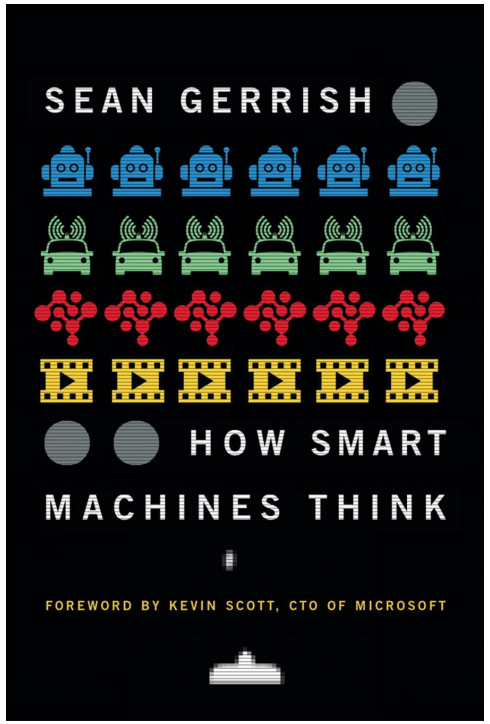
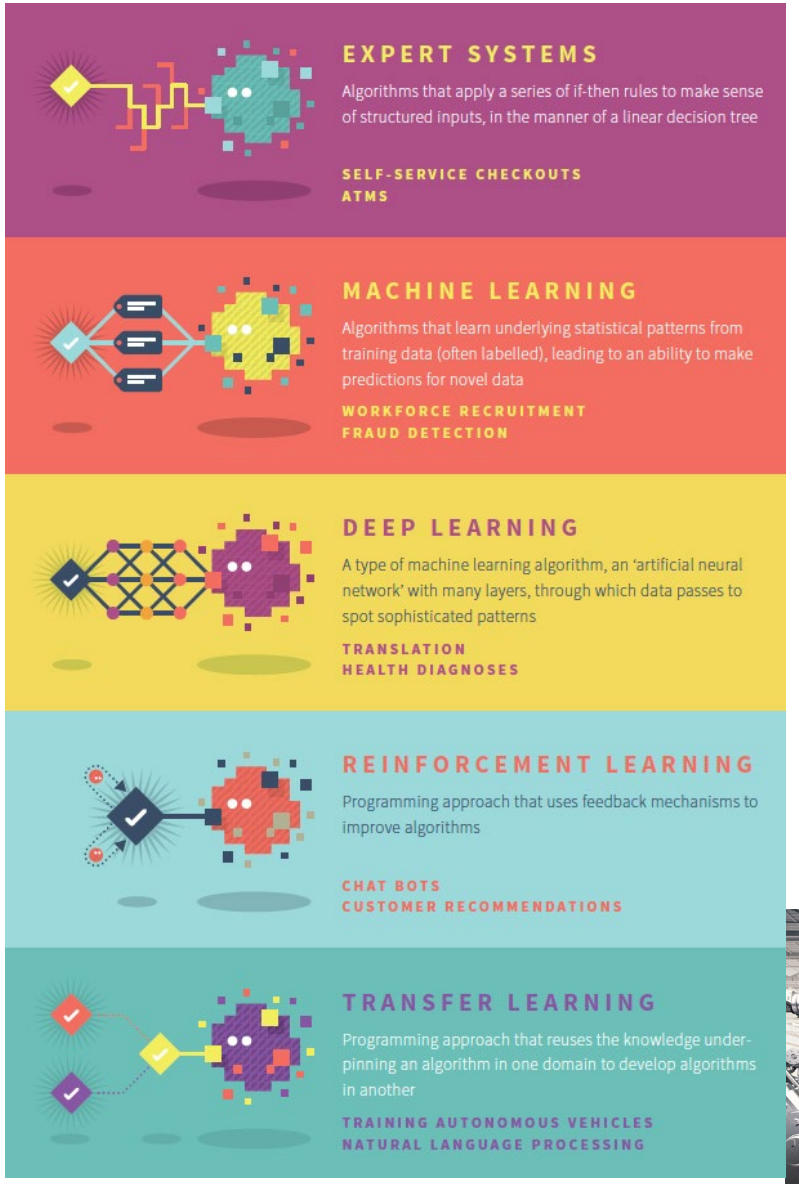
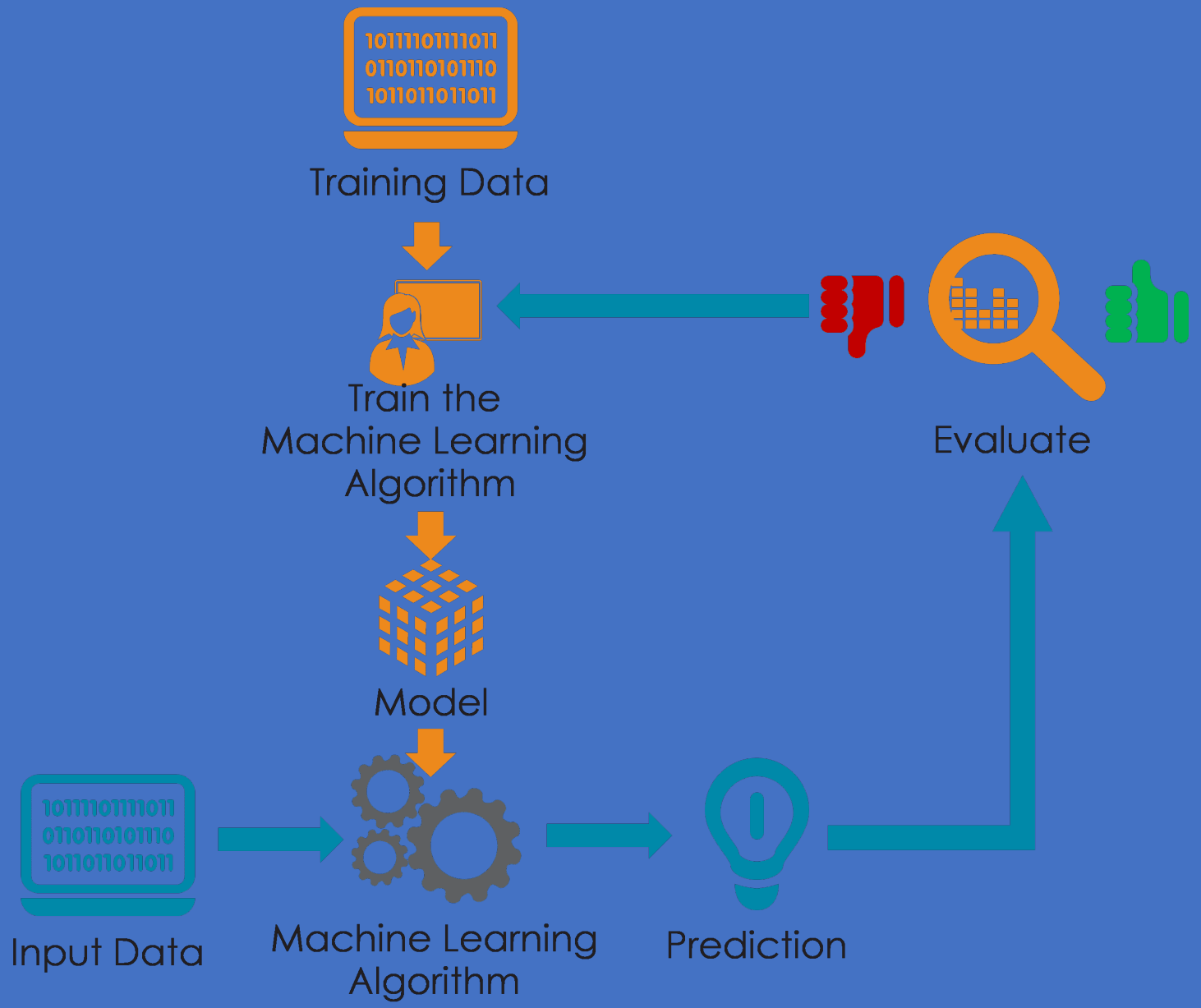


Mundane (Ordinary) Tasks	Formal Tasks	Expert Tasks
Perception ▪ Computer Vision ▪ Speech, Voice	▪ Mathematics ▪ Geometry ▪ Logic ▪ Integration and Differentiation	▪ Engineering ▪ Fault Finding ▪ Manufacturing ▪ Monitoring
Natural Language Processing ▪ Understanding ▪ Language Generation ▪ Language Translation	Games ▪ Go ▪ Chess (Deep Blue) ▪ Ckeckers	Scientific Analysis
Common Sense	Verification	Financial Analysis
Reasoning	Theorem Proving	Medical Diagnosis
Planing		Creativity
Robotics ▪ Locomotive		

AI is often defined
as
software agent
==
Algorithm as a service
Data Product




Training Data
Train the Machine Learning Algorithm
Evaluate
Model
Input Data
Machine Learning Algorithm
Prediction

NEXT WEEK:

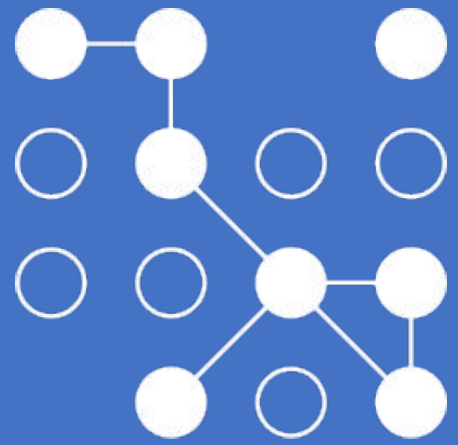
DATA + Algorithm

HUMAN FACTORS MODEL

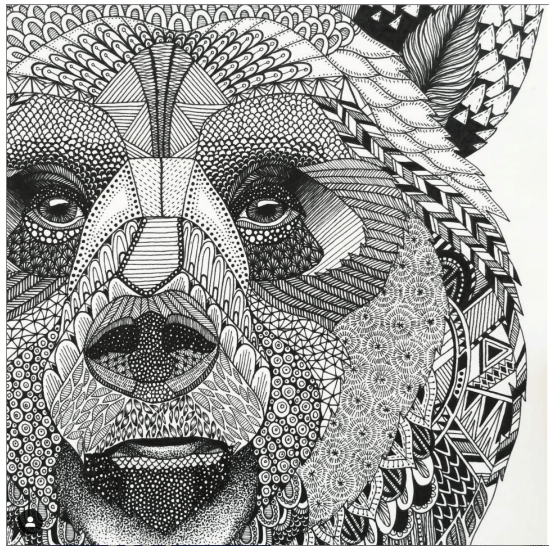
DATA PRODUCT

+

=



{04}
Do it Yourself



Describe by means of a conceptual model
what kind of data-product you to build or explain.
Must contain a description of:

Data description
Model description (type of DATA VIZ)
(learning)algorithm

See also: https://github.com/robvdw/RCA_AIG_042Q6_ARTIFICIAL_INTELLIGENCE

NEXT WEEK:

Wat geeft grip op DATA?

[How to design/evaluate meaningful data products]

Data Types
Data Viz
Data Pipelines
Data Frames

(Learning) Algorithms
Conceptual Models

Wat geeft grip op DATA? VIZ MODELS

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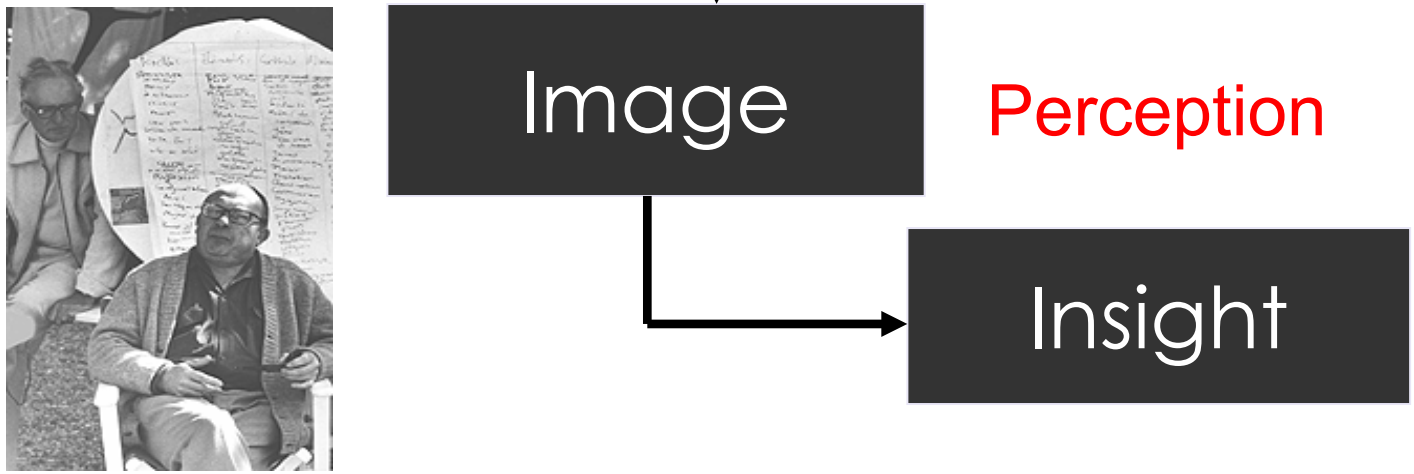
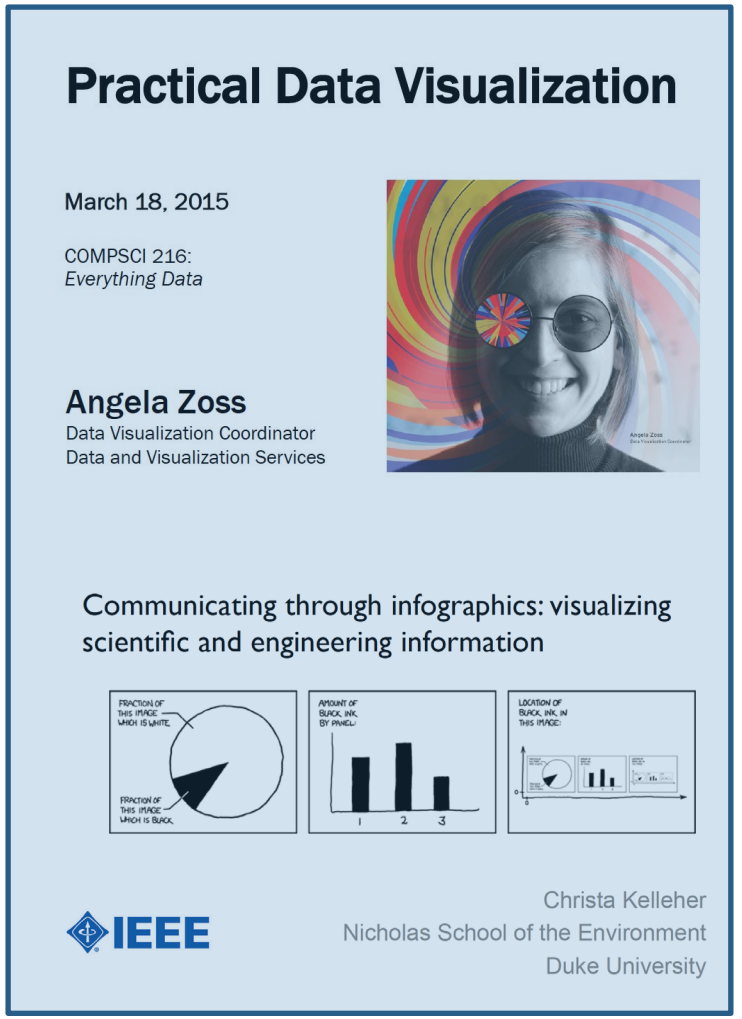
Jacques Bertin who wrote the classic works of **graphical visualization** "Semiology of Graphics" states that the "transformation from numbers to insight requires two stages"

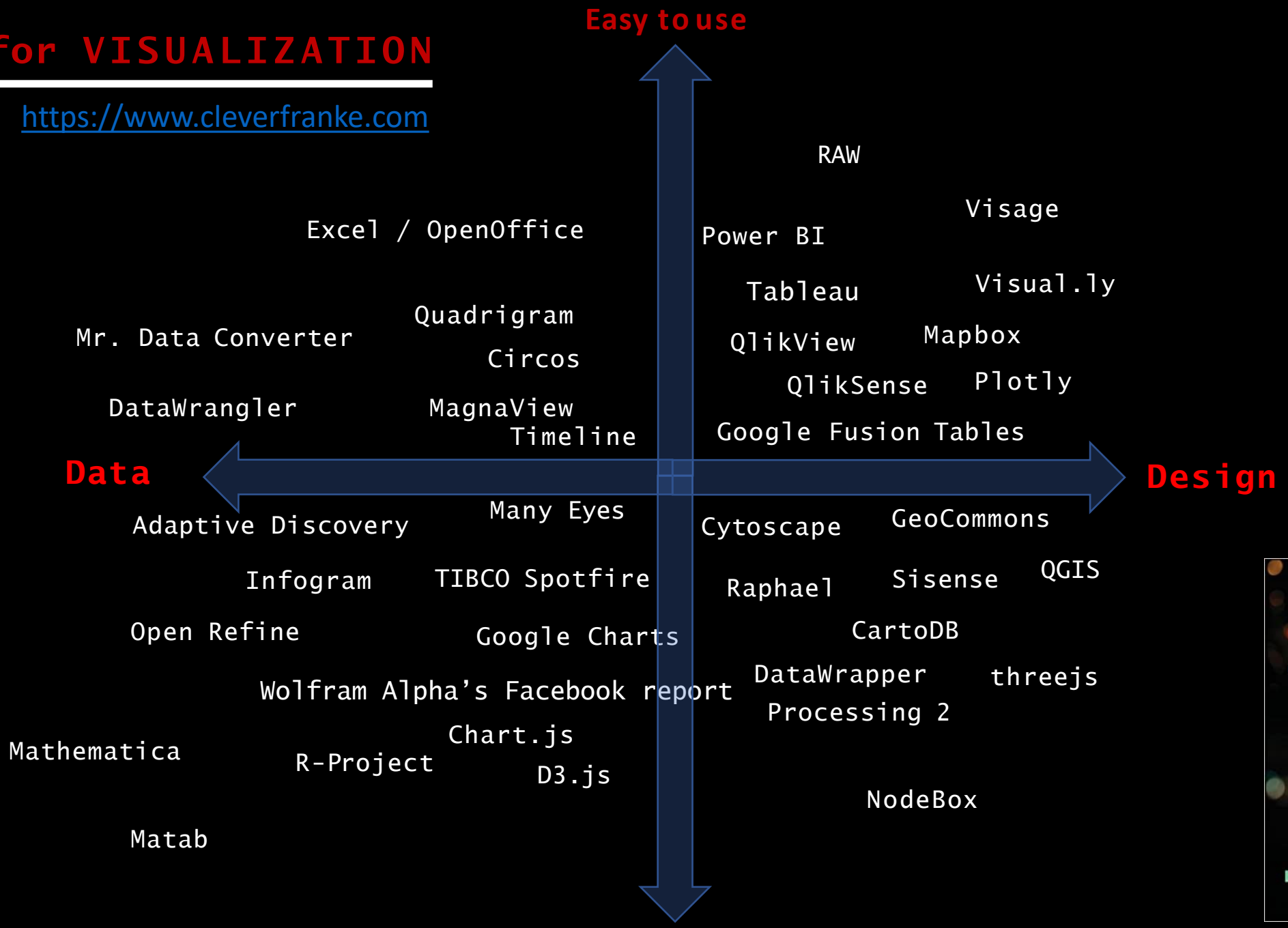


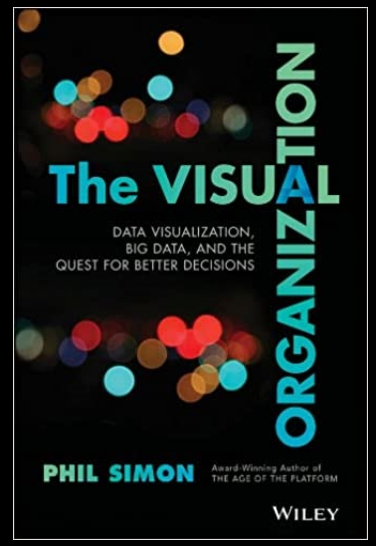


SEE ALSO: http://www.cs.wright.edu/~jgalli/hfe306/Data_Visualization_Quenin.ppt

TOOLS for VISUALIZATION

https://www.cleverfranke.com





Wat geeft grip op DATA?

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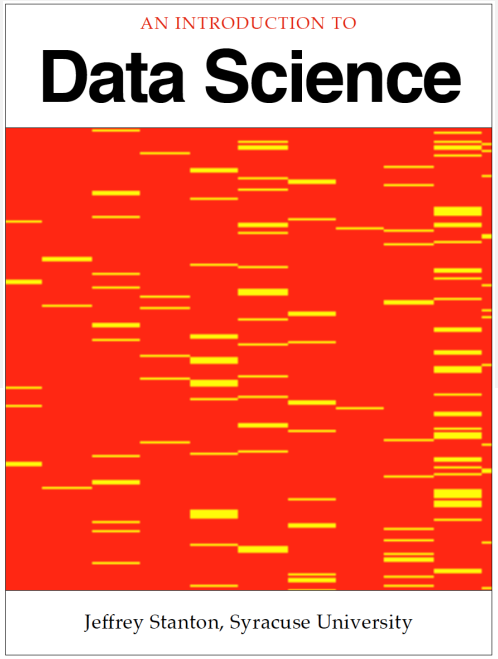
Data [gegevens]

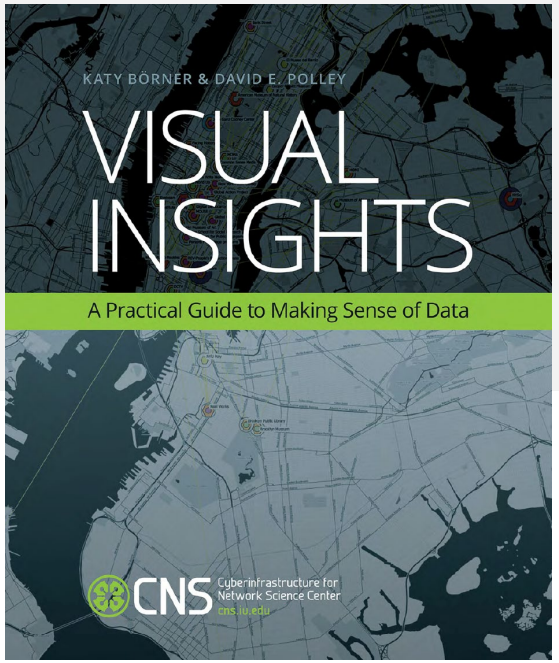
Raw Facts
No Context
Numbers
Symbols



Information

Data with structure = processed data
Value-added to Data

- **Summarised**
- **Organised**
- **Analysed**



Structured versus Unstructered

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Data Structuring

Structured (organized) data:
This is data that can be thought of as observations and characteristics. It is usually organized using a table method (rows and columns).

Unstructured (unorganized) data:
This data exists as a free entity and does not follow any standard organization hierarchy.

Structured Data
High Degree of organization, such as a relational database

Column	Value
Patient	Joe Brown
Date of Birth	02/13/1972
Date Admitted	02/05/2014

Unstructured Data
Information that is difficult to organize using traditional mechanisms

"The patient came in complaining of chest pain, shortness of breath, and lingering headaches…smokes 2 packs a day… family history of heart disease…has been experiencing similar symptoms for the past 12 hours…."

Generalized form of data structure

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Data Table [DATA MATRIX]

A generalized version of the data table is shown.

This table can represent any number of observations described over multiple variables.

This table describes a series of observations (from o1 to on) where each observation is described using a series of variables (from x1 to xp). A value is provided for each variable of each observation.

		Variables				
Observations		x_1	x_2	x_3	...	x_p
	o_1	x_{11}	x_{12}	x_{13}	...	x_{1p}
	o_2	x_{21}	x_{22}	x_{23}	...	x_{2p}
	o_3	x_{31}	x_{32}	x_{33}	...	x_{3p}
	...	...	...	...	...	...
	o_n	x_{n1}	x_{n2}	x_{n3}	...	x_{np}

Most data that exists in text form, including server logs and Facebook posts, is unstructured

Scientific observations, as recorded by careful scientists, are kept in a very neat and organized (structured) format: THE DATA TABLE

A genetic sequence of chemical nucleotides [ACGTATTGCA] is unstructured even if the order of the nucleotides matters

Generalized form of data structure

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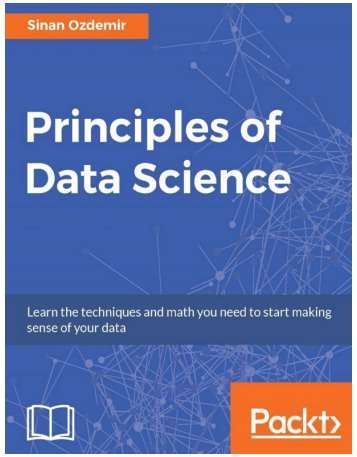
	o_3	x_{31}	x_{32}	x_{33}	...	x_{3p}
	...	...	...	...	...	...
	o_n	x_{n1}	x_{n2}	x_{n3}	...	x_{np}

Patient ID	Treated	Age	Outcome	Random
1	Yes	Young	Positive	0.24
2	No	Young	Positive	0.85
3	Yes	Old	Negative	0.64
4	No	Old	Negative	0.70
5	No	Old	Negative	0.87
6	No	Old	Negative	0.72
7	No	Old	Negative	0.86
8	No	Young	Negative	0.16
9	No	Young	Positive	0.17



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Data

Numerical
Made of numbers

Age, weight, number of children, shoe size

Continuous
Infinite options

Age, weight, blood pressure

Discrete
Finite options

Shoe size, number of children

Categorical
Made of words

Eye colour, gender, blood type, ethnicity

Ordinal
Data has a hierarchy

Pain severity, satisfaction rating, mood

Nominal
Data has no hierarchy

Eye colour, dog breed, blood type

Data [gegevens]

Raw Facts
No Context
Numbers
Symbols

Data comes from the Latin word, "datum," meaning a "thing given."

Although the term "data" has been used since as early as the 1500s, modern usage started in the 1940s and 1950s as practical electronic computers began to input, process, and output data.

98734975471894614398734578
20875980542158009258202908
12349823094823048002343423

98734975471894614398734578
20875980542158009258202908
12349823094823048002343423

TYPES OF DATA: Quantitative versus Qualitative [numerical vs categorical]

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Data Quantification

Quantitative [Numerical] data:
This data can be described using numbers, and basic mathematical procedures, including addition, are possible on the set. It can be discrete (countable numbers) or continuous (infinitely large or small)

Qualitative [Categorical] data:
This data are categories.
It cannot be described using numbers and basic mathematics. Is generally thought of as being described using"natural" categories and language.

- Quantitative values
  - **Measure** things
  - *Revenue, Units, Marketshare, Duration, Customer Satisfaction, Visits, Price, etc.*
- Categorical values
  - Subdivide things into **groups**
  - *Region, product, category, employee, etc.*

DATA: PRIMARY LEVELS OF MEASUREMENT

We onderscheiden 4 **meetniveaus**:

nominaal + ordinaal [discrete data]

interval + ratio [continue data]

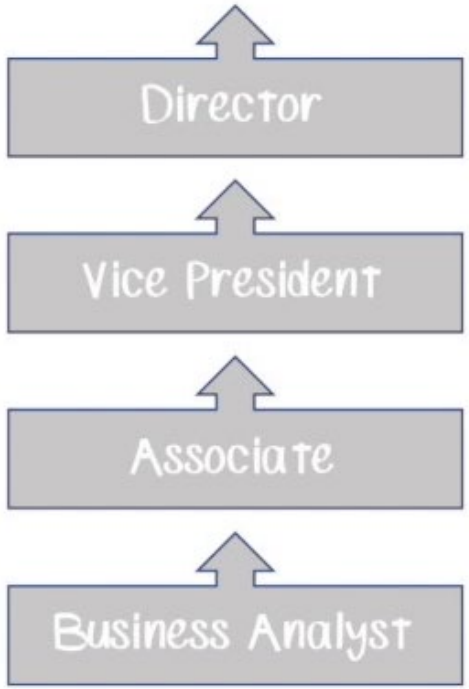

Data
Qualitative
Descriptive information
"I drink coffee every day"
Quantitative
Numerical information
Discrete
(Counted)
4
"I drink 4 coffees every day"
Continuous
(Measured)
80g
"I drink 80grs of coffee every day"

CATEGORICAL DATA

NOMINAL DATA

hair color

ORDINAL DATA



job hierarchy

DATA: LEVELS OF MEASUREMENTS versus OBSERVATION SCALES

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Meetniveaus [level] /Meetschalen [scale]:

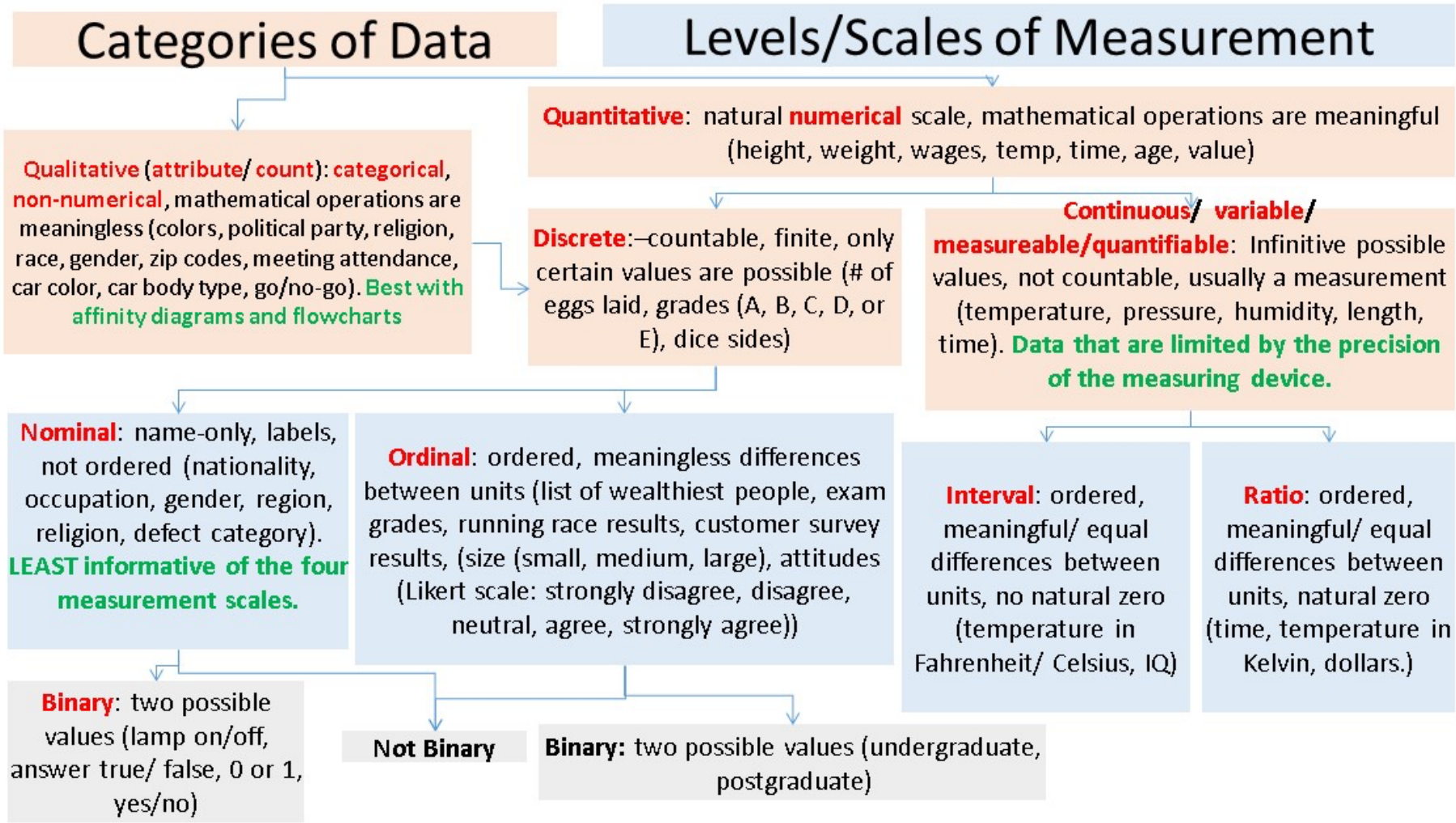
De hoogte van het meetniveau is bepalend voor:

Statische-analyse / Grafische weergave

Meetniveaus & hun kenmerken

		Scale	**Rationiveau**
		Intervalniveau	Verhouding blijven gelijk
	Ordinaal niveau	Gelijke verschillen	Gelijke verschillen
Nominale niveau	Ordening	Ordening	Ordening
Onderscheid	Onderscheid	Onderscheid	Onderscheid
Geslacht	*Opleidingsniveau*	*Intelligentie*	*Leeftijd*

Data Typen versus Meetschalen



A modern more holistic view of data {types}

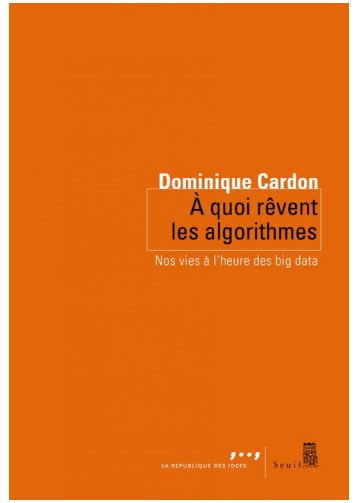
In "What are algorithms dreaming of ?"
Cardon proposes a framework based on four types of web measurements, each resting on a specified data type:

1st type of filter bubble: the one created by audience measurement

2nd type of filter bubble: the one created by hyperlinks

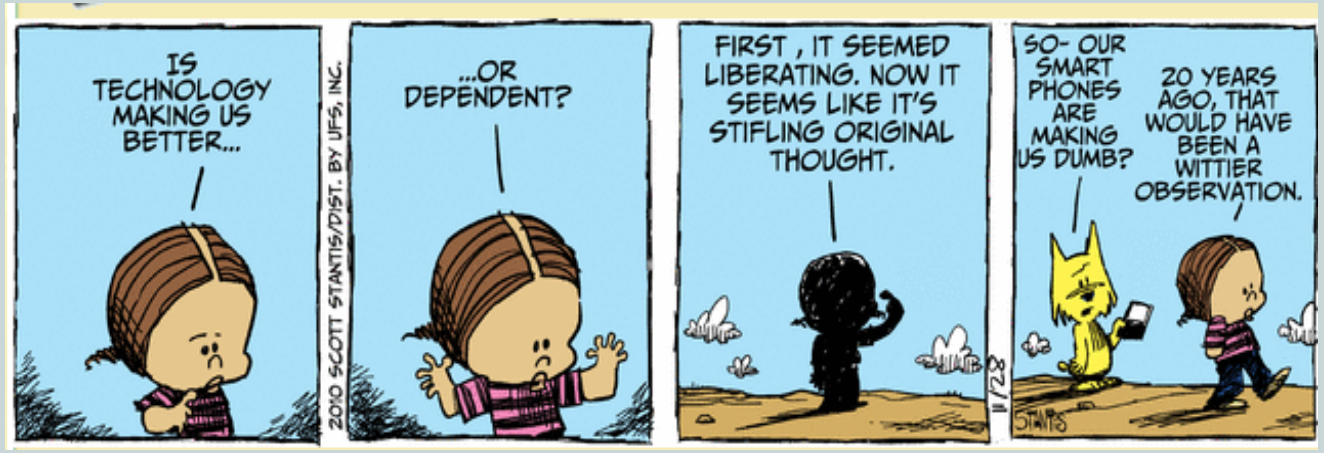
3rd type of filter bubble: the one created by social influencers

4th type of filter bubble: one created by our own behavior



A modern more holistic view of data {types}

	On the side	Above	In	Below
Examples	Médiamétrie, Google Analytics, advertising	Google Page Rank, Digg, Wikipedia	Number of Facebook friends, Retweets on Twitter, ratings	Amazon Recommendation, Targeted advertising
Data	Views	Links	Likes	Tracks
Population	Representative sample	Selective vote, communities	Social network, affinities, declarative data	implicit feedback and behaviors
Type of computation	Vote	Meritocratic rankings	Benchmark	Machine Learning
Principle	Popularity	Authority	Reputation	Prediction



This lesson was developed by:

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OKT 2020

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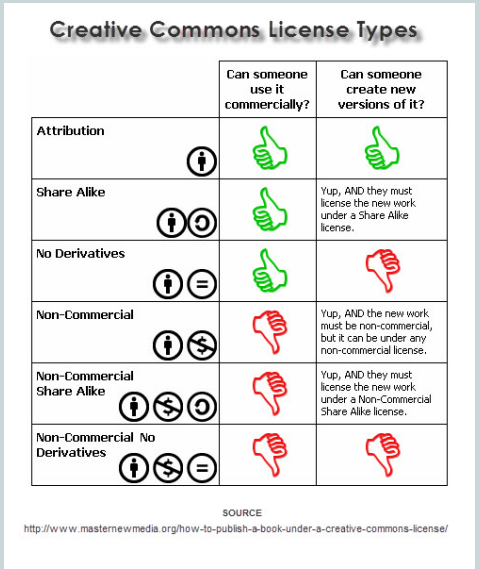

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TECHNOLOGY TRENDS TO WATCH
Christian Leborg
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