





# **Analytische Visualisierungen**

oder

Wie explizite Semantik hilft Zusammenhänge aufzuzeigen

Prof. Dr. Harald Sack

Workshop Problemfelder und Lösungsvisionen im Umgang mit Datenbanken und Visualisierungen in digitaler Musikverlagsforschung und verwandten Gebieten der Digital Humanities 22. April 2021

# -21



-21°
24.000



# -21° 24.000 Smolensk



-21° 24.000 Smolensk

14. November 1812





#### FIGURATIVE MAP of the successive losses in men of the French Army in the RUSSIAN CAMPAIGN OF 1812-1813 Moscow Drawn by Mr. Minard, Inspector General of Bridges and Roads in retirement, Paris, 20 November 1869, The numbers of men present are represented by the widths of the colored zones in a rate of one millimeter for ten thousand men; these are also written beside the zones. Red designates men moving into Russia, black those on retreat. — The informations used for drawing the map were taken from the works of Messrs. Chiers, de Ségur, de Fezensac, de Chambray and the unpublished diary of Jacob, pharmacist of the Army since 28 October. In order to facilitate the judgement of the eye regarding the diminution of the army, I supposed that the troops under Prince Jerôme and under Marshal Davoust, who were sent to Minsk and Mobilow and who rejoined near Orscha and Witebsk, had always marched with the army. Polotsk Glubokoe Malo-jarosewli Doroboy Vilna Smolensk Kovno Orscha Common leagues of France (map of Fezensac) Studienska Mohilow GRAPHIC TABLE of the temperature in degrees of Réaumur thermometer °R °C Rain October 24 -10 -13 The Cossacks pass the frozen 9° November 9 Niémen at a gallop 20° November 28 -21° November 14 -24° December 1 -26° December 7 -30° December 7

Infographics by Charles Minard (1781-1870) from data of Napoleon's Russian Campaign 1812/13



[2] 



### Von Daten zu Wissen





**future** *novelty* 

# Knowledge information enriched with semantics

past experience

Information

in usable form

Data raw characters and symbols

DIKW Pyramide, Ackoff 1989

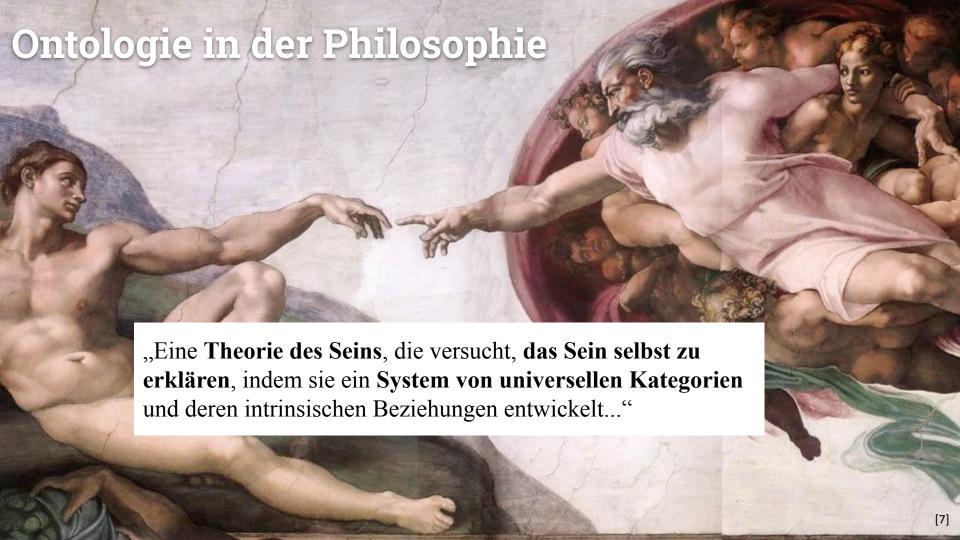
Data



### ...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?





# Ontologien in der Informatik



### Eine Ontologie ist eine

explizite, formale Spezifikation einer gemeinsamen Konzeptualisierung

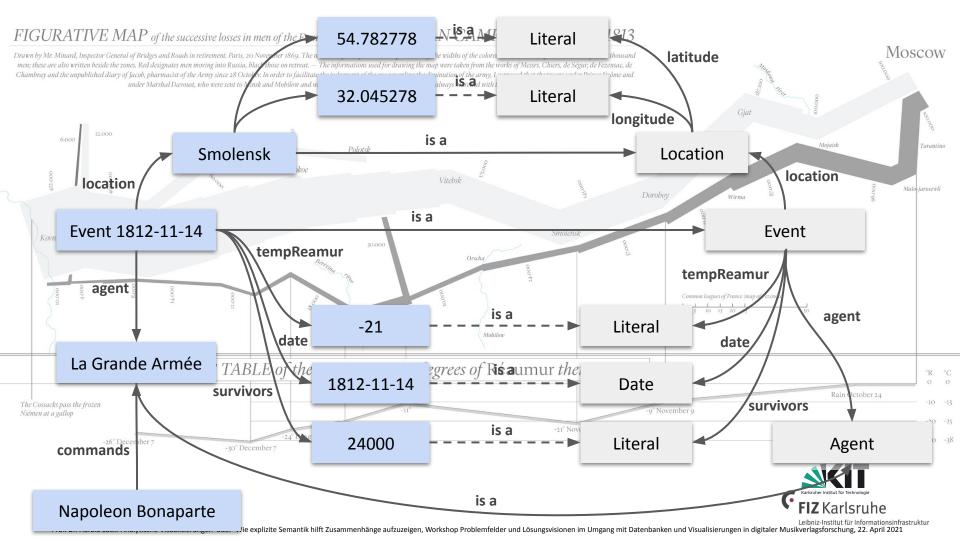
**Konzeptualisierung**: Abstraktes Modell

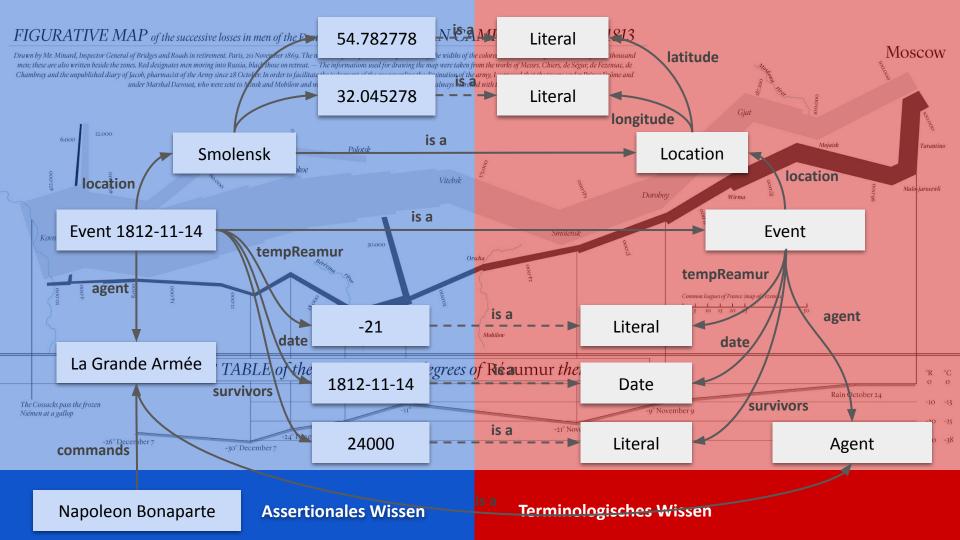
(Fachgebiet, relevante Konzepte, Beziehungen)

**explizit**: Alle Konzepte müssen definiert sein

**formal**: maschinenverstehbar

gemeinsam: notwendiger Konsens über die Ontologie





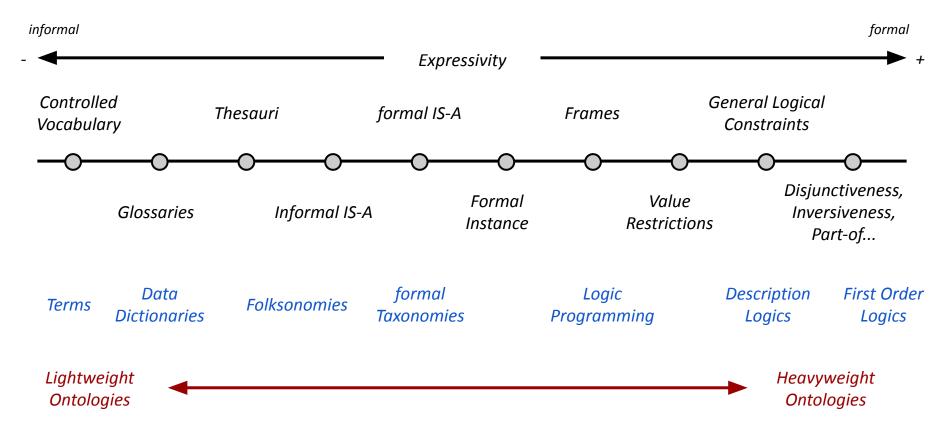
### FIGURATIVE MAP of the successive losses in men of the French Army in the RUSSIAN CAMPAIGN OF 1812-1813 Moscow Drawn by Mr. Minard, Inspector General of Bridges and Roads in retirement, Paris, 20 November 1869, The numbers of men present are represented by the widths of the colored zones in a rate of one millimeter for ten thousand men; these are also written beside the zones. Red designates men moving into Russia, black those on retreat. — The informations used for drawing the map were taken from the works of Messrs. Chiers, de Ségur, de Fezensac, de Chambray and the unpublished diary of Jacob, pharmacist of the Army since 28 October. In order to facilitate the judgement of the eye regarding the diminution of the army, I supposed that the troops under Prince Jerôme and under Marshal Davoust, who were sent to Minsk and Mobilow and who rejoined near Orscha and Witebsk, had always marched with the army, Glubokoe Malo-jarosewli Event □ ∃location.Location □ ∃agent.Agent Location ⊆ ∃longitude. ¬ ¬ ∃latitude. ¬ Kovno {Event1812-11-14} Event □ ∃location.{Smolensk} □ ∃agent.{LaGrandeArmée} □ ∃ date.{1812-11-14~xsd:date} □ ∃ survivors.{24000} □ ∃ tempReamur.{-21} °R °C Agent(LaGrandeArmée) Rain October 24 Person(NapoleonBonaparte) The Cossacks pass the frozen Niémen at a gallop agent(Event1812-11-14, LaGrandeArmée) commands(NapoleonBonaparte, LaGrandeArmée)

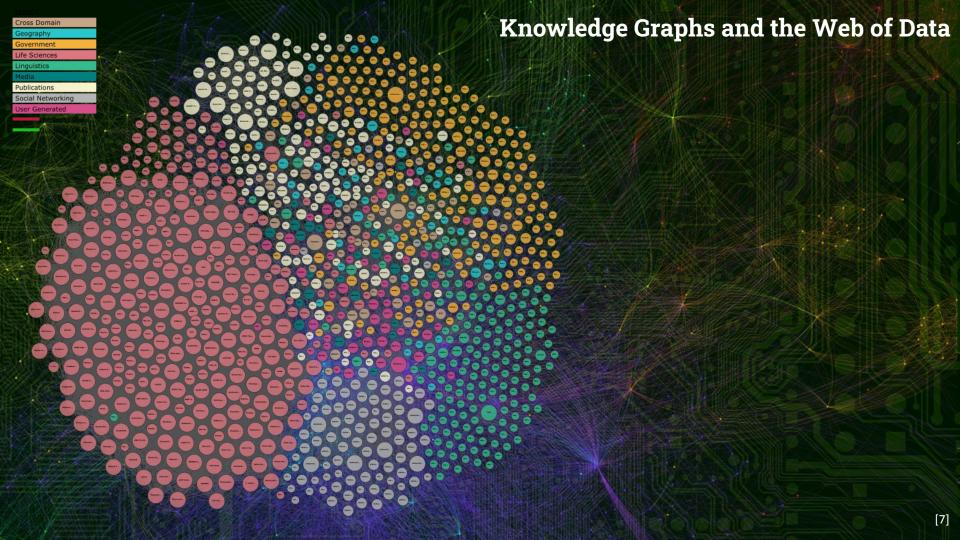
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Prof. Dr. Harald Sack: Analytische Visualisierungen oder Wie explizite Semantik hilft Zusammenhänge aufzuzeigen, Workshop Problemfelder und Lösungsvisionen im Umgang mit Datenbanken und Visualisierungen in digitaler Musikverlagsforschung, 22. April 2021

# **Ontology Types and Categories**



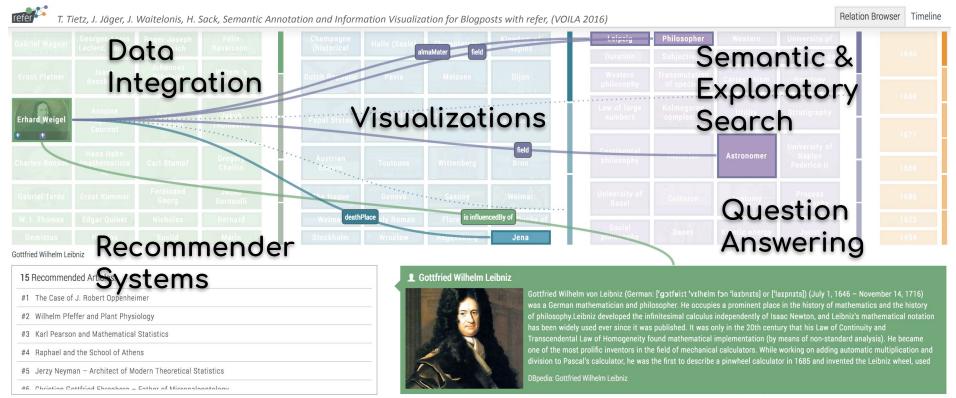
according to their level of Semantic Expressivity







### **Knowledge Graph Applications**



# Retrieval vs. Exploration



Tchaikovsky, Peter Ilich 1812 overture Shilkret, Nathaniel Victor Symphony Orchestra Victor, 1923-06-01 RCN 35729 C-26552/6

SCHLAGWORTKATA BEF - BERF

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SCHLAGWORTKATALOG

SCHLAGWORTKATALOG

BISM - BODEN: E

## Retrieval vs. Exploration



J. Waitelonis, H. Sack: Towards exploratory video search using linked data, Multimedia Tools and Applications, Vol 59, No 2 (2012)

# **Explorative Suche**



- Finde etwas "Interessantes" für mich
- Gibt es **thematisch ähnliche** Aufnahmen?
- Welche Aufnahmen **hängen** inhaltlich damit **zusammen**?
- Wie hat sich das **Genre** über die Zeit **entwickelt**?
- Was soll ich als nächstes hören?

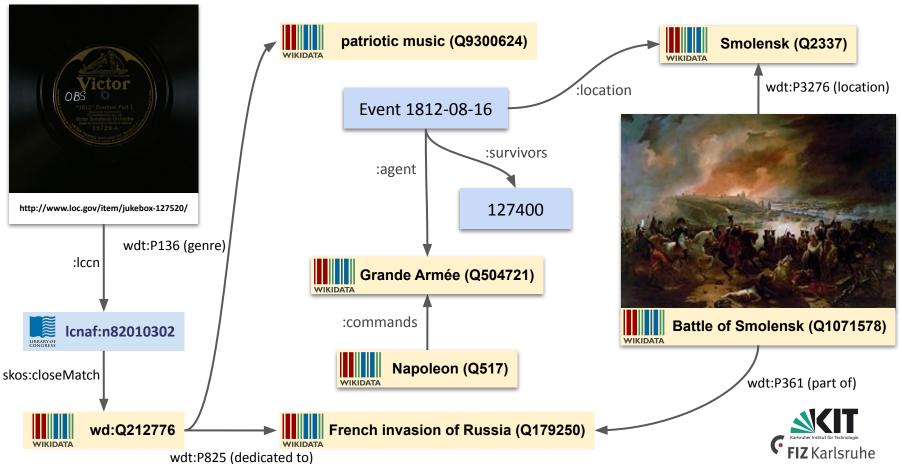
• ...



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### **Knowledge Graph basierte Explorative Suche**



### **Knowledge Graph basierte Explorative Suche**



ch Tolstoi (1794-1837), his mother Marija Nikolajewna, née e became an orphan at the age of nine, his father's sister ying oriental languages at the University of Kazan in 1844.

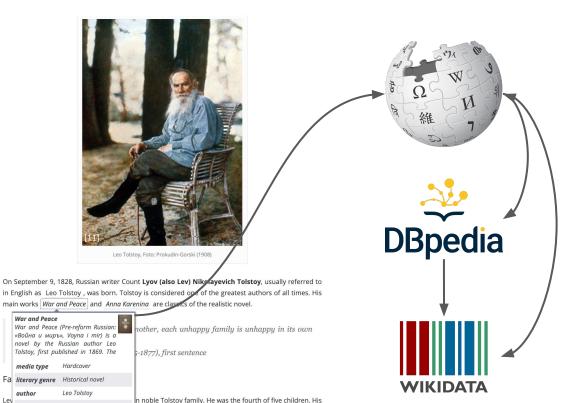
After a change to the law racuity, he discontinued his studies in 1847 in order to improve the situation of

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Ontology & Knowledge Graph Applications

literary genre Philosophical fiction

http://scihi.org/



Requires **semantic annotation** and tools for **visualization** 



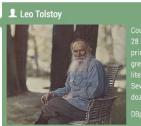


**Ontology & Knowledge Graph Applications** 



Leo Tolstoy

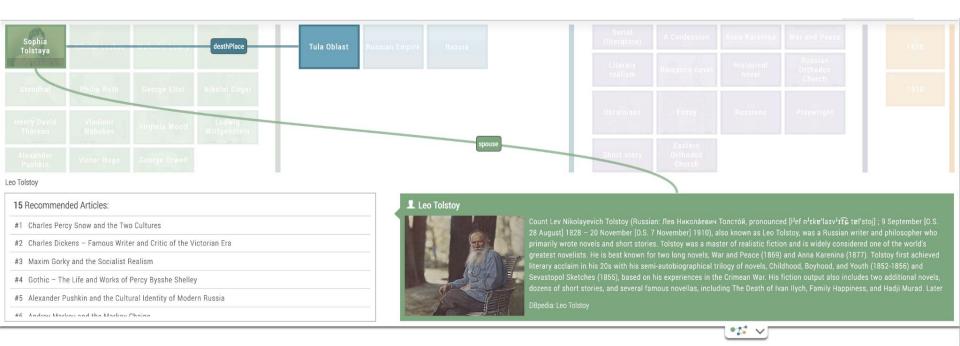
15	Recommended Articles:	
#1	Charles Percy Snow and the Two Cultures	
#2	Charles Dickens – Famous Writer and Critic of the Victorian Era	
#3	Maxim Gorky and the Socialist Realism	
#4	Gothic – The Life and Works of Percy Bysshe Shelley	
#5	Alexander Pushkin and the Cultural Identity of Modern Russia	
#6	Andrew Markey and the Markey Chains	



Count Lev Nikolayevich Tolstoy (Russian: Лев Никола́евич Толсто́й, pronounced [l<sup>1</sup>fe n<sup>1</sup>tke'latv<sup>1</sup>t͡G tel'stoj]; 9 September [0.S. 28 August] 1828 – 20 November [0.S. 7 November] 1910), also known as Leo Tolstoy, was a Russian writer and philosopher who primarily wrote novels and short stories. Tolstoy was a master of realistic fiction and is widely considered one of the world's greatest novelists. He is best known for two long novels, War and Peace (1869) and Anna Karenina (1877). Tolstoy first achieved literary acclaim in his 20s with his semi-autobiographical trilogy of novels, Childhood, Boyhood, and Youth (1852-1856) and Sevastopol Sketches (1855), based on his experiences in the Crimean War. His fiction output also includes two additional novels, dozens of short stories, and several famous novellas, including The Death of Ivan Ilych, Family Happiness, and Hadji Murad. Later

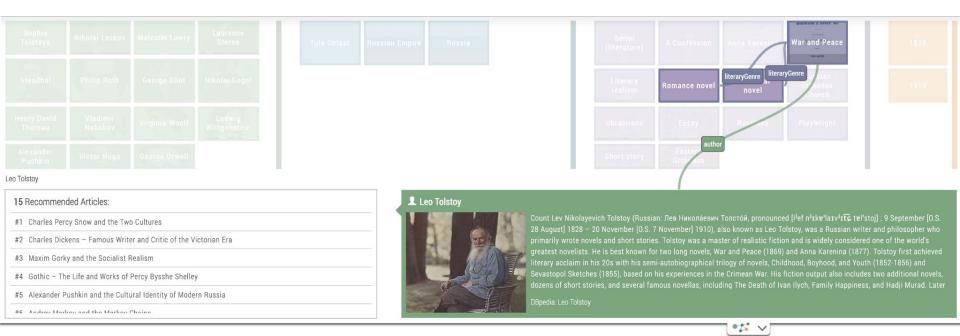






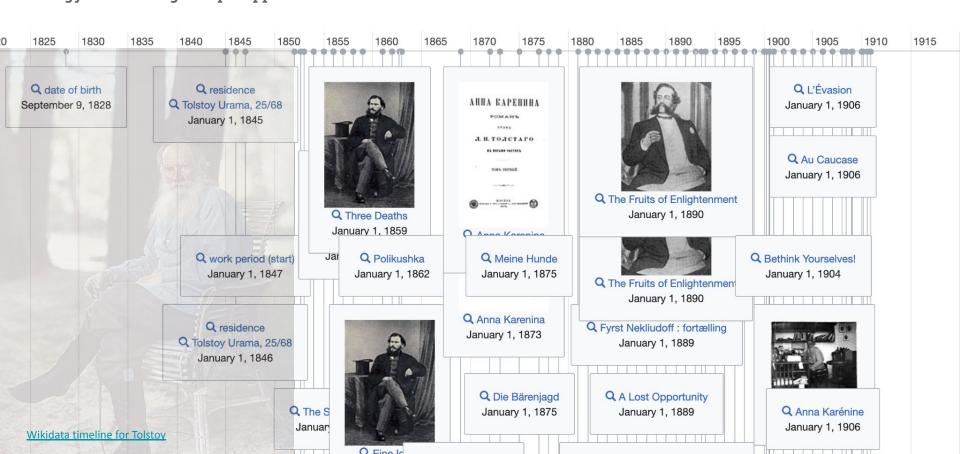






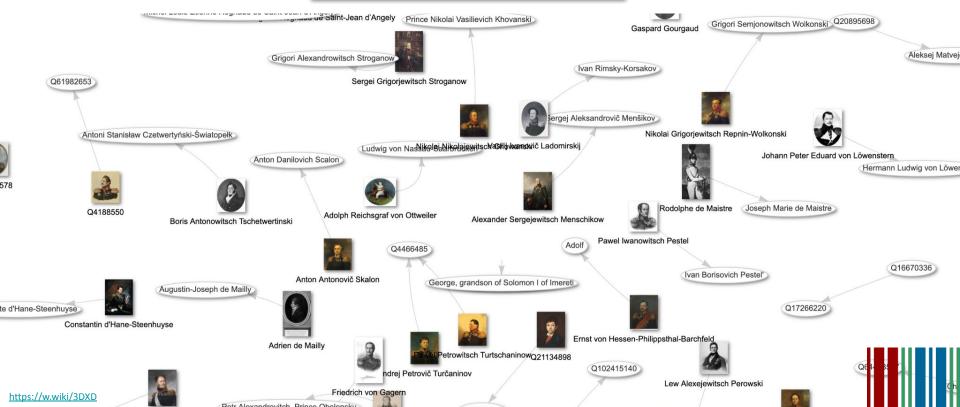


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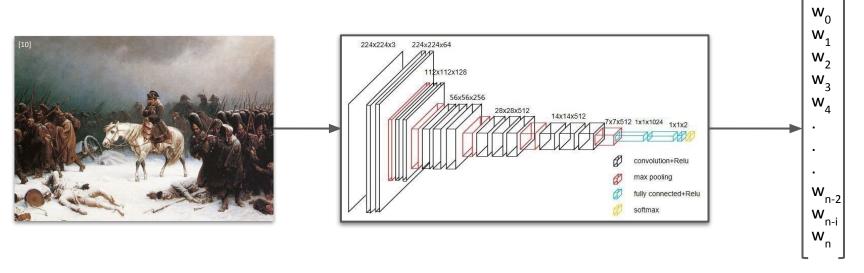
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**Subsymbolic Knowledge Representation & Deep Learning** 



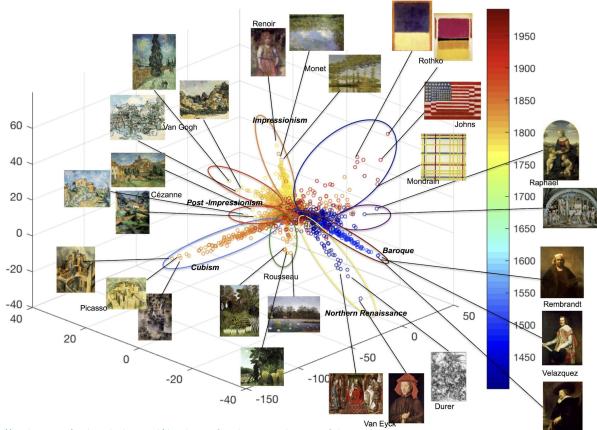
**Image** 

**Pretrained Convolutional Neural Network** 

**Image vector** 



Subsymbolic Knowledge Representation & Deep Learning







## **Exploration & Recommendation**

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https://wikiview.net/

**Subsymbolic Knowledge Representation** 





Prof. Dr. Harald Sack
Analytische Visualisierungen oder
Wie explizite Semantik hilft Zusammenhänge aufzuzeigen



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#### **Image References:**

- [1] Charles Minard's 1869 chart showing the number of men in Napoleon's 1812 Russian campaign army, public domain, https://commons.wikimedia.org/wiki/File:Minard.png
- [2] Matrix Computer Screen, <u>pixabay license</u> <u>https://pixabay.com/illustrations/matrix-code-computer-pc-data-356024/</u>
- [3] UBC Library Card Catalog, Paul Joseph, cc-by-2.0, https://commons.wikimedia.org/wiki/File:2009\_3544505541\_card\_catalog.jpg
- [4] Tree of knowledge based on the French Encyclopedie from 1780, public domain, <a href="https://commons.wikimedia.org/wiki/File:Essai\_d%27une\_distribution\_g%C3%A9n%C3%A9alogique\_des\_sciences\_et\_des\_arts\_principaux,\_1780.jpg">https://commons.wikimedia.org/wiki/File:Essai\_d%27une\_distribution\_g%C3%A9n%C3%A9alogique\_des\_sciences\_et\_des\_arts\_principaux,\_1780.jpg</a>
- [5] Pieter Bruegel the Elder, The Tower of Babel, 1563, public domain, <a href="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</a>
- [6] Niklas Jansson, Touched by His Noodly Appendage, public domain, <a href="https://commons.wikimedia.org/wiki/File:Touched\_by\_His\_Noodly\_Appendage\_HD.jpg">https://commons.wikimedia.org/wiki/File:Touched\_by\_His\_Noodly\_Appendage\_HD.jpg</a>
- [7] The Linked Data Cloud, 2019, cc-by, https://lod-cloud.net
- [8] 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/) ]
- [9] Carl Spitzweg, Der Bücherwurm, 1850 [public domain], <a href="https://commons.wikimedia.org/wiki/File:Carl\_Spitzweg\_021.jpg">https://commons.wikimedia.org/wiki/File:Carl\_Spitzweg\_021.jpg</a>
- [10] Adolph Northen, Napoleon's retreat from Moscow, 1851, public domain, https://commons.wikimedia.org/wiki/File:Napoleons\_retreat\_from\_moscow.jpg
- [11] Sergej Prokudi-Gorskii, "Lev Tolstoy in Yasnaya Polyana", 1908, the first color photo portrait in Russia. Public domain, <a href="https://commons.wikimedia.org/wiki/File:L.N.Tolstoy">https://commons.wikimedia.org/wiki/File:L.N.Tolstoy</a> Prokudin-Gorsky.jpg