

Artificial Intelligence

Algorithms and Applications with Python

Chapter 09



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python

Outline

9

Building Productive AI-based Information Systems

- 9.1 Why AI Projects Fail
 - 9.2 AI Project Management
 - 9.3 Ethics and Trust in AI
 - 9.4 Human AI Interaction
 - 9.5 Explainable and Under
 - 9.6 How to Continue your

Exam Preparation and Course Repetitorium

Capstone Project / Case Challenge

► What you will learn:

- Why many AI-based Information systems and intelligent agents fail in practice and how to tackle common problems in implementing AI-based information systems and intelligent agents
 - Outlook and Future steps if you are interested in an AI-job



Image source: ↗ [Pixabay](#) (2019) / ↗ [CC0](#)

► Duration:

- 180 min

► Relevant for Exam:

- 9193-94

9.1 Current AI Systems Outperform Humans in Many Tasks

- In the last chapters, we have discussed how to build AI their potential for automation. But is AI really better than humans in decision-making?
- Yes! There is overwhelming evidence that artificial intelligence, clearly outperforms human decision-making:
 - **Paul Meehl:** „Clinical vs. Statistical Prediction: A Theoretical Analysis and a Review of the Evidence“
 - **Daniel Kahneman:** „Thinking Fast and Slow“, or „Noise“
- But does it really succeed?

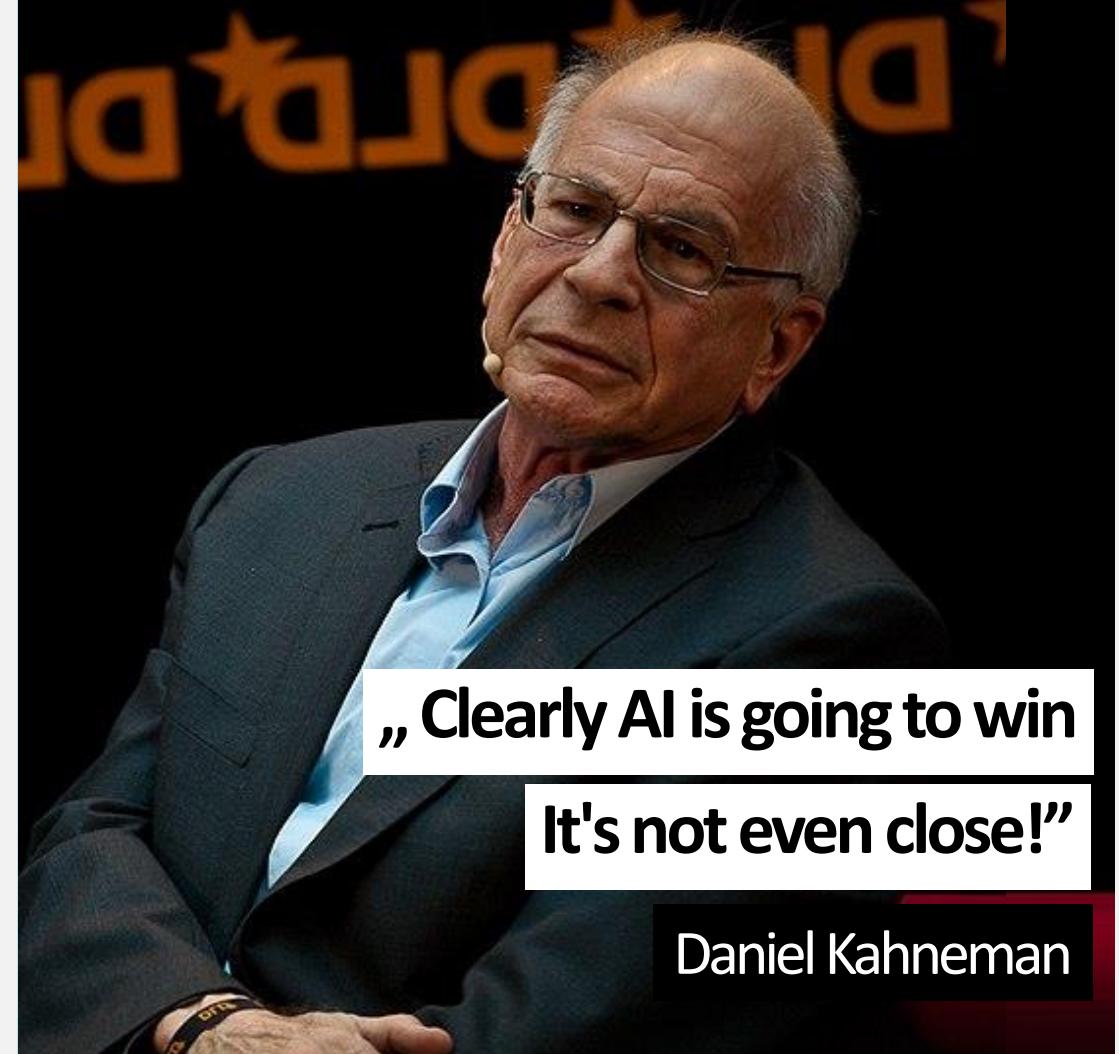
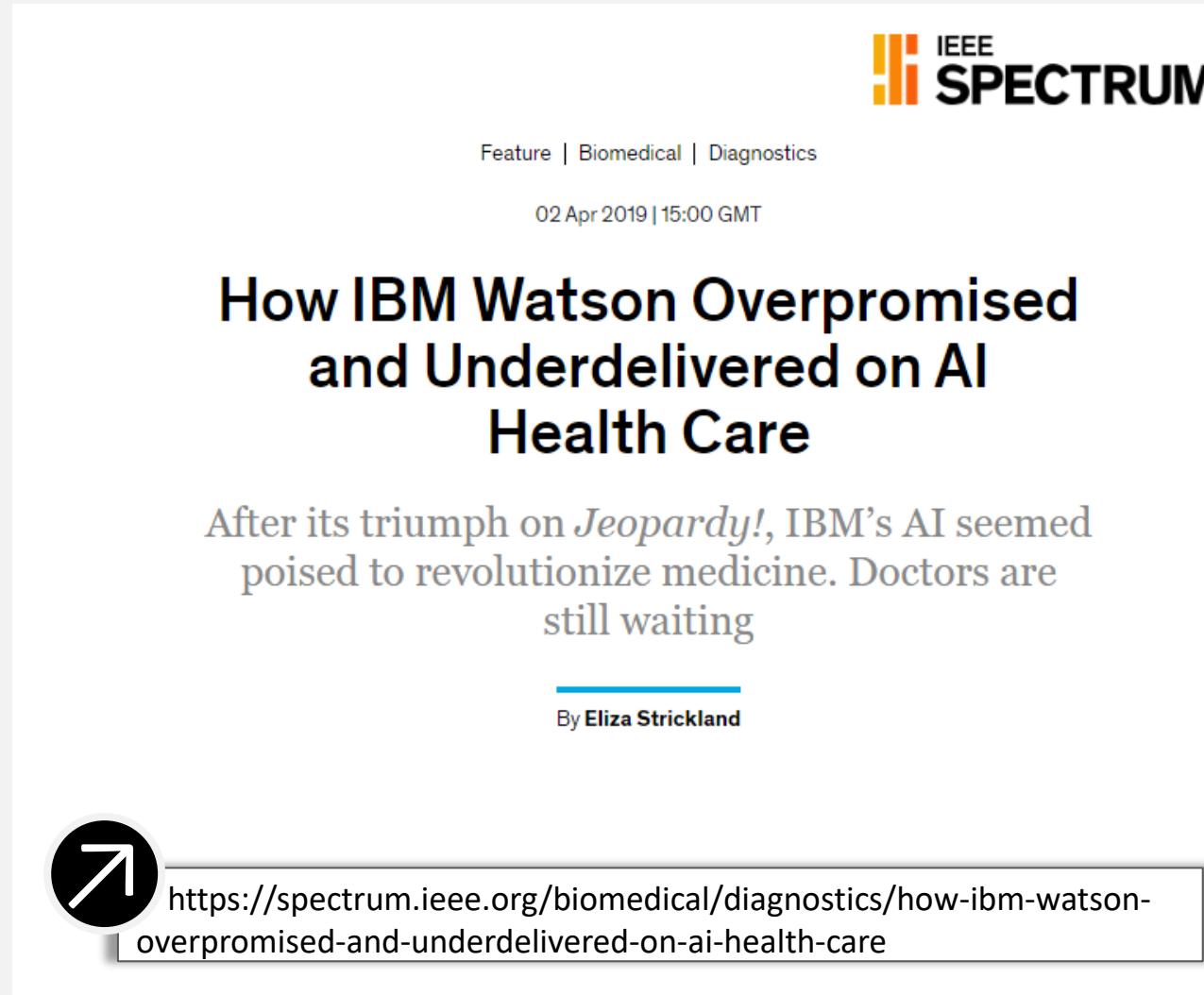


Image source: ↗[Daniel Kahneman](#) (2009) by nrkbeta from Wikimedia / ↗[CC BY-SA 3.0](#)

9.1 Why Do They Fail? ► MD Anderson Cancer Center and IBM Watson



The screenshot shows a news article from IEEE Spectrum. The header includes the IEEE SPECTRUM logo, a subcategory 'Feature | Biomedical | Diagnostics', and a timestamp '02 Apr 2019 | 15:00 GMT'. The main title is 'How IBM Watson Overpromised and Underdelivered on AI Health Care'. Below the title is a subtitle: 'After its triumph on *Jeopardy!*, IBM's AI seemed poised to revolutionize medicine. Doctors are still waiting'. The author is listed as 'By Eliza Strickland'. A circular icon with a stylized '7' is on the left. A URL box at the bottom contains the link: <https://spectrum.ieee.org/biomedical/diagnostics/how-ibm-watson-overpromised-and-underdelivered-on-ai-health-care>.

- 62 Million dollars has been spent by University of Texas before the contract was canceled
- Chamath Palihapitiya: “Watson is a joke, just to be honest. I think that IBM is excellent at **using their sales and marketing infrastructure to convince people** who have **asymmetrically less knowledge to pay** for something.”

9.1 Why Do They Fail? ► Violent Yandex's Alice Chatbot

The screenshot shows a news article from The Telegraph. The title is "Russian AI chatbot found supporting Stalin and violence two weeks after launch". Below the title is a snippet of a mobile phone screen displaying a conversation with the Alice chatbot. The URL of the article is highlighted with a white box and a large black arrow pointing upwards.

<https://www.telegraph.co.uk/technology/2017/10/25/russian-ai-chatbot-found-supporting-stalin-violence-two-weeks/>

- Users of the “Alice” assistant have reported it responding positively to questions about domestic violence and saying that “enemies of the people” must be shot
- Supports wife-beating, child abuse and suicide

9.1 Why Do They Fail? ► Google Map Classification



The screenshot shows a news article from the website golem.de. The logo 'golem.de IT-NEWS FÜR PROFIS' is at the top. Below it, the text 'GOOGLE MAPS IN BERLIN' is followed by the main title 'Wenn aus Aussetzfahrten eine neue U-Bahn-Linie wird'. The article text discusses how Google Maps sometimes misinterprets public transport data, leading to incorrect routes. It includes a byline 'Von Andreas Sebayang' and a date '9. Juli 2019, 11:12 Uhr'. At the bottom left is a circular icon with a white arrow pointing up and to the right. A URL box contains the link: <https://www.golem.de/news/google-maps-in-berlin-wenn-aus-aussetzfahrten-eine-neue-u-bahn-linie-wird-1907-142415.html>.

- Google determines the routes of tram lines through AI.
- However, this leads sometimes to obviously wrong results: data from public transport was misinterpreted and Google Maps had for some days new underground lines in Berlin.

9.1 Building Productive AI-based Information Systems is hard...

“60% of models developed to operationalize them were never actually operationalized”

Gartner Data Science Team Survey of January 2018



ginablaber
@ginablaber

Follow

The story of enterprise Machine Learning: “It took me 3 weeks to develop the model. It’s been >11 months, and it’s still not deployed.”
@DineshNirmalIBM #StrataData #strataconf

10:19 AM - 7 Mar 2018

Why 85% of AI projects fail



The Myth of Agile AI/Machine Learning in the Enterprise



Eric Broda [Follow](#)
Jul 31, 2019 · 13 min read ★



Are AI applications failing to live up to hype in enterprise adoption?

ComputerWeekly.com



Why do some AI projects fail in real life?

9.1 Key Decisions in AI Projects

1

Definition of the Problem

- What should be automated?
- Which kind of AI problem do I have?
- What options are available?

2

Use Case Environment

- Who is my customer? What are the users' characteristics of my AI-based Information System?
- What is the goal of the Use Case?

3

IT Environment

- What are the prerequisites of the chosen tool?
- What type of IT-Infrastructure is available?

The first step is to find out which class of AI-based Information System is required, and which kind of AI problem has to be solved:

Some example goals of use cases might be...

- Visualizing key characteristics of a dataset to understand the drivers of a specific problem (e.g. specific dealers have higher costs than other dealers)
- Create a proof of concept of decision-support systems like a dashboard to make management-decisions (e.g. make sales forecasts on specific data)

9.1 Main Problem Machine Learning Engineers Should Tackle

Specify the objective

The objective of the AI-project has not been specified this leads to problems on a general level.

1. What specific task should the model be automating?
 2. Which data should be used/can be used for the task? How reliable is the data?
-
- Understand the problem from the perspective of the user (subject yourself to the problem)
 - Integrate the User in the development process
 - Do not underestimate the need for accurate data

Understand the problem

AI-based information systems have low usability

1. How does the user interact with the AI-based information system?
 2. How can it actually help the user to be more efficient?
-
- Prototype and iterate on the user experience using mockups or sketches
 - Understand the -real- user behavior: user studies, workshops, wizard of os experiments etc.
 - Rely on established guidelines

Design (user-)specific

AI-based information systems have low coherence and often are too general instead user specific tools

1. What information should we expose to the user?
 2. How should we expose information to the user?
-
- Develop a shared language with your project stakeholders
 - Start with simple models, deploy a productive baseline model as soon as possible
 - Deliver value incrementally and quickly

9.1 Understand the Objective from the Perspective of the User

- Start with informational one-on-one interviews with the end users to get a feeling of their perspective
- In this phase do not start suggesting or developing (!) a solution, you are simply trying to understand the problem
- Nevertheless, it can make sense to communicate the capabilities of ai-based information systems

9.1 Subject Yourself to the Problem

- After the informational interviews, perform the task that should be automated manually (or the problem that should be solved)
- Do not jump right into modelling!
- If you do the task, pay attention to how you and the key users solve the task. This gives you a first impression of first features, that might be important.

9.1 Get Better Understanding of the User's Problem

- Now, you can start sketching out first possible solutions of the ai-based information system you plan to develop
- Iterate on the user experience using prototypes, sketches and mockups to communicate first possible solutions
- Ask questions and find motivations behind solutions (!)
- To test the AI module use wizard-of-oz experiments

9.1 Choose Representative Participants for Your Studies

- To test your mockups with 1-2 selected users will NOT help you
- Even during this early feedback stages, look for a wide range of different test users with different characteristics:



What are typical types of characteristics you should consider?

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Having a clearly-defined goal usually brings with it other prerequisites on a tool, e.g.:

- What does the **operative environment** in which the final outcome of the project is to be deployed look like?
- Is it a “Big Data Use Case” (volume and velocity of data flow)?
- Price (open source?) Availability of APIs to other tools
- Ease of use (e.g. presence of a GUI)
- Computational efficiency
- Availability of technical support/online documentation/community

9.1 Project Communication

- Do not fear to over-communicate: Talk, talk, talk
- Discuss and present your ideas and progress often in short daily/weekly/etc. to ensure that you are still going in the right direction
- Discuss model metrics / performance measures to illustrate the progress of the model. This allows your project partner to present and justify the project in the organization

9.1 Win by Deployment



Rules of Machine Learning:

Best Practices for ML Engineering

Martin Zinkevich

- Deploy simple models in the spirit of winning by shipping
- Make quick iterations through the outermost development loop

Based on Bernardi, L et al. (2019); Google (2019); Zinkevich, M (2019)

9.1 Deploy Models on Real Data as Fast as Possible

- Deploy a baseline model on production data as soon as possible
- Deploying your model on production data can be enlightening
- As a countermeasure, it's often a good idea to deploy a simple model on production data as soon as possible
- Deliver value incrementally and quickly
- Measure time to results, not results. Sometimes it can be tricky to get into the mindset of delivering value quickly.

9.1 Key Decisions in AI Projects

1

Definition of the Problem

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IT Environment

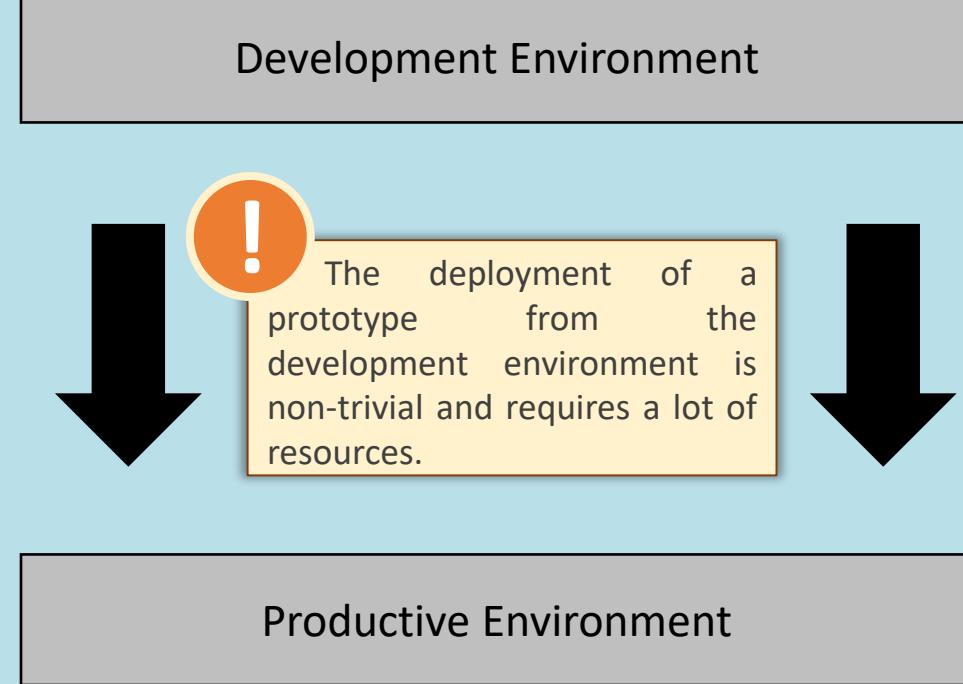
- What are the prerequisites of the chosen tool?
- What type of IT-Infrastructure is available?

The first step is to find out what the Toolbox of the respective department is:

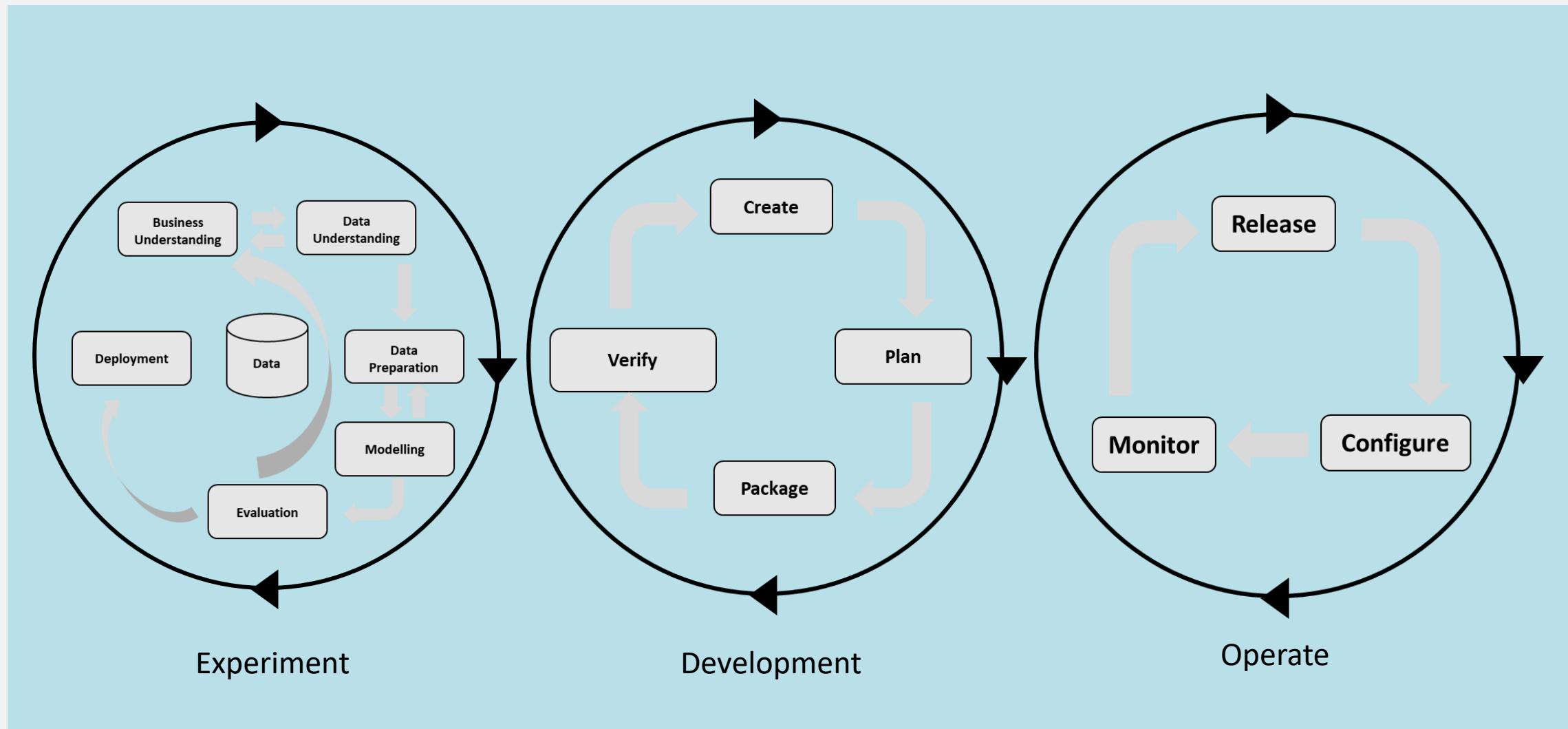
- What tools are even available?
- How fast can additional licenses be obtained for proprietary software and how many are necessary?
- Is there the option of introducing new tools or will the approval process take too long?

9.1 Lifecycle of AI-based Information Systems

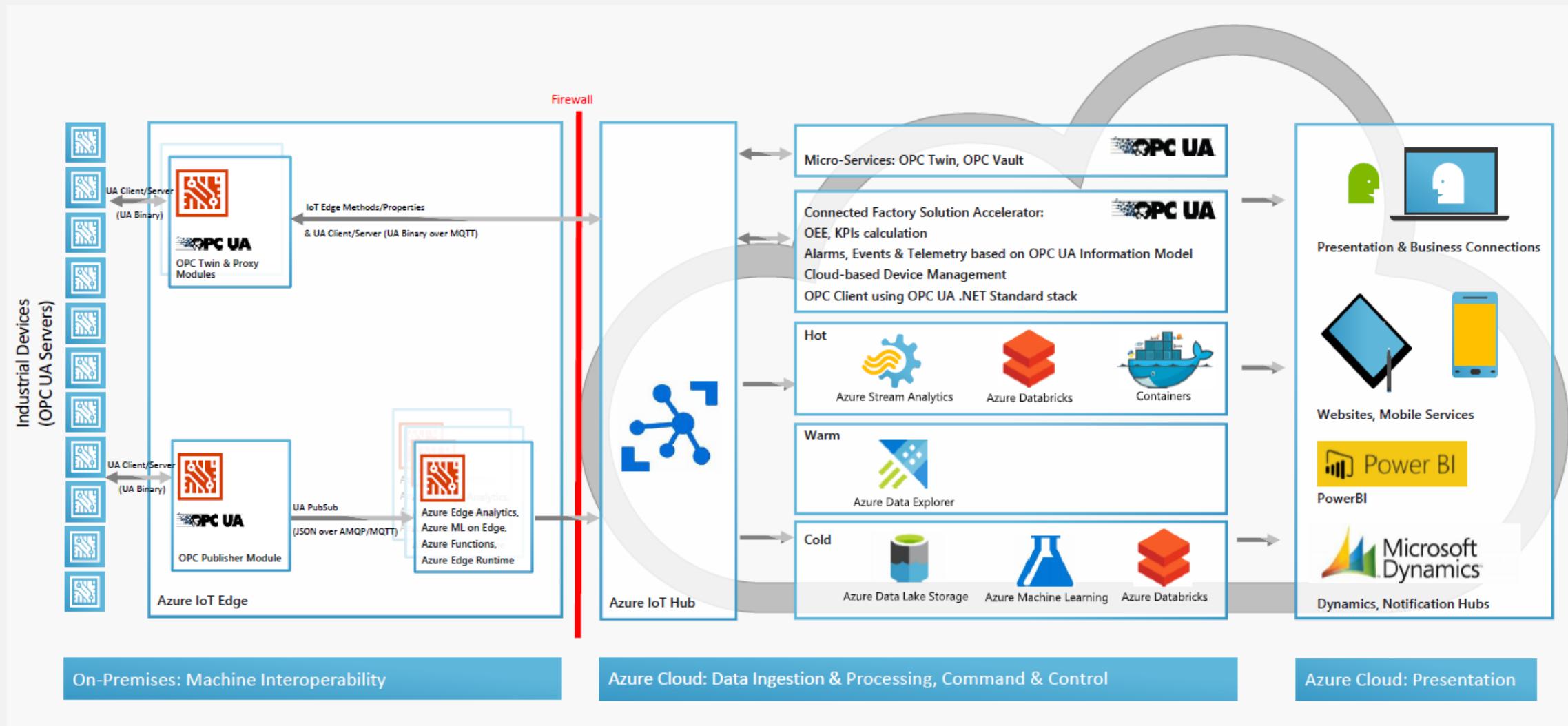
- Most projects consist of several phases and aspects, that all together make up an AI-based IS's life cycle.
- The life cycle spans the very inception of a data science use case up until its productive rollout



9.1 Lifecycle of AI-based Information Systems

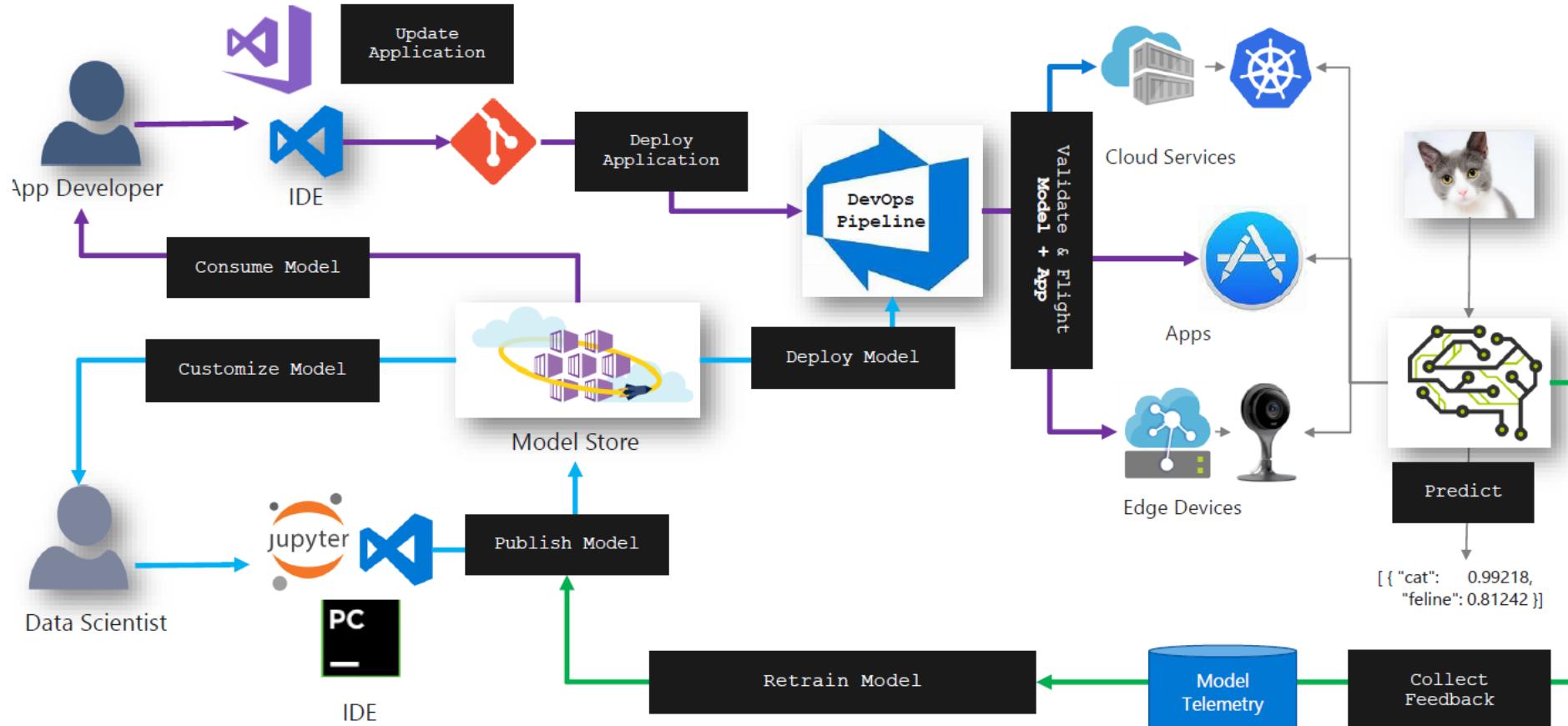


9.1 Integrated AI-Plattforms: Azure

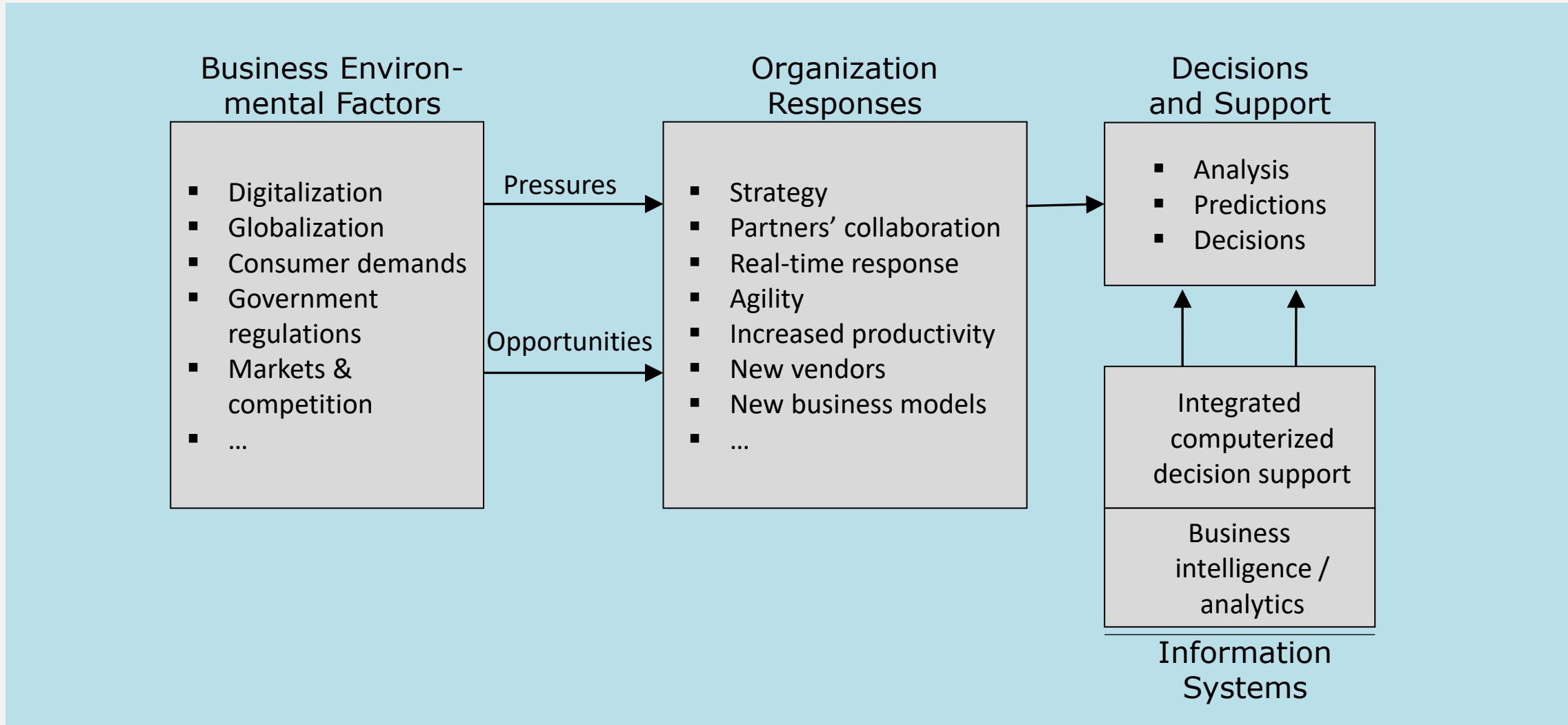


9.1 Example: Azure ML Development Process

ML + App Dev Process

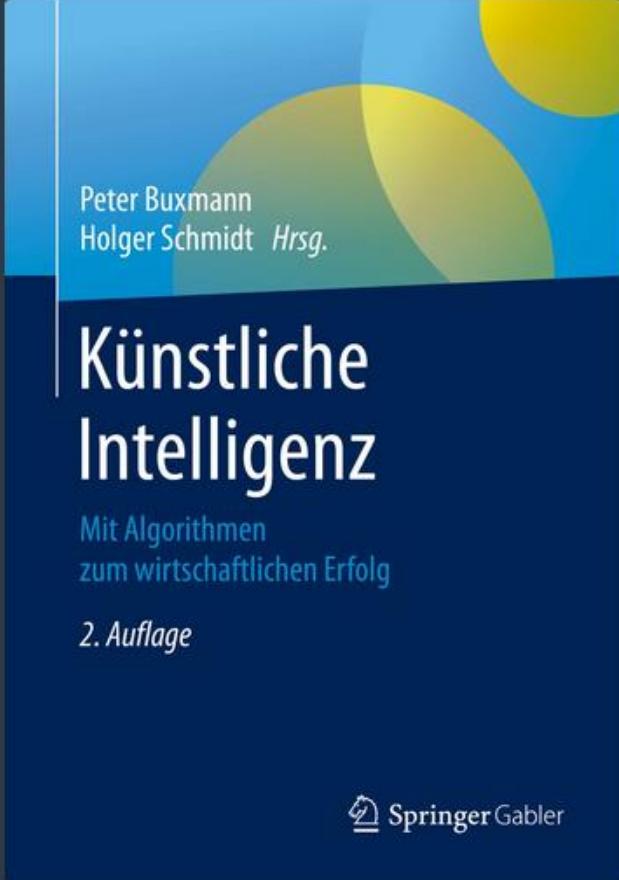


9.1 The Business Pressure-Response-Support Model



Based on Sharda et al. (2014)

9.1 Successful AI Projects: Book Recommendation



Künstliche Intelligenz wird als Basistechnologie ähnlich wie Elektrizität viele Unternehmen und Arbeitsplätze grundlegend verändern. Nach einer allgemein verständlichen Einführung in die technischen Grundlagen und ökonomischen Effekte zeigen zehn Unternehmen in der 2. Auflage unseres Buches, wie sie Algorithmen einsetzen, um Routinejobs zu automatisieren, aus Daten Erkenntnisse abzuleiten und neue Geschäftsmodelle zu entwickeln. Mit dem Buch wollen wir KI entmystifizieren, für Unternehmen handhabbar und für Interessierte verständlich machen. Wir wollen Entscheidern:innen Mut machen, sich mit dieser essentiellen Technologie stärker zu beschäftigen, damit der Vorsprung der amerikanischen und chinesischen Wettbewerber nicht noch größer wird. Mit Beiträgen von:

- Commerzbank: Künstliche Intelligenz in Banken
- Volkswagen: KI-Innovationen über das autonome Fahren hinaus
- Otto: Data Science im Online-Handel
- SAP: Effiziente Prozesse mit Künstlicher Intelligenz
- Microsoft: Künstliche Intelligenz in der Cloud
- Serviceware: Künstliche Intelligenz im Enterprise Service Management
- Software AG: Intelligentes IOT: Erkenntnisse aus IOT-Daten durch Machine Learning
- IBM: Intelligente KI-Lösungen
- Empolis: Mit KI immer die richtigen Entscheidungen treffen
- Heraeus: KI-gestützte visuelle Inspektion in der Elektronikindustrie



Künstliche Intelligenz: Mit Algorithmen zum wirtschaftlichen Erfolg ([↗ki-business.de](http://ki-business.de))

9.1 Classroom Task



Previous
Exam Task!

Your turn!

Task

What are the three main problems an AI-designer should have in mind when he/she designs AI-based information systems? Choose an example and explain them.

Outline

9

Building Productive AI-based Information Systems

9.1

Why AI Projects Fail

9.2

AI Project Management

9.3

Ethics and Trust in AI

9.4

Human AI Interaction

9.5

Explainable and Understandable AI (XAI)

9.6

How to Continue your AI Journey

Exam Preparation and Course Repetitorium

Capstone Project / Case Challenge

► What you will learn:

- Why many AI-based Information systems and intelligent agents fail in practice and how to tackle common problems in implementing AI-based information systems and intelligent agents
- Outlook and Future steps if you are interested in an AI-job



Image source: [↗ Pixabay](#) (2019) / [↗ CCO](#)

► Duration:

- 180 min

► Relevant for Exam:

- 9.1, 9.3-9.4

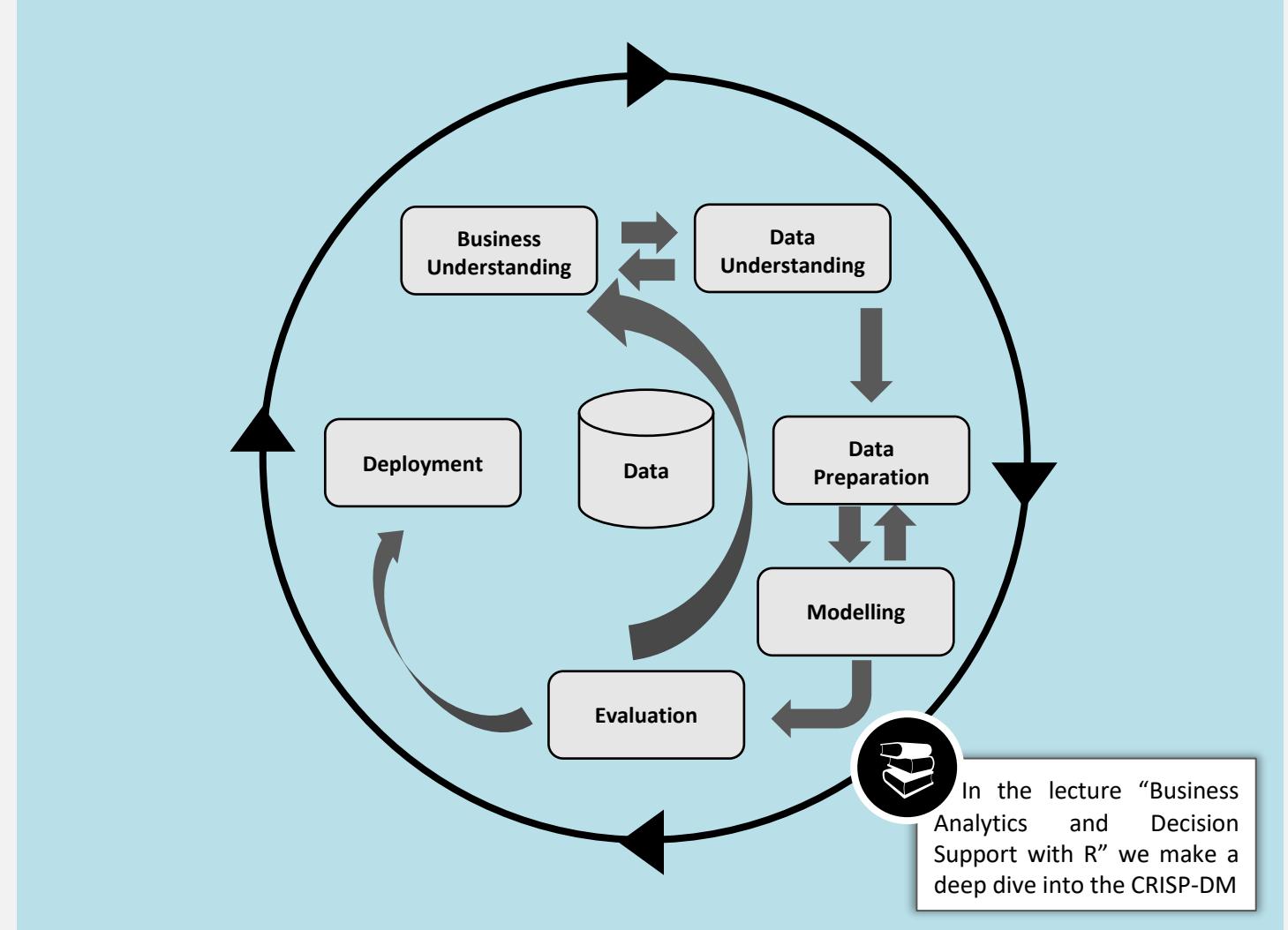
9.2 Recapitulation: CRISP-DM

- Cross-Industry Standard Process for Data Mining (CRISP-DM)
- Process model describing commonly used approaches that data science experts use to tackle problems



Free "CRISP-DM 1.0
*Step-by-step data
mining guide*"
In-depth documentation and process guide

Adopted from Chapman Pete et al. (1999)





9/11

9.2 Business Case: Sentinel Programm

01 | Executive Summary

Virtual Case File (or VCF) was a software application developed by the FBI between 2000 and 2005. The project was not close to completion when it was officially abandoned in January 2005, having turned into a complete fiasco for the FBI. In addition to wasting at least US \$100 million, the failure brought widespread criticism to the bureau and its director, Robert S. Mueller III. Finally, \$575 million dollars were wasted on the first two attempts at the project (VCF + Sentinel) until an (agile) solution was found.

02 | Solution

- Scrum Team was set up near the product owner in the basement of the Hoover Building
- Staff reduced from 400 to 40, and in 1 year and \$30 million, they were code complete, at a cost savings of more than 90 percent

Take-Aways



- Agil project management gets things done
- Agile development is cheaper



Feature | Computing | Software

1 Sep 2005 | 15:40 GMT

Who Killed the Virtual Case File?

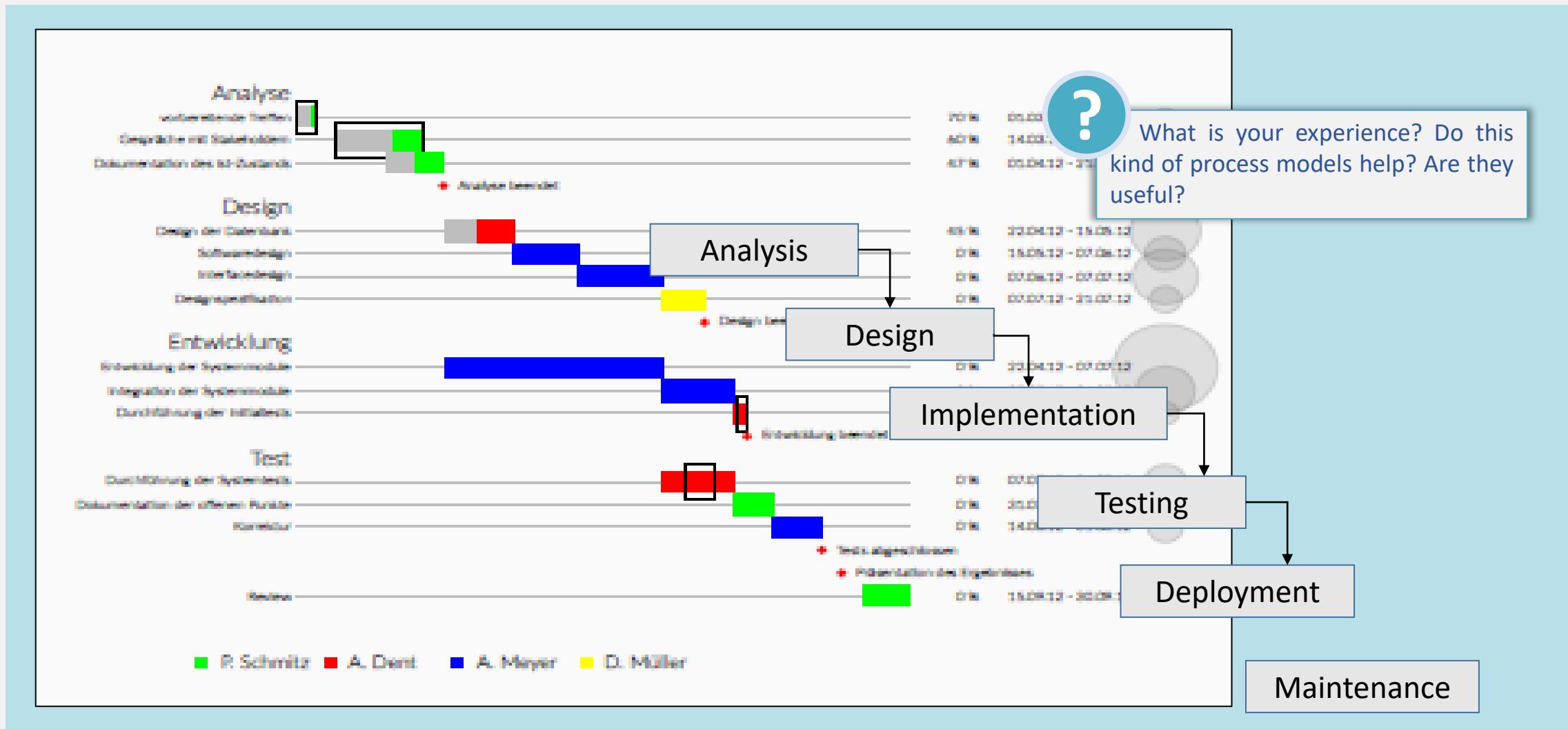
How the FBI blew more than \$100 million on case-management software it will never use

By Harry Goldstein

03 | □ References

- <https://spectrum.ieee.org/computing/software/who-killed-the-virtual-case-file>

9.2 Old School (IT) Project Planning



9.2 Why Agile Project Management

**“Gantt charts (or timeline charts)
are basically and always wrong”**

Adopted from Sutherland J – Die Scrum Revolution

Jeff Sutherland

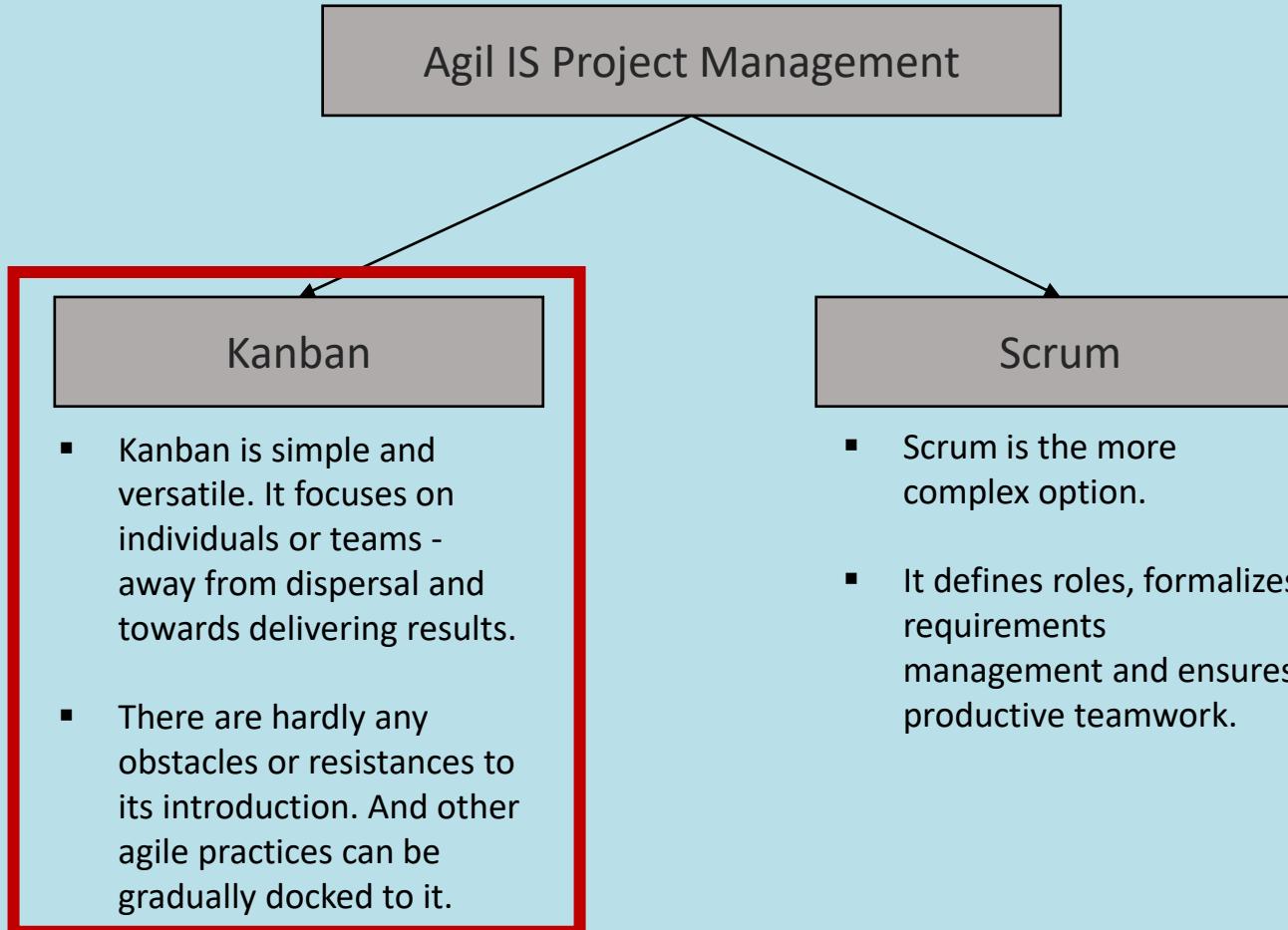
Co-Inventor of Scrum

↗ [Jeff Sutherland\(2009\)](#) from Anders Wegge Keller ↗ [CC BY SA 3.0](#)



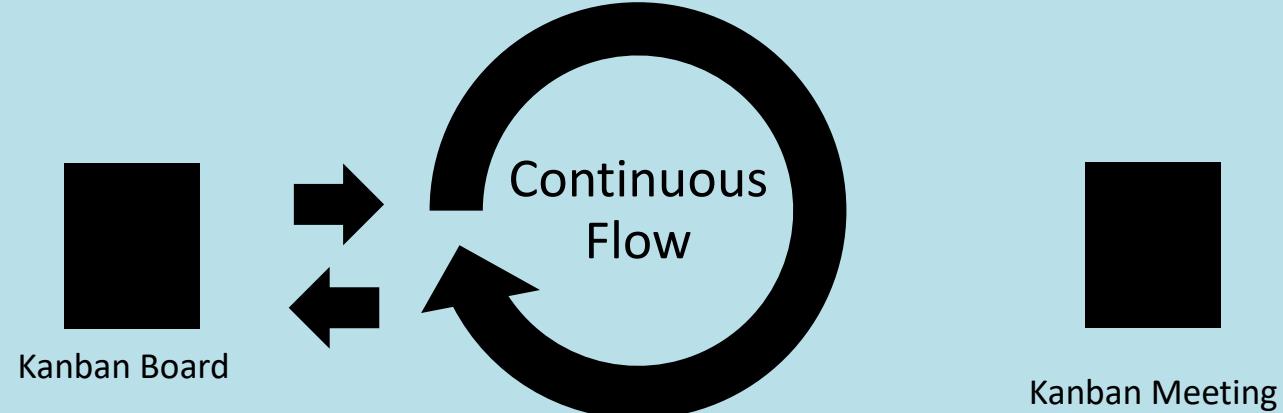
Adapted from Sutherland, J. (2015)

9.2 Most Popular Types of Agile IS Project Management



Adapted from Schwaber & Sutherland (2011)

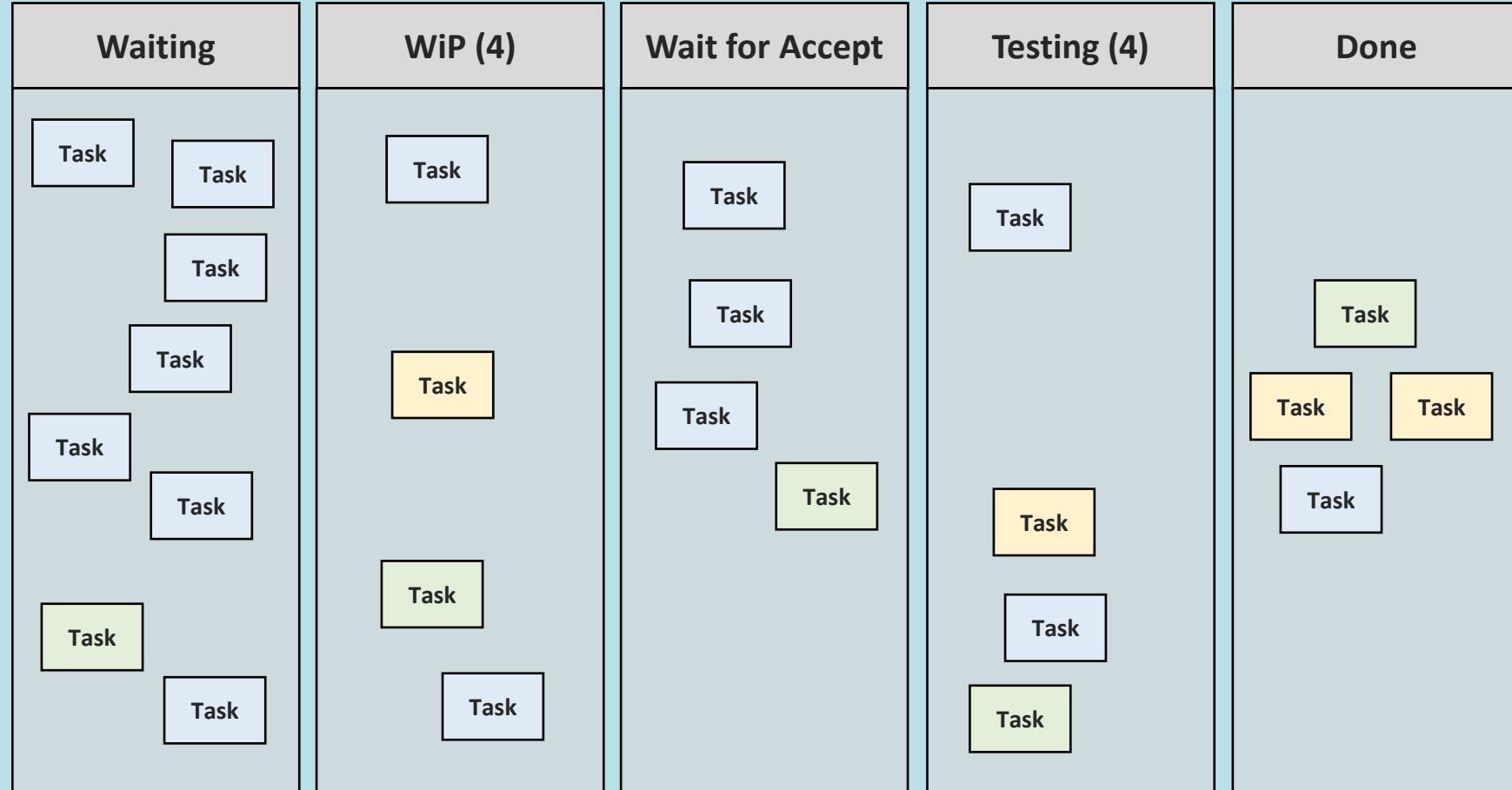
9.2 The KANBAN Approach



- Teams and team members minimize unproductive jumping between too many tasks or topics. They finish one thing before another begins.
- The flow of tasks from start to finish is visualized on the Kanban board. This helps the team communicate more productively with each other and coordinate task completion.
- Third, the "real" productivity is continuously measured and increased by a simple but central key figure, namely the "average lead time". How long it takes to complete the things that have started.

Adapted from Schwaber & Sutherland (2011)

9.2 The KANBAN – Task Board



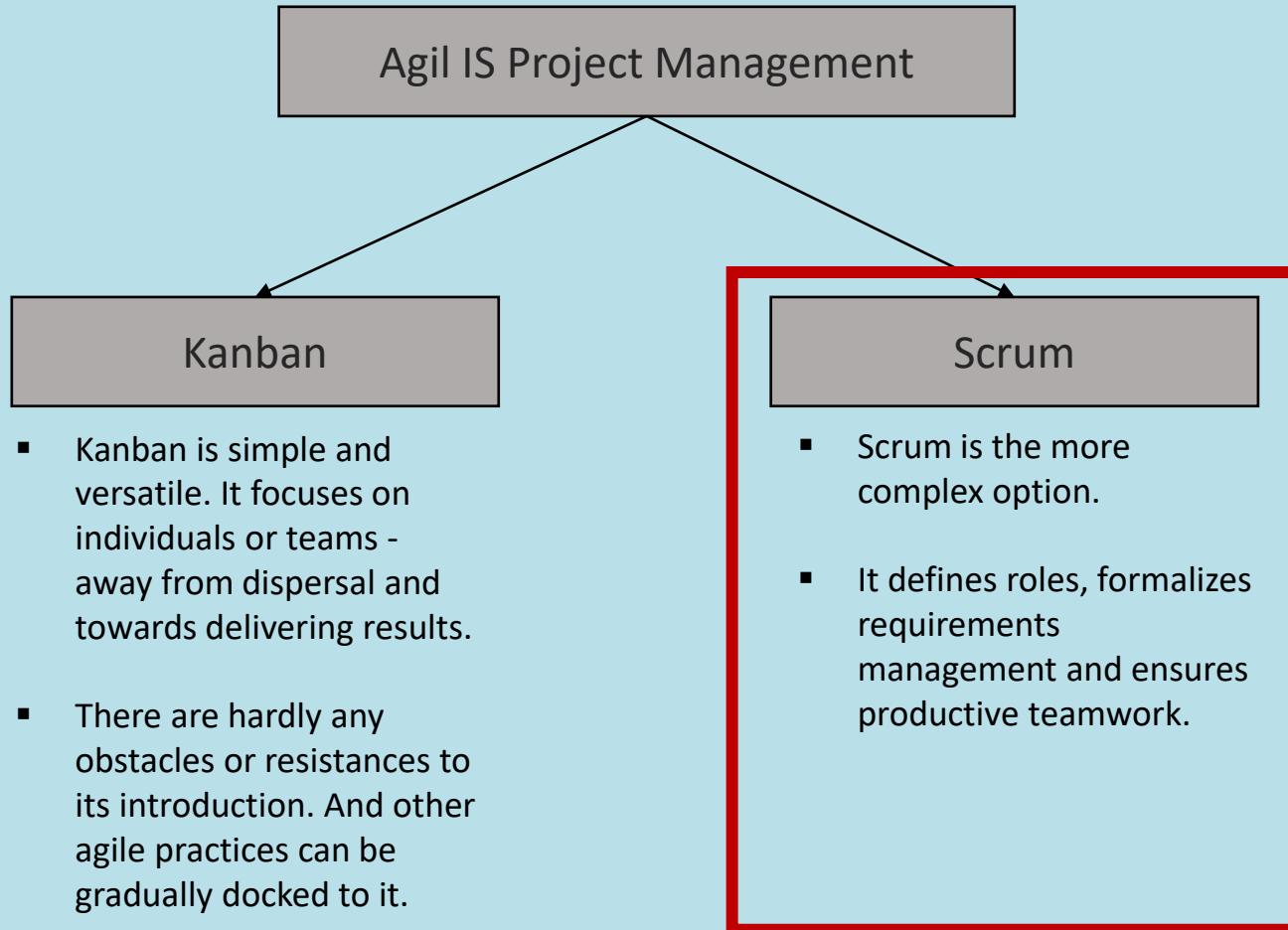
Adapted from Schwaber & Sutherland (2011)

9.2 Further KANBAN Characteristics

- With Kanban project management, project teams also achieve sustainable productivity. However, this is not achieved by working in tact, but by avoiding the biggest productivity killer in modern organizations and projects: the dissipation.
- Too many tasks are started, work on each one is frequently interrupted - and too little, too late, is completed.
- Kanban is a flow system: The aim is a uniform flow of flow elements (cars, chip bags, tasks, projects) across workstations (plants, teams) with a minimum throughput time.
- In principle (and also in practice), a project team can control the project with Kanban and successively supplement all Scrum practices. Except Sprints! Because with the conversion from flow (Kanban) to clocking (Scrum) it would have arrived at Scrum.

Adapted from Schwaber & Sutherland (2011)

9.2 Most Popular Types of Agile IS Project Management



Adapted from Schwaber & Sutherland (2011)

9.2 The fable of the pig and the chicken

A Pig and a Chicken are walking down the road.

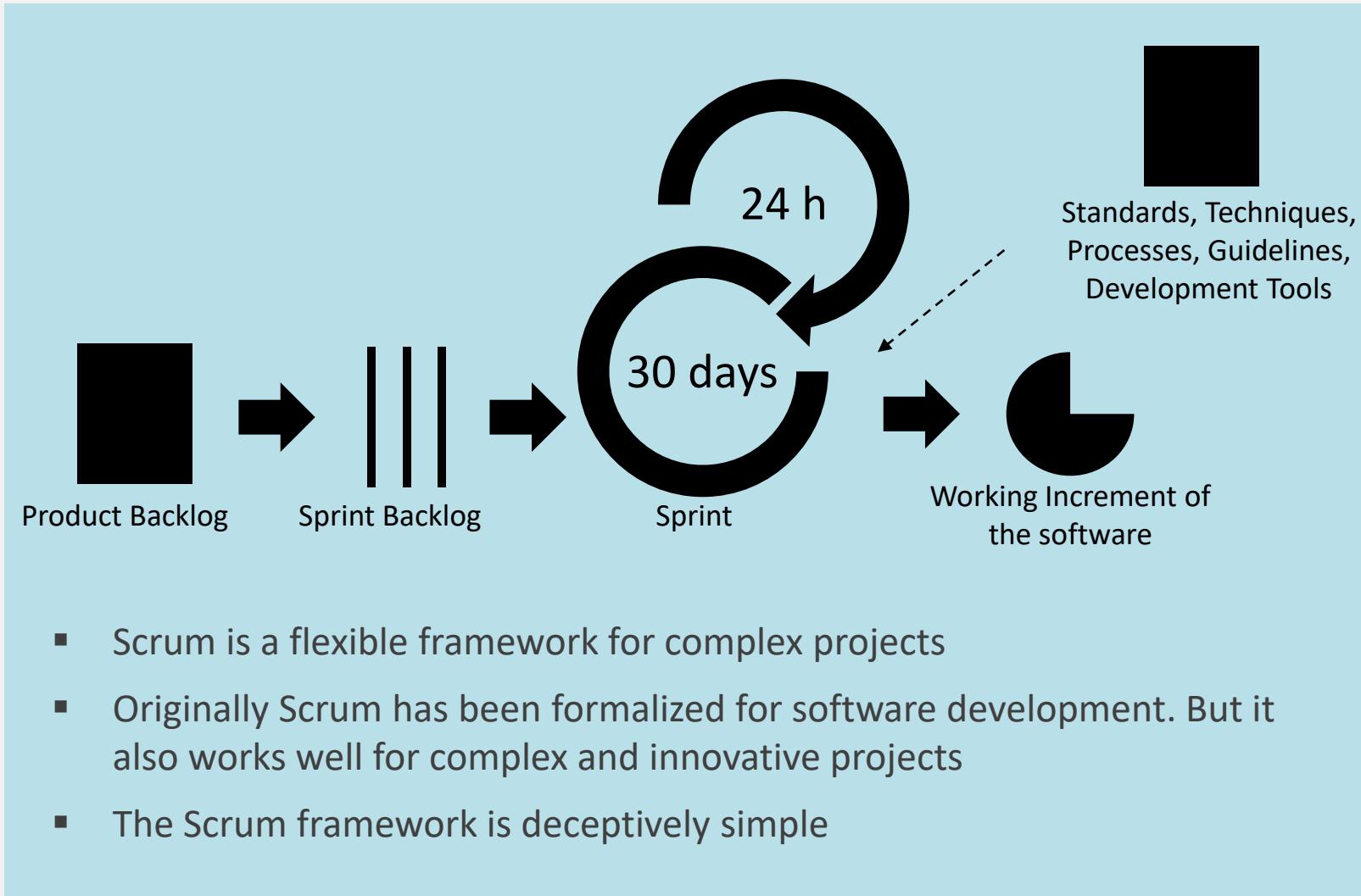
The Chicken says: "*Hey Pig, I was thinking we should open a restaurant!*"

Pig replies: "*Hm, maybe, what would we call it?*"

The Chicken responds: "*How about 'ham-n-eggs'?*"

The Pig thinks for a moment and says: "*No thanks. I'd be committed, but you'd only be involved.*"

9.2 Scrum Approach



Adapted from Schwaber & Sutherland (2011)

Pigs: The Scrum Team
Team
Scrum Master
Product Owner

Chicken: The Stakeholders
Management
Customer
Users

“No one (not even the Scrum Master) tells the Development Team how to turn Product Backlog into Increments of potentially releasable functionality.”

9.2 Scrum: Step by step

1

Sprint Planning

- **Product Owner** sets a list of features called **product backlog**
- During the **sprint planning**, the team “**pulls**” a piece of the top of that list: the **Sprint Backlog**; and decide how to implement it
- The Team has a time-box to reach this goal: **the Sprint**

2

Daily Sprint

- Each day, the Team measures its progress during a 15 min meeting: the **daily scrum**
- During the whole project, the **Scrum Master** ensures that the Team is still focused on its objective
- At the end of the Sprint, the work has to be **potentially shippable**. This work is considered as done

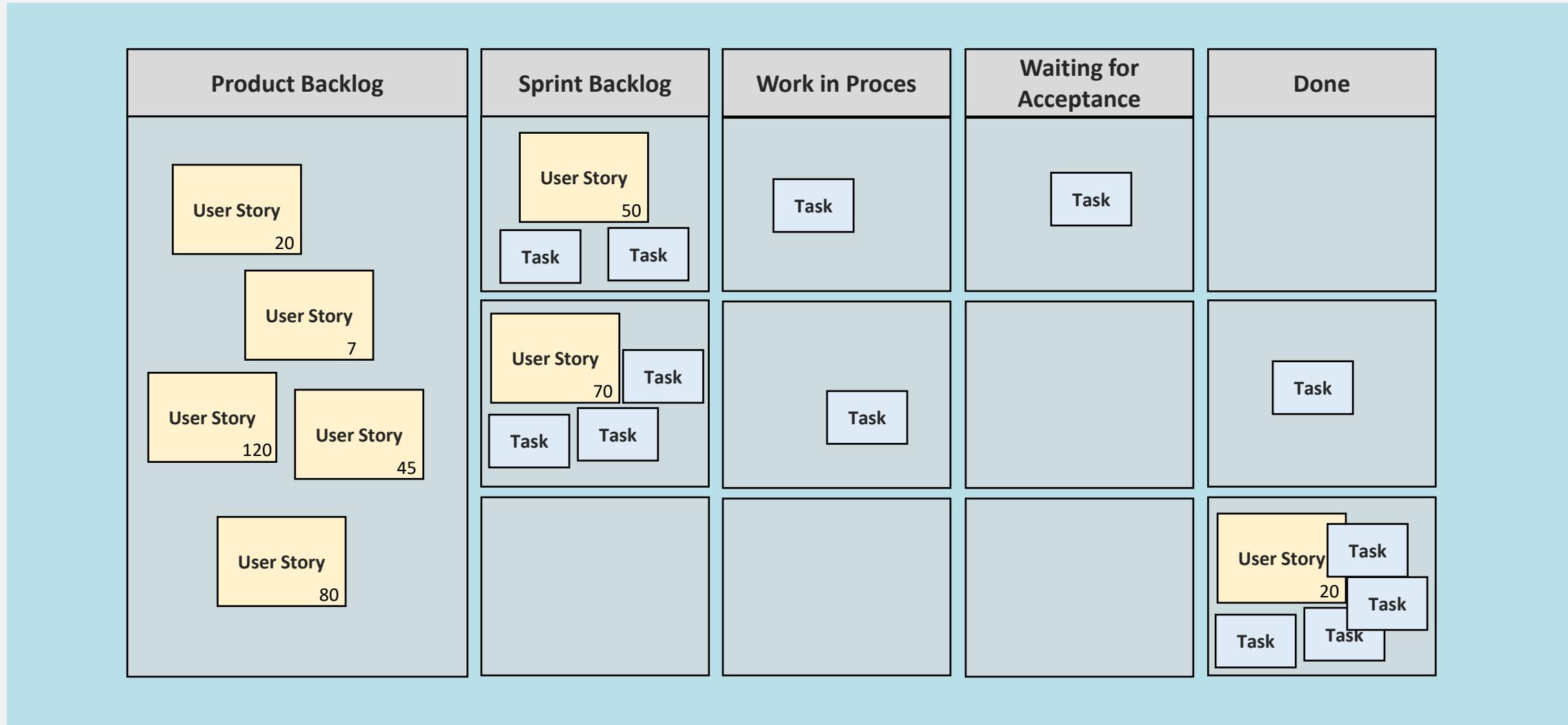
3

Sprint Review

- The Sprint ends with the **Sprint Review** and the **Retrospective**
- When the next Sprint starts, the Team selects a new piece of the Product Backlog and restarts the process
- The process is done, when all features are implemented, or the budget is consumed, or when the time is over

Adapted from Schwaber & Sutherland (2011)

9.2 Scrum Spring Board



Adapted from Schwaber & Sutherland (2011)

9.2 Scrum Roles and Responsibilities

Organisation of a Scrum Team

- Key concept of Scrum: Self-managed team
- 5-7 people, constituted by generalist and specialists

Product Owner

- Defines the features of the product
- Decides on release date and content
- Responsible for the profitability of the product (ROI)
- Prioritizes features according to market and/or user value
- Can change features and priority every 30 days
- Accepts or rejects work results

Scrum Master

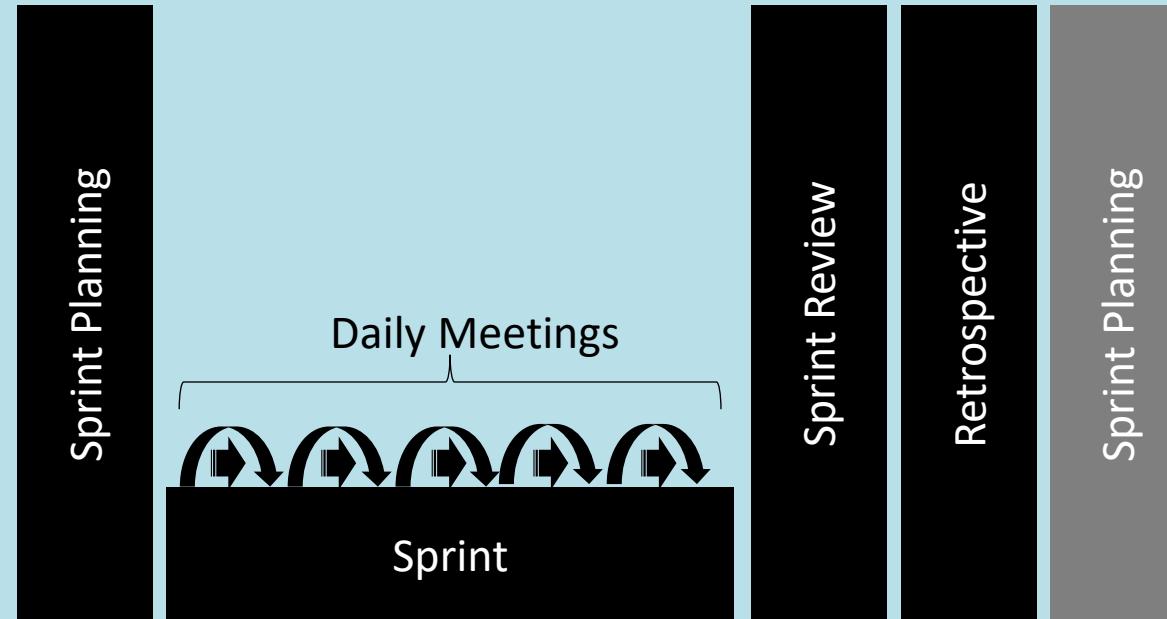
- Ensures that the team is fully functional and productive
- Enables close cooperation across all roles and functions and removes barriers
- Shields the team from external interferences
- Ensures that the process is followed, invites to daily scrum, iteration review and planning meetings

Team

- Cross-functional, seven plus/minus two members
- Selects the iteration goal and specifies work results
- Has the right to do everything within the boundaries of the project
- Organizes itself and its work
- Demos work results to the end-user and stakeholders

Adapted from Schwaber & Sutherland (2011)

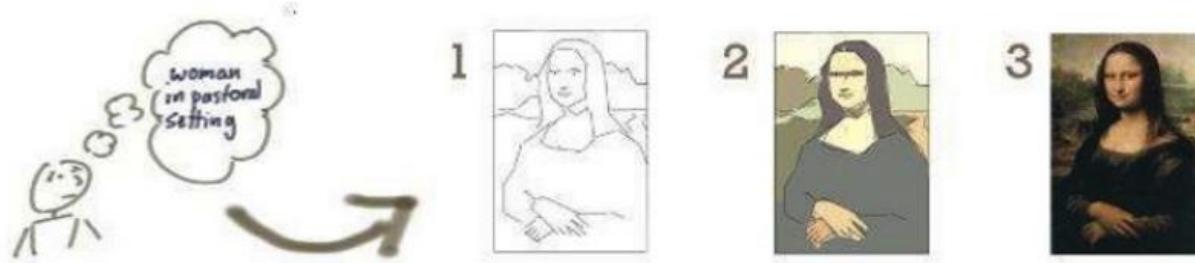
9.2 Scrum is a Cycle of Ceremonies



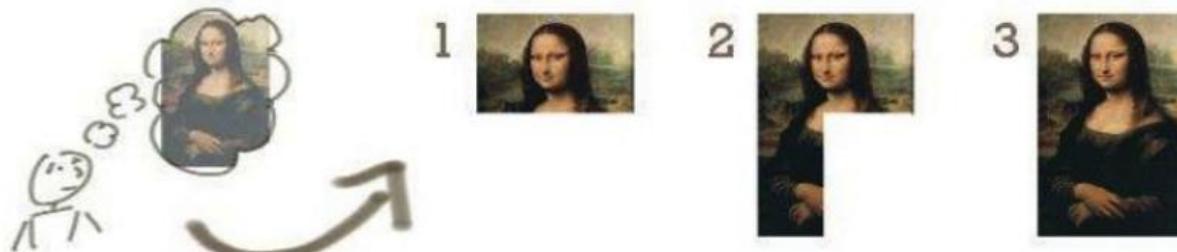
Adapted from Schwaber & Sutherland (2011)

9.2 Iterative and Incremental

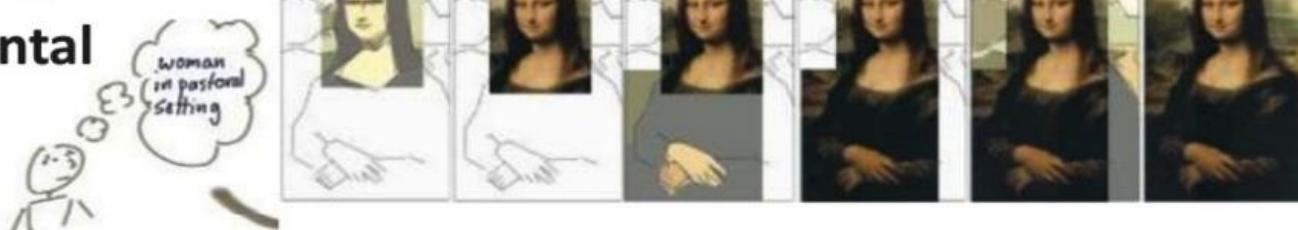
Iterative



Incremental



Iterative & Incremental



9.2 Sprint Planning Meeting

Participants	Structure
<ul style="list-style-type: none">Moderator: Product OwnerParticipants: Team (active), Scrum Master (passive)Duration: 8 h (4 week Sprint)	<ol style="list-style-type: none">Sprint Planning – WHAT?Sprint Planning – HOW? <p>Product Owner:</p> <ul style="list-style-type: none">Provides the customer's prioritized product backlogPresents the Release PlanExplain the Vision <p>Team:</p> <ul style="list-style-type: none">Estimates the Product Backlog in terms of feasibility (functional estimation)Slice the Product Backlog to Sprint Backlogs with the Product OwnerSlice Sprint Backlog in Tasks <p>Team and Product Owner:</p> <ul style="list-style-type: none">Define the Sprint objectiveEstablish “Definition of Done” for the Sprint
<p>The diagram illustrates the iterative nature of a sprint. It features a red vertical bar on the left labeled "Sprint Planning". To its right is a light blue area containing a black horizontal bar labeled "Sprint" with a sequence of six circular arrows above it, indicating a cycle. Above the "Sprint" bar is the text "Daily Meetings". To the right of the "Sprint" bar are three vertical bars: a dark blue one labeled "Sprint Review", a grey one labeled "Retrospective", and a light grey one labeled "Sprint Planning".</p>	

Adapted from Schwaber & Sutherland (2011)

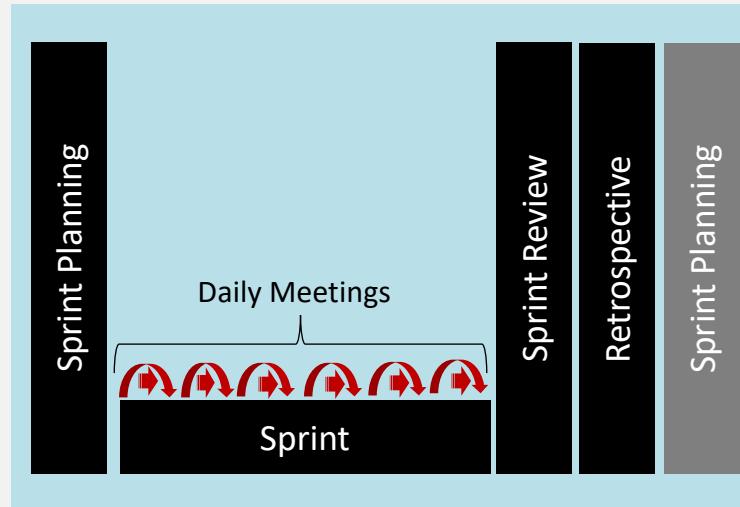
9.2 Sprint

Participants	Structure
<ul style="list-style-type: none">▪ Moderator: Team▪ Participants: Team, Scrum Master, Product Owner▪ Duration: 2-4 weeks	<ul style="list-style-type: none">▪ Development of the applications from the Sprint Backlog in which the team is involved▪ Maintenance of the Level of Done:<ul style="list-style-type: none">▪ Development▪ Unit test▪ Acceptance▪ Integration tests▪ System tests▪ Performance▪ Co-Management of impediments with the Scrum Master▪ Co-Maintenance of the Sprint Backlog with Product Owner

Adapted from Schwaber & Sutherland (2011)

9.2 Daily Meetings

Participants	Structure
<ul style="list-style-type: none">▪ Moderator: Team▪ Participants: Team (active), Scrum Master (passive), Product Owner (passive)▪ Duration: 15 min	<ul style="list-style-type: none">▪ It is the Inspect-and-Adapt from Team▪ Synchronization and Commitment▪ The three questions:<ul style="list-style-type: none">▪ <i>What did I do yesterday?</i>▪ <i>Which impediments?</i>▪ <i>What am I planning to do for today?</i>



Adapted from Schwaber & Sutherland (2011)

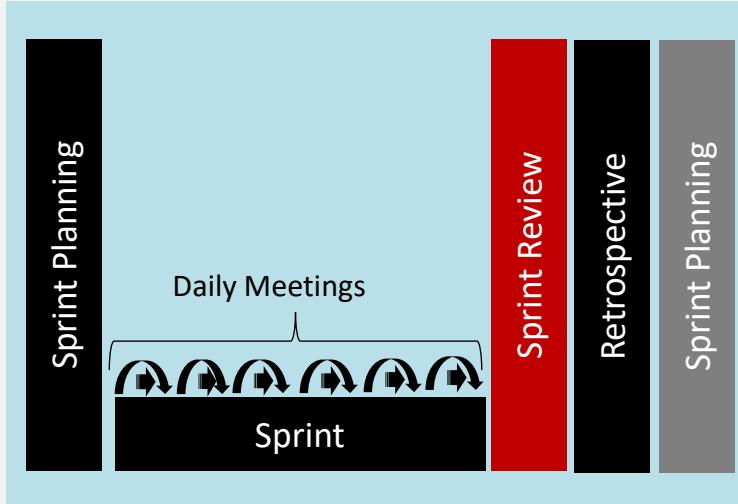
9.2 Sprint Review

Participants

- **Moderator:** Product Owner
- **Participants:** Team (active), Scrum Master (passive), Management (active), Customer (active), Users (active)
- **Duration:** 4 h (4 week Sprint)

Structure

- It is the Inspect-and-Adapt from Customer, Users and Management
- The team presents the results of the Sprint
- Users/Customer/Management express their comments and find a compromise with the team
- The product Owner accepts or rejects Sprint Backlog Items according to the Definition of Done
- The Product Owner has the last word here



Adapted from Schwaber & Sutherland (2011)

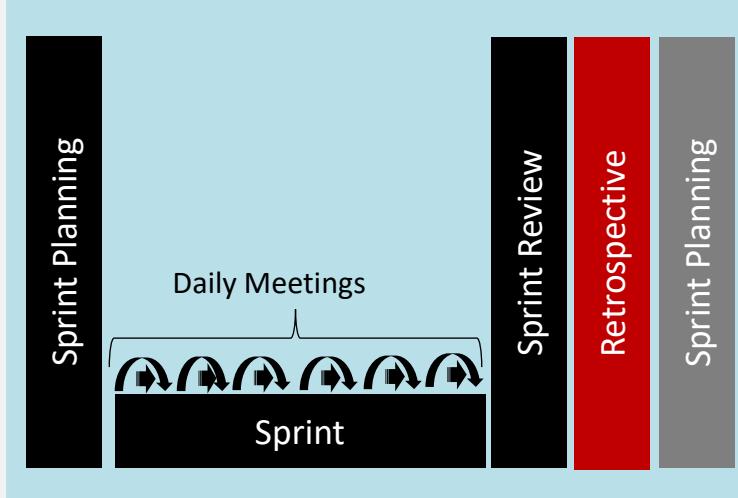
9.2 Retrospective

Participants

- **Moderator:** Scrum Master
- **Participants:** Team (active), Scrum Master (passive), Product Owner (active as Scrum Team Member)
- **Duration:** 3 h (4 week Sprint)

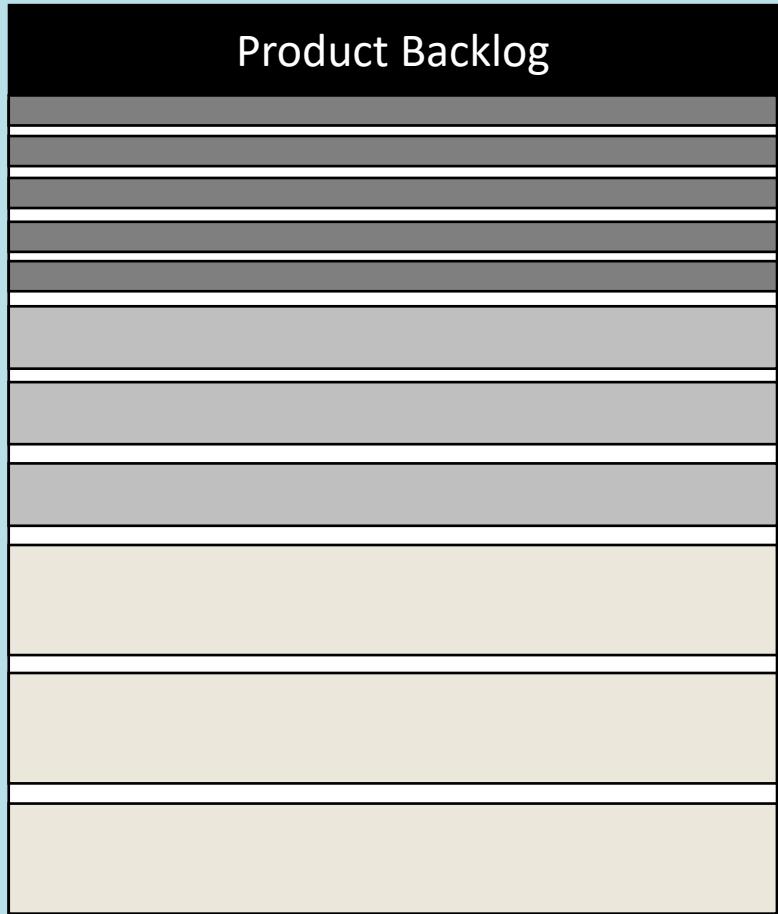
Structure

- **Scrum Process Analysis**
 - How?
 - How can we improve ourselves?
- **Inspection priorities:**
 - *Team communication*
 - *Relationship between team members*
 - *Processes and Tools*
 - *Training issues*
 - *etc.*



Adapted from Schwaber & Sutherland (2011)

9.2 Product Backlog



Fine-grained, detailed requirements ready for consumption in the next iteration, e.g. small user stories

Medium-grained requirements, e.g. larger user stories

Coarse-grained requirements, e.g. epics

→ The Product Backlog answers the following questions:
What? When? For who?

Adapted from Schwaber & Sutherland (2011)

9.2 Key Success Factor: Document every change

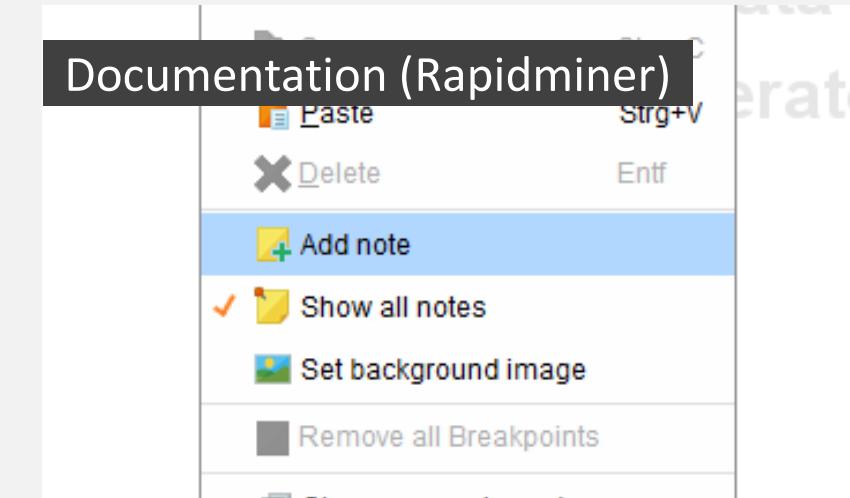
- Your results must be reproducible even after months (or years)
- Reproducibility requires good documentation of every change
- Quick manual changes result in irreproducible results
- Document changes in each of your scripts or workflows
- Your work can be reused easily, and applied to new data to obtain the same preprocessing

Adapted from Schwaber & Sutherland (2011)

Documentation (Python)

```
28 df = pd.DataFrame(data)
29 print(df)

32 import numpy as np
33 import matplotlib.pyplot as plt
34
35 x = [1,2,3,4,5]
36 l = ['Lisp', 'Java', 'GO', 'R', 'Python']
37 plt.bar(l, x, align='center')
38 plt.show()
39
40
41
42 """
43 """
44 Lecture - Artificial Intelligence Based Information Systems
45 """
```



9.2 Classroom Case

Case

In the next 15-30 minutes we will play a short competition. Please form several teams. The best team will win a special present. If every team is ready the task will be presented.



9.2 Classroom Case

- What did you learn from the game?
- How did the team make decisions?
- How would things have gone differently if the team had an appointed leader?
- How important were retrospectives?
- Did you realize stress? – When?
- Which team dynamics did you experience?

Outline

9

Building Productive AI-based Information Systems

9.1

Why AI Projects Fail

9.2

AI Project Management

9.3

Ethics and Trust in AI

9.4

Human AI Interaction

9.5

Explainable and Understandable AI (XAI)

9.6

How to Continue your AI Journey

Exam Preparation and Course Repetitorium

Capstone Project / Case Challenge

► What you will learn:

- Why many AI-based Information systems and intelligent agents fail in practice and how to tackle common problems in implementing AI-based information systems and intelligent agents
- Outlook and Future steps if you are interested in an AI-job



Image source: [↗ Pixabay](#) (2019) / [↗ CCO](#)

► Duration:

- 180 min

► Relevant for Exam:

- 9.1, 9.3-9.4

9.3 Biased Data is a Huge Challenge in AI Design



**„We need to be vigilant about how we
design and train these machine-learning systems,
or we will see ingrained forms of bias
built into the artificial intelligence of the future”**

Kate Crawford

Image source: [Associate Professor Kate Crawford, University of New South Wales](#) (2009) by [andresmh](#) from Wikimedia / [CC BY-SA 2.0](#)

9.3 Amazon AI Recuriter doesn't like Women

TECHNOLOGY NEWS OCTOBER 10, 2018 / 5:12 AM / A YEAR AGO

Amazon scraps secret AI recruiting tool that showed bias against women

Jeffrey Dastin

8 MIN READ

SAN FRANCISCO (Reuters) - Amazon.com Inc's ([AMZN.O](#)) machine-learning specialists uncovered a big problem: their new recruiting engine did not like women.

<https://www.reuters.com/article/us-amazon-com-jobs-automation-insight/amazon-scraps-secret-ai-recruiting-tool-that-showed-bias-against-women-idUSKCN1MK08G>

- Amazons “AI Recruiting Information System” had to be scrapped after showing a distinct bias against woman
- Amazon’s system taught itself that male candidates were preferable.
- It penalized resumes that included the word “women’s,” as in “women’s chess club captain.”
- It downgraded graduates of two all-women’s colleges, according to people familiar with the matter.

9.3 Biased AI Models Have Real-World Consequences

YT Fact Check Algorithm Fails

Mail Online

YouTube fact-check algorithm incorrectly tags live broadcast of Notre Dame fire with details of the 9/11 terror attack

- YouTube accidentally tagged the Notre Dame fire with details of the 9/11 attacks
- Google-owned company linked footage of the blaze to New York terror outrage
- Fact-checking algorithm blamed for error in connecting the collapsing towers



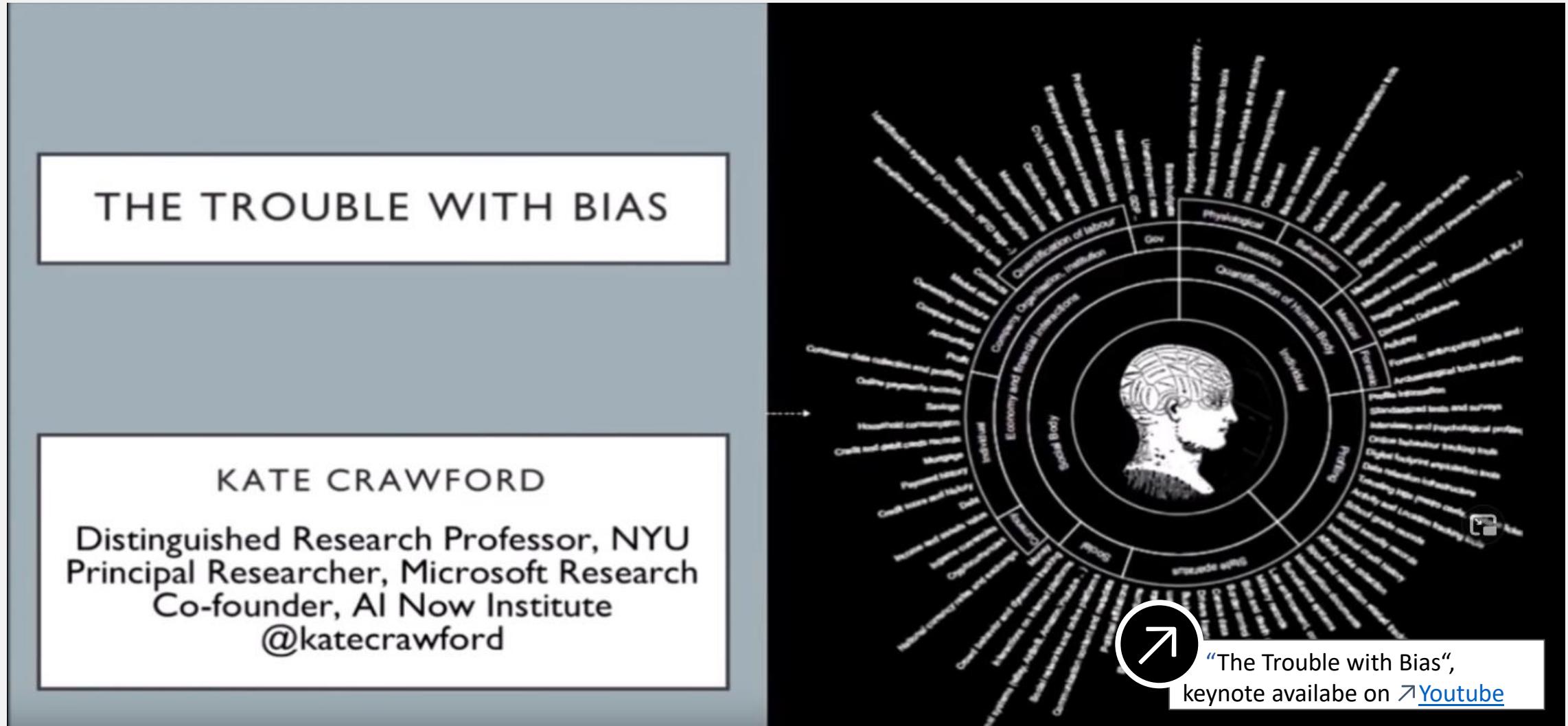
Google Photo Fail 2015

Jun 29
Google Photos, y'all fucked up. My friend's not a gorilla.
pic.twitter.com/SMkMCsNVX4

- Bias, as in “our model differs systematically between the expected prediction and the true value”, is a machine learning problem
- Bias, as in “a model reflecting undue prejudice in its predictions” is **not** simply a machine learning problem

Image source: COMPAS ↗[Pixabay](#) (2019) / ↗[CC0](#)

9.3 The Trouble with Bias - NIPS 2017 Keynote - Kate Crawford



9.3 Harm that AI Can Cause

- A “harm” is caused when a prediction or end outcome negatively impacts
 - an individual’s ability to establish their rightful personhood (harms of representation),
 - or leading to or independently impacting their ability to access resources (harms of allocation)
- **Implication:** Incorrectly representing individual’s identify in AI-based information systems, or any consecutive decision made by these systems in regards to individual

9.3 Ethics in Artificial Intelligence

- **Ethics:** Dealing with right vs wrong, and moral obligations and duties of humans
- How right, how fair and how just, is the output, outcome and impact?
- Being answerable to these constitute moral obligations and duties of AI developers

9.3 Ethical Issues in Artificial Intelligence

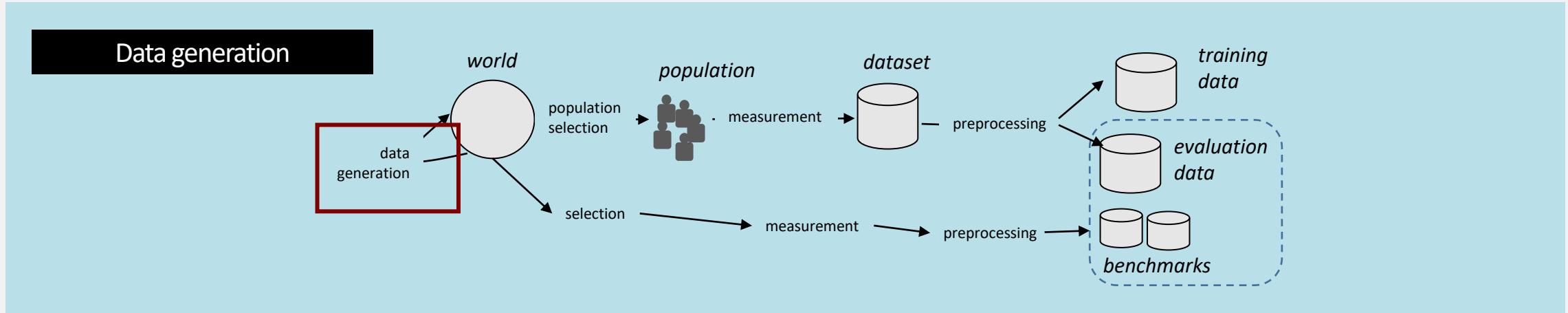
- **What AI is**
 - Bias and Fairness
 - Accountability
 - Transparency and Understandability
 - Interpretability

- **What AI does**
 - Work- and process security
 - Cyber-security and Malicious Use
 - Privacy
 - Human-AI interaction

- **What AI impacts**
 - Jobs and Labor trends
 - Impact to modern society
 - Human-Human interaction
 - Communication

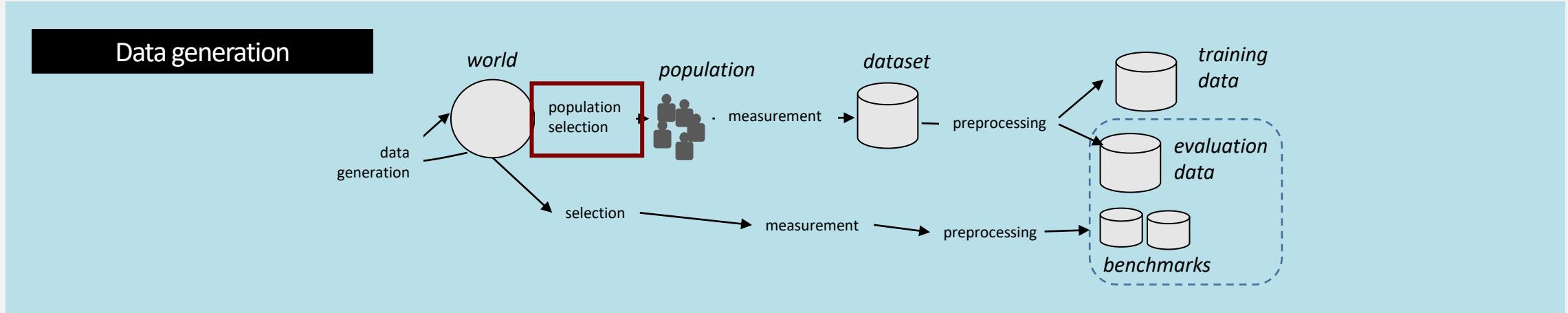
- **What AI can be**
 - Singularity?
 - robot rights (see e.g Assimov)?

9.3 Historical Bias



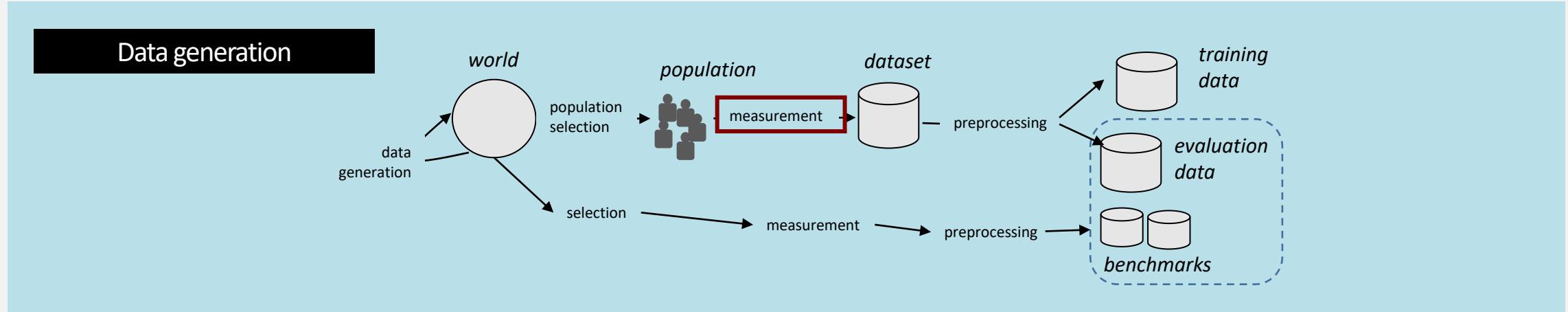
- Historical bias arises when there is a misalignment between world as it is and the values or objectives to be encoded and propagated in a model.
- It is a normative concern with the state of the world, and exists even given perfect sampling and feature selection.

9.3 Representation Bias



- Representation bias arises while defining and sampling a development population
- It occurs when the development population under-represents, and subsequently causes worse performance, for some part of the final population

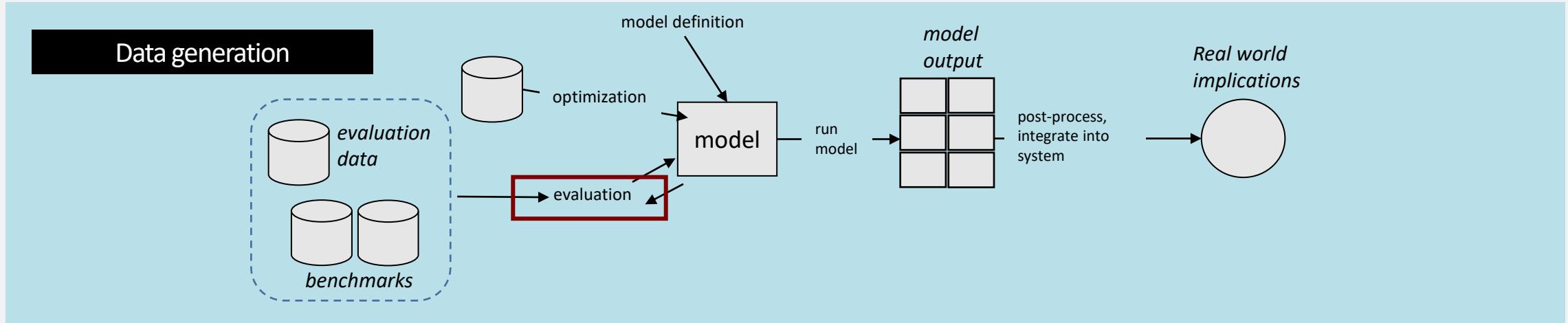
9.3 Measurement Bias



Measurement bias arises when choosing and measuring the particular features and labels of interest

- Features considered to be relevant to the outcome are chosen, but these can be incomplete or contain group- or input dependent noise.
- In many cases, the choice of a single label to create a classification task may be an oversimplification that more accurately measures the true outcome of interest for certain groups.

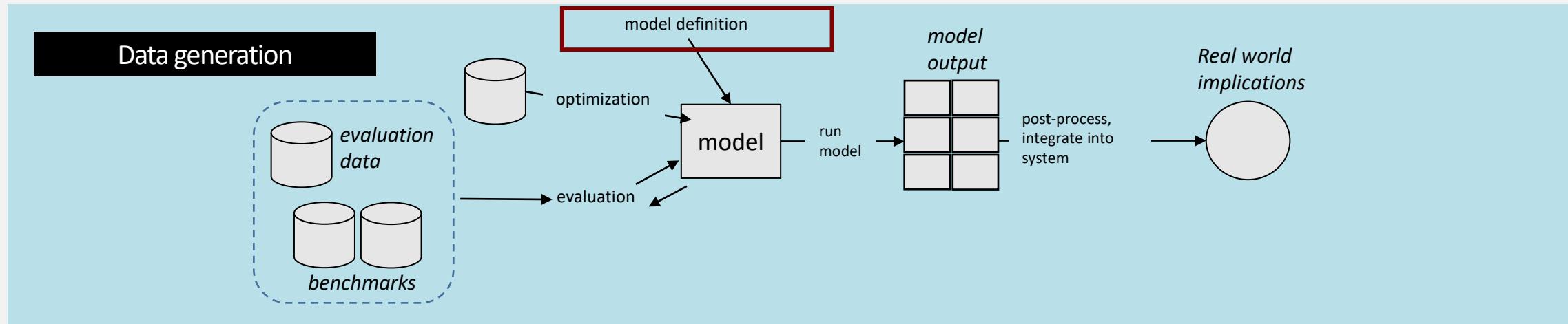
9.3 Evaluation Bias



Evaluation bias occurs during model iteration and evaluation, when the testing or external benchmark populations do not equally represent the various parts of the final population

- Evaluation bias can also arise from the use of performance metrics that are not granular or comprehensive enough.

9.3 Aggregation Bias



Aggregation bias arises when flawed assumptions about the population affect model definition. In many applications, the population of interest is heterogeneous and a single model is unlikely to suit all subgroups.

Your turn!

Task

Please explain in your own words:

- Why is biased data a challenge for AI Design?
- What is the difference between Aggregation and Measurement bias?

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- Outlook and Future steps if you are interested in an AI-job



Image source: [↗ Pixabay](#) (2019) / [↗ CCO](#)

► Duration:

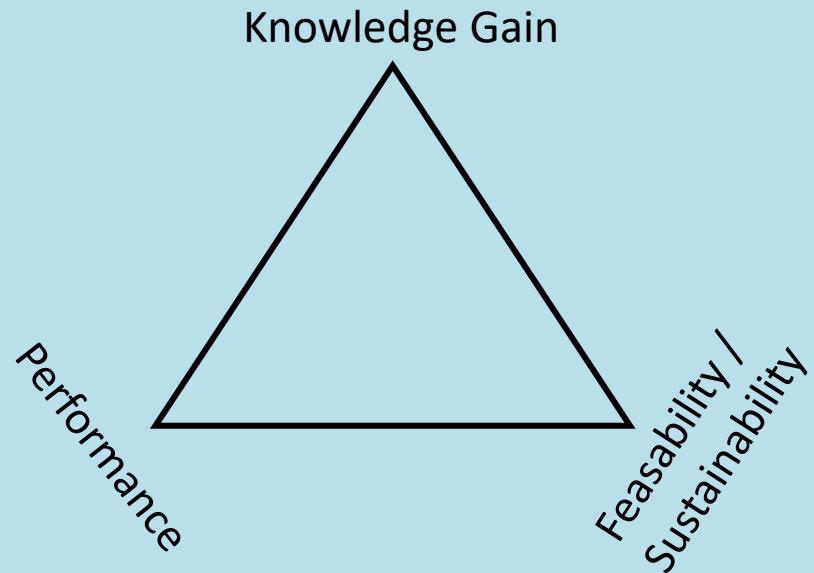
- 180 min

► Relevant for Exam:

- 9.1, 9.3-9.4

9.4 Challenge of AI Selection

Contextual Complexity



An easy and understandable model that solves a complex tasks with high accuracy while being very easy to implement and use in production is very rare...

Technology Intelligence

Russian AI chatbot found supporting Stalin and violence two weeks after launch

share Save

Лучь до адреса Москва. Столичные маршруты до Кропоткинкой займет 15 минут, причем надо будет пройти 900 метров пешком.

МАРШРУТ НА КАРТЕ

9.4 Guidelines for Human-AI Interaction from Microsoft

- The Researcher propose 18 generally applicable design guidelines for human-AI interaction.
- Guidelines are validated through multiple rounds of evaluation including a user study where this guideline is tested against other popular AI-infused products.



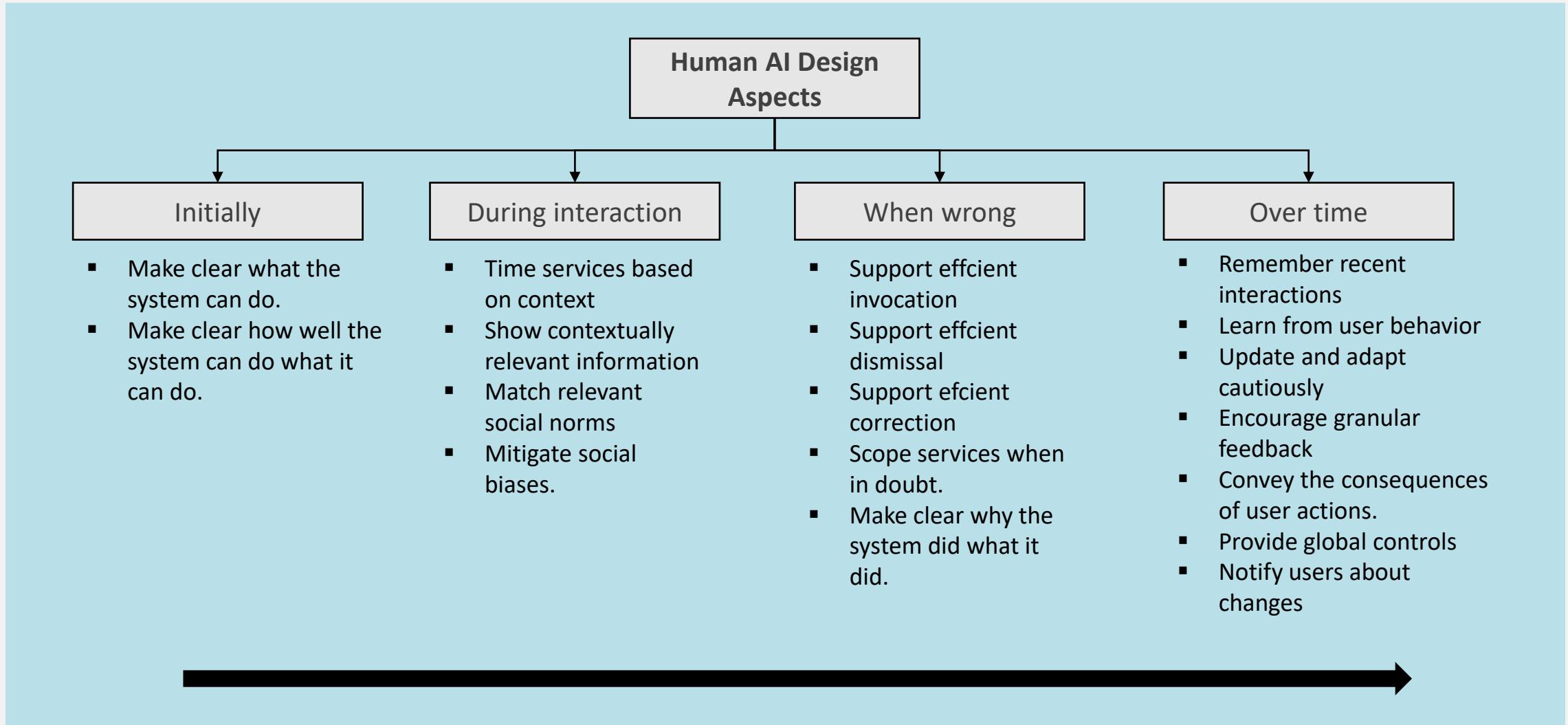
The following part of the lecture is mainly based on Microsoft's Best Practices for AI-Design ↗www.microsoft.com.

Adapted from Amershi, S et al. (2019)

	AI Design Guidelines	Example Applications of Guidelines
Initially	G1 Make clear what the system can do. Help the user understand what the AI system is capable of doing.	[Activity Trackers, Product #1] "Displays all the metrics that it tracks and explains how. Metrics include movement metrics such as steps, distance traveled, length of time exercised, and all-day calorie burn, for a day."
	G2 Make clear how well the system can do what it can do. Help the user understand how often the AI system may make mistakes.	[Music Recommenders, Product #1] "A little bit of hedging language: 'we think you'll like'."
During interaction	G3 Time services based on context. Time when to act or interrupt based on the user's current task and environment.	[Navigation, Product #1] "In my experience using the app, it seems to provide timely route guidance. Because the map updates regularly with your actual location, the guidance is timely."
	G4 Show contextually relevant information. Display information relevant to the user's current task and environment.	[Web Search, Product #2] "Searching a movie title returns show times in near my location for today's date"
When wrong	G5 Match relevant social norms. Ensure the experience is delivered in a way that users would expect, given their social and cultural context.	[Voice Assistants, Product #1] "[The assistant] uses a semi-formal voice to talk to you - spells out 'okay' and asks further questions."
	G6 Mitigate social biases. Ensure the AI system's language and behaviors do not reinforce undesirable and unfair stereotypes and biases.	[Autocomplete, Product #2] "The autocomplete feature clearly suggests both genders [him, her] without any bias while suggesting the text to complete."
Over time	G7 Support efficient invocation. Make it easy to invoke or request the AI system's services when needed.	[Voice Assistants, Product #1] "I can say [wake command] to initiate."
	G8 Support efficient dismissal. Make it easy to dismiss or ignore undesired AI system services.	[E-commerce, Product #2] "Feature is unobtrusive, below the fold, and easy to scroll past...Easy to ignore."
	G9 Support efficient correction. Make it easy to edit, refine, or recover when the AI system is wrong.	[Voice Assistants, Product #2] "Once my request for a reminder was processed I saw the ability to edit my reminder in the UI that was displayed. Small text underneath stated 'Tap to Edit' with a chevron indicating something would happen if I selected this text."
	G10 Scope services when in doubt. Engage in disambiguation or gracefully degrade the AI system's services when uncertain about a user's goals.	[Autocomplete, Product #1] "It usually provides 3-4 suggestions instead of directly auto completing it for you"
	G11 Make clear why the system did what it did. Enable the user to access an explanation of why the AI system behaved as it did.	[Navigation, Product #2] "The route chosen by the app was made based on the Fastest Route, which is shown in the subtext."
	G12 Remember recent interactions. Maintain short term memory and allow the user to make efficient references to that memory.	[Web Search, Product #1] "[The search engine] remembers the context of certain queries, with certain phrasing, so that it can continue the thread of the search (e.g., 'who is he married to' after a search that surfaces Benjamin Bratt)"
	G13 Learn from user behavior. Personalize the user's experience by learning from their actions over time.	[Music Recommenders, Product #2] "I think this is applied because every action to add a song to the list triggers new recommendations."
	G14 Update and adapt cautiously. Limit disruptive changes when updating and adapting the AI system's behaviors.	[Music Recommenders, Product #2] "Once we select a song they update the immediate song list below but keeps the above one constant."
	G15 Encourage granular feedback. Enable the user to provide feedback indicating their preferences during regular interaction with the AI system.	[Email, Product #1] "The user can directly mark something as important, when the AI hadn't marked it as that previously."
	G16 Convey the consequences of user actions. Immediately update or convey how user actions will impact future behaviors of the AI system.	[Social Networks, Product #2] "[The product] communicates that hiding an Ad will adjust the relevance of future ads."
	G17 Provide global controls. Allow the user to globally customize what the AI system monitors and how it behaves.	[Photo Organizers, Product #1] "[The product] allows users to turn on your location history so the AI can group photos by where you have been."
	G18 Notify users about changes. Inform the user when the AI system adds or updates its capabilities.	[Navigation, Product #2] "[The product] does provide small in-app teaching callouts for important new features. New features that require my explicit attention are pop-ups."

Table 1: Our 18 human-AI interaction design guidelines, roughly categorized by when they likely are to be applied during interaction with users, along with illustrative applications (rated as "clearly applied" by participants) across products tested by participants in our user study.

9.4 AI Design Guidelines



Adapted from Amershi, S et al. (2019)

9.4 AI Design Guideline: Initially

1

G1 - Make clear what the system can do.

- Help the user understand what the AI system is capable of doing
- **Example:** [Activity Trackers, Product #1] “Displays all the metrics that it tracks and explains how. Metrics include movement metrics such as steps, distance traveled, length of time exercised, and all-day calorie burn, for a day.”
- **Example:** [Photo Organizers, Product #1] “We know the AI is able to detect and associate an image with a category, but the user does not know all the categories available.”

Example: User Onboarding

Here you see <functionality>!

Try out to...

This button allows you to <function>

Adapted from Amershi, S et al. (2019)

9.4 AI Design Guideline: Initially

2

G2 - Make clear how well the system can do what it can do.

- Help the user understand how often the AI system may make mistakes.
- **Example:** [Music Recommenders, Product #1] “A little bit of hedging language: ‘we think you’ll like.’”
- **Example:** [Voice Assistants, Product #1] “Aside from the ‘Hi, how can I help?’, [the product] does not promise anything more. No expectation of quality is set.”

Example: Message / show how often you used the functionality of the system

**9 of 10
Warnings
correct**

Number of correct cases

Adapted from Amershi, S et al. (2019)

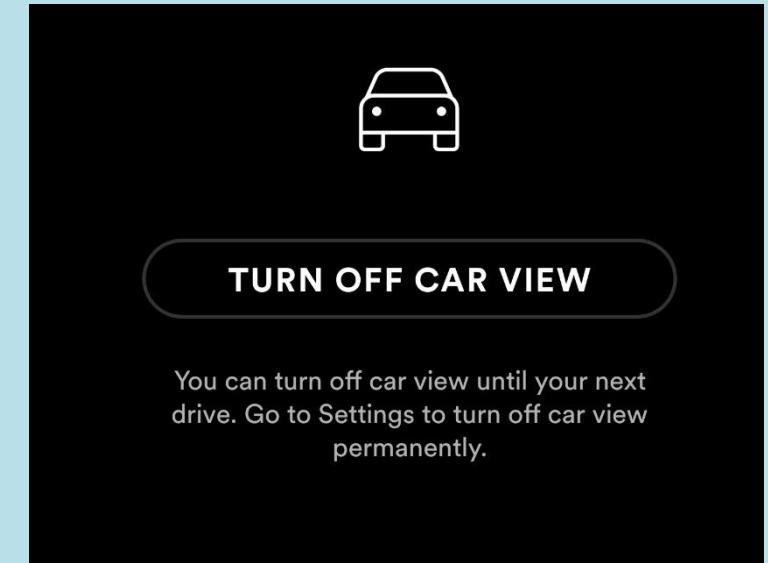
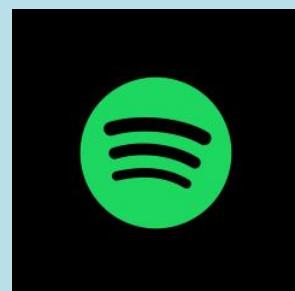
9.4 AI Design Guideline: During interaction

3

G3 - Time services based on context.

- Time when to act or interrupt based on the user's current task and environment
- **Example:** [Autocomplete, Product #1] "Suggestions are always present when you might need them (whenever the keyboard is up)"
- **Example:** [Social Networks, Product #1] "If the user has not accessed [the product] in a while, the application will let the user know that there is something new to be explored - a story, video, etc."

Example: User-sensitive systems



Adapted from Amershi, S et al. (2019)

9.4 AI Design Guideline: During interaction

4

G4 - Show contextually relevant information.

- Display information relevant to the user's current task and environment.
- **Example:** [Web Search, Product #2] "Searching a movie title returns show times near my location for today's date"
- **Example:** [Navigation, Product #1] "When I use [the product] for driving directions, it remembers where I parked my car. Next time when I open the app, it suggests routing me back to my car."

Example: Search a recent movie in the google search of your android phone and it returns playtimes of your local cinema.



Adapted from Amershi, S et al. (2019)

9.4 AI Design Guideline: During interaction

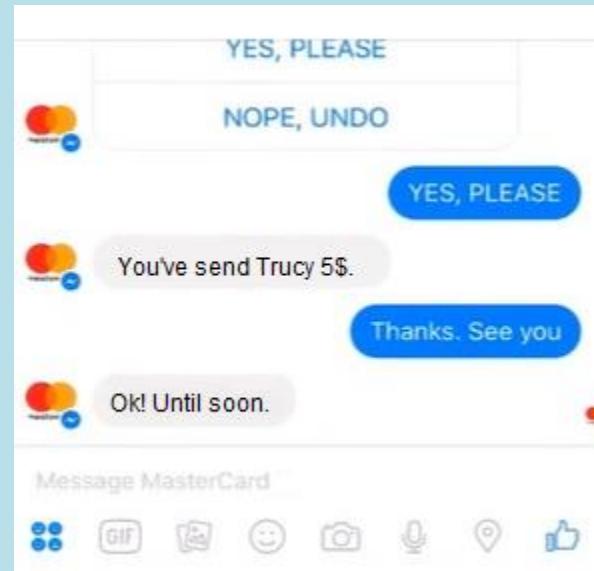
5

G5 - Match relevant social norms

- Ensure the experience is delivered in a way that users would expect, given their social and cultural context.
- **Example:** [Voice Assistants, Product #1] “[The assistant] uses a semiformal voice to talk to you - spells out “okay” and asks further questions.”
- **Example:** [Navigation, Product #1] “If you select walking, the AI avoid(s) busy roads and searches for trails.”

Example: Example Mastercard chatbot interface

(I know like most chatbots this is no 100% AI example)



Adapted from Amershi, S et al. (2019)

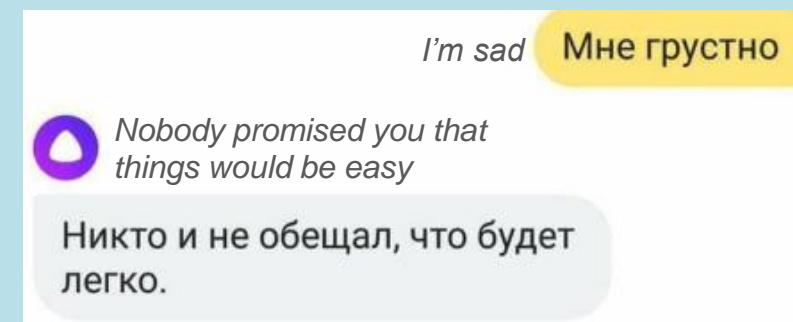
9.4 AI Design Guideline: During interaction

6

G6 - Mitigate social biases.

- Ensure the AI system's language and behaviors do not reinforce undesirable and unfair stereotypes and biases.
- **Example:** [Web Search, Product #2] “a search for CEO or Doctor shows somewhat diverse people in the resulting images...The images are pretty diverse in terms of gender and ethnicity, although still lack in some respects such as disability”
- **Example:** [Autocomplete, Product #2] “The autocomplete feature clearly suggests both genders [him, her] without any bias while suggesting the text to complete.”

Example: Yandex Assistant



Adapted from Amershi, S et al. (2019)

9.4 AI Design Guideline: When wrong

7

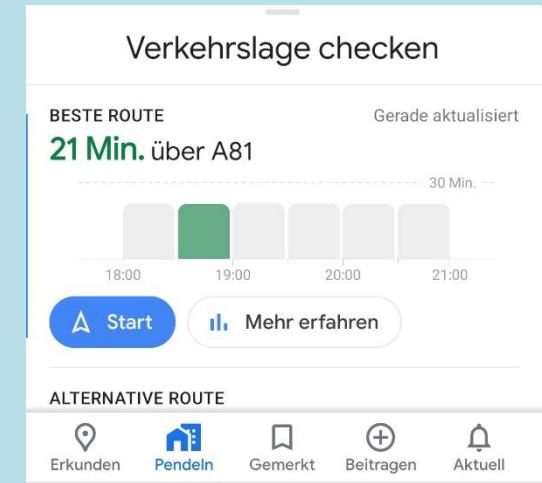
G7 - Support efficient invocation.

- Make it easy to invoke or request the AI system's services when needed.
- **Example:** [Voice Assistants, Product #1] “I can say [wake command] to initiate.”
- **Example:** [E-commerce, Product #1] “In addition to the system giving you recommendations as you browse, you can go to your “Browsing history > Manage history > More like this” to get recommendations specific to a particular product.”

Example: Google Work

If you add your workplace and your home, Google warns you if there are any unexpected events (e.g. traffic jam)

Furthermore, it adds your standard ways to the app interface



Adapted from Amershi, S et al. (2019)

9.4 AI Design Guideline: When wrong

8

G8 - Support efficient dismissal

- Make it easy to dismiss or ignore undesired AI system services.
- **Example:** [E-commerce, Product #2] “Feature is unobtrusive, below the fold, and easy to scroll past...Easy to ignore.”
- **Example:** [Voice Assistants, Product #1] “I can say “nevermind” to dismiss it once I have said [wake command]. I can also just not say anything and it stops listening.”



Stop or pause:

- "Alexa, stop" or,
- "Alexa, shut up."

Mute or unmute:

- "Alexa, mute" or,
- "Alexa, unmute."

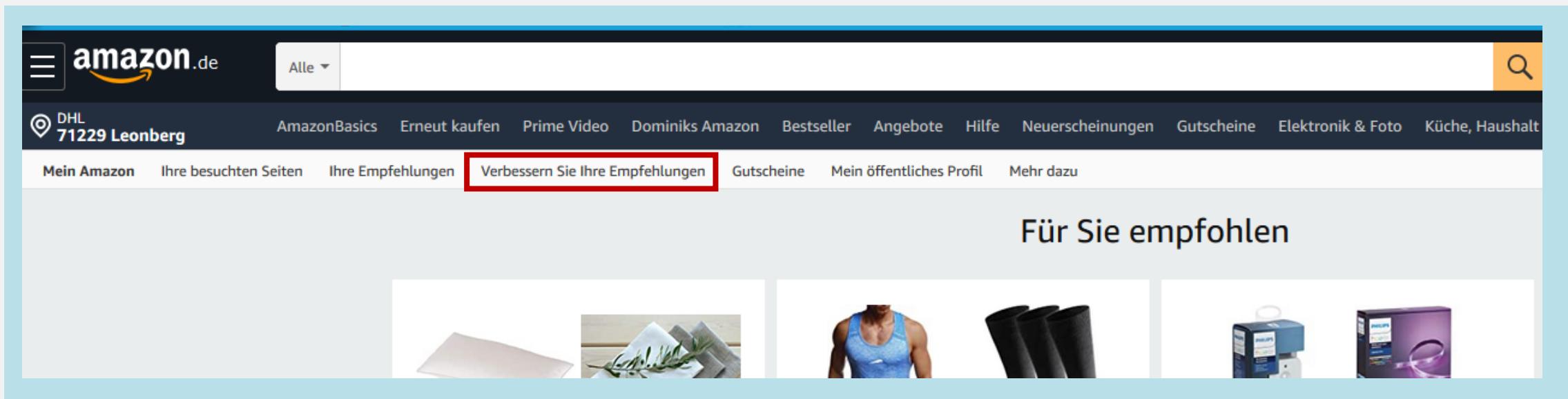
Adapted from Amershi, S et al. (2019)

9.4 AI Design Guideline: When wrong

9

G9 - Support efficient correction.

- Make it easy to edit, refine, or recover when the AI system is wrong.
- **Example:** [Navigation, Product #1] “If [the product] is wrong about where I parked my car, it provides an easy way to edit the location by dragging on the map.”
- **Example:** [Web Search, Product #2] “automatically ‘corrects’ spelling errors, etc. but gives option at top to return to query as originally typed...Notes that the query had been corrected and is one click to revert back to original”



Adapted from Amershi, S et al. (2019)

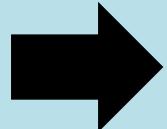
9.4 AI Design Guideline: When wrong

10

G10 - Scope services when in doubt.

- Engage in disambiguation or gracefully degrade the AI system's services when uncertain about a user's goals.
- **Example:** [Navigation, Product #1] "If more than one line takes the same route the user can choose between the preferred line."
- **Example:** [Autocomplete, Product #1] "It usually provides 3-4 suggestions instead of directly auto completing it for you"

I would like a romantic place
for Italian food near my
office



Hey, I found these Italian
restaurants which reviews say
are romantic close to your work

Adapted from Amershi, S et al. (2019)

9.4 AI Design Guideline: When wrong

11

G11 - Make clear why the system did what it did.

- Enable the user to access an explanation of why the AI system behaved as it did.
- **Example:** [E-commerce, Product #1] “Clicking “Why recommended” explains why they have recommended that particular item to you.”
- **Example:** [Music Recommenders, Product #2] “I think this applies because each of recommendation has some information as to which songs are displayed on it - similar to the song, from the same artist, from the same album etc.”

The image contains two screenshots. The left screenshot shows the Google News interface with a heading 'Optimieren, was auf Google News personalisiert angezeigt wird'. It includes a paragraph explaining personalization and a note that the feature is available if logged into a Google account. The right screenshot shows a news article from finanz-szene.de with the title 'Zins-Attacke: DKB liebäugelt mit revolvierenden Kreditkarten' and a small image of a hand holding a credit card.

Adapted from Amershi, S et al. (2019)

9.4 AI Design Guideline: Over time

12

G12 - Remember recent interactions.

- Maintain short term memory and allow the user to make efficient references to that memory.
- **Example:** [Navigation, Product #1] “Opening the app shows a list of recent destinations, as well as allows you to access “favorite” locations.”
- **Example:** [Voice Assistants, Product #1] “[The assistant] seems to remember conversation context at least one command back. When asked “[wake command], what’s the reminder?” she announces the last unheard remind me.”

Resume the last played audiobook: "Alexa, resume my book."



Adapted from Amershi, S et al. (2019)

9.4 AI Design Guideline: Over time

13

G13 - Learn from user behavior.

- Personalize the user's experience by learning from their actions over time.
- **Example:** [Music Recommenders, Product #2] "I think this is applied because every action to add a song to the list triggers new recommendations."
- **Example:** [Email, Product #1] "(My guess is) the system learns from what previous emails have attracted more attention from me (i.e. longer/more frequent reply, reading time taken, longer email threads, etc.) and infer email importance."

The screenshot shows a user's Amazon Prime account dashboard. At the top, there's a navigation bar with a search icon, a German flag, a greeting 'Hallo, Dominik', a 'Konto und Listen' dropdown, links for 'Warenrücksendungen und Bestellungen', 'Entdecken Sie Prime', and a shopping cart icon with '0' items labeled 'Einkaufswagen'. Below the navigation, there are four main sections: 'Nochmals kaufen' (highlighted with a red border), 'Meine Listen', 'Mein Konto', and a promotional banner for 'Amazon Prime | 30 Tage gratis nutzen'. The 'Nochmals kaufen' section displays a product thumbnail for 'PARADIES Kopfkissen Softy-Tip medium 40 x 80 cm' priced at '28,00 €' with a 'In den Einkaufswagen' button. The 'Meine Listen' section lists 'Alexa-Einkaufsliste' (0 Artikel), 'Wunschzettel', 'Einkaufsliste', 'Bücher und Hörbücher', and 'Ihre Listen'. The 'Mein Konto' section lists 'Mein Konto', 'Meine Bestellungen', 'Meine Dash Buttons', 'Wunschzettel', 'Empfehlungen', and 'Spar-Abo verwalten'.

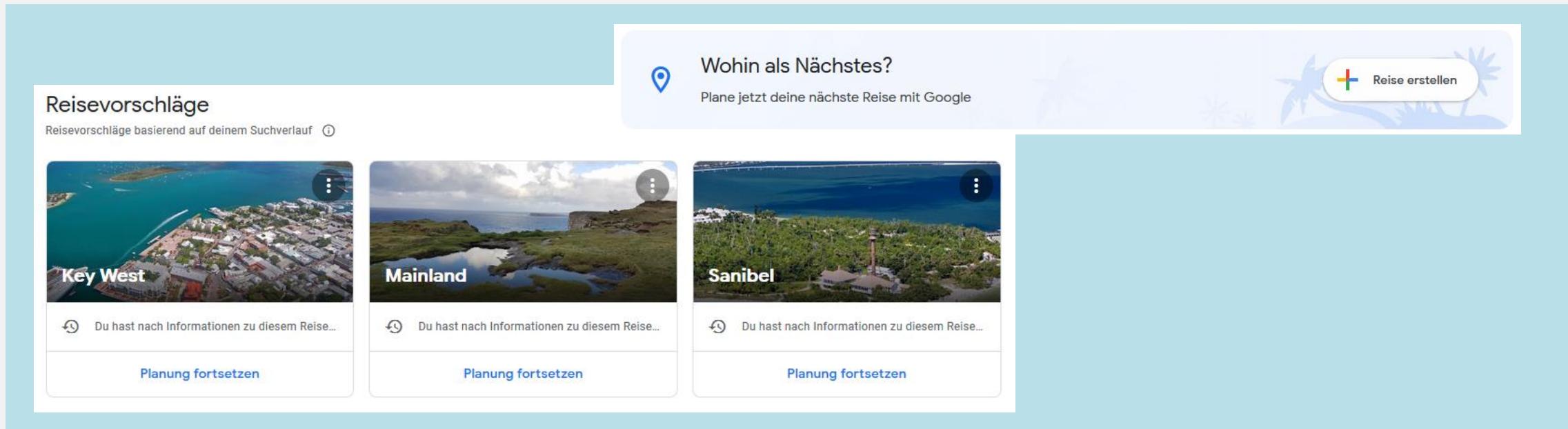
Adapted from Amershi, S et al. (2019)

9.4 AI Design Guideline: Over time

14

G14 - Update and adapt cautiously

- Limit disruptive changes when updating and adapting the AI system's behaviors.
- **Example:** [Music Recommenders, Product #2] “Once we select a song they update the immediate song list below but keeps the above one constant.”
- **Example:** [Social Networks, Product #1] “Think this is good. When I unfollow someone it shows there stuff for a little bit? But after a day or so its gone. Or once I reload. But not RIGHT away.”



Adapted from Amershi, S et al. (2019)

9.4 AI Design Guideline: Over time

15

G15 - Encourage granular feedback.

- Enable the user to provide feedback indicating their preferences during regular interaction with the AI system.
- **Example:** [Music Recommenders, Product #1] “Love/dislike buttons are prominent and easily accessible.”
- **Example:** [Email, Product #1] “The user can directly mark something as important, when the AI hadn’t marked it as that previously.”



Adapted from Amershi, S et al. (2019)

9.4 AI Design Guideline: Over time

16

G16 - Convey the consequences of user actions.

- Immediately update or convey how user actions will impact future behaviors of the AI system.
- **Example:** [Music Recommenders, Product #1] “Tapping the like/dislike button results in immediate popups informing that the user will receive more/fewer recommendations like it.”
- **Example:** [Web Search, Product #1] “With different filters, the search results are auto updated.”



Google

decision support sys|

X

- decision support system
- decision support systems
- decision support system example
- decision support system beispiel
- decision support system deutsch

Adapted from Amershi, S et al. (2019)

9.4 AI Design Guideline: Over time

17

G17 - Provide global controls

- Allow the user to globally customize what the AI system monitors and how it behaves.
- **Example:** [Web Search. Product #2] “It has settings such as...private results that help users get results that are more relevant to them.”
- **Example:** [Photo Organizers, Product #1] “[The product] allows users to turn on your location history so the AI can group photos by where you have been.”

The image shows a mobile application interface for travel planning. The main header reads "Wohin als Nächstes?" with a location pin icon. Below it, the text "Plane jetzt deine nächste Reise mit Google" is displayed. A red box highlights the text "Nur für dich sichtbar" (Visible only to you) with an info icon. To the right, there is a grid of travel-related images labeled "Orte" (Places), showing various locations like Pfullingen, Klichberg, Feldberg (Schwarzwald), Rust, Santa Clara, Ettlingen, Wien, Hué, and Nhâ Trang.

Adapted from Amershi, S et al. (2019)

9.4 AI Design Guideline: Over time

18

G18 - Notify users about changes.

- Inform the user when the AI system adds or updates its capabilities.
- **Example:** [Email, Product #2] “The help tab for the interface features a “What’s new” section which could be used to inform the user about AI system additions or capability updates.”
- **Example:** [Navigation, Product #2] “I don’t have a way to show this, but it does provide small in-app teaching callouts for important new features. New features that require my explicit attention are pop-ups.”



Adapted from Amershi, S et al. (2019)

9.4 Classroom Task



Previous
Exam Task!

Your turn!

Task

Please name examples from real-life AI applications for the following design recommendations:

- G3 - Time services based on context.
- G7 - Support efficient invocation.
- G14 - Update and adapt cautiously

Outline

9

Building Productive AI-based Information Systems

9.1

Why AI Projects Fail

9.2

AI Project Management

9.3

Ethics and Trust in AI

9.4

Human AI Interaction

9.5

Explainable and Understandable AI (XAI)

9.6

How to Continue your AI Journey

Exam Preparation and Course Repetitorium

Capstone Project / Case Challenge

► What you will learn:

- Why many AI-based Information systems and intelligent agents fail in practice and how to tackle common problems in implementing AI-based information systems and intelligent agents
- Outlook and Future steps if you are interested in an AI-job



Image source: [↗ Pixabay](#) (2019) / [↗ CCO](#)

► Duration:

- 180 min

► Relevant for Exam:

- 9.1, 9.3-9.4

9.6 Start your AI Journey



Image source: ↗ [Pixabay](#) (2019) / ↗ [CC0](#)

9.6 Start your AI Career!

The screenshot shows a news article from the website of Wirtschaftswoche (Wirtschaft). The title of the article is „Der Arbeitsmarkt für KI-Experten ist leergefegt“ (The labor market for AI experts is empty). The author is DIETMAR HARHOFF, and it was published on 19.03.2019 at 10:18. Below the title is a portrait photo of Dietmar Harhoff, a man with glasses and a beard, wearing a suit and red tie. A small downward arrow icon is in the bottom left corner of the photo. The text below the photo discusses how Google and other tech giants pay high salaries to AI professionals, and the public research should not leave them to fend for themselves. A share icon is in the bottom right corner.

FORSCHUNGSGIPFEL IN BERLIN

„Der Arbeitsmarkt für
KI-Experten ist leergefegt“

VON DIETMAR HARHOFF
VERÖFFENTLICHT AM 19.03.2019 - 10:18

Google und die anderen Tech-Giganten zahlen KI-Profis hohe Gehälter. Die öffentliche Forschung sollte ihnen nicht das Feld überlassen, schreibt der Vorsitzende der Expertenkommission Forschung und Innovationspolitik in einem Gastbeitrag.

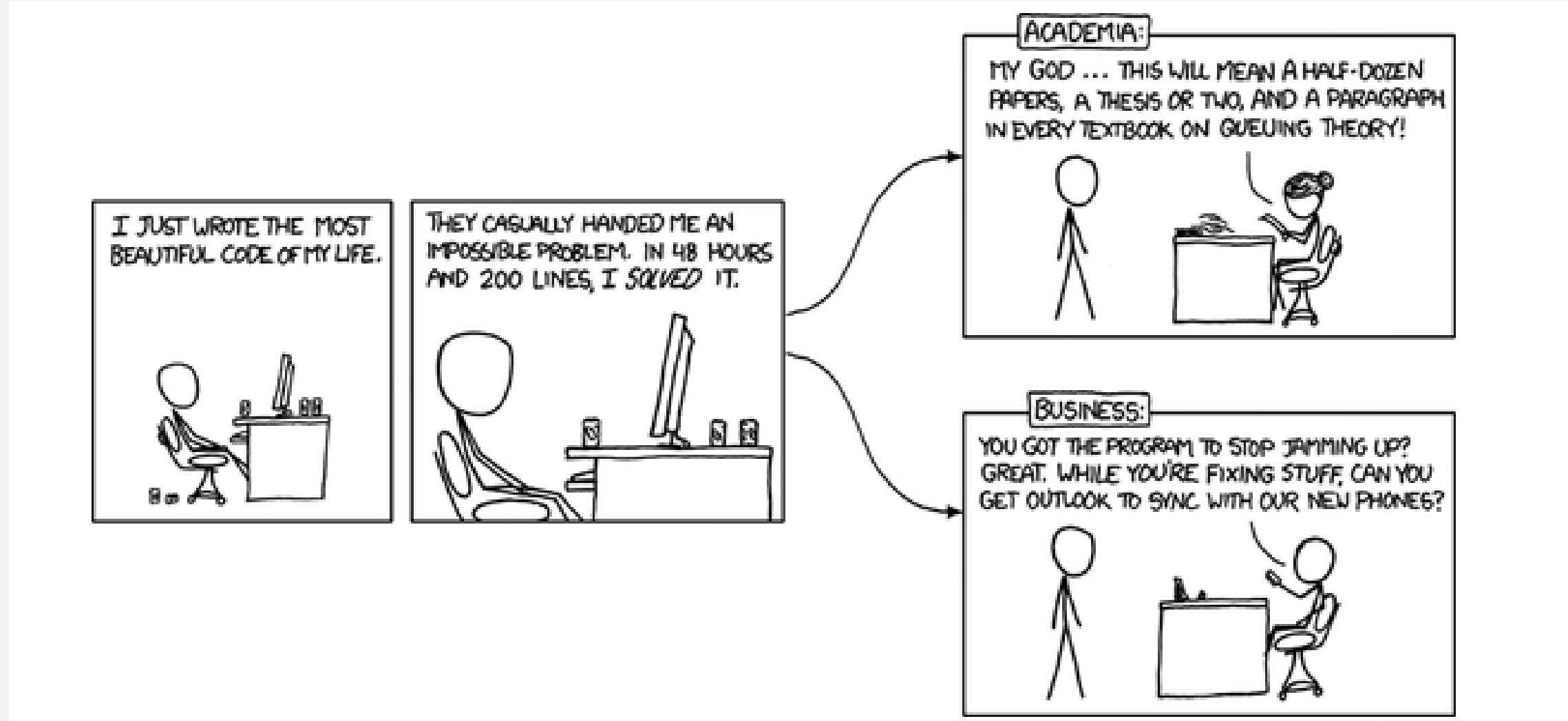
I can recommend to take courses in the following subjects to widen your practical AI skillset:

- Data Management and Warehousing
- Algorithms
- Software Engineering and Architecture
- Statistics and Operations Research

- Further AI fields: Natural Language Processing, Robotics, Machine Learning (!) etc.

- Application domains: Bio-Informatics, Econometrics etc.

9.6 PhD or Not



9.6 Maintaining Your Competitive Advantage is Hard

You Retweeted



Will Koehrsen
@koehrsen_will

Develop new algorithms as a PhD student: \$30k/year

Use pre-built sklearn models as a data scientist: \$120k/year

Build regression models in excel as a hedge fund analyst: \$200k/year

Make pie charts as a CEO: \$14 million/year

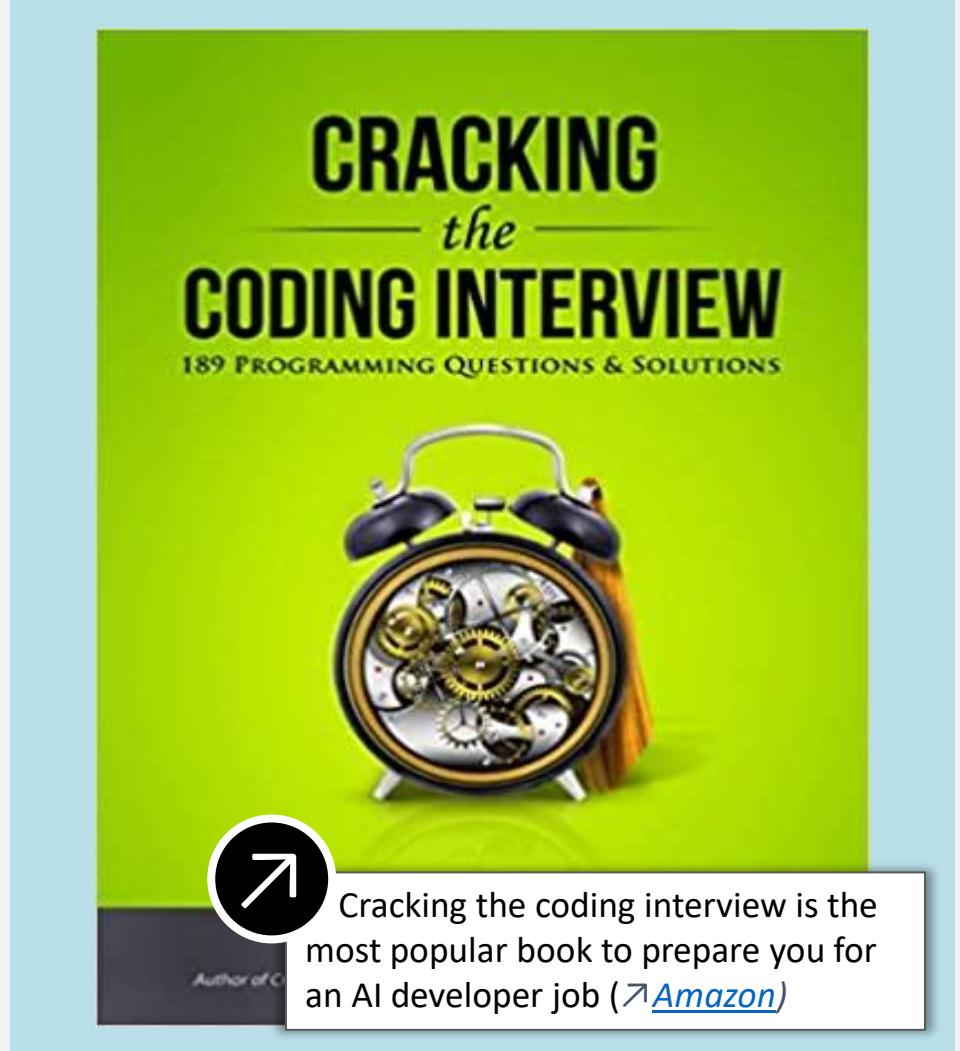
8:18 PM · 10/27/19 · Twitter Web App

5,460 Retweets 26.3K Likes

- Half-life of AI knowledge (see e.g. DistBelief, Toolboxes, AutoML)
- AI Tools will become more and more easy to use
- Better data will trump AI skills
- Do not rely solely on your AI Skills

9.6 Cracking the AI Interview

- If you apply for an AI job in big or in IT companies you will probably face a coding interview
- Coding interviews require some preparation (or many many years experience as AI developer)
- Best preparation is to apply for student jobs besides your studies



Your next project: AI Capstone (e.g. 2021 with Porsche AG)



9. Exercises

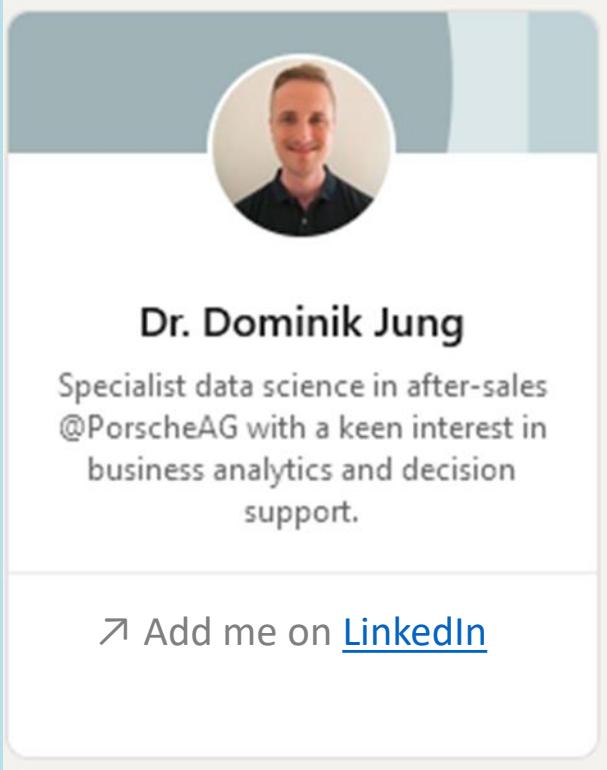
Workbook Exercises

- Please read the chapters 26 to 27 from Rusell, S., & Norvig, P. (2016) and reflect the pros and cons of AI for i) your life, ii) everyday's life iii) application in industry iv) civilization. Then work through the exercises of the chapters.

Coding Exercises

- Due to capstone project or case challenge, there will be no coding exercises in this chapter

9. Feel Free to Add me on LinkedIn



A screenshot of a LinkedIn profile card. It features a circular profile picture of a man with short brown hair, wearing a dark blue shirt. Below the picture, the name "Dr. Dominik Jung" is displayed in bold black text. Underneath the name, a descriptive text reads: "Specialist data science in after-sales @PorscheAG with a keen interest in business analytics and decision support." At the bottom of the card, there is a button with the text "↗ Add me on [LinkedIn](#)".

- If you want to stay in contact or if have further job-related questions, you can add me on LinkedIn. I try to answer most messages on my weekends.
- Additionally, I try continuously to improve and update the course material on git, hence if you have any experiences, ideas, wishes, case studies, or questions please feel free to write me.

9. References

Literature

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2. Bernardi, L., Mavridis, T., & Estevez, P. (2019). 150 Successful Machine Learning Models: 6 Lessons Learned at Booking. com. In *Proceedings of the 25th ACM SIGKDD International Conference on Knowledge Discovery & Data Mining* (pp. 1743-1751). Online available at: <https://www.kdd.org/kdd2019/accepted-papers/view/150-successful-machine-learning-models-6-lessons-learned-at-booking.com>
3. Google (2019a): Google's People+AI Guidebook - Designing human-centered AI products. Online available at: <https://pair.withgoogle.com/guidebook>
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5. Zinkevich M (2019): Rules of Machine Learning - Best Practices of ML Engineering. Published on Google Developers. Online available at: <https://developers.google.com/machine-learning/guides/rules-of-ml>

News articles

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4. Sebayang A (2019): Wenn aus Aussetzfahrten eine neue U-Bahn-Linie wird. Golem Online. Online verfügbar unter: <https://www.golem.de/news/google-maps-in-berlin-wenn-aus-aussetzfahrten-eine-neue-u-bahn-linie-wird-1907-142415.html>

9. References

Images

All images that were not marked other ways are made by myself, or licensed ↗[CC0](#) from ↗[Pixabay](#).

Further reading

- I strongly recommend to take a look at Design Blog from Google (↗[Google Design](#)), where the Designers from Google share their knowledge and best practices. Further interesting tutorials and best practices you find on Google Developers Guide Archive (↗[Google Developers](#)). Both links are a must-read for information systems developer!
- The famous republica study raising very relevant questions about the usage of the COMPASS algorithm in the US is online available at: ↗[www.propublica.org](#)

9. Google's People+AI Guidebook (Google Research, Google Design)

+PAIR

GUIDEBOOK EXPLORABLES TOOLS RESEARCH



People + AI Guidebook

The People + AI Guidebook was written to help user experience (UX) professionals and product managers follow a human-centered approach to AI.

Getting Started

Its recommendations are based on data and insights from over a hundred individuals across Google product teams, industry experts, and academic research.

These six chapters follow the product development flow, and each one has a related worksheet to help turn guidance into action.

User Needs + Defining Success

Identify user needs, find AI opportunities, and design your reward function.

↗ Read Chapter ↘ Get Worksheet

Data Collection + Evaluation

Decide what data are required to meet your user needs, source data, and tune your machine learning model.

↗ Read Chapter

Mental Models

Explainability + Trust

Google's People+AI Guidebook
[↗ pair.withgoogle.com](https://pair.withgoogle.com)

9. Glossary

Explainable AI *Explainable AI (XAI) is artificial intelligence in which the results of the solution can be understood by humans. It contrasts with the concept of the "black box" in machine learning*

Product Backlog *An interactive, ordered list of the new features, changes to existing features, bug fixes, infrastructure changes or other activities that an AI developer team may deliver*

Product Owner *Defines the features of the AI product and is responsible for the profitability of the product (ROI)*

Scrum *Scrum is a project management framework. It defines roles, formalizes requirements management and ensures productive teamwork.*

Bucket List - US National Parks

1872 Yellowstone
1890 Yosemite (CA SP 1864)
Sequoia
1899 Mount Rainier
1902 Crater Lake
1903 Wind Cave
1906 Mesa Verde
1910 Glacier
1915 Rocky Mountain
1916 Lassen Volcanic (Cinder Cone NM & Lassen Peak NM 1907)
Hawaii Volcanoes (originally part of Hawaii NP)
Haleakala (originally part of Hawaii NP)
1917 Denali (originally Mt McKinley NP, renamed in 1980)
1919 Grand Canyon (NM 1908)
Zion (Mukuntuweap NM 1909)
Acadia (Sieur de Monts NM 1916, originally Lafayette NP, renamed in 1929)
1921 Hot Springs (Reservation 1832)
1926 Shenandoah (established 1935)
1928 Bryce Canyon (NM 1923)
1929 Grand Teton
1930 Carlsbad Caverns (1923)
1934 Everglades (established 1947)
Great Smoky Mountains (established 1940)
1938 Olympic (Mt Olympus NM 1909)
1940 Kings Canyon
Isle Royale
1941 Mammoth Cave

1944 Big Bend
1956 Virgin Islands
1962 Petrified Forest (NM 1906)
1964 Canyonlands
1966 Guadalupe Mountains (established 1972)
1968 North Cascades
Redwood
1971 Capitol Reef (NM 1937)
Voyageurs (established 1975)
Arches (NM 1929)
1978 Theodore Roosevelt (National Memorial Park 1947)
Badlands (NM 1929)
1980 Channel Islands (NM 1938)
Biscayne (NM 1968)
Katmai (NM 1918)
Glacier Bay (NM 1925)
Gates of the Arctic (NM 1978)
Kenai Fjords (NM 1978)
Kobuk Valley (NM 1978)
Lake Clark (NM 1978)
Wrangell St. Elias (NM 1978)
1986 Great Basin (Lehman Caves NM 1922)
1988 National Park of American Samoa (established 1993)
1992 Dry Tortugas (Fort Jefferson NM 1935)
1994 Death Valley (NM 1933)
Saguaro (NM 1933)
Joshua Tree (NM 1936)
1999 Black Canyon of the Gunnison (NM 1933)

2000 Cuyahoga Valley (National Recreation Area 1974)
2003 Congaree (Congaree Swamp NM 1976)
2004 Great Sand Dunes (NM 1932)
2013 Pinnacles (NM 1908)
2018 Gateway Arch (Jefferson National Expansion Memorial 1935)
2019 Indiana Dunes (National Lakeshore 1966)
White Sands (NM 1933)
2020 New River Gorge (National River 1978)