

Data Driven Foresight Helfen (Publikations-)Daten die Zukunft vorherzusagen?

Dr. Marcus John, KATI Lab, Fraunhofer INT
Offenes Forschungsseminar Kompetenznetzwerk Bibliometrie

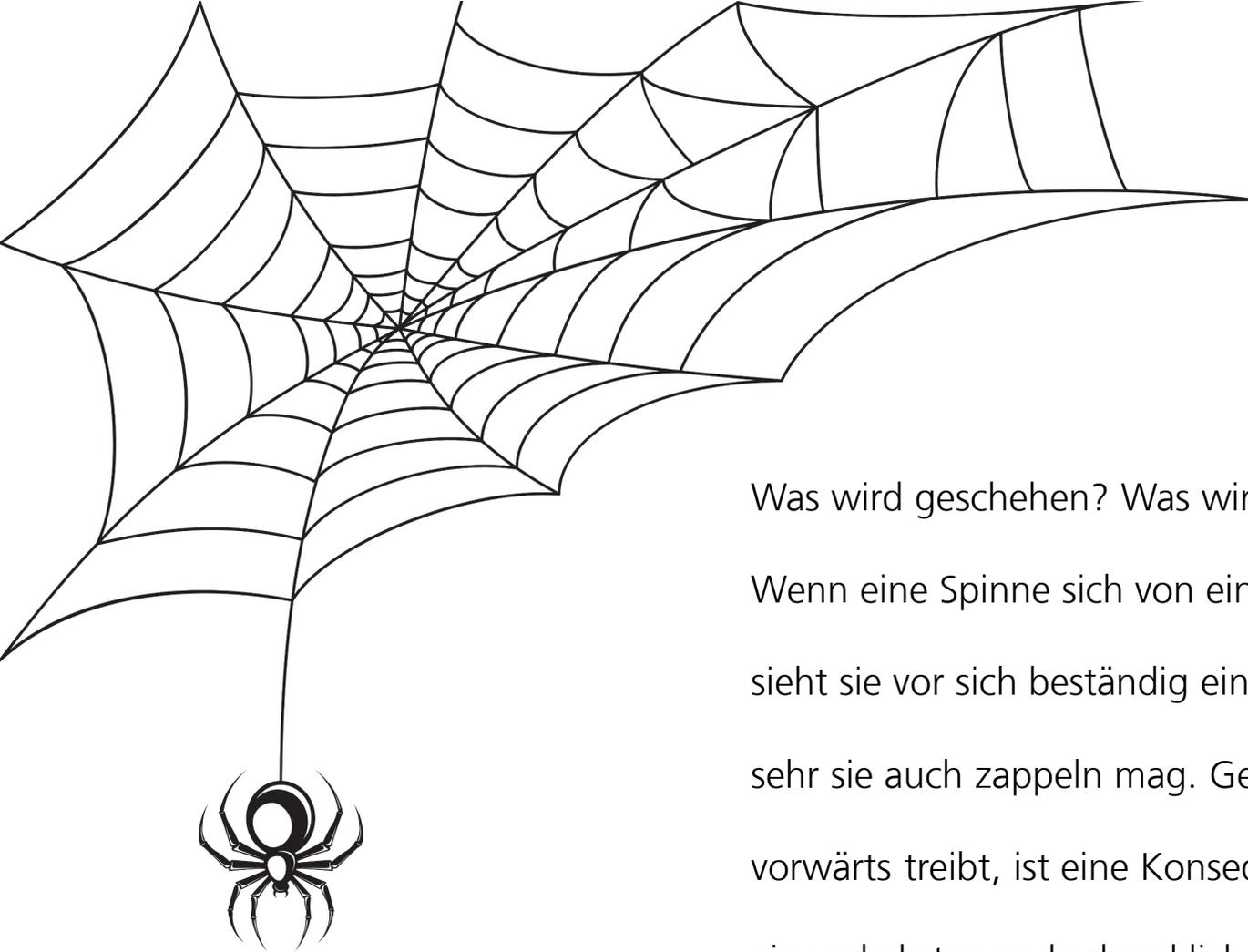
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Spoiler Alert
Jain!

Warum befassen wir uns mit der Zukunft?

Eine sehr kurzer Überblick über die
Zukunftsforschung



Was wird geschehen? Was wird die Zukunft bringen? Ich weiß nicht; ich ahne nichts.
Wenn eine Spinne sich von einem festen Punkte aus in ihre Konsequenzen hinabstürzt, da sieht sie vor sich beständig einen leeren Raum, in welchem sie nirgends Fuß findet, wie sehr sie auch zappeln mag. Geradeso geht es mir. Vorn immer ein leerer Raum; was mich vorwärts treibt, ist eine Konsequenz, deren erster Anstoß hinter mir liegt. Dieses Leben ist ein verkehrtes und schreckliches, nicht zum Aushalten.

Søren Kierkegaard, Entweder – Oder, 1843



Schwer zu sehen,

in ständiger Bewegung

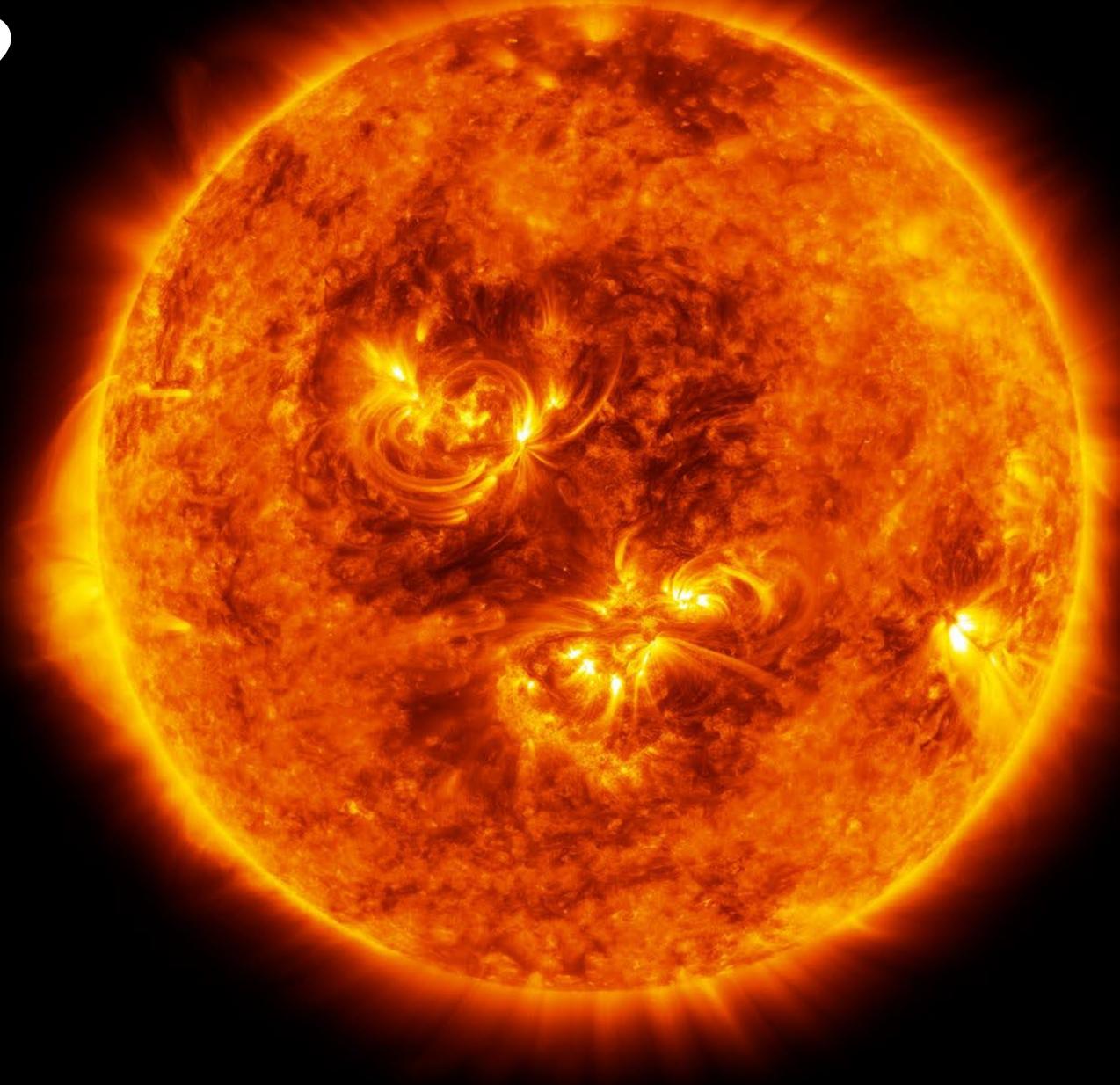
die **Zukunft** ist.



Can we **predict**

the future?

For a **star**?



YES we can



... quite well!

Das **Wetter** in 4 Tagen?



Nun ...

das ist schwierig!

16:17 Suchen Berlin

Map showing Berlin and surrounding areas with temperature indicators: Rathenow (24), Berlin (24), Gorzów Wielkopolski (23), Magdeburg (24), Zielona Góra (22), Cottbus (22).

aktuell heute morgen

Vorhersage

Nachmittag	Abend	Nacht	Vormittag
24°	19°	8°	17°
30 %	20 %	10 %	10 %

morgen 05.06.	Montag 06.06.	Dienstag 07.06.	Mittwoch 08.06.	Donnerstag 09.06.
27°	25°	24°	20°	22°
8°	16°	12°	13°	11°
15 h	6 h	9 h	2 h	15 h
40 %	80 %	30 %	50 %	0 %

Anzeige

16:17 Berlin

24°
Teils bewölkt
H:24° T:13°

Sonne erwartet gegen 20:00.

Jetzt	17 Uhr	18 Uhr	19 Uhr	20 Uhr
24°	24°	24°	23°	22°

10-TAGE-VORHERSAGE

Heute	So	Mo	Di	Mi
13° - 24°	10° - 28°	16° - 26° (80 %)	14° - 23° (60 %)	14° - 24° (40 %)

16:19 Berlin, Deutschland 16:19 CEST

24°

04:47 21:23

Time	Temp	Time	Temp	Time	Temp	Time	Temp
17:00	24°	18:00	24°	19:00	23°	20:00	22°
21:00	20°	22:00	18°	23:00	16°		

Day	Icon	Hoch	Tief
Heute		24°	15°
Sonntag		27°	11°
Montag		24°	17° (25%)
Dienstag		23°	14°
Mittwoch		23°	14°
Donnerstag		22°	14°
Freitag		24°	14°
Samstag		26°	16°
Sonntag		23°	16°
Montag		23°	15°

Weniger anzeigen ^ F° / C°

ANZI! SCROLLEN, UM MIT DEM INHALT FORTZUFAHREN

Gleicher Ausgangspunkt

Aber ..

Unterschiedliche Temperaturen

Unterschiedliche Regenwahrscheinlichkeit

Suchen Berlin

aktuell heute morgen

Vorhersage			
Nachmittag	Abend	Nacht	Vormittag
24°	19°	8°	17°
☁️☀️	☀️	🌙	☀️
🌧️ 30%	🌧️ 20%	🌧️ 10%	🌧️ 10%

morgen	Montag	Dienstag	Mittwoch	Donne
05.06.	06.06.	07.06.	08.06.	09.06.
27°	25°	24°	20°	22°
8°	16°	12°	13°	11°
☀️	☁️☀️	☁️☀️	☁️☀️	☀️
☀️ 15h	☀️ 6h	☀️ 9h	☀️ 2h	☀️
🌧️ 40%	🌧️ 80%	🌧️ 30%	🌧️ 50%	🌧️

16:17

Berlin 24°

Teils bewölkt
H:24° T:13°

Sonne erwartet gegen 20:00.

Jetzt	17 Uhr	18 Uhr	19 Uhr	20 Uhr
☁️☀️	☁️☀️	☁️☀️	☁️☀️	☀️
24°	24°	24°	23°	22°

10-TAGE-VORHERSAGE

Heute	So	Mo	Di	Mi
☁️☀️	☀️	☁️☔	☁️☔	☁️☔
13° - 24°	10° - 28°	16° - 26°	14° - 23°	14° - 24°
		80%	60%	40%

Berlin, Deutschland
16:19 CEST

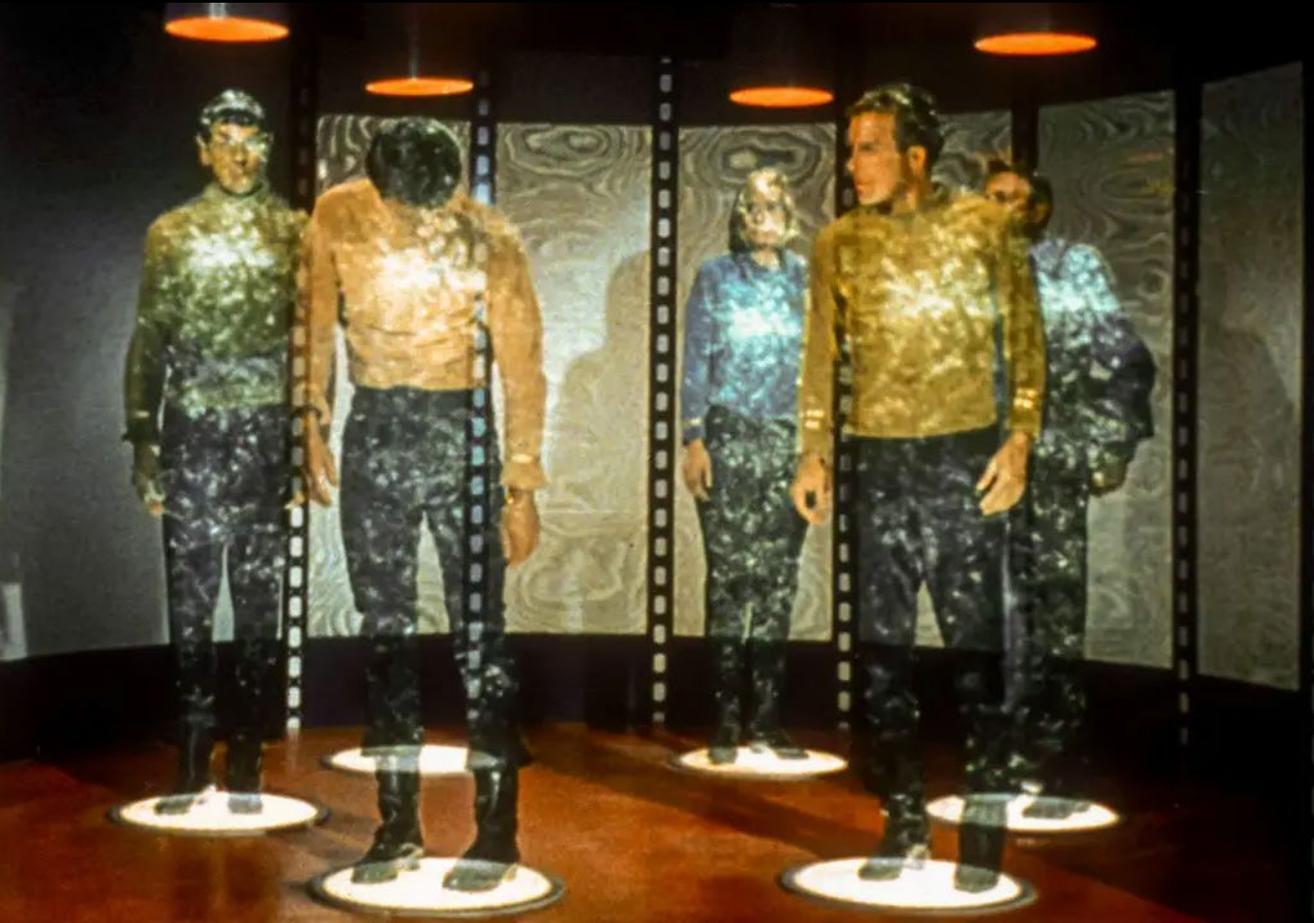
24

04:47 21:23

	Hoch	Tief
Heute	24°	15°
Sonntag	27°	11°
Montag	24°	17°
Dienstag	23°	14°
Mittwoch	23°	14°
Donnerstag	22°	14°
Freitag	24°	14°
Samstag	26°	16°
Sonntag	23°	16°
Montag	23°	15°

Weniger anzeigen ^ F° / C°

Und wie ist es mit



künftigen Technologien?



Schwer zu sehen,

in ständiger Bewegung

die **Zukunft** ist.

Warum lassen sich manche Systeme besser vorhersagen als andere?

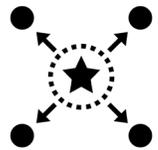
Ein kurzes Zwischenfazit



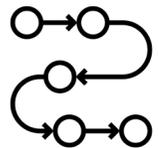
Sie lassen sich beobachten.



Sie lassen sich vermessen.



Es existiert ein Modell.



Es existiert ein (Erkenntnis)-Prozess.



Technologieorientierte Zukunftsforschung

Technologiefrühaufklärung



Woraus werden Pumpen
im Jahre 2030 gebaut?

Können wir den
Menschen
leistungsfähiger machen?

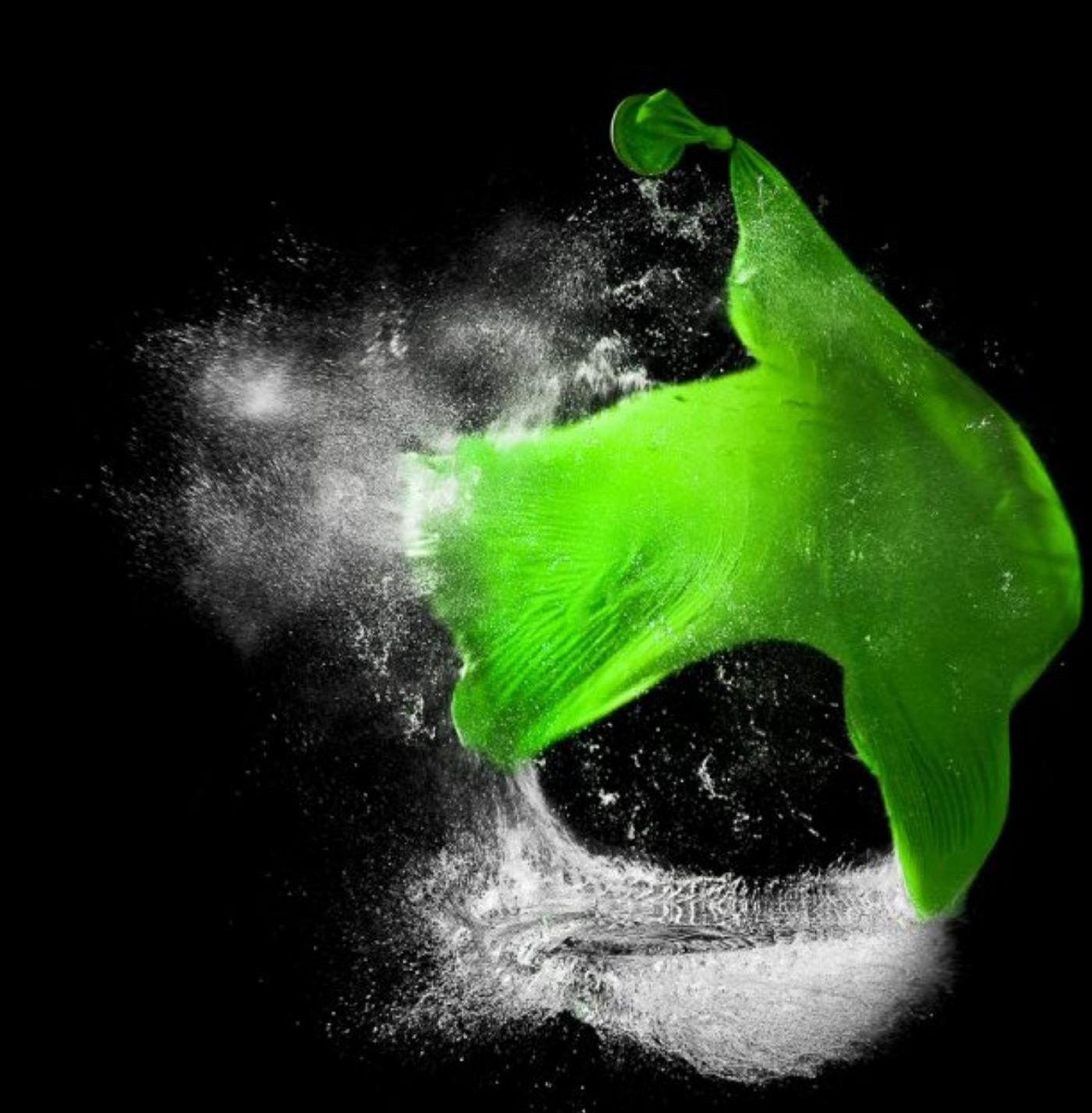
Werden wir 2035 noch
Waschmaschinen haben?



Zentrale Aufgaben der

Technologiefrühaufklärung

- **Befasst** sich mit langfristigen Entwicklungen
in Wissenschaft & Technologie.
- **Identifiziert** daraus resultierende Chancen & Risiken.
- **Betrachtet** das Zusammenspiel von Technik, Politik,
Ökonomie & Gesellschaft.

A bright green, textured, fish-like shape is shown against a black background. The shape has a rounded head, a dorsal fin, and a tail. It is surrounded by a spray of white particles, which appear to be dust or a fine mist, emanating from the left side and trailing behind the shape. The overall effect is dynamic and suggests movement or a process of transformation.

Technologiefrüh-

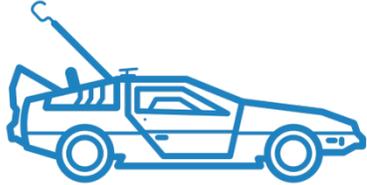
aufklärung

Warum ist Zukunftsforschung schwierig?

(Einige) Herausforderungen der Zukunftsforschung

Herausforderungen der Zukunftsforschung

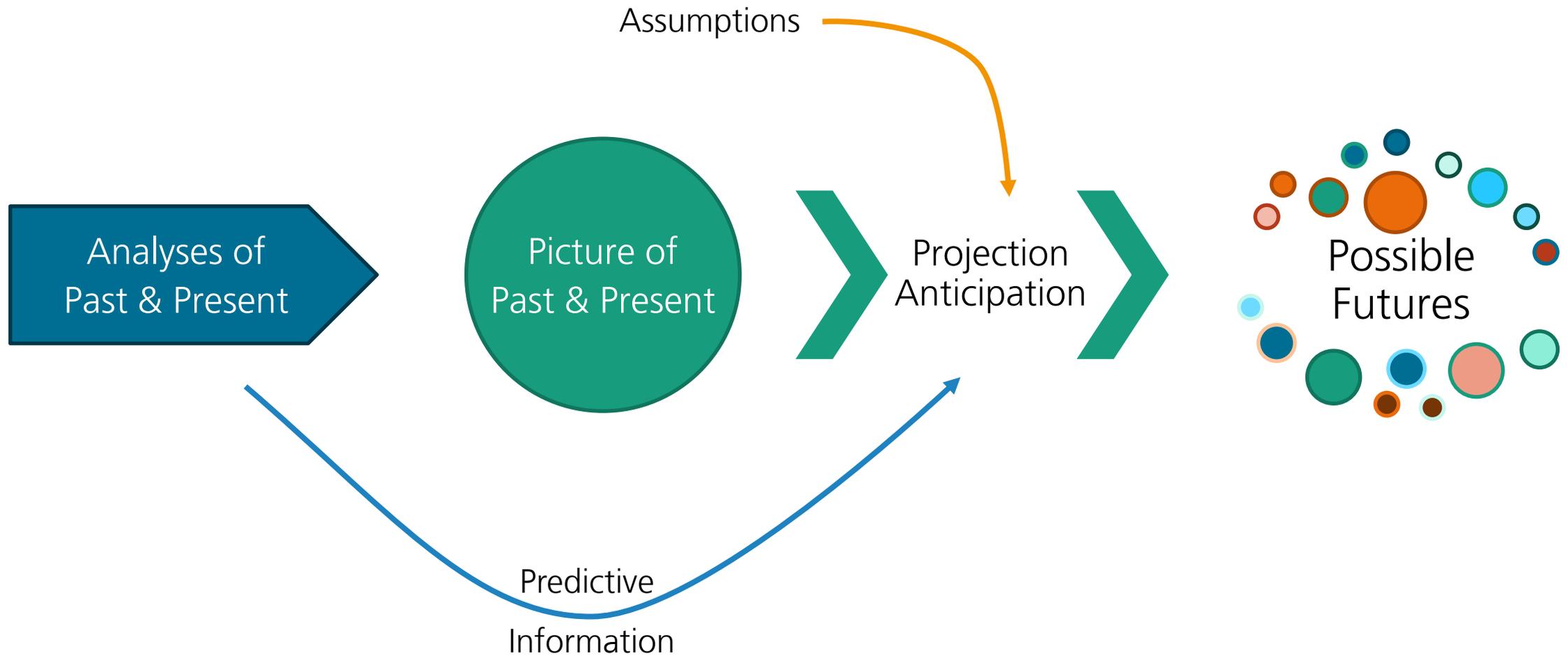
Herausforderung Nr. 1



The Problem of the missing DeLorean

Das Prognose Problem

Herausforderung Nr. 1





Die Technik von **Morgen**

basiert auf der **Forschung**, die

heute in den Labors

betrieben wird.

Technologiefrühaufklärung

benötigt eine Art

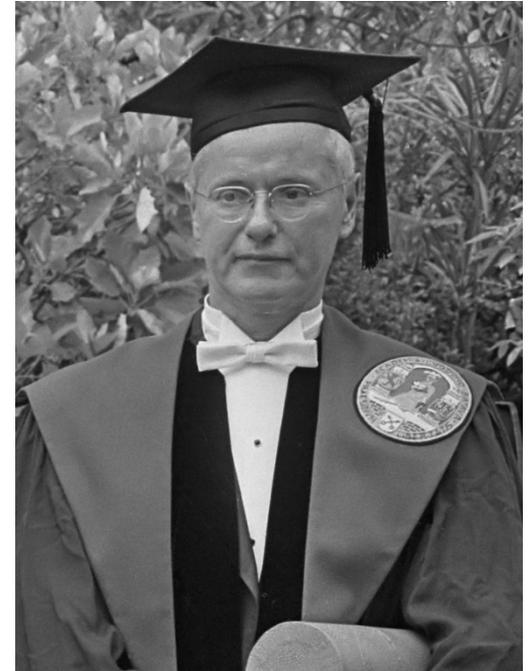
Science Observatory



Warum publizieren Wissenschaftler?

Ein kurzer Exkurs

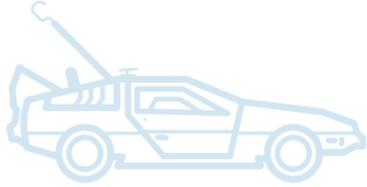
But, for science to be advanced, it is not enough that fruitful ideas be originated or new experiments developed or new problems formulated or new methods instituted. The innovations must be effectively communicated to others. That, after all, is what we mean by a contribution to science - something given to the common fund of knowledge.



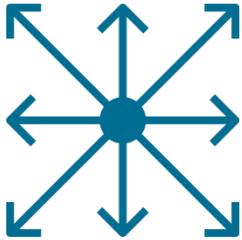
Robert K. Merton

Herausforderungen der Zukunftsforschung

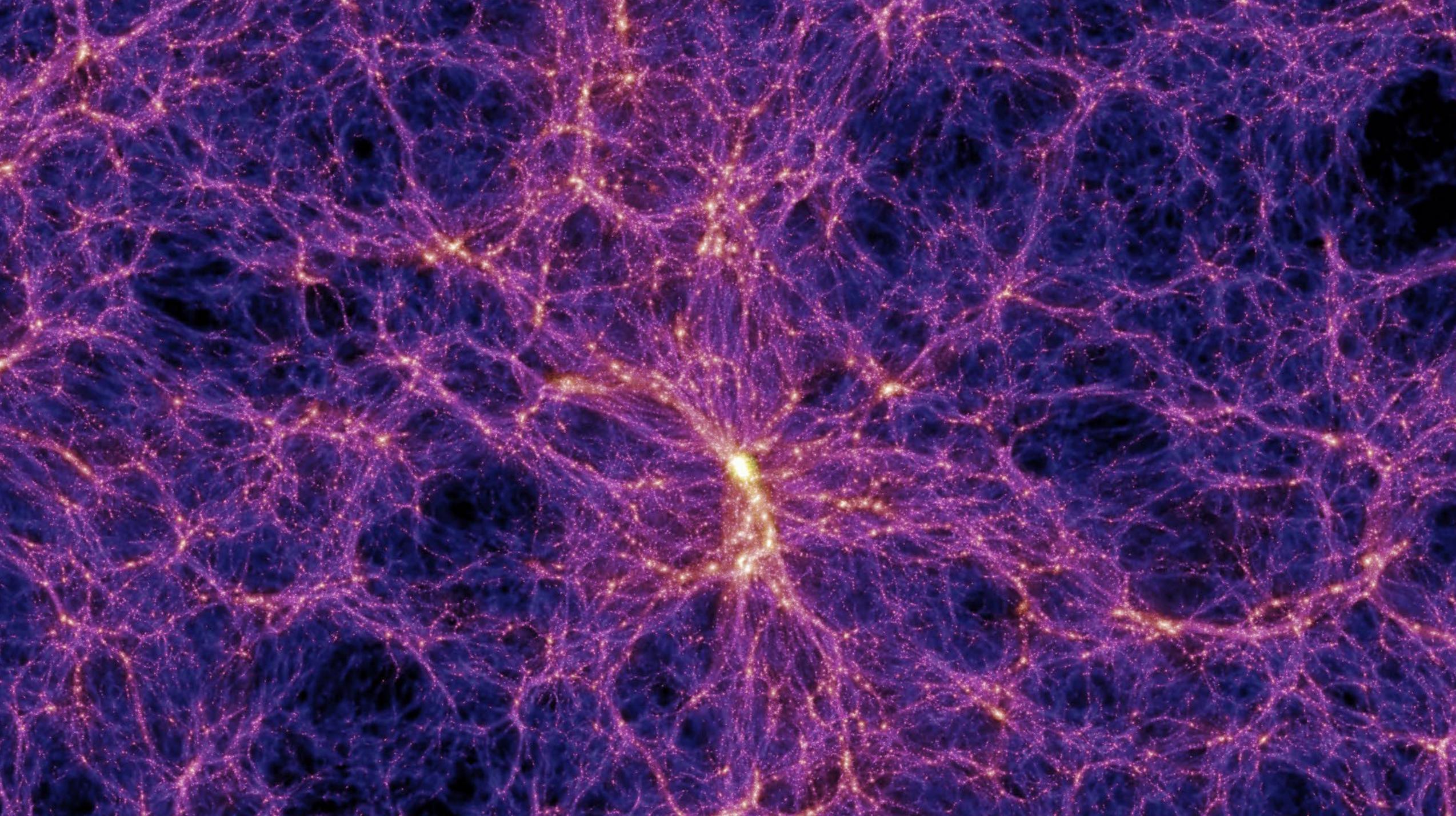
Herausforderung Nr. 2

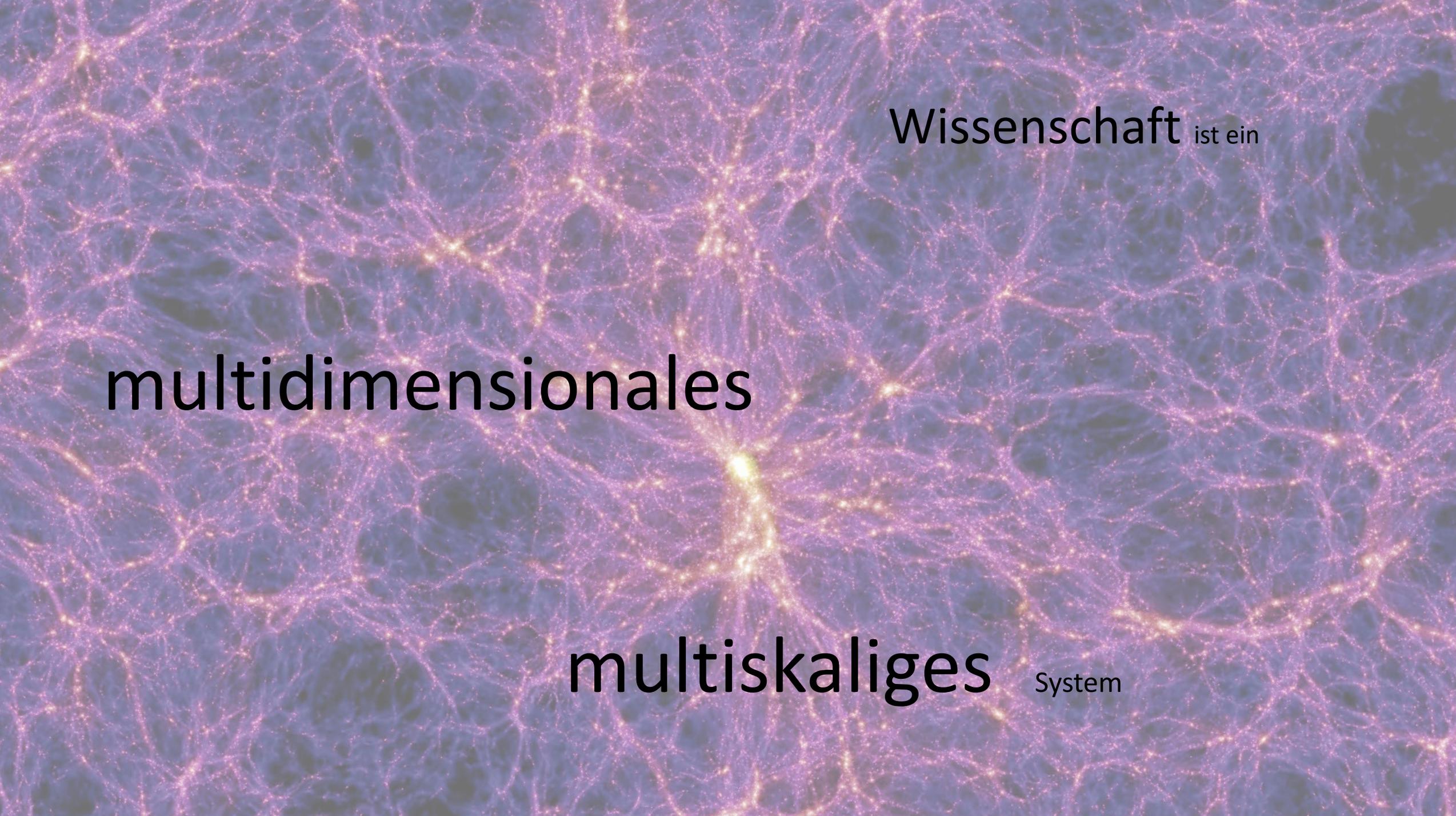


The Problem of the missing DeLorean



The Problem of Dimensionality



The background of the image is a complex, fractal-like structure representing the cosmic web. It consists of a dense network of thin, purple and blue filaments that intersect and branch out, creating a web-like pattern. Scattered throughout this network are numerous bright, yellowish-gold points of light, which represent galaxy clusters and individual galaxies. The overall appearance is that of a vast, interconnected system of matter in space.

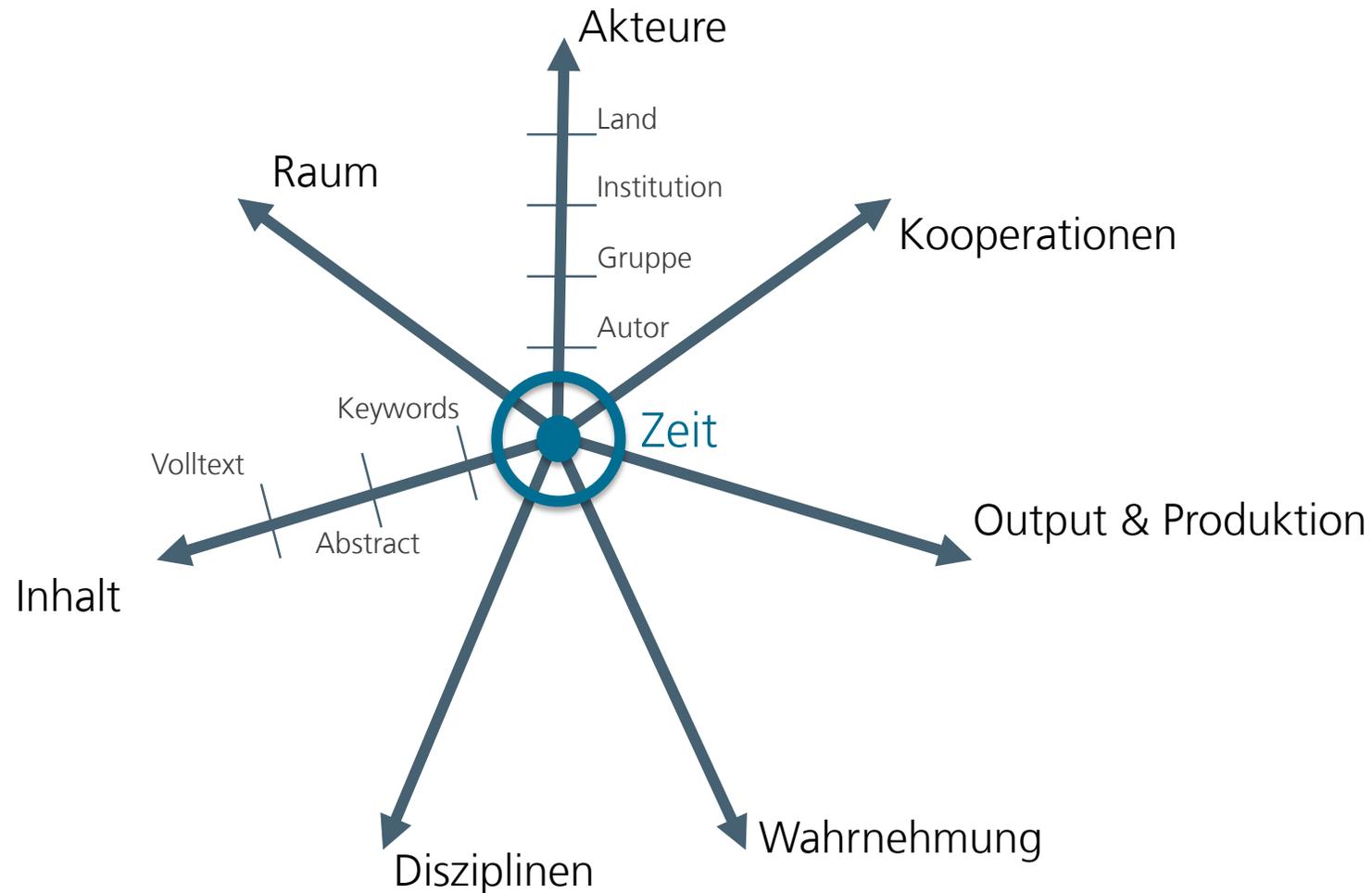
Wissenschaft ist ein

multidimensionales

multiskaliges System

Wissenschaft ist ein multidimensionales multiskaliges System

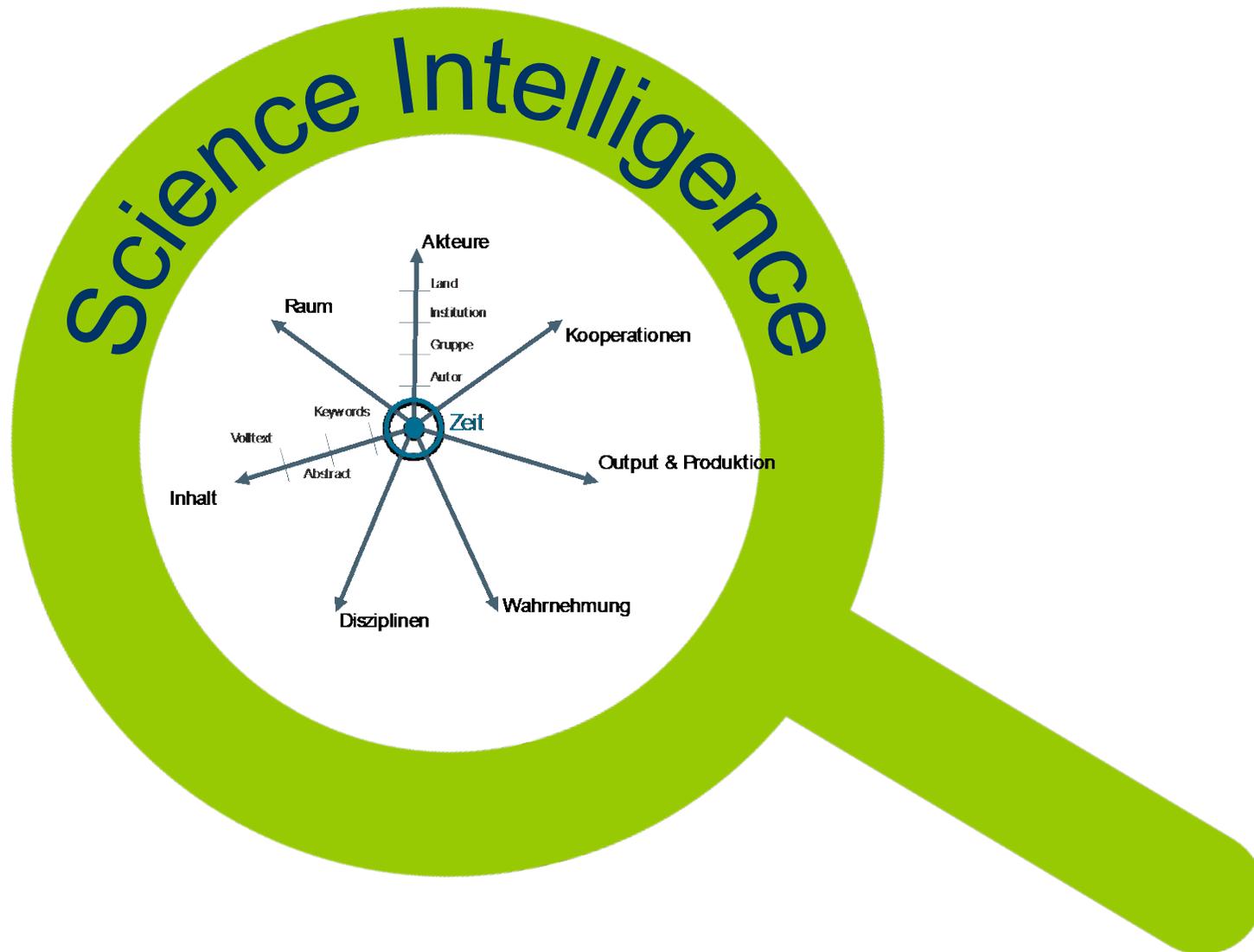
Herausforderung Nr. 2



Das System ist
dynamisch!

Wissenschaft ist ein multidimensionales multiskaliges System

Herausforderung Nr. 2



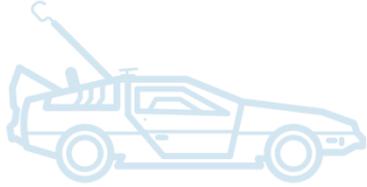
inhaltliche Analyse

+ daten-gestützte Analyse

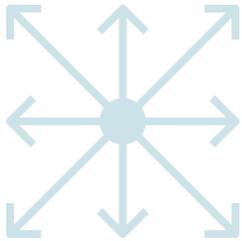
Science Intelligence

Herausforderungen der Zukunftsforschung

Herausforderung Nr. 3



The Problem of the missing DeLorean



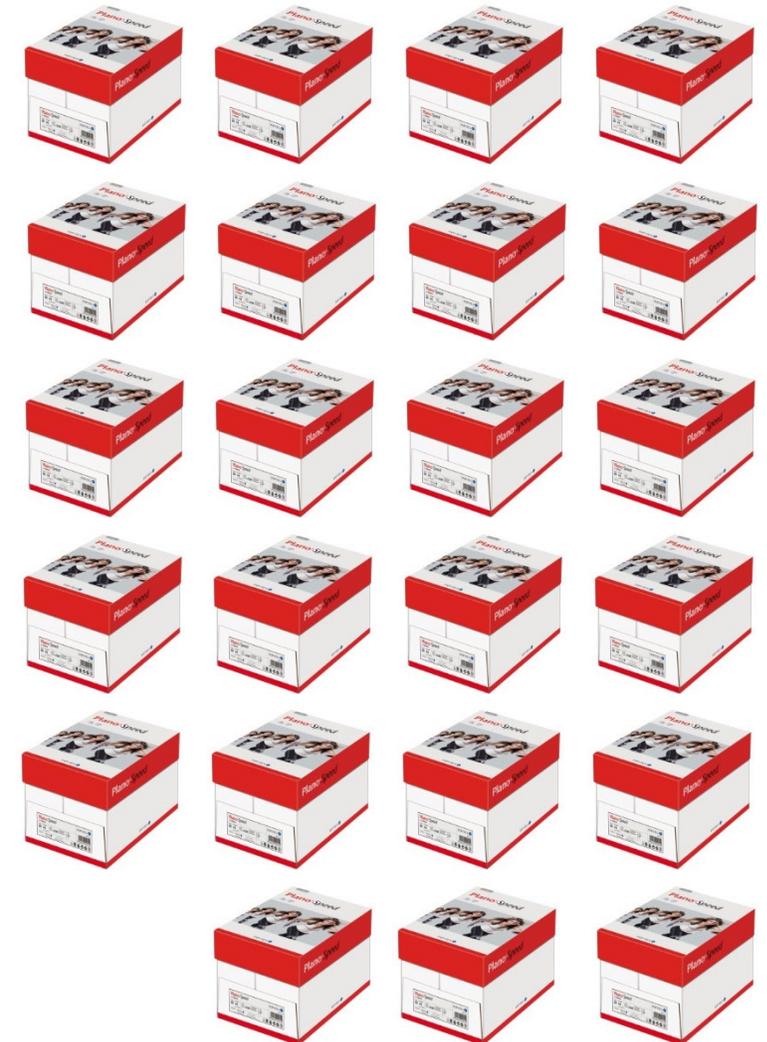
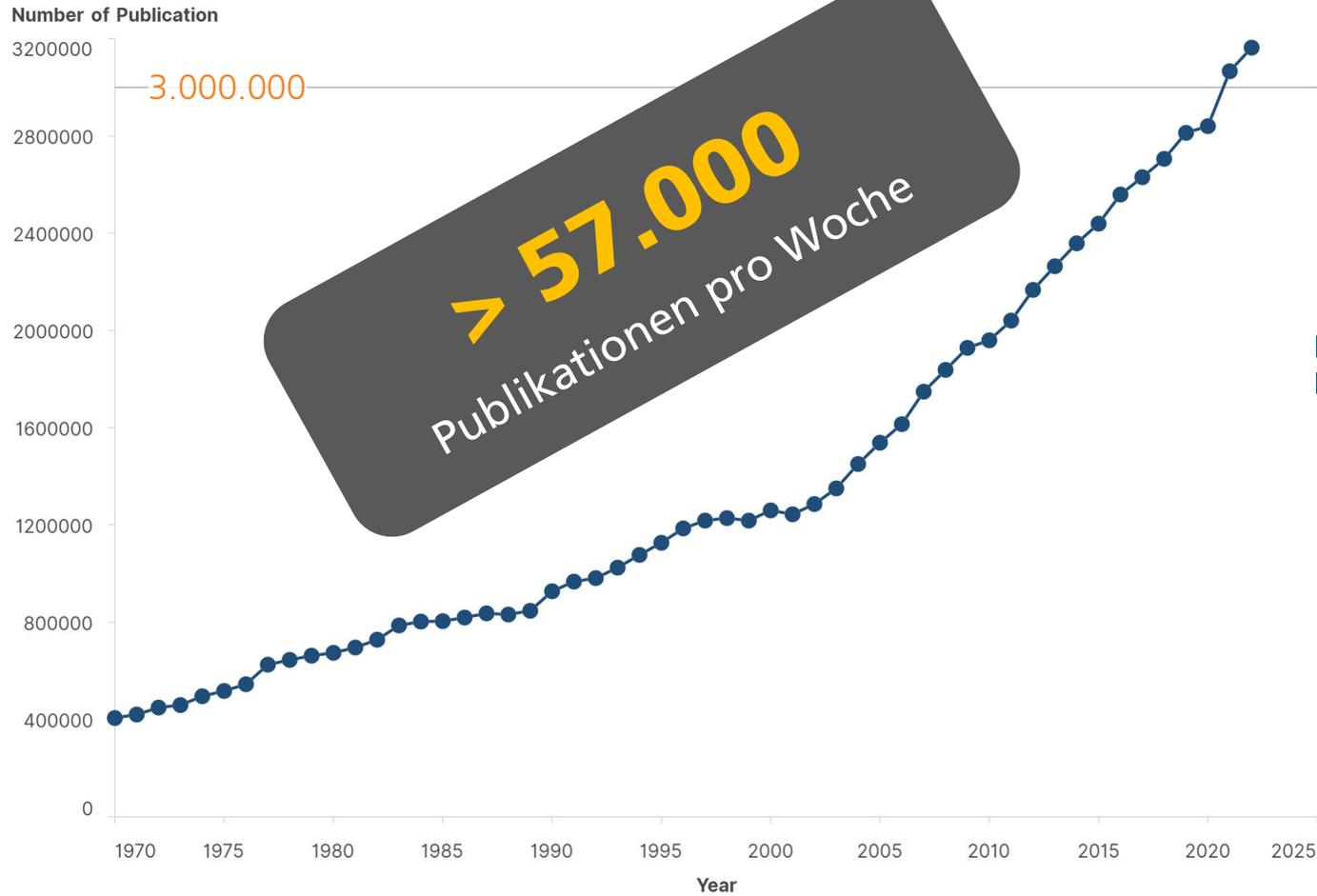
The Problem of Dimensionality



The Problem of Information Overload

Mehr als 3.000.000 Publikationen in 2021

Herausforderung Nr. 3



Wie

erkundet man

dieses unentdeckte Land?



Zutaten für Data Driven Foresight

Womit haben wir es zu tun?



Zukunftsforschung braucht ein gutes Verständnis des **Systems Wissenschaft**

A hand with light pink nail polish holds a yellow measuring tape. The tape is stretched across the frame, showing markings in centimeters and millimeters. The background is a blurred stack of books with various colored spines (blue, orange, green).

Warum sollten wir die **Werkzeuge**

der empirischen Wissenschaften

nicht auf die Wissenschaft

selbst anwenden?

Warum sollen wir

nicht **messen** und verallgemeinern,

Hypothesen aufstellen und Schlüsse ableiten?

Derek de Solla Price, Little Science, Big Science, 1963

Wissenschaft als System

Welche Ebene gibt es?



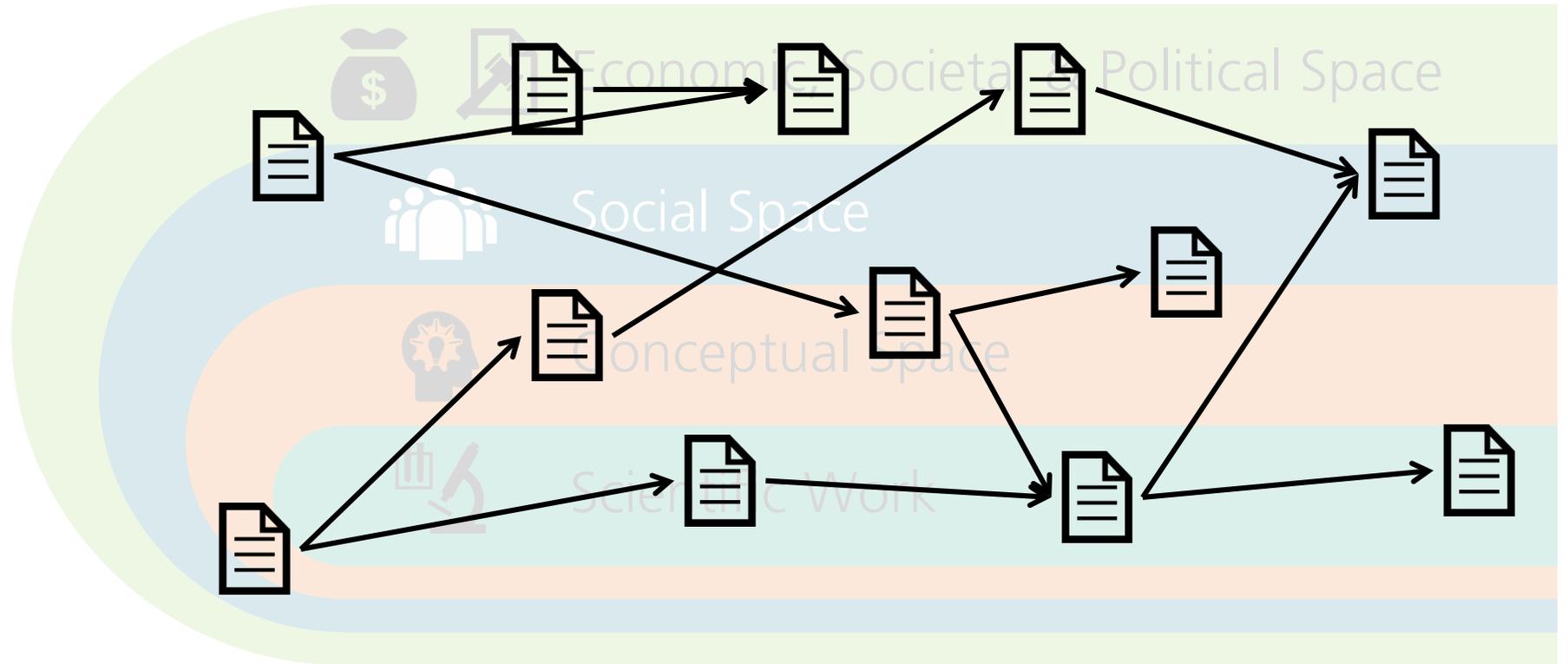
Wissenschaft als System

Und was können wir beobachten?

Bibliometrie ist eine Art

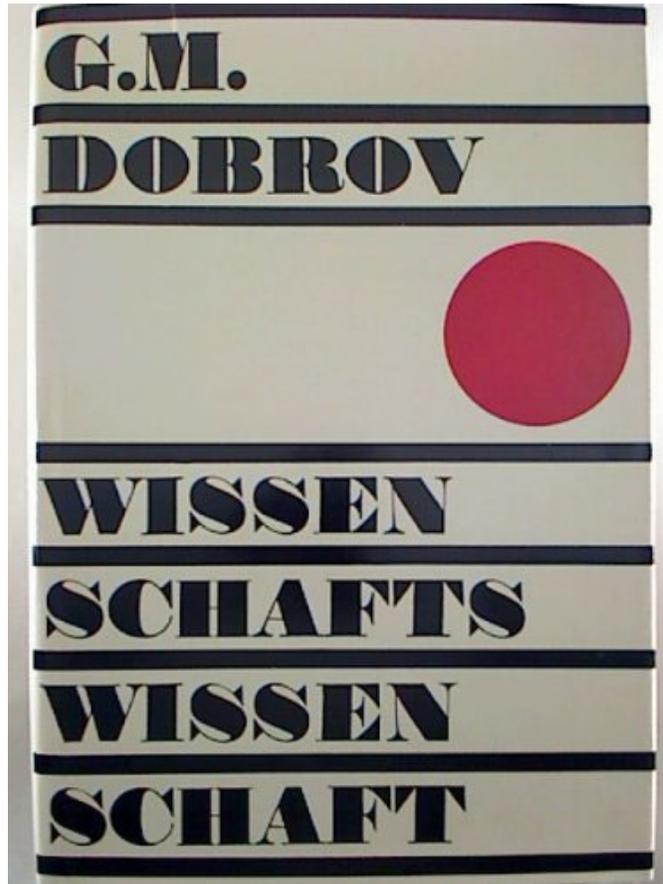
Seismograph der Wissenschaften

Publikationslandschaft



Science of Science

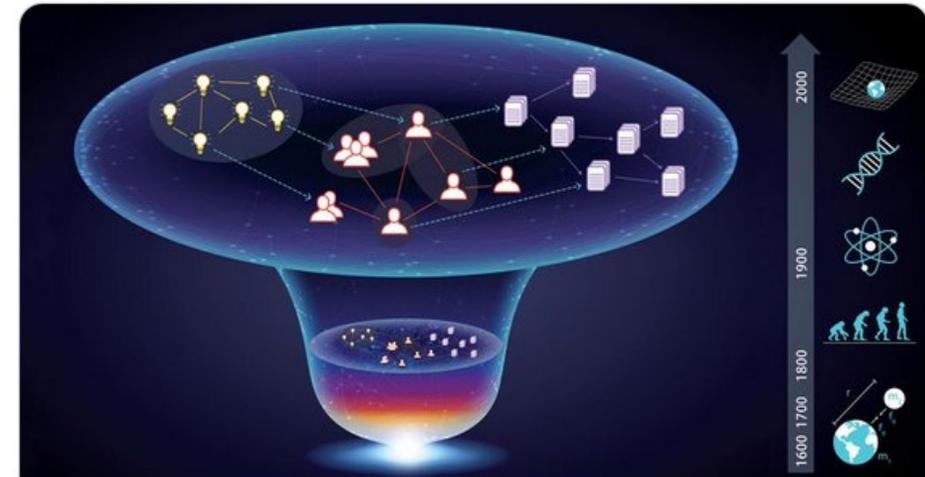
Alter Wein in (vielen) neuen Schläuchen



Emanuel Kulczycki
@ekulczycki

Replying to @schneider_jw

Always when I read that „science of science” is an emerging field (e.g. science.sciencemag.org/content/359/63...), I return to works of Znaniecki, Ossowski, Dobrov, and Nalimov (all translated into English for dozens of years) and read them again ;-)



Science of science

The science of science (SciSci) is based on a transdisciplinary approach that uses large data sets to study the mechanisms underlying the doing of science—from ...

science.sciencemag.org

Zutaten für Data Driven Foresight

Womit haben wir es zu tun?



Zukunftsforschung braucht ein gutes Verständnis des **Systems Wissenschaft**



Bibliometrie & Science of Science verbessern unser Verständnis des **Systems Wissenschaft**

The Future of Futurists:

Can a Machine Produce This Forecast?

By Randall Mayes

Artificial intelligence is becoming a disruptive force in growing numbers of knowledge-age professions—and futurism is not immune. Whether machines are able to conduct useful analysis and forecasts—i.e., whether the futurist “Singularity” is near or not—is subject to debate.

Quelle: [7]

As futurists, we scan articles for social trends and developments in emerging technologies, analyze them, and write scenarios or enlist panels of experts to provide short and long-term forecasts. Ultimately, the results help inform policy makers who are trying to solve complex world problems and businesses that have to make decisions regarding the bottom line.

What about the future of our own profession, futurism? Advances in data and cognitive analytics, struggling media companies, and breakthroughs in artificial intelligence (AI) are among the trends driving advances (and disruptions) in the knowledge industry, including foresight professionals.

Decision making is becoming increasingly automated in data-intensive fields, including military intelligence and a wide range of commercial applications, such as health care, education, energy, journalism, and finance. AI applications are not directly aimed at replacing futurists, but the major tools used by futurists are among those becoming increasingly automated (to wit, “predictive analytics”).

So, are the days numbered for human futurists laboriously scanning the Internet, analyzing trends, assembling expert panels, and writing forecasts? With the advances in the knowledge industry, how will the human-machine relationship change in future forecasting?

For futurists, trend analysis and

tured qualitative data, content not organized in databases (for example, the open-ended comments that respondents provide on surveys, in addition to their numerical choices). Analysts at International Data Corporation, a provider of market intelligence, estimate that as much as 80% of data is unstructured, and it is continually growing. Using the machine-learning technique of natural language processing, AI researchers have made significant progress in fusing the two types of data by giving unstructured data numerical values and then linking these values with structured data.

With machine learning, AI has also made breakthroughs in automated journalism. Today, robot journalism is more common than most people would suspect. Machines can scan the articles I used to research this article. However, can they compete with humans analyzing scanned content? This is the divisive and unresolved issue.

Moravec’s paradox states that computers currently have greater than adult-level intelligence in working with numbers, but they only have a one-year-old’s perception ability. To some, this has led to skepticism regarding the potential of cognitive analytics. This split on AI’s capabilities has led to two scenarios for the future.

The Singularity Is Not Near

While the AI era officially began at

failed to deliver on the promise of developing intelligent machines.

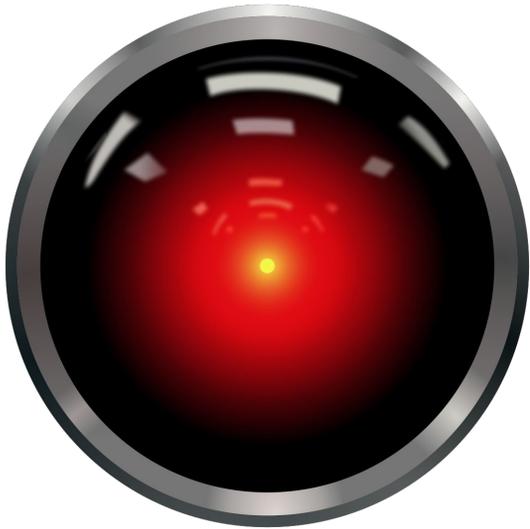
Most of us are familiar with the successful search engines Google and Bing for data mining, and the computational knowledge or answer engines Wolfram|Alpha and IBM’s Watson. IBM is currently working with Watson technology to design advanced analytics capabilities in the health-care industry. AI could potentially provide hospitals, physicians, and patients better access to critical and timely information and more-efficient diagnoses and treatments.

In order to address Moravec’s paradox and develop advanced cognitive analytics, AI researchers are turning to cognitive neuroscience. A current goal of AI research is to take what it learns about the brain and place it on neuromorphic chips (i.e., microprocessors that mimic the architecture of the brain).

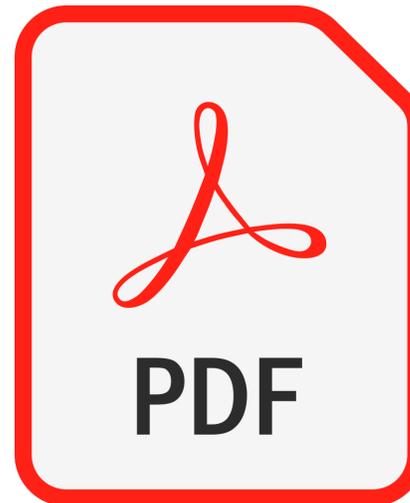
• **Brain Simulation.** Reverse engineering is one method that AI researchers are using to simulate the brain’s neural networks. Ventures such as the European Union’s Human Brain Project, Obama’s Brain Initiative, The Human Connectome Project, and the Allen Institute for Brain Science are dedicated to better understanding human brain circuitry. IBM’s SyNAPSE project is developing software using billions of neurons and trillions of synapses to create a model of the neocortex, the area of the brain responsible for perception, memory, and recursive hierarchal thinking.

ChatGPT als Zukunftsforscher?

Künstliche Intelligenz in der Zukunftsforschung



... und die Sehnsucht nach dem Create-PDF-Button!



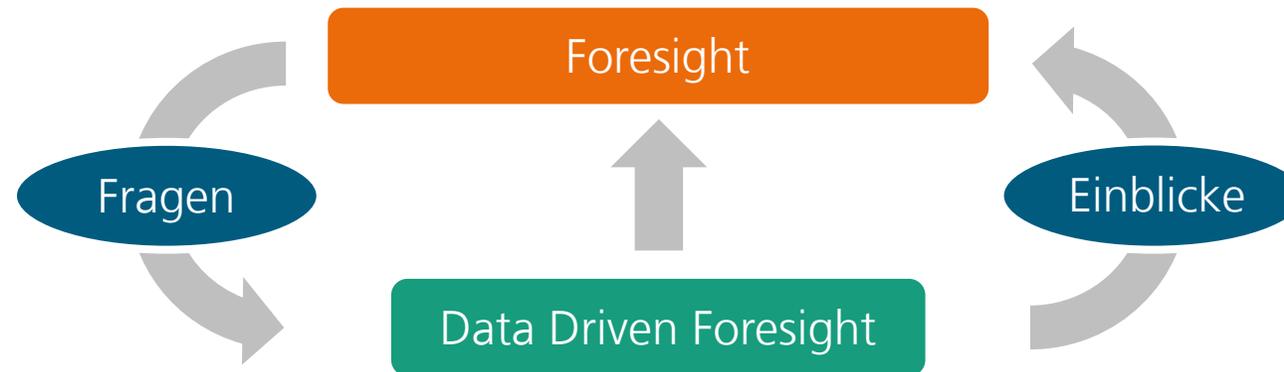
Hätte die Veranstaltung nicht
auch **KI** in der ZuFo
heißen können?



Data Driven Foresight

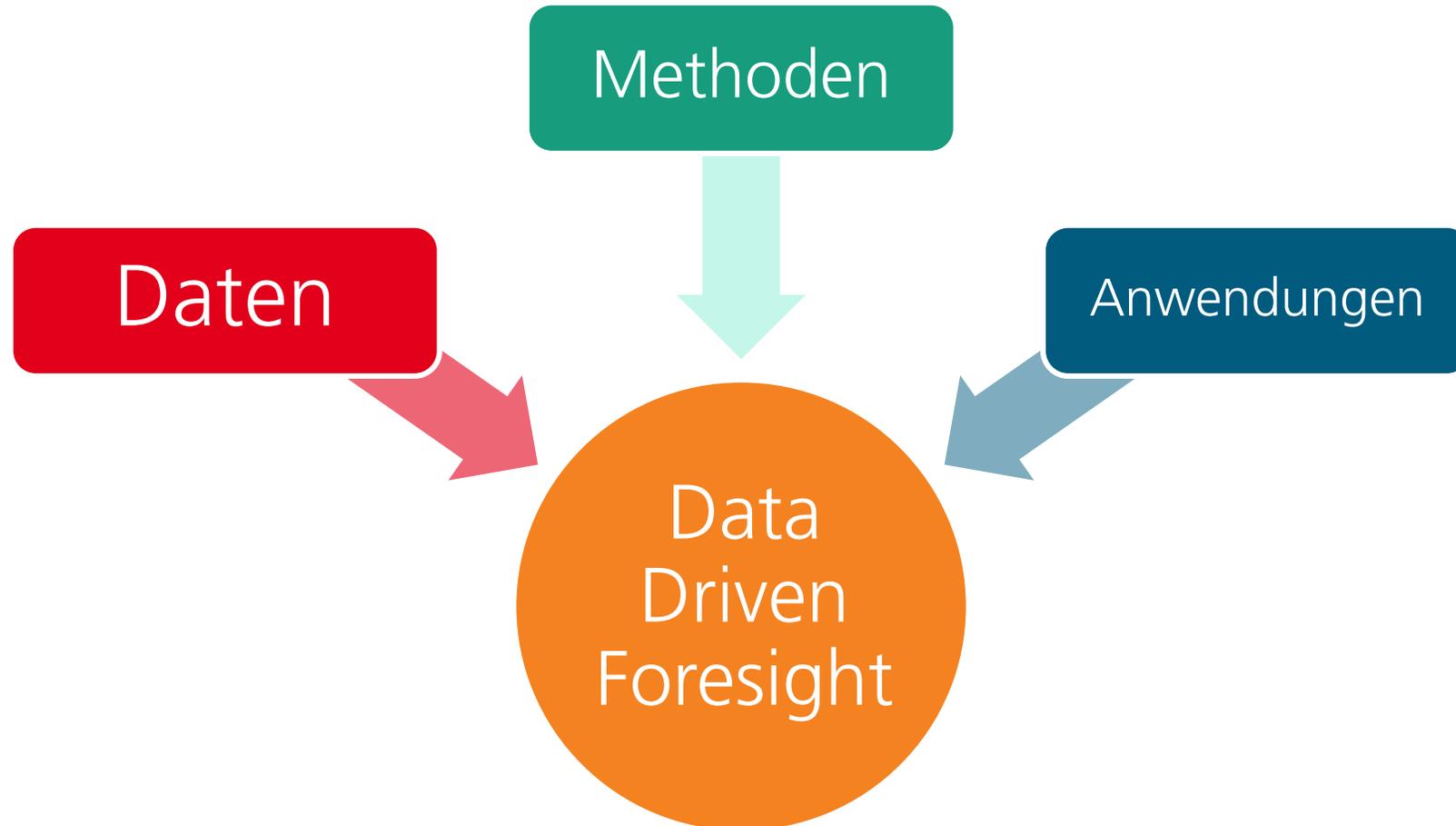
Eine erste Definition

Data Driven Foresight beschreibt einen Foresight-Prozess, welcher die Analyse großer Datenmengen nutzt, um aus diesen Aussagen über (technologische) Zukünfte zu generieren.



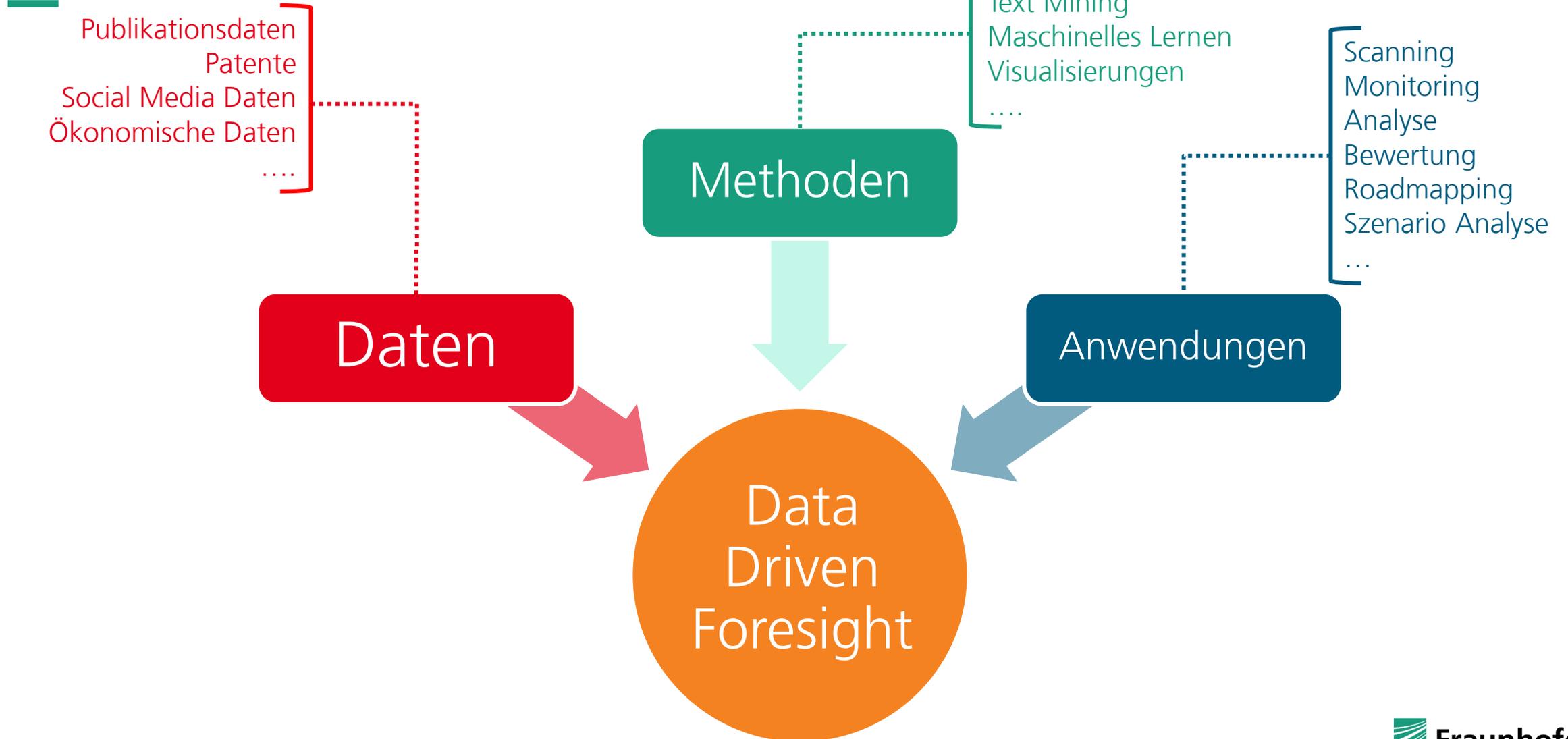
Dimensionen von Data Driven Foresight

Was braucht man?



Dimensionen von Data Driven Foresight

Was braucht man?



Zutaten für Data Driven Foresight

Womit haben wir es zu tun?



Zukunftsforschung braucht ein gutes Verständnis des **Systems Wissenschaft**



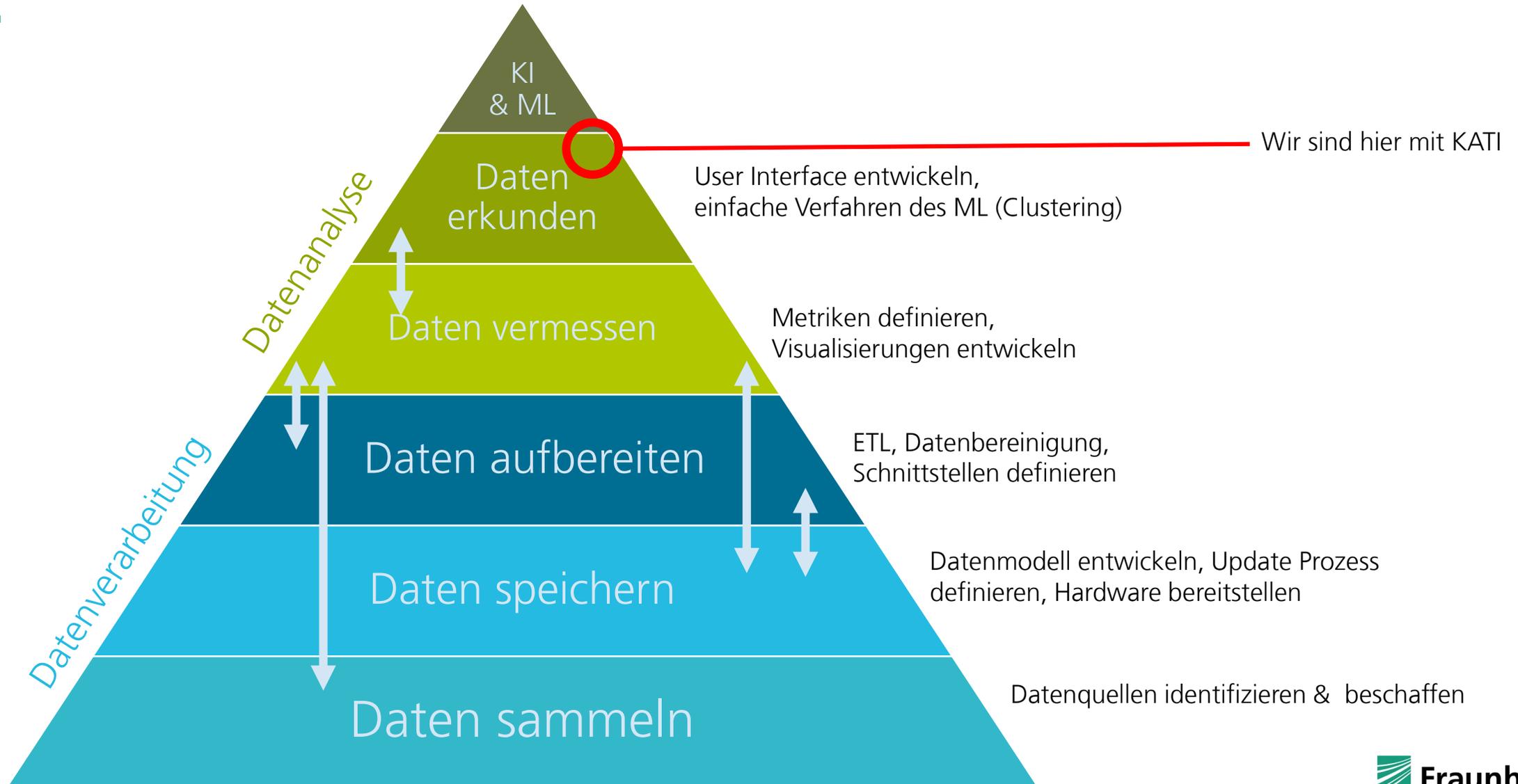
Bibliometrie & Science of Science verbessern unser Verständnis des **Systems Wissenschaft**



Es gibt die Daten und die Methoden, um das **System Wissenschaft** zu verstehen

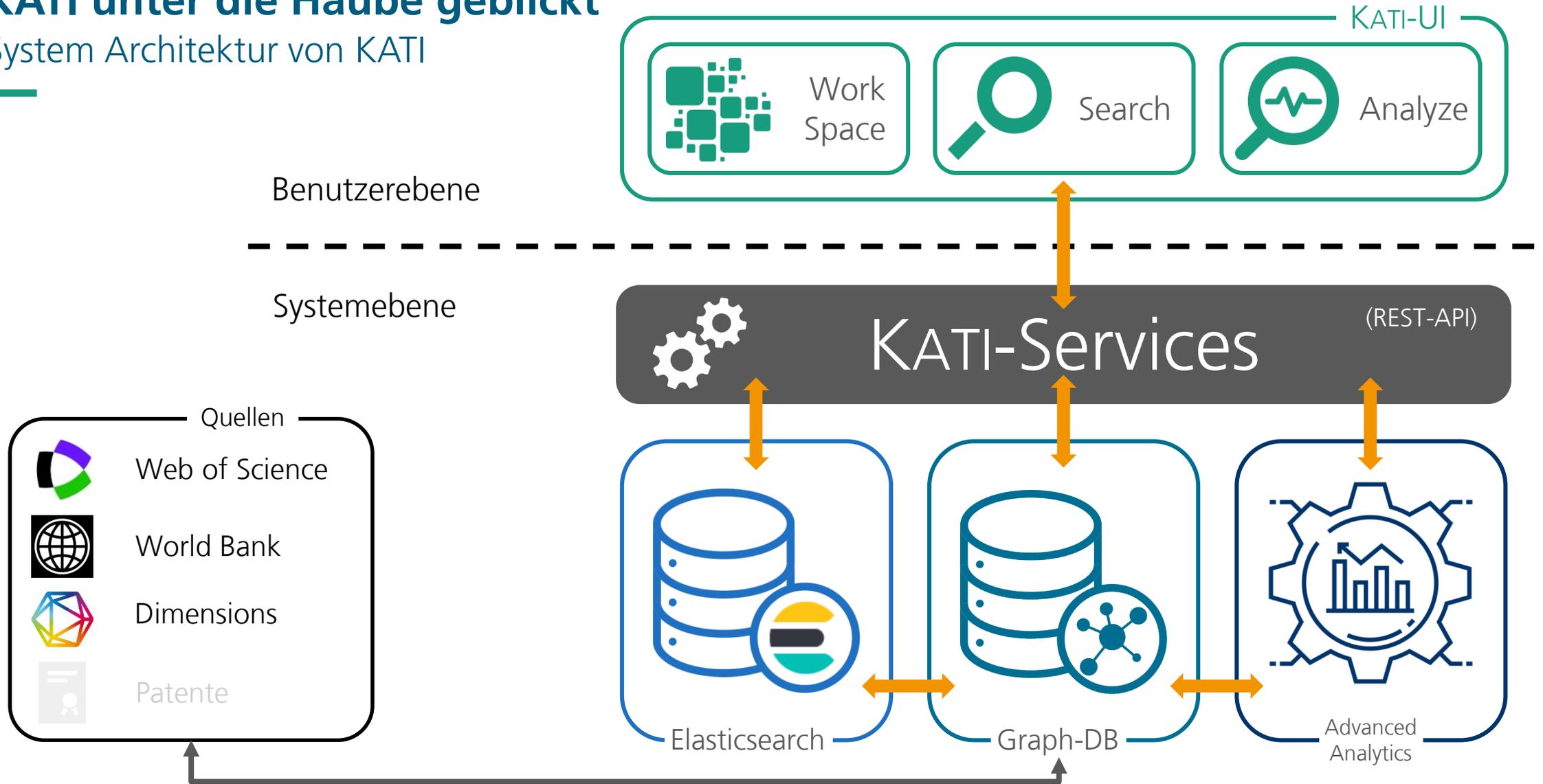
Hierarchy of Needs

Was braucht man?



KATI unter die Haube geblickt

System Architektur von KATI



Einblick ins KATI-System

Die Suchseite

Fraunhofer INT KATI

Search for...

Support John

Save Analyze Web of Science

Filter **Workspace**

Search workspaces

Personal

- Digital Twin
- Bee Colony
- Smart Farming
- MP3
- Hyperpolarized Xenon - SQ 2
- Xenon Hyepr
- Kunden
- Hannover Messe 2023
- Masterarbeit Eva
- TFA Intelligence
- Schulung
- Test
- Early Birds
- Vortrag FoMa
- KATI Schulung

Shared

Queries

Tasks

Welcome to Knowledge Analytics for Technology and Innovation

Getting Started

- Create new search
- Set the collection
- Open shared workspaces
- Open your query history
- Learn more about using KATI
- KATI screencasts
- Fraunhofer INT

KATI Knowledge: changing appearance of a single widget

You can change the appearance of plot by using the symbols in the upper right corner of the widget.

The symbols – from right to left have the following meaning:

- change the height of the widget in a cyclic way:
- change the width of the widget in a cyclic way
- export the picture using one of the following file formats: PNG, SVG or JPG
- removes a widget

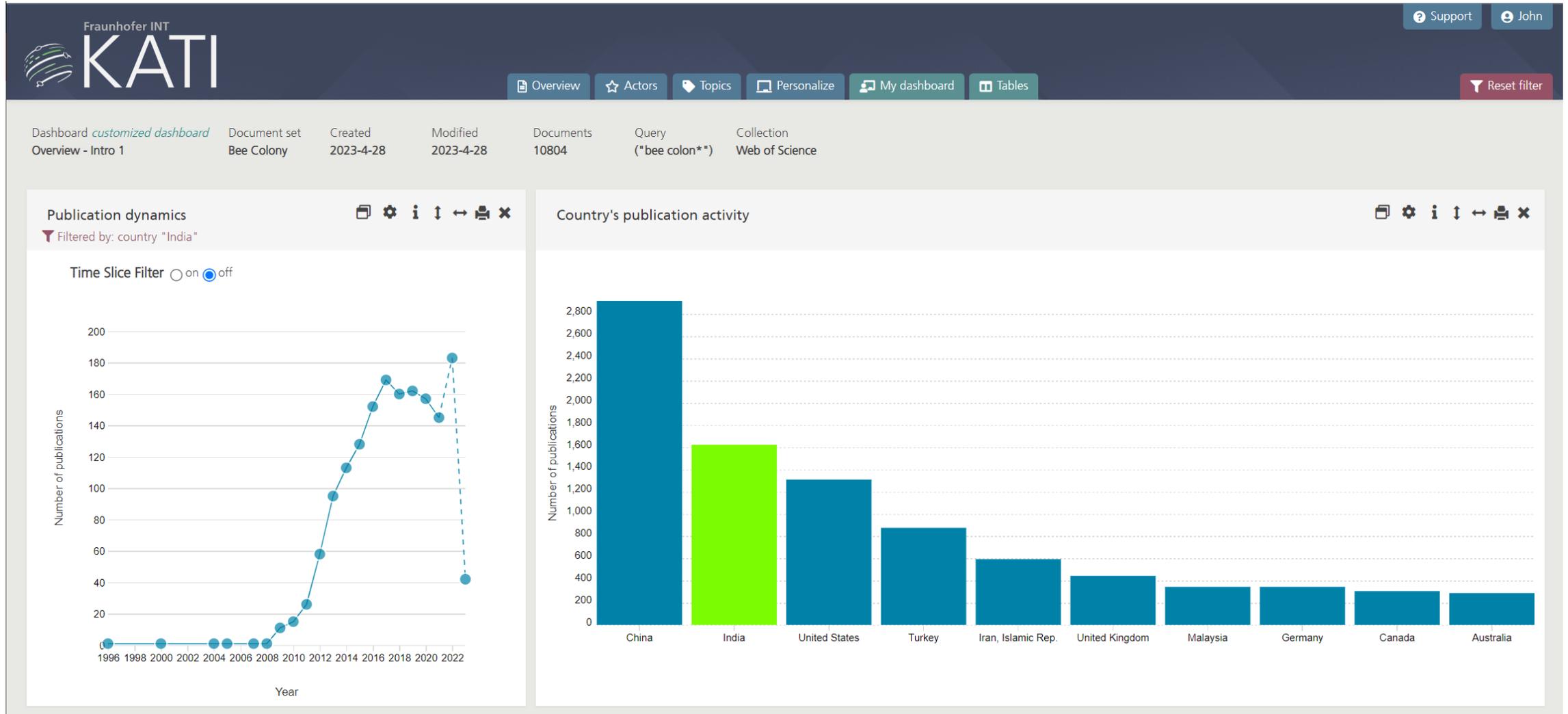
Widgets can be added using the menu **Personalize Dashboard**.

Recent Activities

- "augmented reality" AND ("gaming" OR "e-sport")
- "augmented reality"
- "digital twin"
- Digital Twin: "digital twin"
- "digital twin"
- ("bee colon")
- Bee Colony: ("bee colon")
- Smart Farming: "smart farm"
- MP3: "MP3"
- Hyperpolarized Xenon - SQ 2: "hyperpolar* xe" OR ("hyperpolar*" AND ("xenon" OR "Xe"))

Einblick ins KATI-System

Die Analyseseite



Zukunftsforschung im Kontext

Eine Zusammenfassung mit Blick auf das Kompetenznetzwerk Bibliometrie

Forschungsfelder

Science & Technology Studies

Science of Science

Innovationsforschung

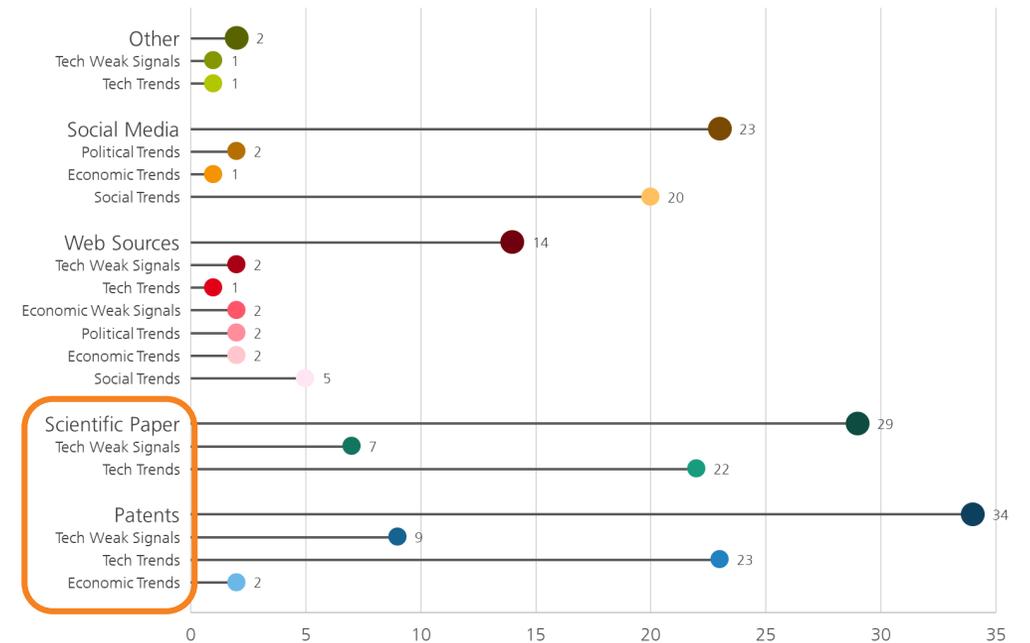
Naturwissenschaft & Technik

Technologieorientierte
Zukunftsforschung

Bibliometrie

Patentometrie

Daten



Methoden

Natural Language Processing

Netzwerkanalysen

Machine Learning

Visualisierungen

Abschlussarbeiten

Join the KATI Lab

Interesse an Abschlussarbeiten
– bitte melden!

WISSENSCHAFT UND WIRTSCHAFT IN EINEM JOB GEHT NICHT.

DOCH.

Finden Sie es heraus bei Fraunhofer.

Kontakt

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Marcus.John@int.fraunhofer.de

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53879 Euskirchen
www.int.fraunhofer.de