



Data - Information - Knowledge Graph

* oder warum Daten alleine nicht ausreichen



Prof. Dr. Harald Sack
FIZ Karlsruhe, Leibniz Institute for Information Infrastructure
#vKG2021, 27. März 2021





(1) Daten, was sonst...?

32

32"

32"

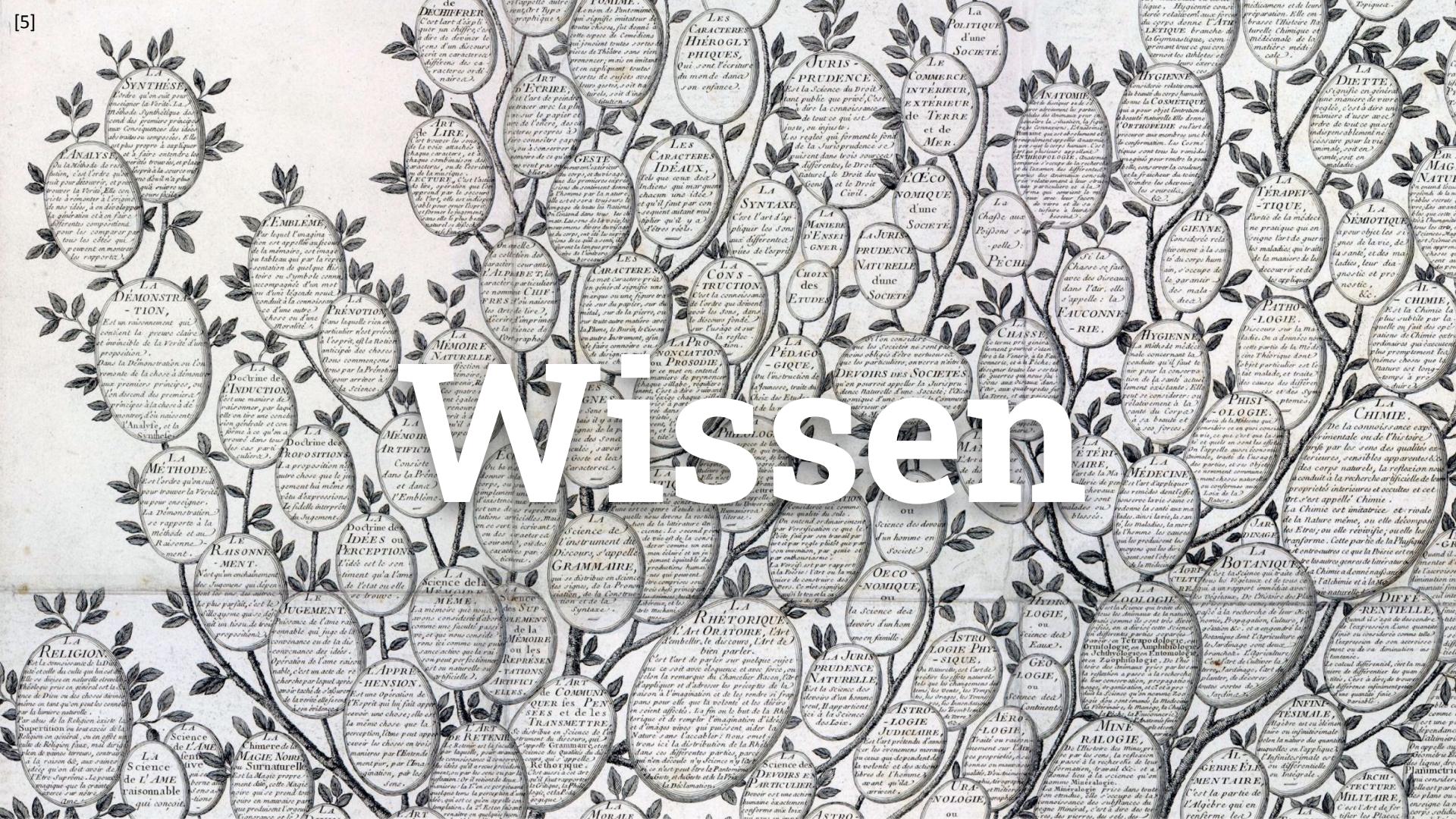
"That's one small step for (a) man; one giant leap for mankind."

T
32"
T

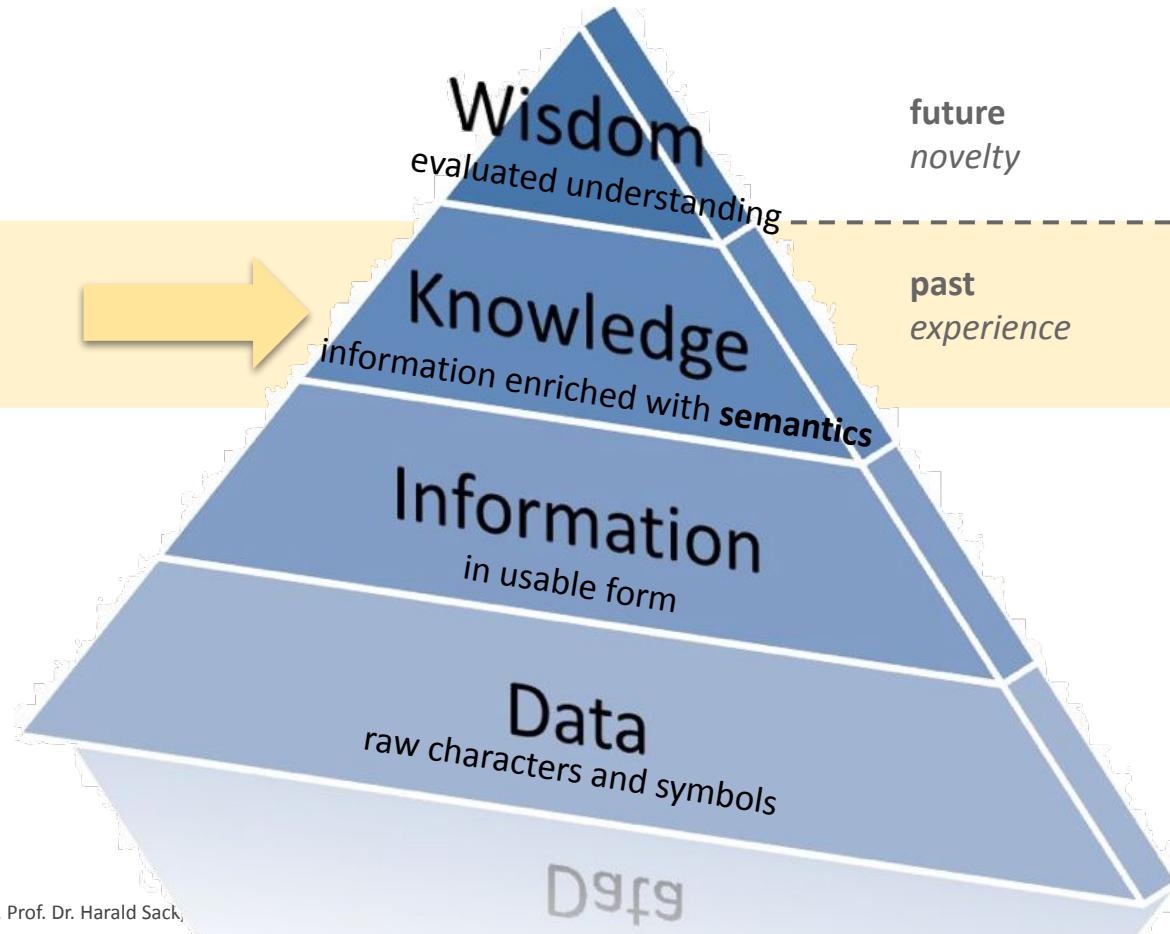
Daten

Information

ASSOCIATION



Von Daten zu Wissen



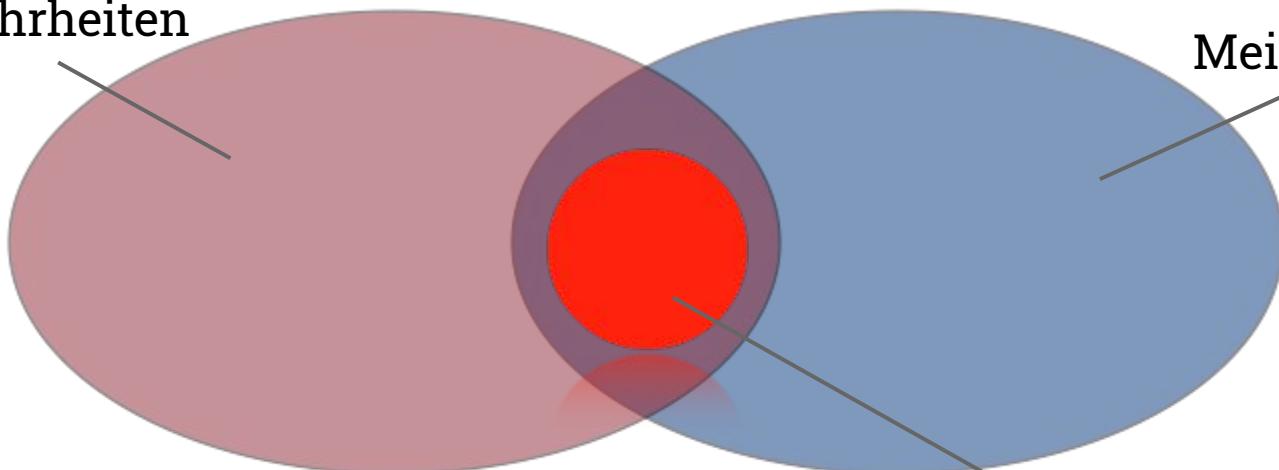
DIKW Pyramide, Ackoff 1989



(2) Wissen !

Was ist Wissen?

Wahrheiten



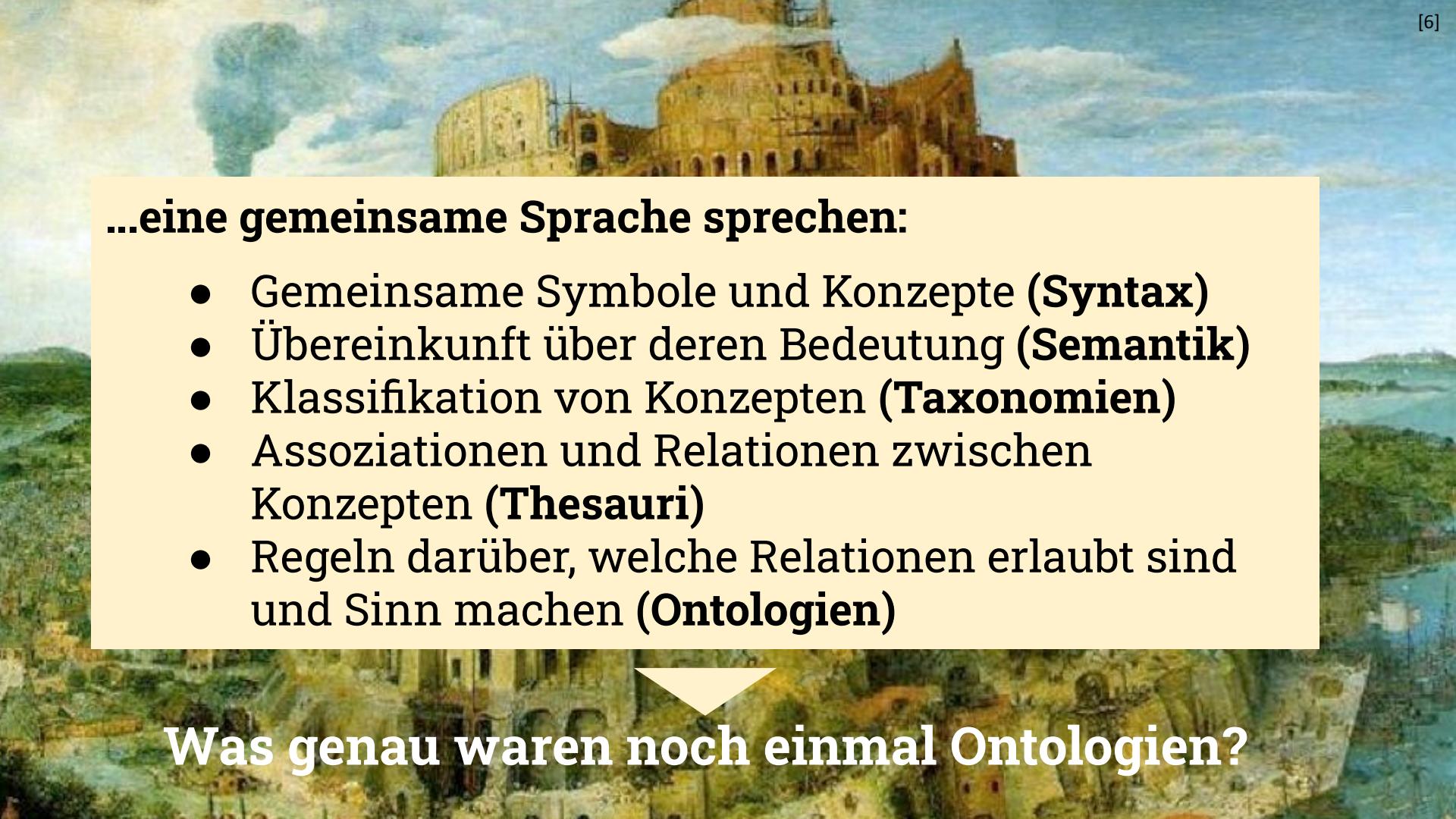
Wissen

Traditionelle Definition: „Wissen ist eine Teilmenge aller wahren Meinungen“



„People can't share knowledge if they don't speak a common language“

Thomas Davenport (1997)



...eine gemeinsame Sprache sprechen:

- Gemeinsame Symbole und Konzepte (**Syntax**)
- Übereinkunft über deren Bedeutung (**Semantik**)
- Klassifikation von Konzepten (**Taxonomien**)
- Assoziationen und Relationen zwischen Konzepten (**Thesauri**)
- Regeln darüber, welche Relationen erlaubt sind und Sinn machen (**Ontologien**)



Was genau waren noch einmal Ontologien?

Ontologie in der Philosophie

„Eine **Theorie des Seins**, die versucht, **das Sein selbst zu erklären**, indem sie ein **System von universellen Kategorien** und deren intrinsischen Beziehungen entwickelt...“

Ontologien in der Informatik

A reproduction of Michelangelo's 'The Creation of Adam' fresco from the Sistine Chapel. It depicts the moment when Adam reaches out his hand towards the finger of God, who is partially visible on the left. The background is a light-colored stone wall.

Eine Ontologie ist eine
explizite, formale Spezifikation einer gemeinsamen Konzeptualisierung

nach Thomas R. Gruber: A Translation Approach to Portable Ontology Specifications. Knowledge Acquisition, 5(2):199-220, 1993.

Ontologien in der Informatik

Eine Ontologie ist eine
explizite, formale Spezifikation einer gemeinsamen Konzeptualisierung

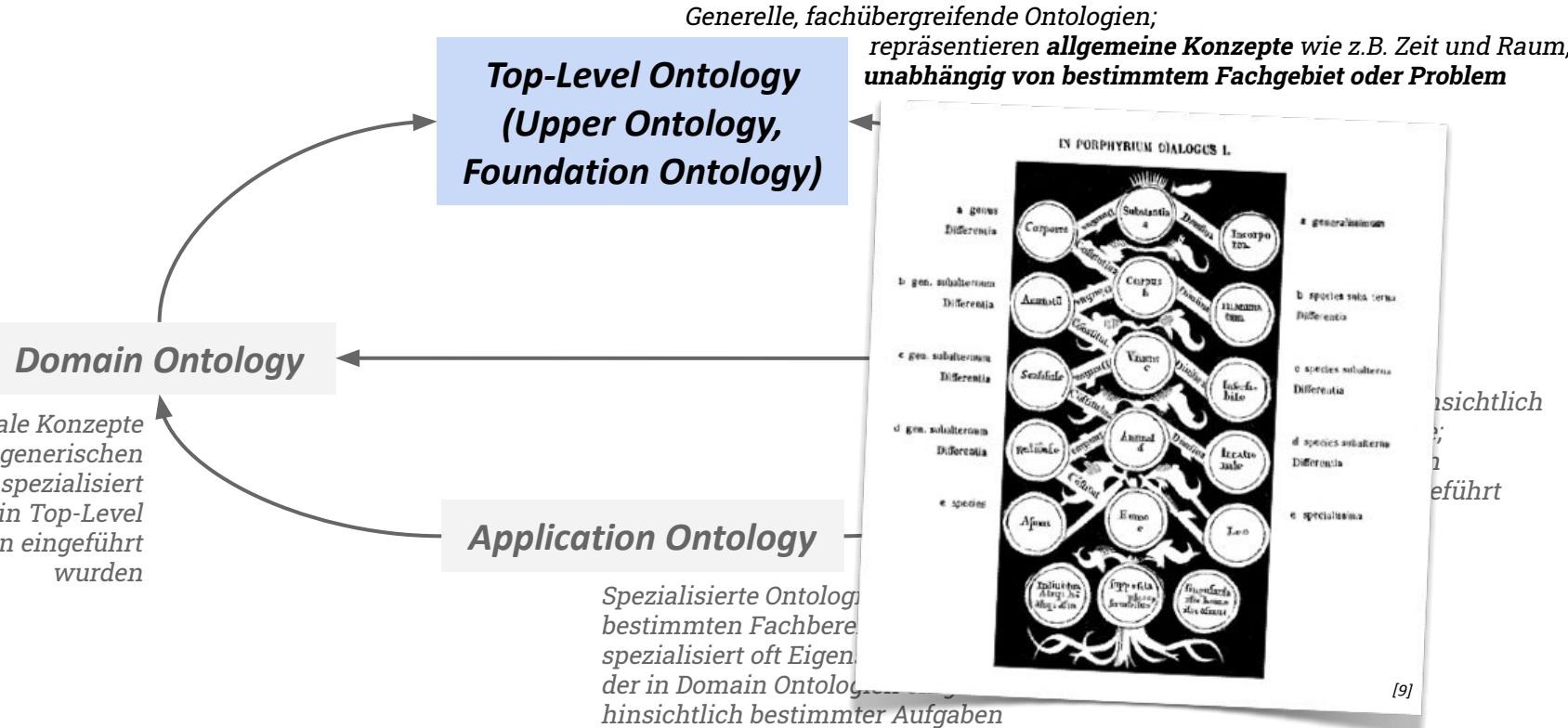
Konzeptualisierung: Abstraktes Modell
(Fachgebiet, relevante Konzepte, Beziehungen)

explizit: Alle Konzepte müssen definiert sein

formal: maschinenverstehbar

gemeinsam: notwendiger Konsens über die Ontologie

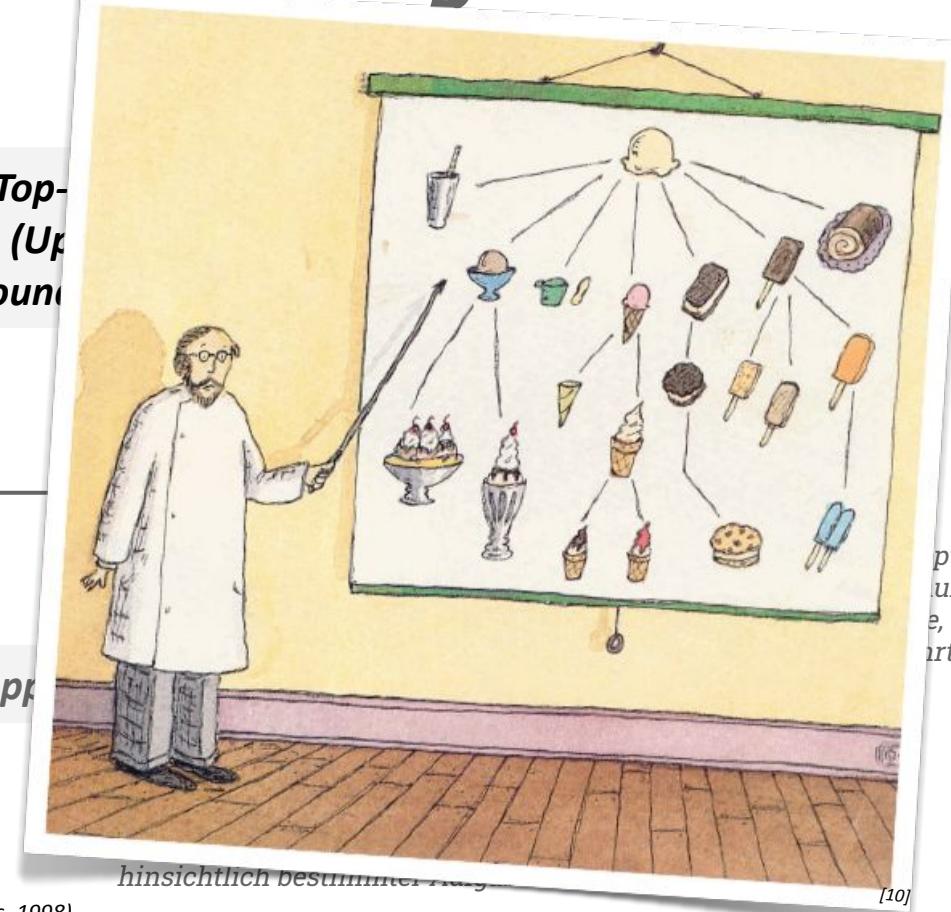
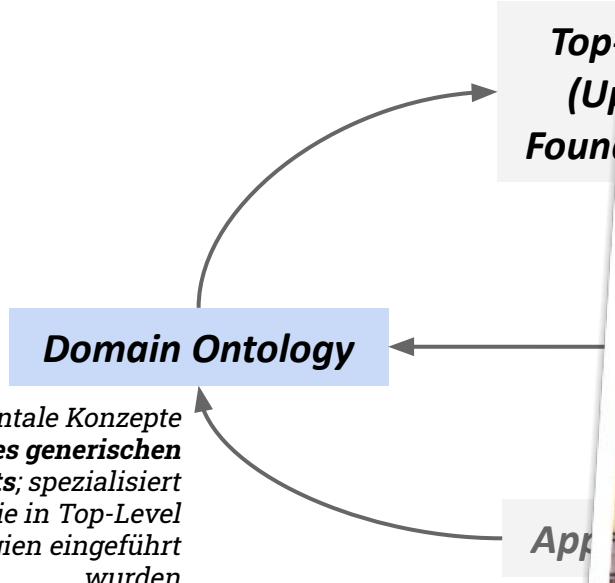
Ontologietypen und Kategorien



(according to Guarino: Formal Ontology in Information Systems, 1998)

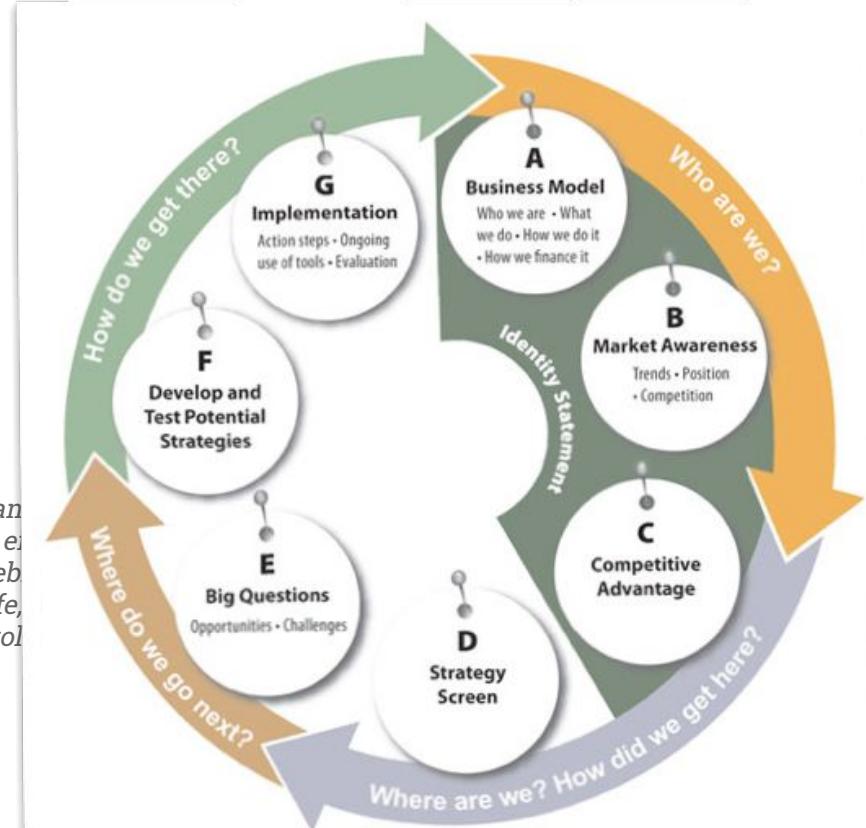
Daten - Information - Knowledge Graph, oder warum Daten alleine nicht ausreichen. Prof. Dr. Harald Sack, #vKG2021, 27. März 2021

Ontologietypen und Kategorien



(according to Guarino: Formal Ontology in Information Systems, 1998)

Ontologietypen und Kategorien



Fundamentele Begriffe, Ontologien

(according to Guarino: Formal Ontology in Information Systems, 1998)

Universelle, fachübergreifende Ontologien;
repräsentieren allgemeine Konzepte wie z.B. Zeit und Raum;
unabhängig von bestimmtem Fachgebiet oder Problem

Ontology,
Ontology,
Ontology)

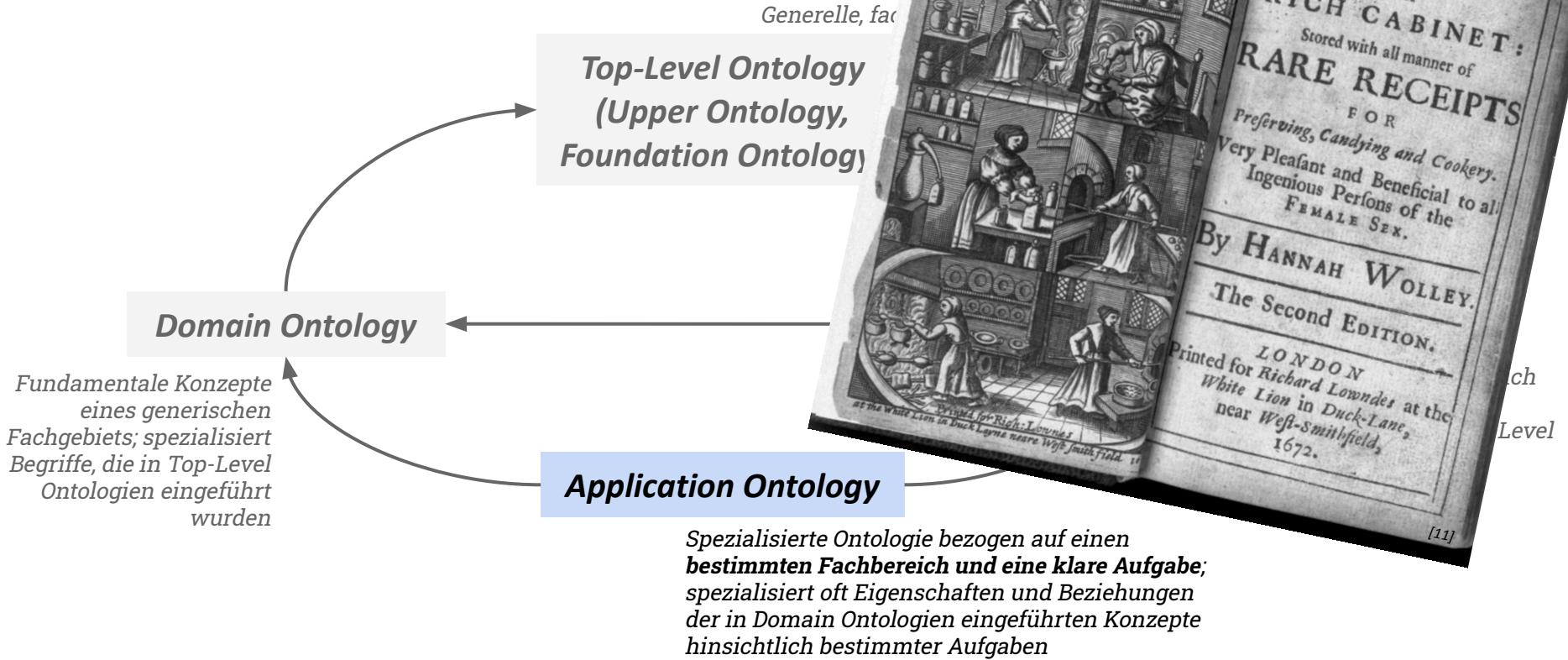
Ontology

Task Ontology

Fundamentale Konzepte hinsichtlich einer **allgemeinen Aufgabe**;
spezialisiert Begriffe, die in Top-Level Ontologien eingeführt wurden

Task Ontologie bezogen auf einen
Fachbereich und eine klare Aufgabe;
oft Eigenschaften und Beziehungen
von Ontologien eingeführten Konzepte
bestimmter Aufgaben

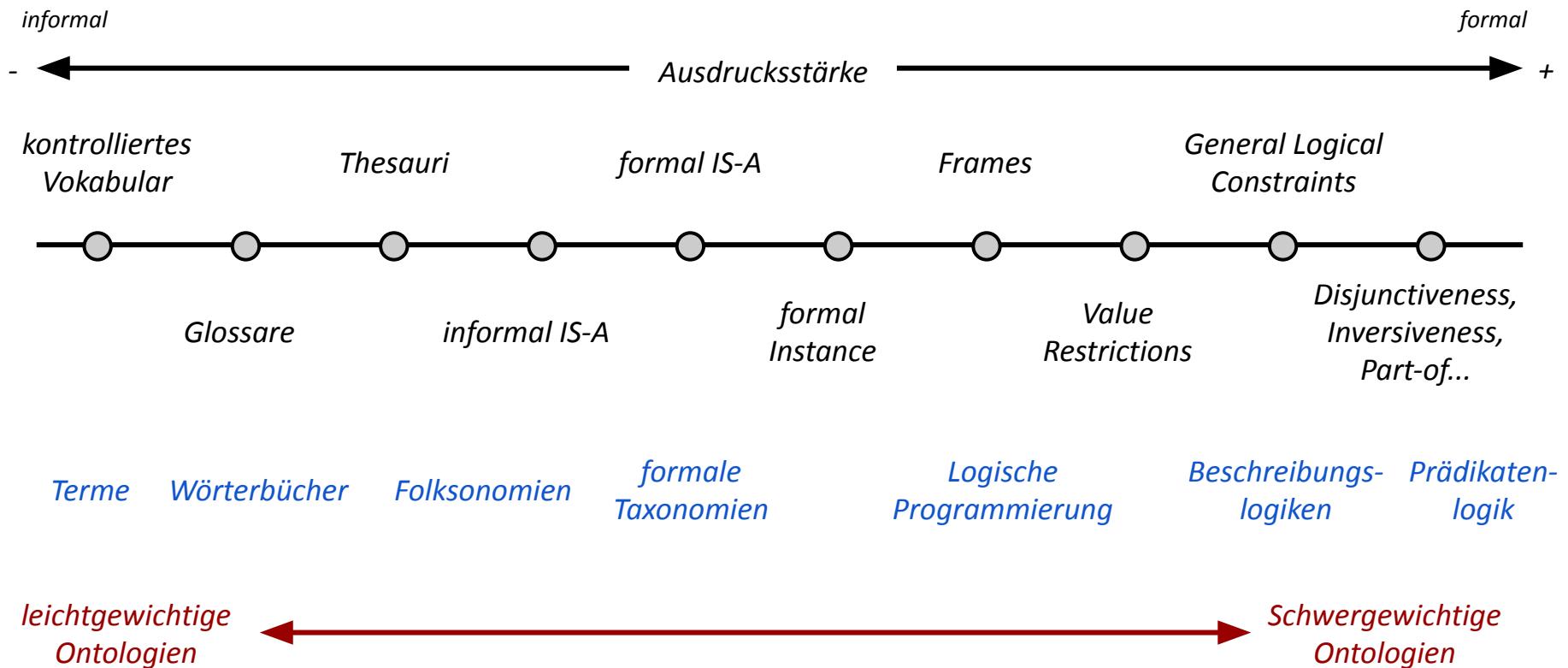
Ontologietypen und Kategorien



(according to Guarino: Formal Ontology in Information Systems, 1998)

Daten - Information - Knowledge Graph, oder warum Daten alleine nicht ausreichen. Prof. Dr. Harald Sack, #vKG2021, 27. März 2021

Ontologietypen und Kategorien





HC SVNT DRACONES

Ontologien als Interpretation der Realität

Die Kategorien der Tiere aus
"einer gewissen chinesischen Enzyklopädie" nach Jorge Luis Borges:

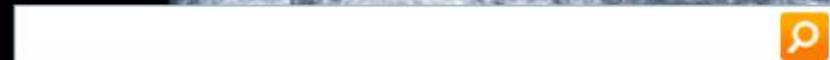
- *dem Kaiser gehörige,*
- *einbalsamierte,*
- *gezähmte,*
- *Milchschweine,*
- *Sirenen,*
- *Fabeltiere,*
- *streunende Hunde,*
- *in diese Einteilung aufgenommene,*
- *die sich wie toll gebärden,*
- *unzählbare,*
- *mit feinstem Kamelhaarpinsel gezeichnete,*
- *und so weiter,*
- *die den Wasserkrug zerbrochen haben,*
- *die von weitem wie Fliegen aussehen.*



Jorge Luis Borges
(1899-1986)



(3) ...und was bringt das?



EXPLORE

Images

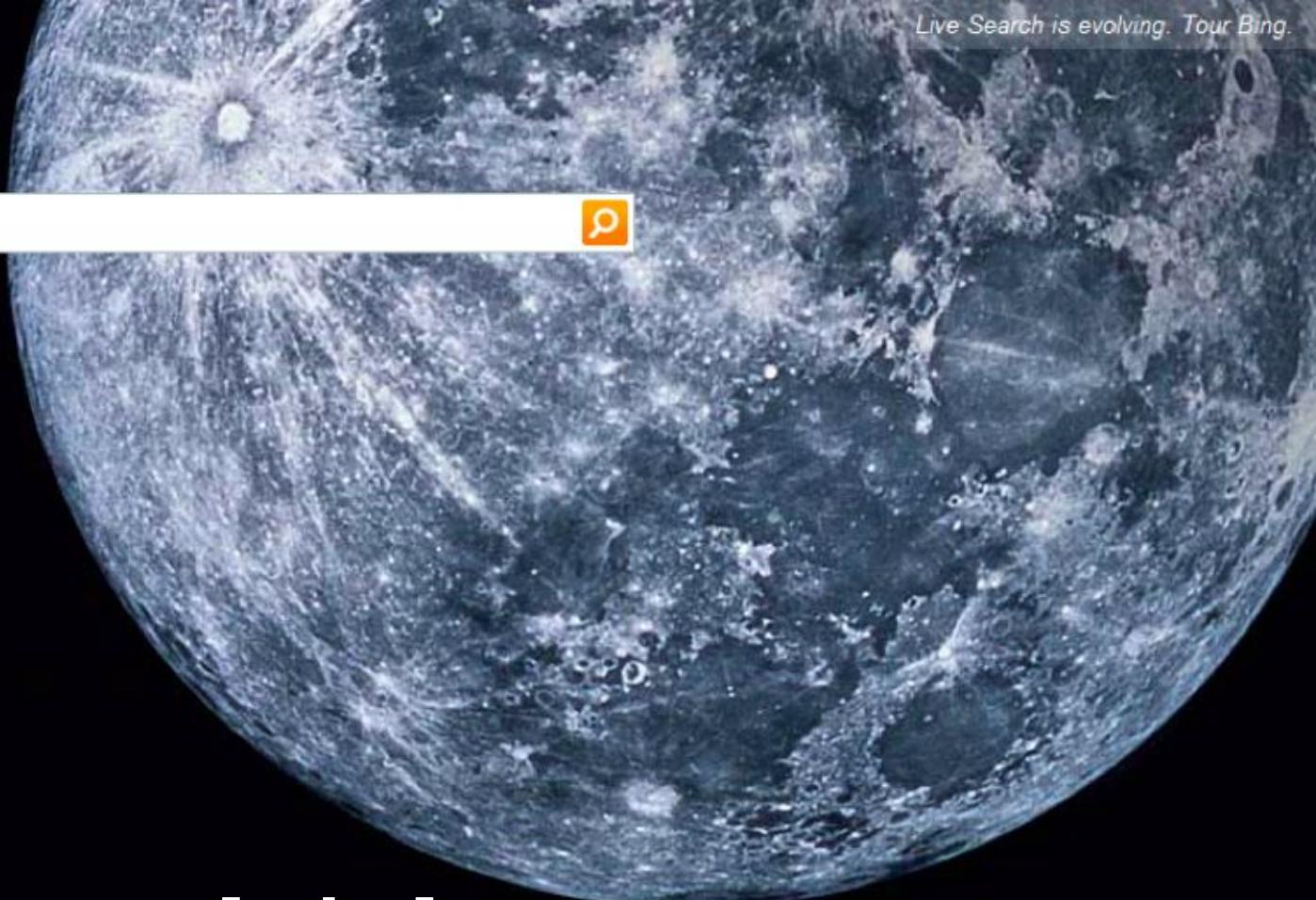
Videos

Shopping

News

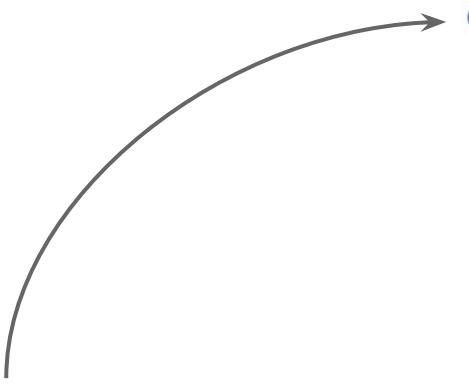
Maps

Travel



Suchen und Finden...





Google

who was the first man on the moon?

All Images News Videos Maps More Settings Tools

About 671.000.000 results (0,49 seconds)

Neil Armstrong

On July 20, 1969, Neil Armstrong became the first human to step on the moon. He and Aldrin walked around for three hours.

Jan 16, 2008



www.youtube.com

NASA - The First Person on the Moon
<https://www.nasa.gov/audience/forstudents/k-4/stories/first-person-on-moon.html>

About this result Feedback

Wer war der erste Mensch auf dem Mond?

People also ask

- Who was actually the first person on the moon? ▾
- Was Neil Armstrong the first man on the moon? ▾
- When was the first man on the moon? ▾
- Who are the 12 astronauts who walked on the moon? ▾

Feedback

Videos



Remembering Neil Armstrong: First Man on the Moon

First Moon Landing 1969

"The First Man on the Moon: Why Neil Armstrong?" Dr. James Hansen

About 21.700.000 results (0,78 seconds)

Neil Armstrong - Wikipediahttps://en.wikipedia.org/wiki/Neil_Armstrong

Neil Alden Armstrong (August 5, 1930 – August 25, 2012) was an American astronaut and the first person to walk on the Moon. He was also an aerospace ...

DJ Neil Armstrong (@djneilarmstrong) · Twitter<https://twitter.com/djneilarmstrong>

Does #theweeknd remind ya of the king of pop? Here's a remix that may make ya think so soundcloud.com/neil-arm... Feel... pic.twitter.com/UW8JRgu...

11 hours ago · Twitter

My new sounds: MJ X The Weeknd Remix soundcloud.com/neil-arm... on #SoundCloud

11 hours ago · Twitter

@okayplayer - If you think the weeknd sounds like #MJ, this might prove your point - djneilarmstrong.com/mjx...

15 hours ago · Twitter

Biography of Neil Armstrong | NASAwww.nasa-usa.de/centers/glenng/about/bios/neilabio.html

National Aeronautics and Space Administration John H. Glenn Research Center Lewis Field Cleveland, Ohio 44135. Neil A. Armstrong, the first man to walk on ...

Top stories**Neil Armstrong's "One small step for man" might be a misquote**

Quartz · 15 hours ago

[More for neil armstrong](#)**Knowledge Graph**

- Facts (structured data)

**Neil Armstrong**

Astronaut

Neil Alden Armstrong was an American astronaut and the first person to walk on the Moon. He was also an aerospace engineer, naval aviator, test pilot, and university professor. [Wikipedia](#)

Born: August 5, 1930, Wapakoneta, Ohio, United States

Died: August 25, 2012, Cincinnati, Ohio, United States

Space missions: Apollo 11, Gemini 8

Spouse: Carol Held Knight (m. 1994–2012), Janet Shearon (m. 1956–1994)

Siblings: Dean Armstrong, June Armstrong

Quotes

View 7+ more

*That's one small step for man, one giant leap for mankind.**Mystery creates wonder and wonder is the basis of man's desire to understand.**I believe that every human has a finite number of heartbeats. I don't intend to waste any of mine running around doing exercises.***People also search for**

View 15+ more



Buzz Aldrin



Michael Collins



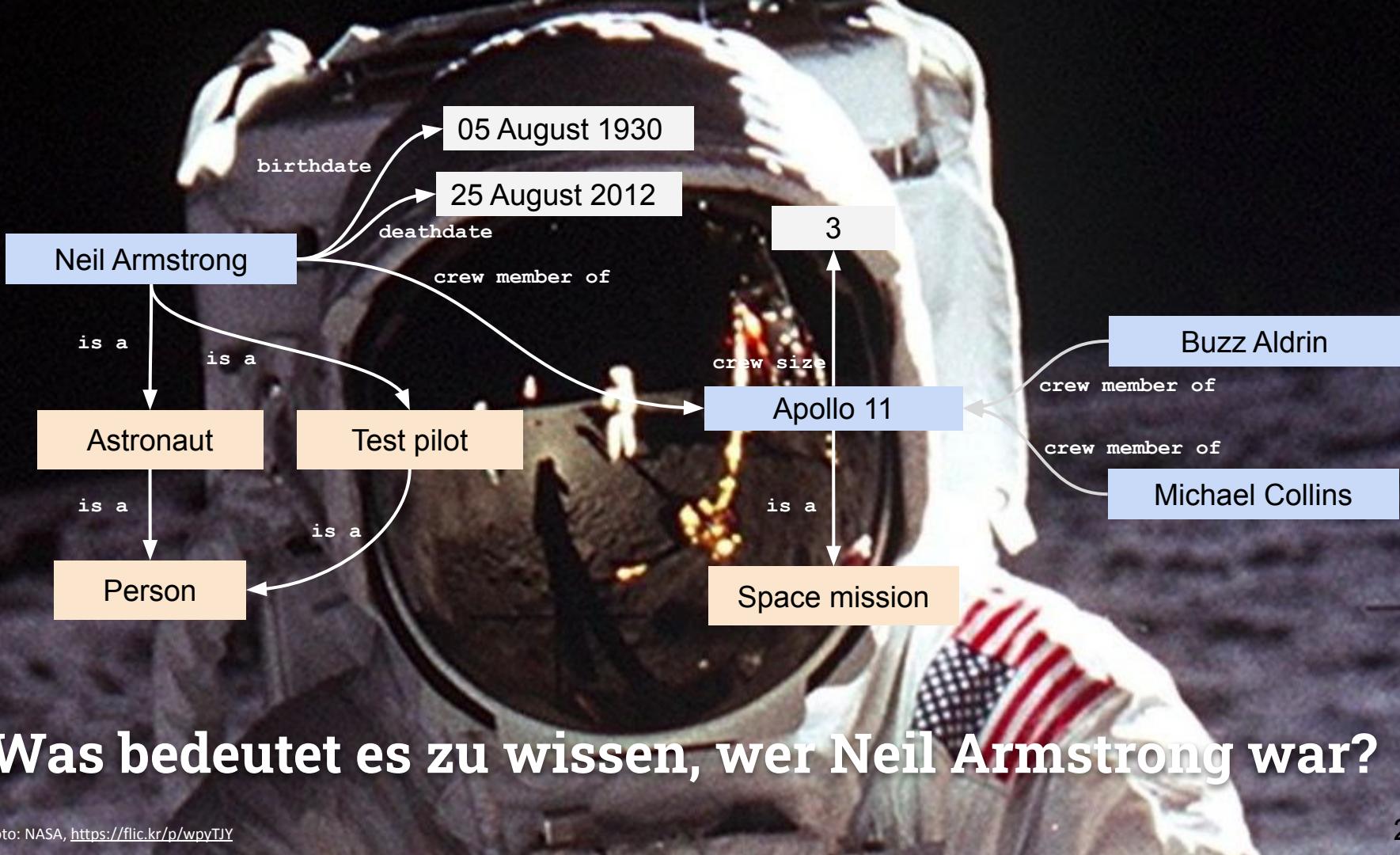
John Glenn

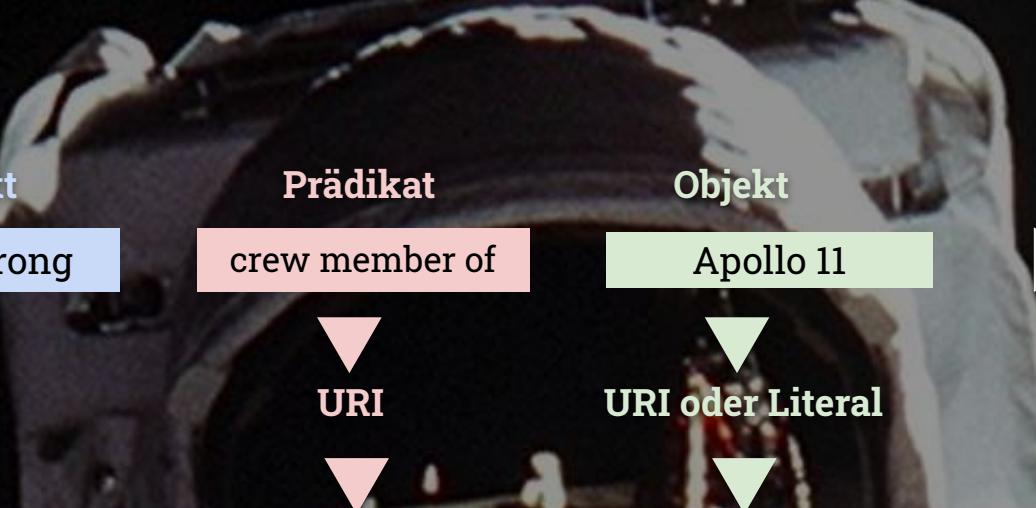


Yuri Gagarin



Alan Shepard



A black and white photograph of Neil Armstrong in a full spacesuit, including a helmet with the visor up, standing next to a piece of equipment on the Moon's surface.

Subjekt

Neil Armstrong



URI



dbr:Neil_Armstrong
dbr:Neil_Armstrong
dbr:Neil_Armstrong
dbr:Neil_Armstrong
dbr:Apollo_11
dbr:Apollo_11
dbr:Buzz_Aldrin
dbr:Buzz_Aldrin
dbr:Michael_Collins
dbr:Michael_Collins
....

Prädikat

crew member of



URI



dbo:crewMember
rdf:type
dbo:birthDate
dbo:deathDate
rdf:type
dbp:crewSize
rdf:type
dbo:crewMember
rdf:type
dbo:crewMember

Objekt

Apollo 11



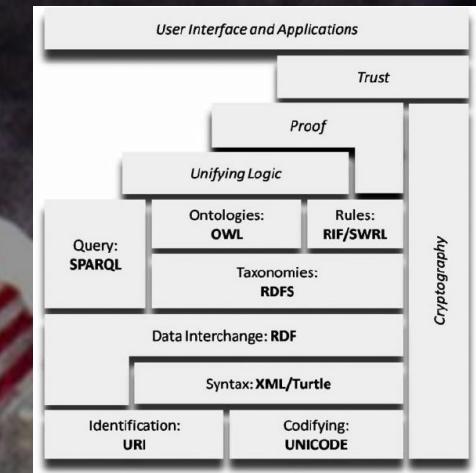
URI oder Literal



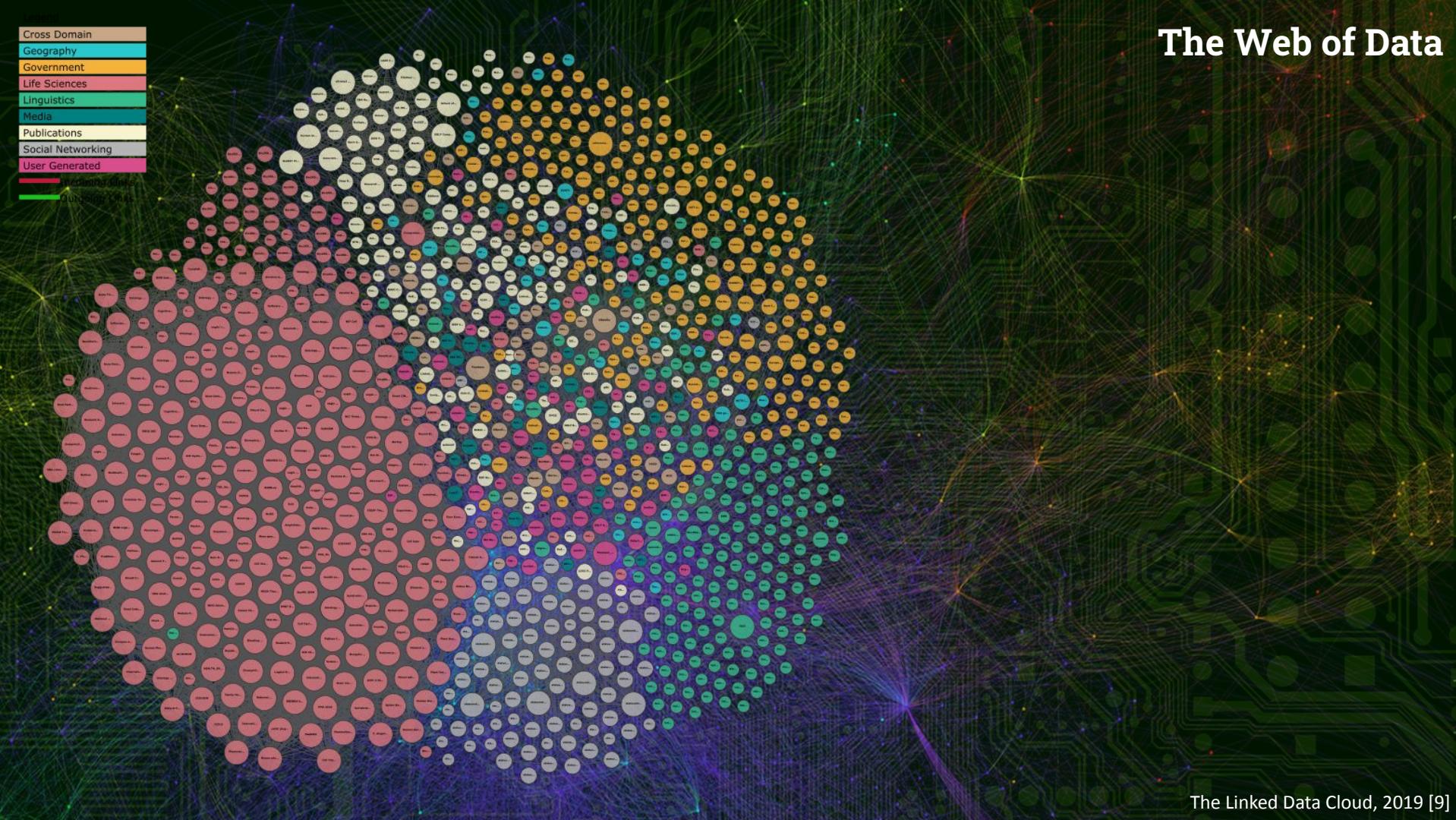
RDF Serialisierung

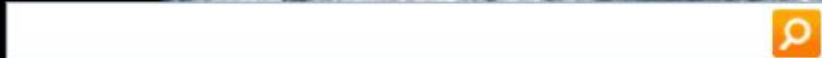
```
dbr:Apollo_11 .  
dbo:Person .  
"1930-08-05"^^xsd:date .  
"2012-08-25"^^xsd:date .  
dbo:SpaceMission .  
3 .  
dbo:Person .  
dbr:Apollo_11 .  
dbo:Person .  
dbr:Apollo_11 .
```

Semantic Web



The Web of Data





EXPLORE

Images

Videos

Shopping

News

Maps

Travel

Suchen und Finden...



Wie funktioniert das eigentlich...?

bir

EXPLORE

Images

Videos

Shopping

News

Maps

Travel

<https://www.flickr.com/photos/diametrik/30931836692> [15]



Anfragen

Anfrage-
formulierung

<http://maxpixel.freepngpicture.com/Paperwork-Paper-Office-Files-Work-Stack-Data-1614223> [16]



Dokumente

Index

Indexierung

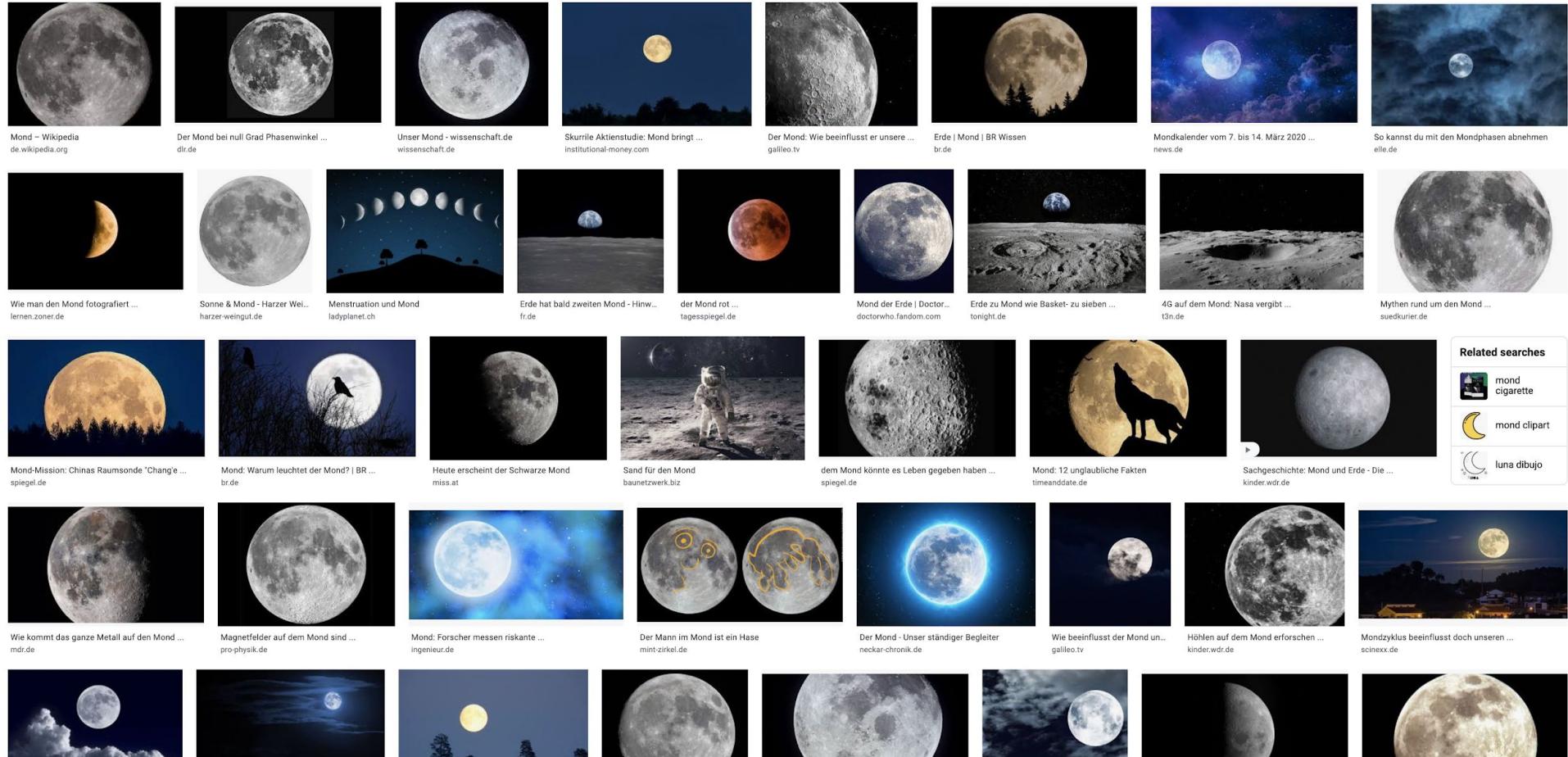
Treffer basierend auf **syntaktischer Ähnlichkeit**

Was aber, wenn wir den passenden Suchbegriff nicht kennen?



Wir versuchen es mit einer "Beschreibung"...

erde wikipedia mondfinsternis mondoberfläche rost wasser rostet des mondes leuchtet warum leuchtet nasa erde mond sonne erdmond planet supermond



Related searches



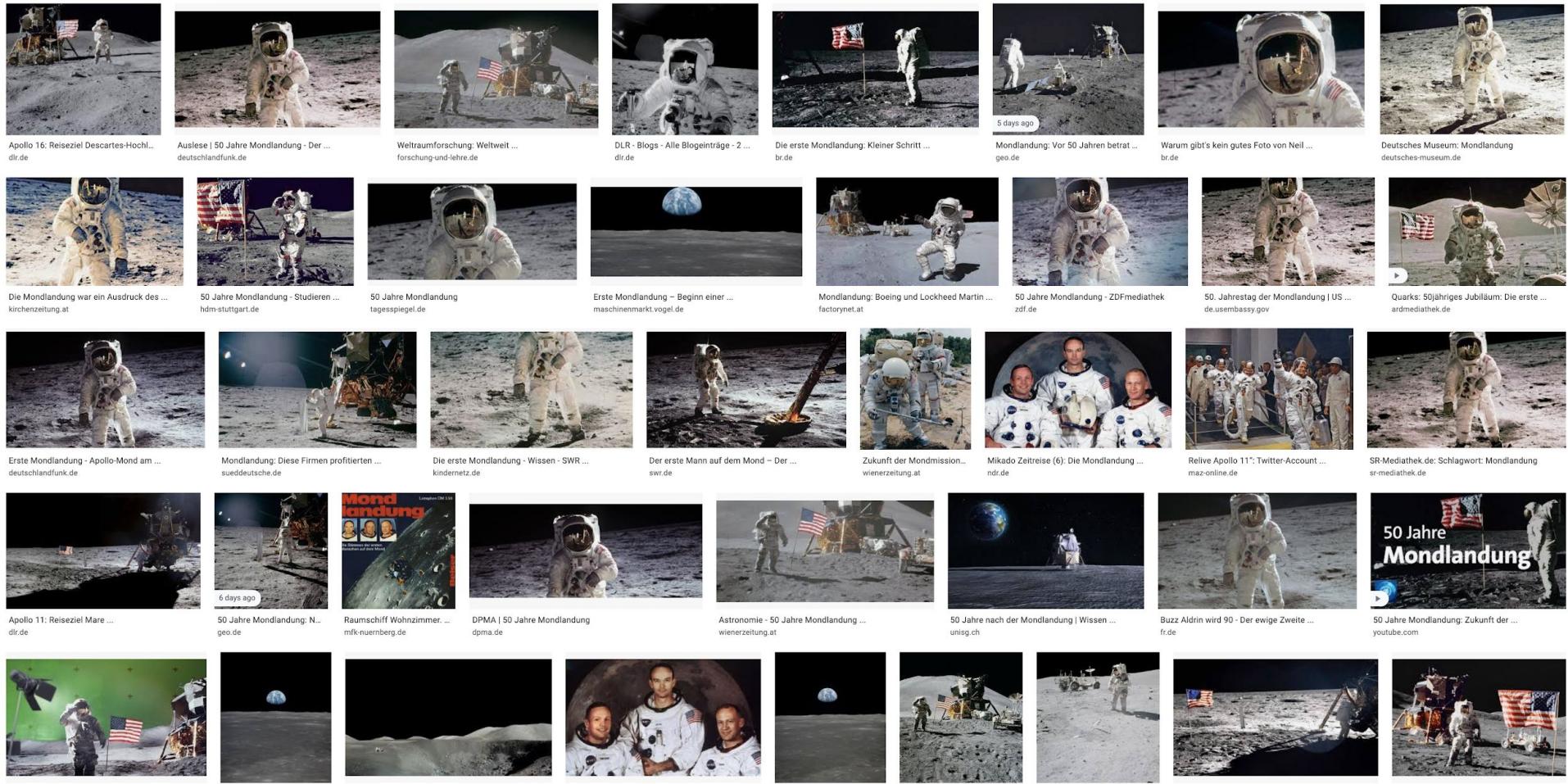
mond cigarette



mond clipart



luna dibujo





Meteoriten: Mond bekommt mehr Treffer ...
scinexx.de

Mehr kosmische Treffer auf Erde und ...
wissenschaft.de

Mond entstand durch Meteoriten-Gewitter ...
mdr.de

Unser Mond - wissenschaft.de
wissenschaft.de

Wie entstand der Mond?
faz.net

Unser Mond - wissenschaft.de
wissenschaft.de

Neue Theorie - Wie kam die Erde zu ...
deutschlandfunk.de

Meteoriten: Mond bekommt m...
scinexx.de



Unser Mond - wissenschaft.de
wissenschaft.de

Große Asteroiden-Treffer auf Erde: Hat ...
n-tv.de

Mond: So entstand das Mar...
scinexx.de

Marsmonde Deimos und Phobos haben einen ...
derstandard.at

Mond bekommt mehr Treffer ab als bisher ...
krone.at

Unser Mond - wissenschaft.de
wissenschaft.de

Zum Inhalt [AK+1] / Zur ORF.at ...
science.orf.at

Planeten und Mond am Himmel: So ist ...
ruhr24.de



Mond und Mars sehen: Spektakel im ...
ruhr24.de

50-Meter-Brocken im Anflug: Knapp an ...
tagesspiegel.de

607 Zunehmender Mond Bilder und Foto...
gettyimages.ch

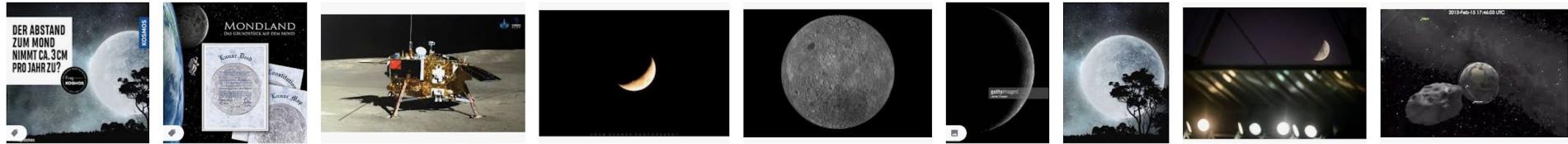
Entstehung des Monde...
de.wikipedia.org

Riesiger Asteroid passiert die Erde
futurezone.at

Stockfoto Unser Mond in der Coronazeit ...
imago-images.de

Zahl der Einschläge von Asteroiden auf ...
derstandard.at

Suchergebnisse - Dif Nova
deutschlandfunknova.de



DER ABSTAND ZUM MOND NIMMT CA. 3 CM PRO JAHR ZU?
kosmos.de

MONDLAND - IM UNTERHÜTENFEST DER KÜ...
amazon.de

Uni Kiel: Erste Messungen der ...
uni-kiel.de

Mond - SWEN DEUMER
swendeumer.de

DLR_next on Twitter: "Schöner Mond war ...
twitter.com

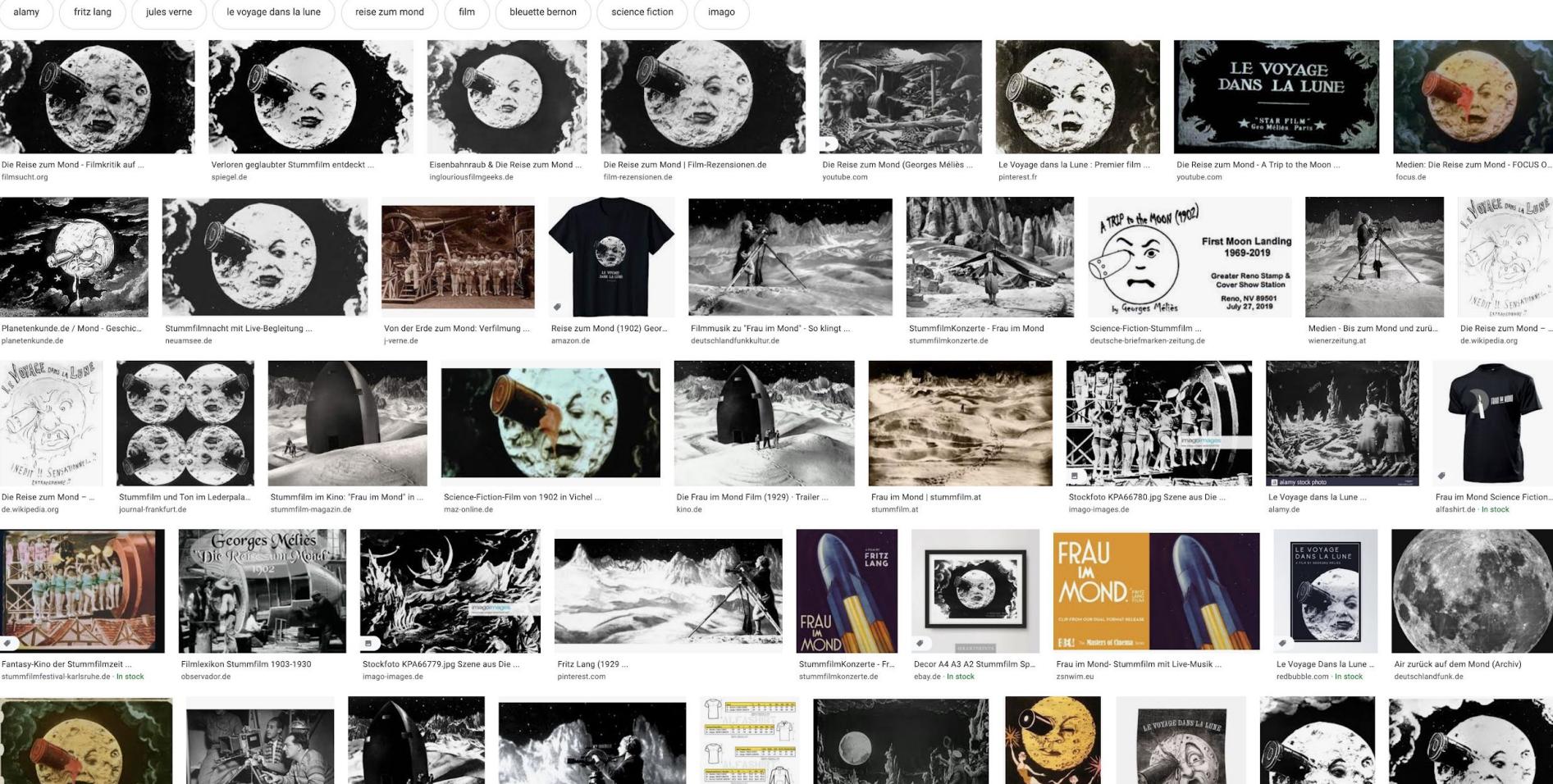
606 Zunehmender Mon...
gettyimages.at

Der Mond: Phasen und G...
kosmos.de

Mond Atmosphäre - Fotos | IMAGO
imago-images.de

Warnung: Grosse Asteroiden-Treffer ...
schweizerbauer.ch





alamy

fritz lang

jules verne

le voyage dans la lune

reise zum mond

film

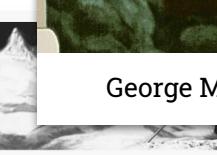
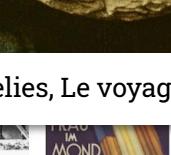
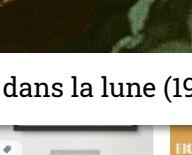
bleuette beron

science fiction

imago

Die Reise zum Mond - Filmkritik auf ...
filmsucht.orgVerloren geglaubter Stummfilm entdeckt ...
spiegel.deEisenbahnraub & Die Reise zum Mond ...
ingloriousfilmgeeks.deDie Reise zum Mond | Film-Rezensionen.de
film-rezensionen.deDie Reise zum Mond (Georges Méliès ...
youtube.comLe Voyage dans la Lune : Premier film ...
pinterest.frDie Reise zum Mond - A Trip to the Moon ...
youtube.comMedien: Die Reise zum Mond - FOCUS O ...
focus.dePlanetenkunde.de / Mond - Geschic ...
planetenkunde.deStummfilmnacht mit Live-Begleitung ...
neuamsee.deVon der Erde zum Mond: Verfilmung ...
j-verne.deReise zum ...
amazon.de

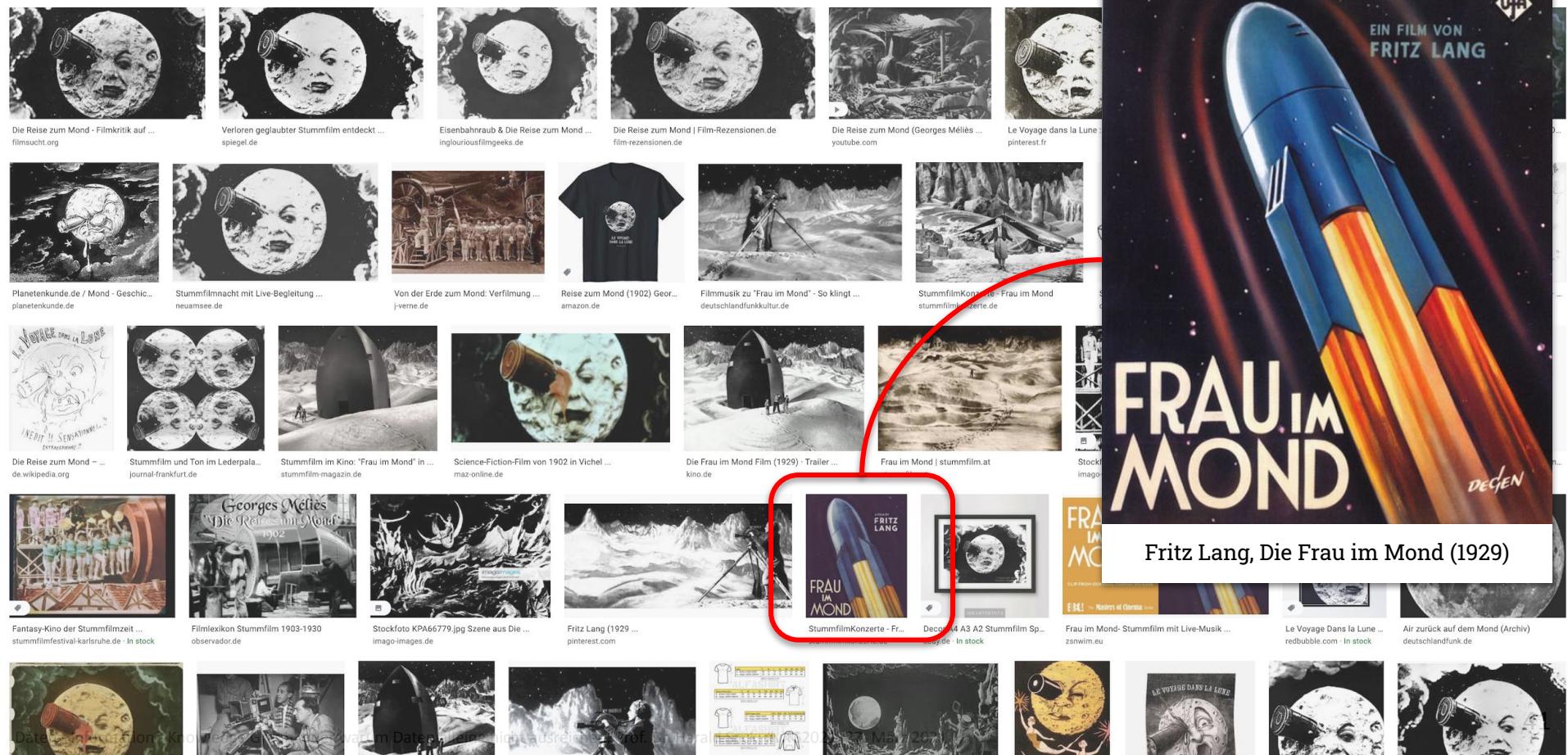
George Melies, Le voyage dans la lune (1902)

First Moon Landing 1969-2019
Greater Reno Stamp & Cover Show ...
Reno, NV 89501 July 27, 2019Szene aus Die ...
alamy stock photoMedien - Bis zum Mond und zurü ...
wienerzeitung.atLe Voyage dans la Lune ...
alamy.deDie Reise zum Mond - ...
de.wikipedia.orgFrau im Mond Science Fiction...
alfashirt.de - In stockFantasy-Kino der Stummfilmzeit ...
stummfilmfestival-karlsruhe.de - In stockFilmlexikon Stummfilm 1903-1930 ...
observador.deStockfoto KPA66779.jpg Szene aus Die ...
imago-images.deFritz Lang (1929 ...
pinterest.comStummfilmKonzerte - Fr ...
stummfilmkonzerte.deDecor A4 A3 A2 Stummfilm Sp ...
ebay.de - In stockFrau im Mond - Stummfilm mit Live-Musik ...
zanzwim.euLe Voyage Dans la Lune ...
redbubble.com - In stockAir zurück auf dem Mond (Archiv) ...
deutschlandfunk.de

Query by Description



Überraschungsfunde...



A composite image featuring a portrait of a man in historical attire looking through a telescope at a large, yellowish celestial body, possibly Earth or the Moon, with visible craters. The background is dark space with some green nebula-like patterns.

(4) ...und wie soll uns der
Knowledge Graph da helfen?

Retrieval vs Exploration



V E R N E, Jules.
From the Earth to the Moon, Direct in
97 Hours 20 Minutes and a Trip Round It,
Sampson Low, Marston&Company,
London (1873),
viii, 323 p. plates.

GRC C.194.a.659, 12516.g.20

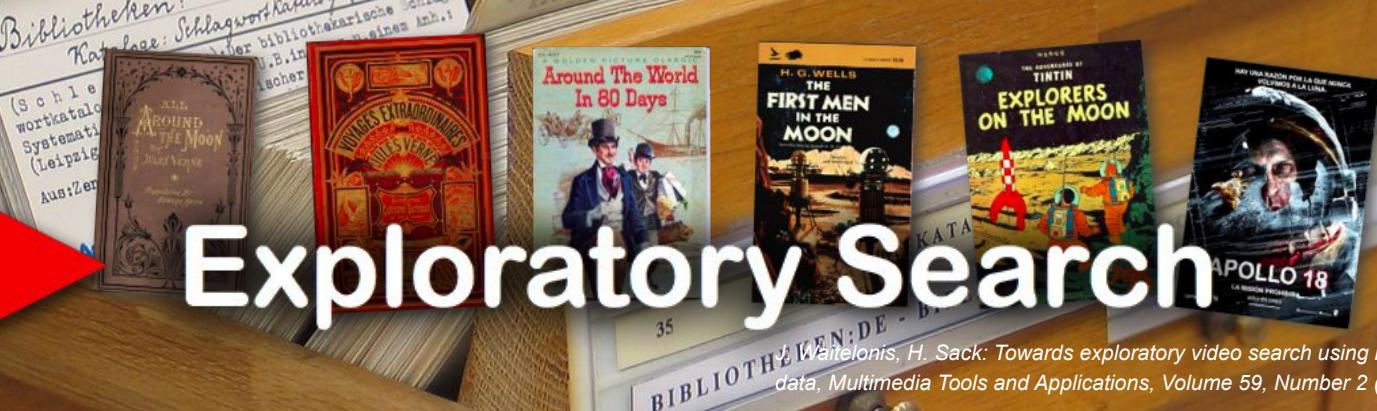


Retrieval vs Exploration



- Finde etwas "**Interessantes**" für mich
- Finde Bücher mit **ähnlichen** Geschichten
- Welche Bücher **hängen** inhaltlich damit **zusammen**?
- Wie hat sich das **Thema** über die Zeit **entwickelt**?
- Was soll ich als nächstes lesen?
- ...

Exploratory Search



**...und intelligente
Empfehlungen**

**Traditionelle Bibliotheken
erlauben explorative Suche**

Knowledge Graph basierte Explorative Suche



:A_Trip_to_the_Moon

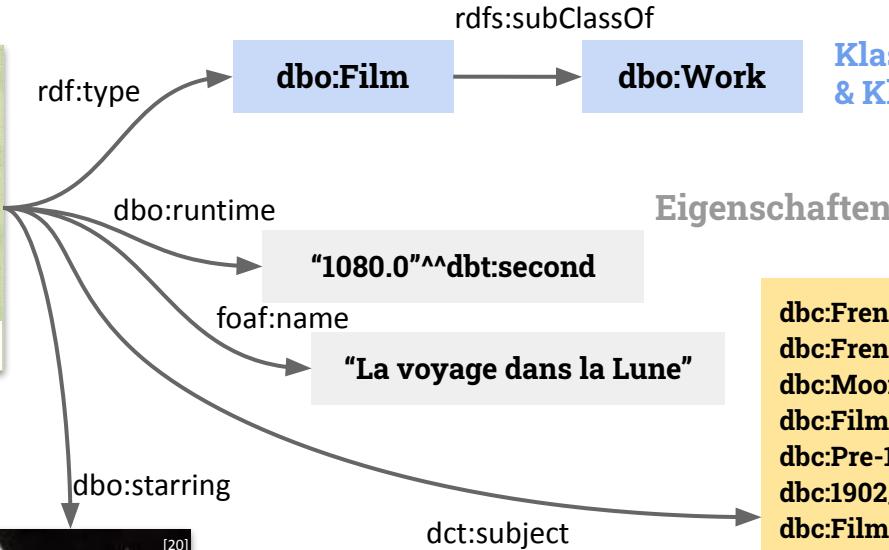
dbo:director
dbo:producer
dbo:writer
dbo:starring



:Georges_Méliès



:Bleurette_Bernon



Beziehungen zu
anderen Entitäten

Klassenzugehörigkeit
& Klassenhierarchien

Eigenschaften

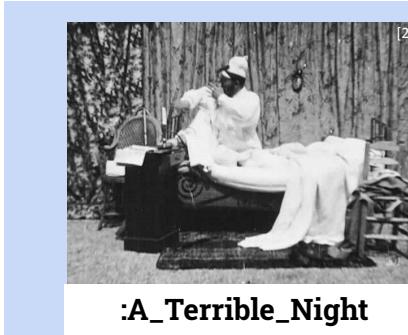
dbc:French_films
dbc:French_science_fiction_films
dbc:Moon_in_film
dbc:Films_based_on_works_by_Jules_Verne
dbc:Pre-1950_science_fiction_films
dbc:1902_films
dbc:Films_directed_by_Georges_Méliès
dbc:1900s_adventure_films
dbc:French_silent_short_films
dbc:Films_based_on_works_by_H._G._Wells
dbc:French_black-and-white_films

Kategorien

Knowledge Graph basierte Explorative Suche



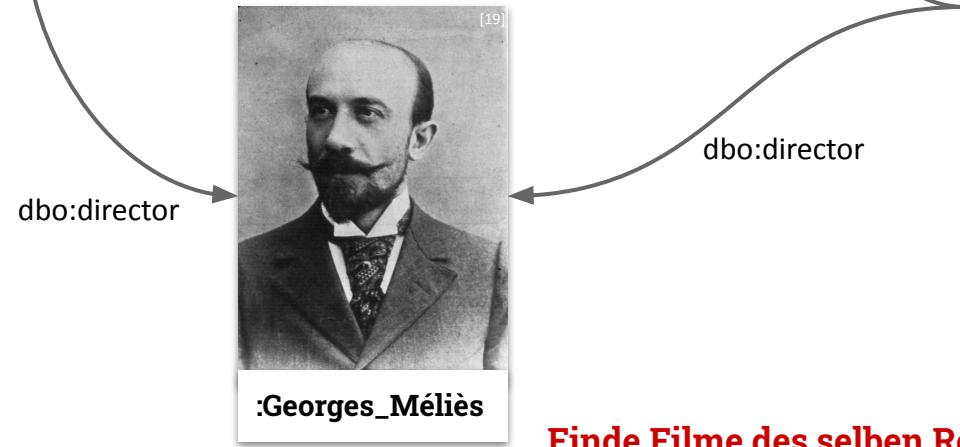
dbo:Movie
rdf:type
rdf:type



:A_Terrible_Night



:After_the_Ball_(1897_film)



dbo:director



:The_Famous_Box_Trick

+ 107 weitere Filme



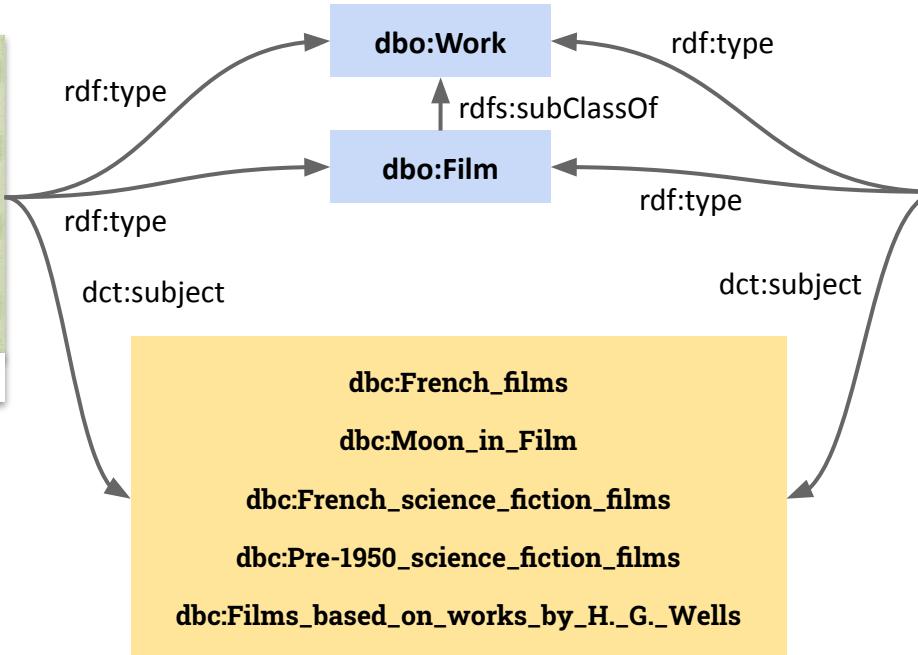
:The_Astronomer's_Dream

Finde Filme des selben Regisseurs

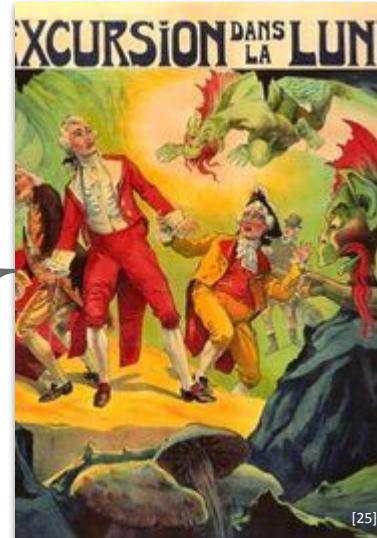
Knowledge Graph basierte Explorative Suche



:A_Trip_to_the_Moon

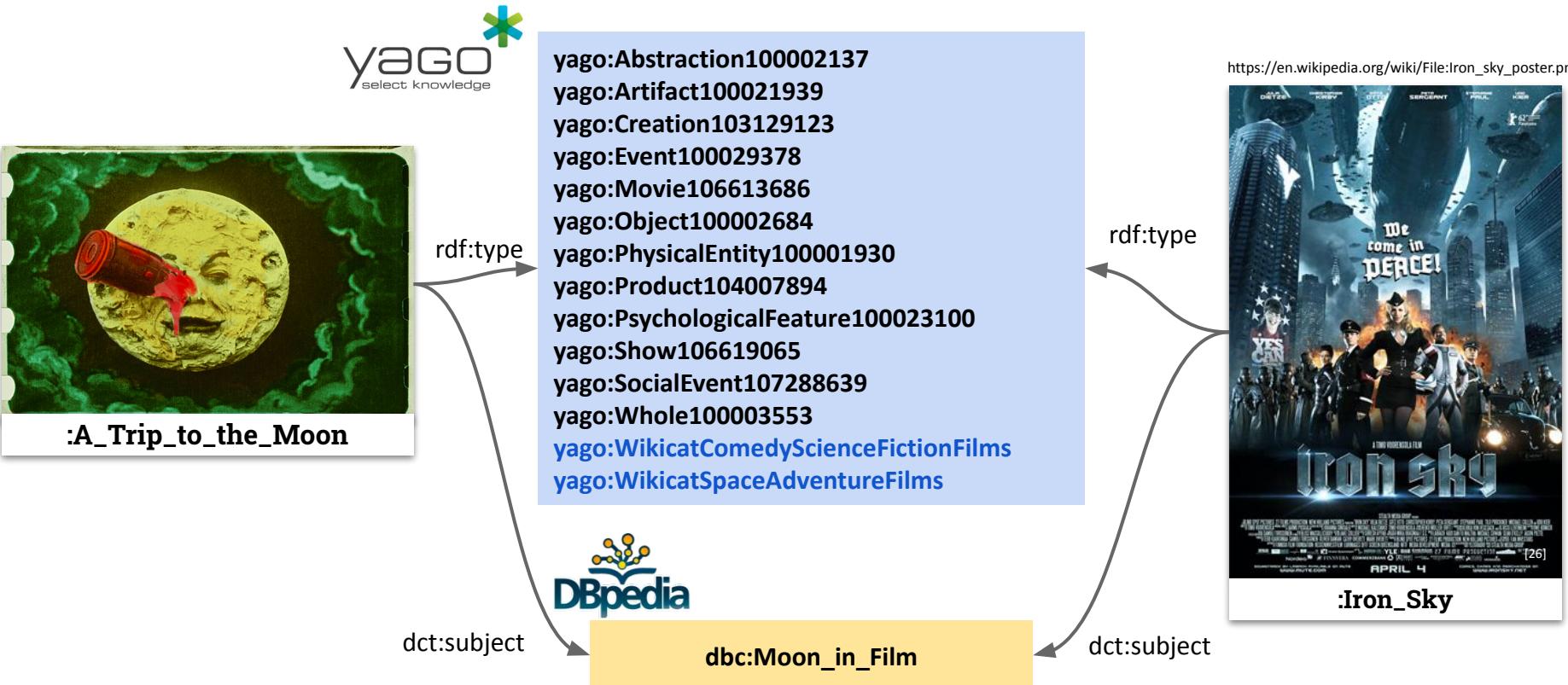


Finde ähnliche Filme



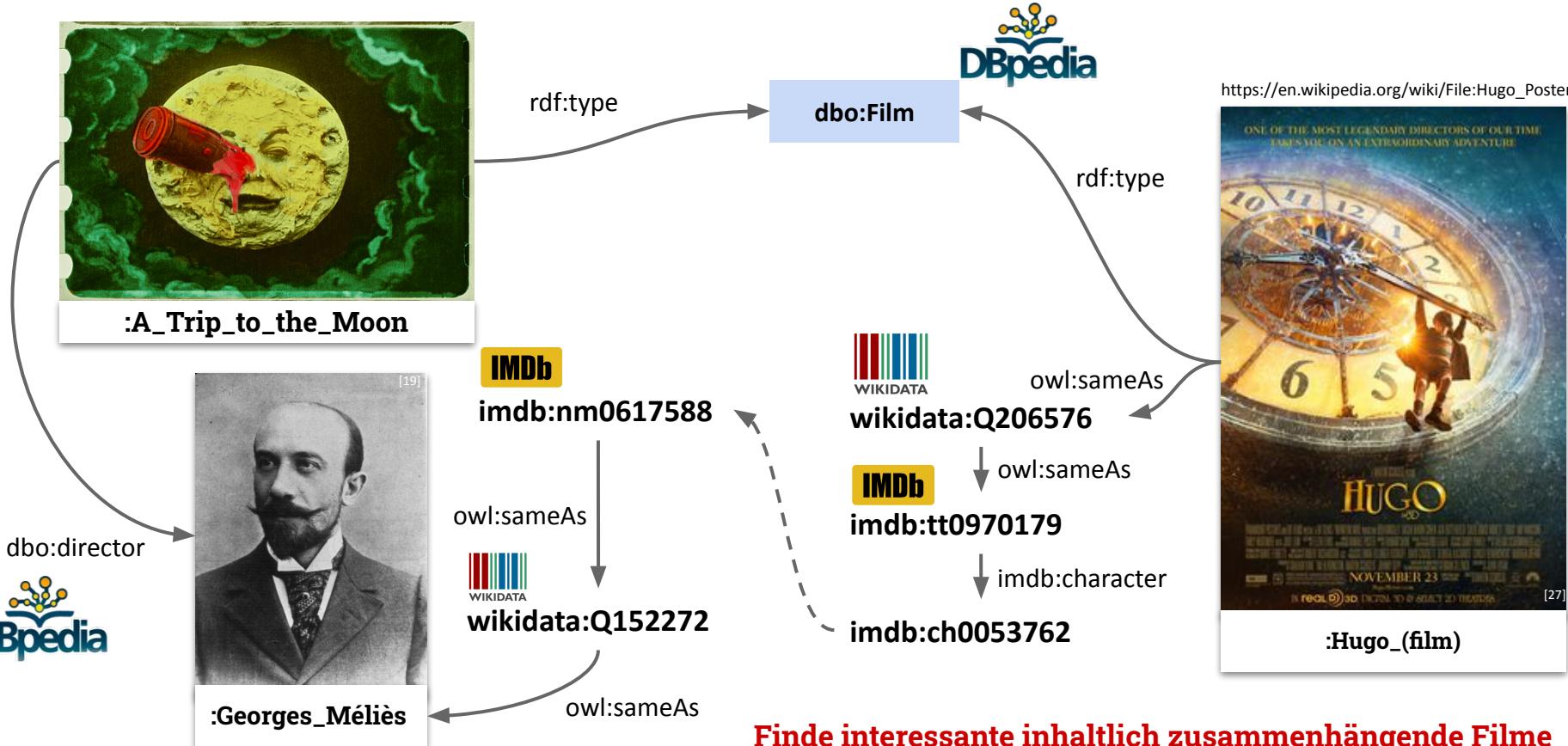
:Excursion_to_the_Moon

Knowledge Graph basierte Explorative Suche



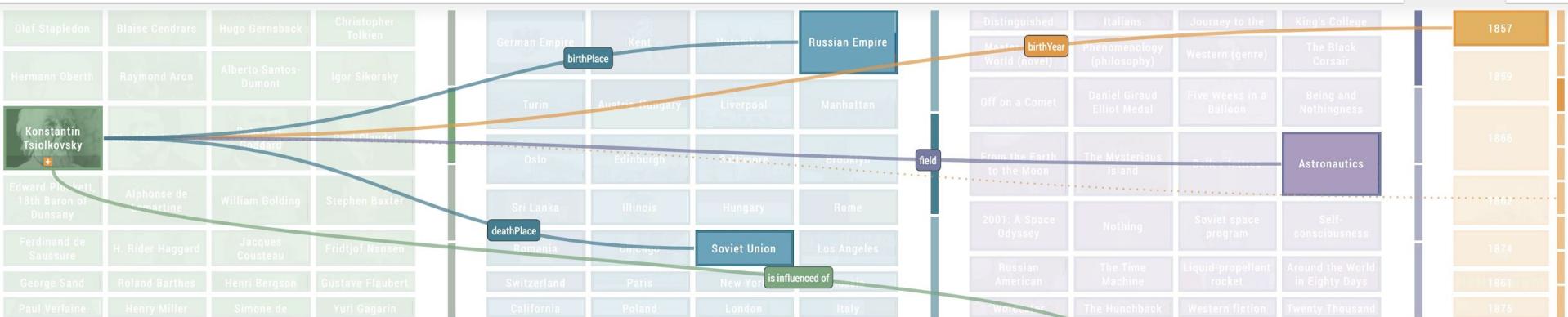
Finde "interessantere" ähnliche Filme

Knowledge Graph basierte Explorative Suche



Exploration & Recommendation

Ontology & Knowledge Graph Applications

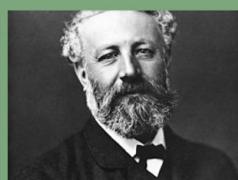


Georges Méliès

16 Recommended Articles:

- #1 The Man who Invented Science Fiction – Hugo Gernsback
- #2 Around the World in 80 Days
- #3 Cardinal Richelieu and the Académie Française
- #4 Nadar and How Photography became an Art
- #5 Elementary, my Dear Watson! – Sir Arthur Conan Doyle and his famous Sherlock Holmes
- #6 H. C. Walla and the Shape of Things to Come

Jules Verne



Jules Gabriel Verne (French: [ʒyl vɛʁn]; 8 February 1828 – 24 March 1905) was a French novelist, poet, and playwright best known for his adventure novels and his profound influence on the literary genre of science fiction. Born to bourgeois parents in the seaport of Nantes, Verne was trained to follow in his father's footsteps as a lawyer, but quit the profession early in life to write for magazines and the stage. His collaboration with the publisher Pierre-Jules Hetzel led to the creation of the Voyages Extraordinaires, a widely popular series of scrupulously researched adventure novels including Journey to the Center of the Earth, Twenty Thousand Leagues Under the Sea, and Around the World in Eighty Days. Verne is generally considered a major literary author in France and most of Europe, where he has had a wide influence on the literary avant-garde and on surrealism. His reputation is markedly different in Anglophone regions, where he has often been labeled a writer of genre fiction or

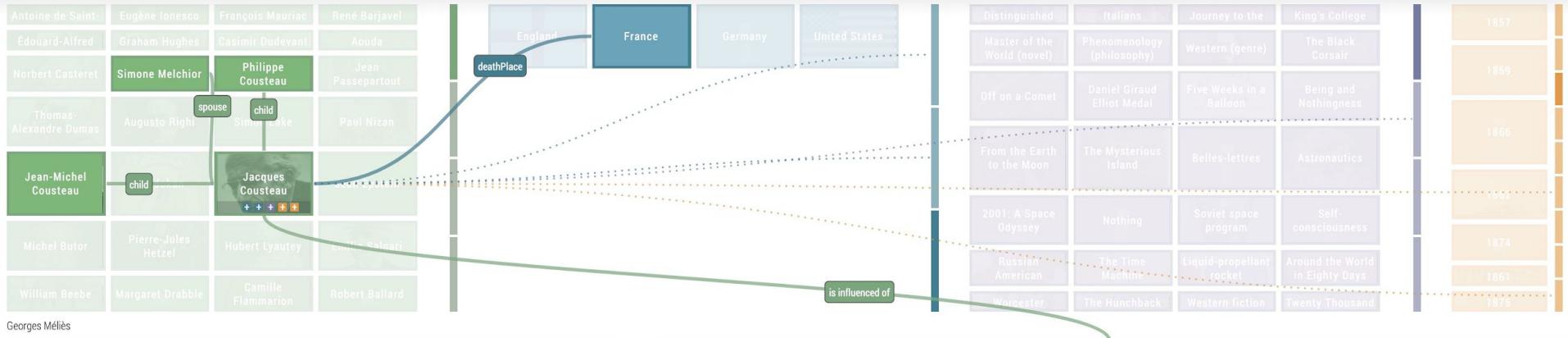
DBpedia: Jules Verne



e.g. via refer.cx WordPress Plugin at <http://scih.org/>

Exploration & Recommendation

Ontology & Knowledge Graph Applications



Georges Méliès

16 Recommended Articles:

- #1 The Man who Invented Science Fiction – Hugo Gernsback
- #2 Around the World in 80 Days
- #3 Cardinal Richelieu and the Académie Française
- #4 Nadar and How Photography became an Art
- #5 Elementary, my Dear Watson! – Sir Arthur Conan Doyle and his famous Sherlock Holmes



Jules Verne

Jules Gabriel Verne (French: [ʒyl vɛʁn]; 8 February 1828 – 24 March 1905) was a French novelist, poet, and playwright best known for his adventure novels and his profound influence on the literary genre of science fiction. Born to bourgeois parents in the seaport of Nantes, Verne was trained to follow in his father's footsteps as a lawyer, but quit the profession early in life to write for magazines and the stage. His collaboration with the publisher Pierre-Jules Hetzel led to the creation of the Voyages Extraordinaires, a widely popular series of scrupulously researched adventure novels including Journey to the Center of the Earth, Twenty Thousand Leagues Under the Sea, and Around the World in Eighty Days. Verne is generally considered a major literary author in France and most of Europe, where he has had a wide influence on the literary avant-garde and on surrealism. His reputation is markedly different in Anglophone regions, where he has often been labeled a writer of genre fiction or

DBpedia: Jules Verne



e.g. via refer.cx WordPress Plugin at <http://scihi.org/>

Daten - Information - Knowledge Graph, oder warum Daten alleine nicht ausreichen. Prof. Dr. Harald Sack, #vKG2021, 27. März 2021

Exploration & Recommendation

Ontology & Knowledge Graph Applications

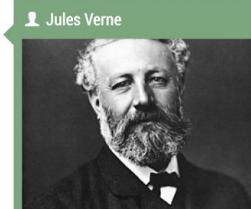
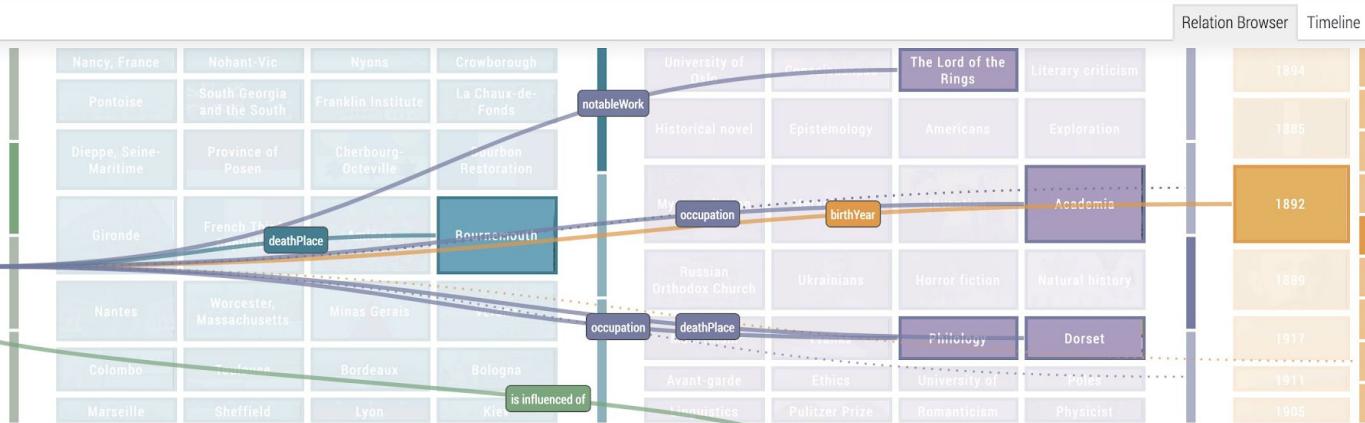


Olaf Stapledon	Blaise Cendrars	Hugo Gernsback	Christopher
Hermann Oberth	Raymond Aron	Alberto Santos-Dumont	Igor Sikorsky
Konstantin Tsiolkovsky	Sheridan Le Fanu	Robert H. Goddard	Pedro Páramo
Edward Plunkett, 18th Baron of Dunsany	Alphonse de Lamartine	William Golding	Stephen Baxter
Ferdinand de Saussure	H. Rider Haggard	Jacques Cousteau	J. R. R. Tolkien
George Sand	Roland Barthes	Henri Bergson	Gustave Flaubert
Paul Verlaine	Henry Miller	Simone de Beauvoir	Yuri Gagarin

Georges Méliès

16 Recommended Articles:

- #1 The Man who Invented Science Fiction – Hugo Gernsback
 - #2 Around the World in 80 Days
 - #3 Cardinal Richelieu and the Académie Française
 - #4 Nadar and How Photography became an Art
 - #5 Elementary, my Dear Watson! – Sir Arthur Conan Doyle and his famous Sherlock Holmes
- © 2011 C. Waller and the Share of Things to Come



Jules Gabriel Verne (French: [ʒyl vɛʁn]; 8 February 1828 – 24 March 1905) was a French novelist, poet, and playwright best known for his adventure novels and his profound influence on the literary genre of science fiction. Born to bourgeois parents in the seaport of Nantes, Verne was trained to follow in his father's footsteps as a lawyer, but quit the profession early in life to write for magazines and the stage. His collaboration with the publisher Pierre-Jules Hetzel led to the creation of the Voyages Extraordinaires, a widely popular series of scrupulously researched adventure novels including Journey to the Center of the Earth, Twenty Thousand Leagues Under the Sea, and Around the World in Eighty Days. Verne is generally considered a major literary author in France and most of Europe, where he has had a wide influence on the literary avant-garde and on surrealism. His reputation is markedly different in Anglophone regions, where he has often been labeled a writer of genre fiction or

DBpedia: Jules Verne





Vielen Dank für Ihre Aufmerksamkeit!

Prof. Dr. Harald Sack

*Data - Information - Knowledge Graph
oder warum Daten alleine nicht ausreichen*

harald.sack@fiz-karlsruhe.de

twitter: [lysander07](https://twitter.com/lysander07)

#vKG2021, 27 März 2021



Leibniz-Institut für Informationsinfrastruktur



Image References

- [1] Frame from the only surviving hand-colored print of Georges Méliès's 1902 film *Le voyage dans la lune*. [Public domain],
https://commons.wikimedia.org/wiki/File:M%C3%A9li%C3%A8s_color_Voyage_dans_la_lune.jpg
- [2] Neil Armstrong (1930–2012), commander of NASA's Apollo 11 mission, descends the ladder of the Apollo Lunar Module to become the first human to set foot on the surface of the Moon. NASA, 1969 [Public Domain], https://commons.wikimedia.org/wiki/File:Apollo_11_first_step.jpg
- [3] Matrix Computer Screen, pixabay license <https://pixabay.com/illustrations/matrix-code-computer-pc-data-356024/>
- [4] UBC Library Card Catalog, Paul Joseph, cc-by-2.0, https://commons.wikimedia.org/wiki/File:2009_3544505541_card_catalog.jpg
- [5] Tree of knowledge based on the French Encyclopédie from 1780, [public domain],
https://commons.wikimedia.org/wiki/File:Essai_d%27une_distribution_g%C3%A9n%C3%A9alogique_des_sciences_et_des_arts_principaux,_1780.jpg
- [6] Pieter Bruegel the Elder, The Tower of Babel, 1563, [public domain],
[https://commons.wikimedia.org/wiki/File:Pieter_Bruegel_the_Elder_-_The_Tower_of_Babel_\(Vienna\)_-_Google_Art_Project_-_edited.jpg](https://commons.wikimedia.org/wiki/File:Pieter_Bruegel_the_Elder_-_The_Tower_of_Babel_(Vienna)_-_Google_Art_Project_-_edited.jpg)
- [7] Michelangelo Buonarroti, Creazione di Adamo, c. 1512, [public domain], [https://en.wikipedia.org/wiki/The_Creation_of_Adam#/media/File:Michelangelo_-_Creation_of_Adam_\(cropped\).jpg](https://en.wikipedia.org/wiki/The_Creation_of_Adam#/media/File:Michelangelo_-_Creation_of_Adam_(cropped).jpg)
- [8] Niklas Jansson, Touched by His Noodly Appendage, [public domain], https://commons.wikimedia.org/wiki/File:Touched_by_His_Noodly_Appendage_HD.jpg
- [9] Arbor porphyrii, in translation of Boetius, 6th century, [public domain], [https://en.m.wikipedia.org/wiki/File:Arbor_porphyrii_\(probably_from_one_of_Boethius%27_translations\).png](https://en.m.wikipedia.org/wiki/File:Arbor_porphyrii_(probably_from_one_of_Boethius%27_translations).png)
- [10] Scientist (Ice Cream) 1986; Cover illustration for *The New Yorker*, August 4, 1986; Courtesy of Roz Chast and Danese/Corey, New York, <https://www.nrm.org/2015/03/roz-chast-cartoon-memoirs/>
- [11] Hannah Wolley, The Queen-like Closet. 1672, public domain, <[link](#)>
- [12] A fantasy map of a flat earth. Photograph: Antar Dayal/Getty Images/Illustration Works <[link](#)>
- [13] Jorge Luis Borges by Annemarie Heinrich, 1967, https://commons.wikimedia.org/wiki/File:Jorge_Luis_Borges_by_Annemarie_Heinrich,_1967.jpg
- [14] Bing, CC BY-NC-SA 3.0, <https://bing.com>
- [15] PostIts, Liang Chang @flickr, CC BY-SA 2.0, <https://www.flickr.com/photos/diametrik/30931836692>
- [16] Paper Data Files Office Stack Work Paperwork, CC0, <https://www.maxpixel.net/Paperwork-Paper-Office-Files-Work-Stack-Data-1614223>
- [17] Dr. Marcus Gossler (Own work) [GFDL (<http://www.gnu.org/copyleft/fdl.html>) or CC-BY-SA-3.0 (<http://creativecommons.org/licenses/by-sa/3.0/>)]
- [18] Carl Spitzweg, Der Bücherwurm, 1850 [public domain], https://commons.wikimedia.org/wiki/File:Carl_Spitzweg_021.jpg
- [19] Georges Méliès (1861–1938), French filmmaker and cinematographer, c. 1890 [public domain], https://commons.wikimedia.org/wiki/File:George_Melies.jpg?uselang=de
- [20] Production still for Georges Méliès's 1902 film "A Trip to the Moon", [public domain], https://commons.wikimedia.org/wiki/File:M%C3%A9li%C3%A8s_Trip_to_the_Moon_planets_still.jpg
- [21] Georges Méliès, Une nuit terrible (Star Film 26, 1896), [public domain],
[https://commons.wikimedia.org/wiki/Category:A_Terrible_Night#/media/File:M%C3%A9li%C3%A8s_Une_nuit_terrible_\(Star_Film_26,_1896\).jpg](https://commons.wikimedia.org/wiki/Category:A_Terrible_Night#/media/File:M%C3%A9li%C3%A8s_Une_nuit_terrible_(Star_Film_26,_1896).jpg)
- [22] Georges Méliès, Apres le bal (Star Film 128, 1897), [public domain],
[https://commons.wikimedia.org/wiki/Category:After_the_Ball_\(1897_film\)#/media/File:M%C3%A9li%C3%A8s_Apres_le_bal_\(Star_Film_128,_1897\).jpg](https://commons.wikimedia.org/wiki/Category:After_the_Ball_(1897_film)#/media/File:M%C3%A9li%C3%A8s_Apres_le_bal_(Star_Film_128,_1897).jpg)
- [23] Georges Méliès, Illusions fantasmagoriques (Star Film 155, 1898), [public domain],
[https://commons.wikimedia.org/wiki/File:M%C3%A9li%C3%A8s_Illusions_fantasmagoriques_\(Star_Film_155,_1898\).jpg](https://commons.wikimedia.org/wiki/File:M%C3%A9li%C3%A8s_Illusions_fantasmagoriques_(Star_Film_155,_1898).jpg)
- [24] Georges Méliès, La lune à un mètre (Star Film 160-162, 1898), [public domain],
[https://commons.wikimedia.org/wiki/File:M%C3%A9li%C3%A8s_La_lune_%C3%A0_un_m%C3%A8tre_\(Star_Film_160-162,_1898\)_02.jpg](https://commons.wikimedia.org/wiki/File:M%C3%A9li%C3%A8s_La_lune_%C3%A0_un_m%C3%A8tre_(Star_Film_160-162,_1898)_02.jpg)
- [25] Segundo de Chomón, Excursion dans la lune French poster, 1908, [public domain], <[link](#)>
- [26] This is a poster for Iron Sky. The poster art copyright is believed to belong to the distributor of the film, Buena Vista International Finland, the publisher of the film or the graphic artist., via English Wikipedia, https://en.wikipedia.org/wiki/File:Iron_sky_poster.png
- [27] This is a poster for Hugo. The poster art copyright is believed to belong to Paramount Pictures. Via English Wikipedia, https://en.wikipedia.org/wiki/File:Hugo_Poster.jpg