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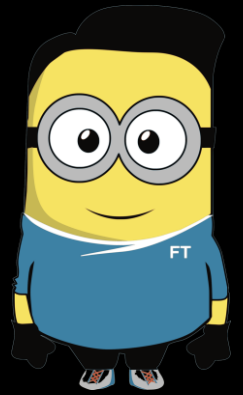
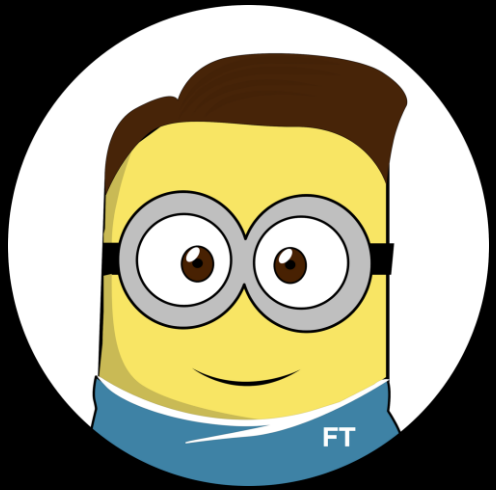
Leibniz-Forschungsinstitut für Archäologie
Department of Scientific Information Technology

CAA

Taming Time Tools:
Alligator and Academic Meta Tool



Cheers!



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RGZM

Leibniz-Gemeinschaft

Our little Minions!

#alligator

#AMT

ALLIGATOR

What?

Web tool for converting CAs with dating information to relative time intervals as RDF.

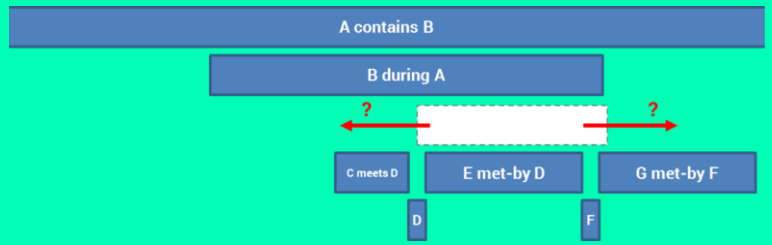
Who?

RGZM, Department of Scientific IT
Florian Thiery, Allard Mees

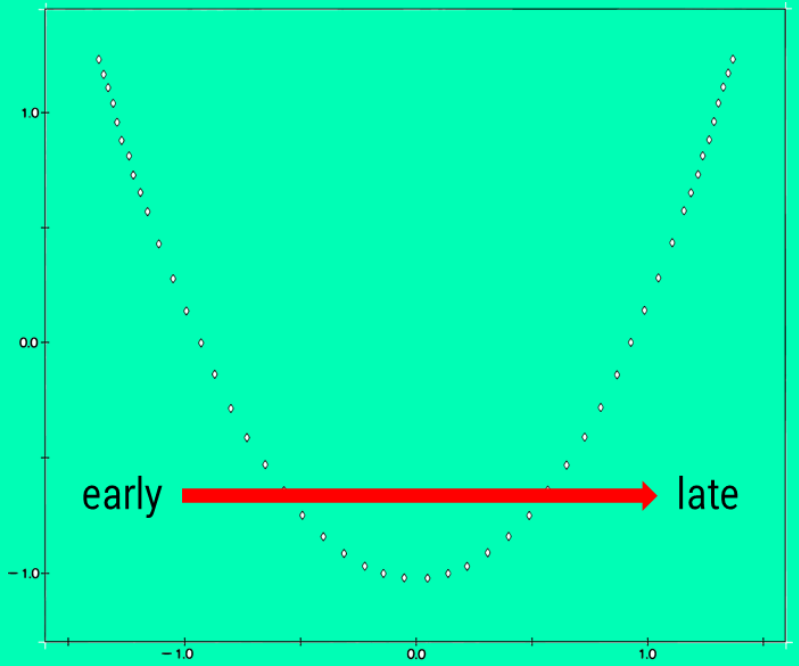
Where?

https://java-dev.rgzm.de/webapp_alligator
https://github.com/RGZM/alligator

ALLIGATOR

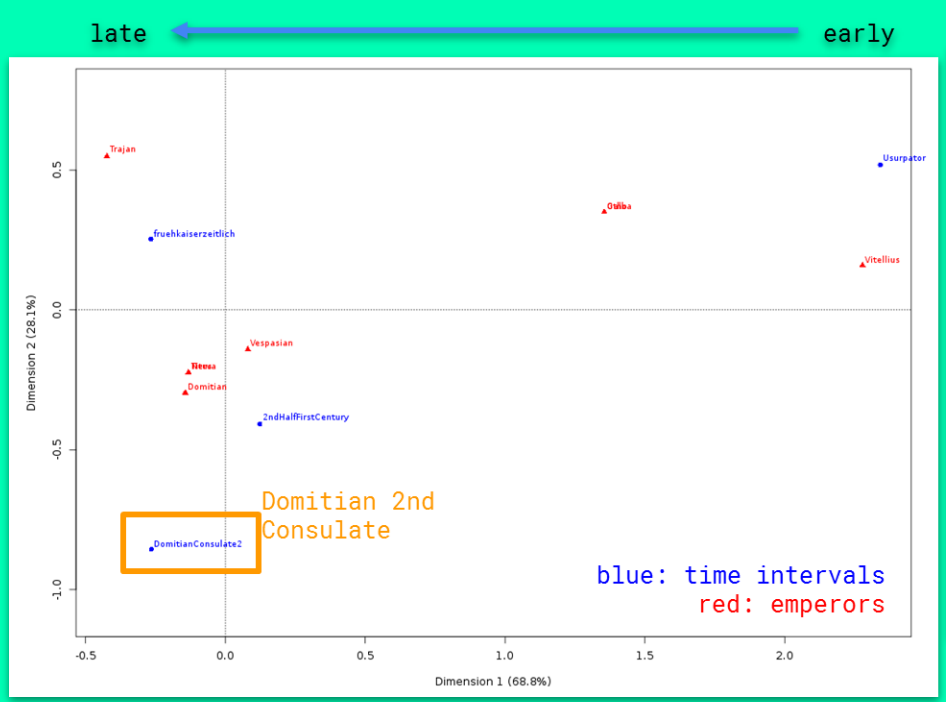


example: modelling of relative chronological information using Allen‘s algebra



To achieve a chronology in archaeological research we use the **horseshoe paradigma** in **Correspondence Analysis** (CA).

based on Madsen T. 1988, Multivariate statistics and archaeology. In: Madsen T. (Ed.), Multivariate Archaeology. Numerical Approaches in Scandinavian Archaeology. Jutland Archaeological Society Publications XII. Aarhus University Press, 7-27. | Madsen 1988, 25, Fig. 11



timeinterval emperor years

	A	B	C
1	fruehkaiserzeitlich	Vitellius	1
2	fruehkaiserzeitlich	Galba	1
3	fruehkaiserzeitlich	Otho	1
4	fruehkaiserzeitlich	Vespasian	10
5	fruehkaiserzeitlich	Titus	2
6	fruehkaiserzeitlich	Domitian	15
7	fruehkaiserzeitlich	Nerva	2
8	fruehkaiserzeitlich	Trajan	19
9	2ndHalfFirstCentury	Vitellius	1
10	2ndHalfFirstCentury	Galba	1
11	2ndHalfFirstCentury	Otho	1
12	2ndHalfFirstCentury	Vespasian	10
13	2ndHalfFirstCentury	Titus	2
14	2ndHalfFirstCentury	Domitian	15
15	2ndHalfFirstCentury	Nerva	2
16	2ndHalfFirstCentury	Trajan	2
17	Usurpator	Galba	1
18	Usurpator	Otho	1
19	Usurpator	Vitellius	1
20	Usurpator	Vespasian	1
21	DomitianConsulate2	Domitian	1

DOI 10.5281/zenodo.2632727

method test: results of a CA of Roman Emperors and reigning years

ALLIGATOR

The horizontal CA dimension axis defines the amount of overlap between the time intervals.

	A	B	C	D	E	F	G
1	name	x	y	z	von	bis	fixed
2	fruehkaiserzeitlich	-0.2660	0.2530	0.0072	1	150	fixed
3	2ndHalfFirstCentury						fixed
4	Usurpator						fixed
5	Galba	13.550	0.3500	0.0580	69	69	fixed
6	Otho	13.550	0.3500	0.0580	69	69	fixed
7	Vespasian	0.0810	-0.1420	-0.1450	69	79	fixed
8	Titus	-0.1320	-0.2240	-0.1790	79	81	fixed
9	Domitian	-0.1430	-0.2960	0.1180	81		
10	Nerva	-0.1320	-0.2240	-0.1790	96		
11	Trajan	-0.4230	0.5490	0.0170	98	117	fixed
12	Vitellius	22.780	0.1590	0.0560	69	69	fixed
13	DomitianConsulate2	-0.2646	-0.8560	10.336	0	0	schwebend

CA x, y, z values

from-to values

fixed/floating values

DOI 10.5281/zenodo.2632727

the starting situation

ALLIGATOR

aim:
fix the floating values and transform the data into a relative chronology

	A	B	C	D	E	F	G
1	name	x	y	z	von	bis	fixed
2	fruehkaiserzeitlich	-0.2660	0.2530	0.0072	1	150	fixed
3	2ndHalfFirstCentury	0.1235	-0.4078	-0.0481	50	100	fixed
4	Usurpator	23.415	0.5180	0.0610	69	69	fixed
5	Galba	13.550	0.3500	0.0580	69	69	fixed
6	Otho	13.550	0.3500	0.0580	69	69	fixed
7	Vespasian	0.0810	-0.1420	-0.1450	69	79	fixed
8	Titus	-0.1320	-0.2240	-0.1790	79	81	fixed
9	Domitian	-0.1430	-0.2960	0.1180	81	96	fixed
10	Nerva	-0.1320	-0.2240	-0.1790	96	98	fixed
11	Trajan	-0.4230	0.5490	0.0170	98	117	fixed
12	Vitellius	22.780	0.1590	0.0560	69	69	fixed
13	DomitianConsulate2	-0.2646	-0.8560	10.336	0	0	schwebend

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the method in action *1/3*

	A	B	C	D	E	F	G
1	name	x	y	z	von	bis	fixed
2	fruehkaiserzeitlich	-0.2660	0.2530	0.0072	1	150	fixed
3	2ndHalfFirstCentury	0.1235	-0.4078	-0.0481	50	100	fixed
4	Usurpator	23.415	0.5180	0.0610	69	69	fixed
5	Galba	13.550	0.3500	0.0580	69	69	fixed
6	Otho	13.550	0.3500	0.0580	69	69	fixed
7	Vespasian	0.0810	-0.1420	-0.1450	69	79	fixed
8	Titus	-0.1320	-0.2240	-0.1790	79	81	fixed
9	Domitian	-0.1430	-0.2960	0.1180	81	96	fixed
10	Nerva	-0.1320	-0.2240	-0.1790	96	98	fixed
11	Trajan	-0.4230	0.5490	0.0170	98	117	fixed
12	Vitellius	22.780	0.1590	0.0560	69	69	fixed
13	DomitianConsulate2	-0.2646	-0.8560	10.336	81	96	schwebend

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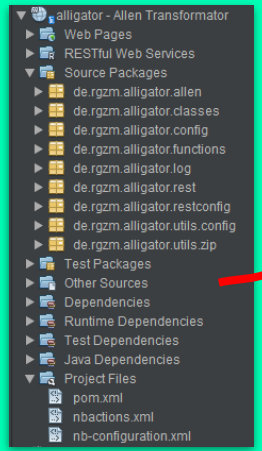
the method in action *2/3*

	A	B	C	D	E	F	G
1	name	x	y	z	von	bis	fixed
2	fruehkaiserzeitlich	-0.2660	0.2530	0.0072	1	150	fixed
3	2ndHalfFirstCentury	0.1235	-0.4078	-0.0481	50	100	fixed
4	Usurpator	23.415	0.5180	0.0610	69	69	fixed
5	Galba	13.550	0.3500	0.0580	69	69	fixed
6	Otho	13.550	0.3500	0.0580	69	69	fixed
7	Vespasian	0.0810	-0.1420	-0.1450	69	79	fixed
8	Titus	-0.1320	-0.2240	-0.1790	79	81	fixed
9	Domitian	-0.1430	-0.2960	0.1180	81	96	fixed
10	Nerva	-0.1320	-0.2240	-0.1790	96	98	fixed
11	Trajan	-0.4230	0.5490	0.0170	98	117	fixed
12	Vitellius	22.780	0.1590	0.0560	69	69	fixed
13	DomitianConsulate2	-0.2646	-0.8560	10.336	81	96	schwebend

DOI 10.5281/zenodo.2632727

the method in action *3/3*

JAVA maven war file, RESTful API



https://t1p.de/3q1i

```java
public Alligator calculate(String tsv, Double startFixedValue, Double endFixedValue) {
    // parse TSV as text/plain
    String[] lines = null;
    List inputfile = new ArrayList();
    if (tsv.contains("\r\n")) {
        lines = tsv.split("\r\n");
    } else if (tsv.contains("\n")) {
        lines = tsv.split("\n");
    }
    for (String line : lines) {
        inputfile.add(line);
    }
    // init Alligator
    Alligator alligator = new Alligator();
    // create alligator events
    alligator.writeToAlligatorEventList(inputfile, startFixedValue, endFixedValue);
    // calculate distances
    alligator.calculateDistances();
    // calculate next fixed neighbours
    alligator.getNextFixedNeighbours();
    // output virtual years
    System.out.println("\r\n===== virtual years =====");
    for (Object event : alligator.events) {
        AlligatorEvent ae = (AlligatorEvent) event;
        System.out.println(ae.name + "\t" + String.valueOf(ae.a) + " " + String.valueOf(ae.b) + " " + ae.startFixed + " " + ae.endFixed);
    }
    // allen
    alligator.calculateAllenSigns();
    return alligator;
}
```

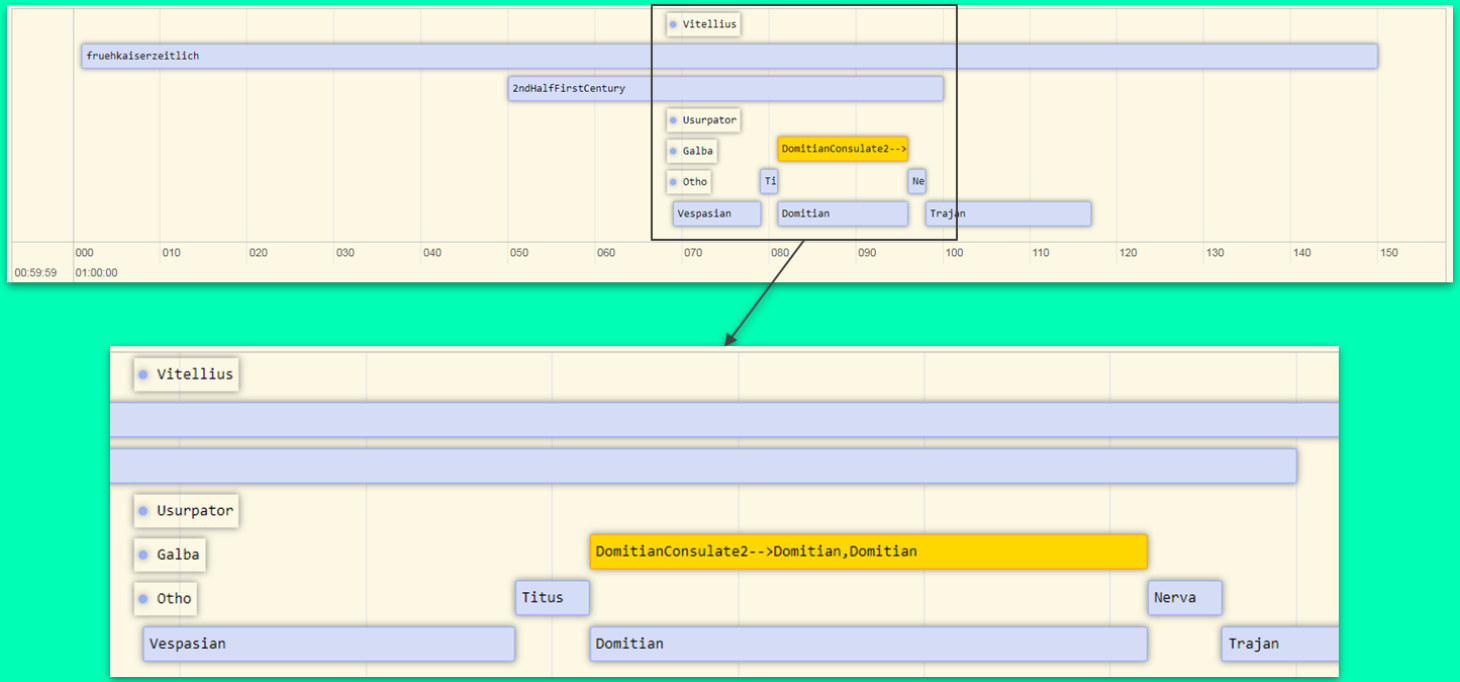
```java
public void calculateDistances() {
    for (Object event : events) {
        AlligatorEvent thisEvent = (AlligatorEvent) event;
        HashMap distances = new HashMap();
        for (Object event2 : events) {
            AlligatorEvent loopEvent = (AlligatorEvent) event2;
            distances.put(loopEvent.id, distance3D(thisEvent.x, thisEvent.y, thisEvent.z, loopEvent.x, loopEvent.y, loopEvent.z));
        }
        thisEvent.distances = distances;
    }
}
```

```java
private double distance3D(double x1, double y1, double z1, double x2, double y2, double z2) {
    double a = Math.pow((x2 - x1), 2);
    double b = Math.pow((y2 - y1), 2);
    double c = Math.pow((z2 - z1), 2);
    double dist = Math.sqrt(a + b + c);
    if (dist < minDistance) {
        minDistance = dist;
    }
    if (dist > maxDistance) {
        maxDistance = dist;
    }
    return dist;
}
```

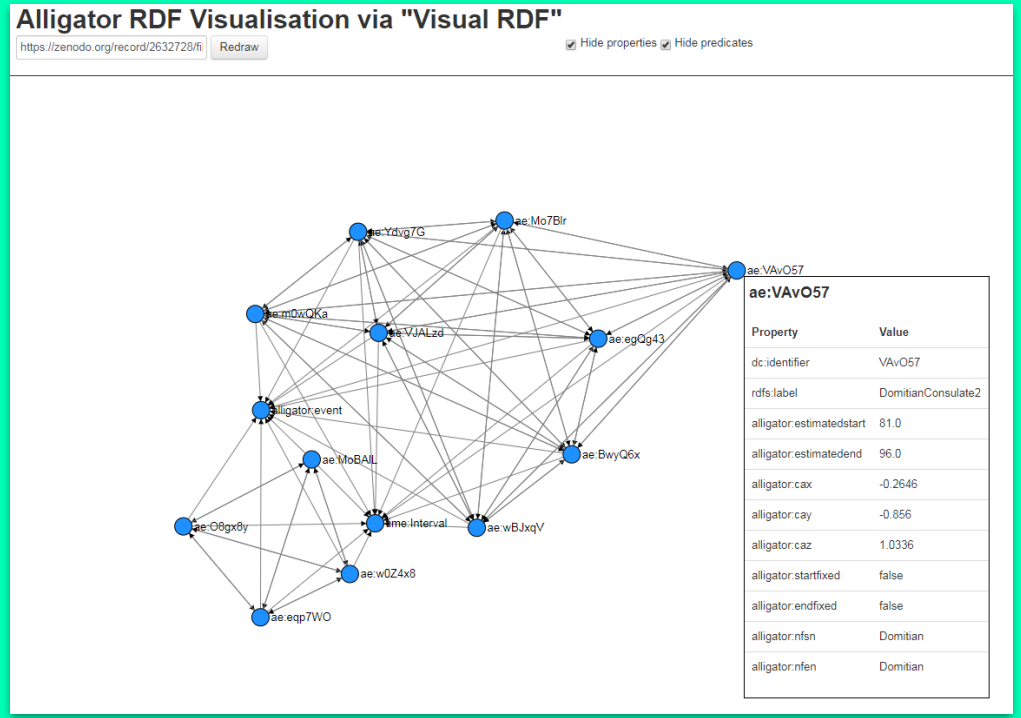
How?

→ calculate 3D distances

→ find nearest 3D neighbours



result (1): **virtual timeline calculated as relative Allen intervals**



RDF

ALLIGATOR

result (2): **Allen Intervals in RDF representation to share as LOD**

http://visualrdf.dernettekleinenerd.de/?url=https%3A%2F%2Fzenodo.org%2Frecord%2F2632728%2Ffiles%2Falligator_re_results_rdf.ttl%3Fdownload%3D1

ACADEMIC **META TOOL**

What?

JavaScript library for modelling and reasoning of vague RDF graph data .

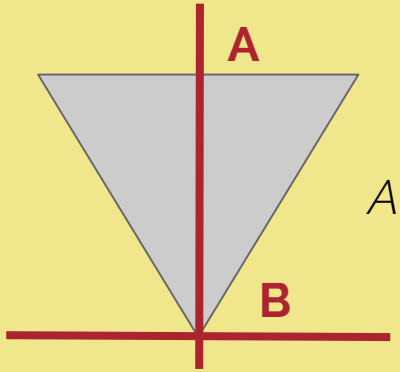
Who?

Mainz Centre for Digitality in the Humanities
and Cultural Studies (mainzed)
Martin Unold, Florian Thiery

ACADEMIC **META TOOL**

Where?

http://academic-meta-tool.xyz
https://github.com/mainzed/academicmetatool-js



A is north of B 70%.

example: modelling and reasoning of vague relative geographical / topographical information

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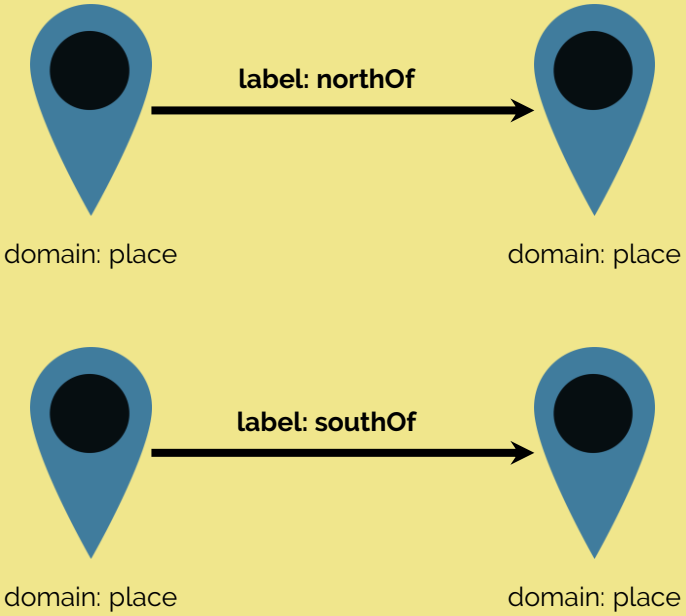
develop ontology

ACADEMIC **META TOOL**

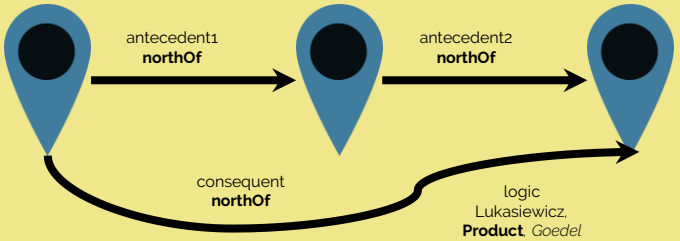
specify node categories »CONCEPTS«

place

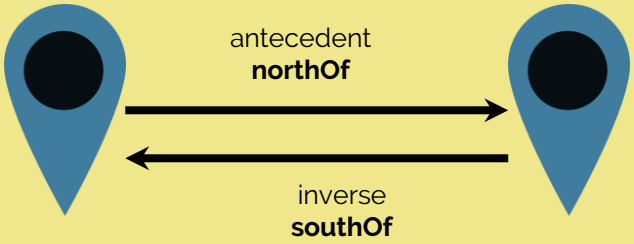
specify edge categories »ROLES«



specify Role-Chain axioms



specify Inverse axioms



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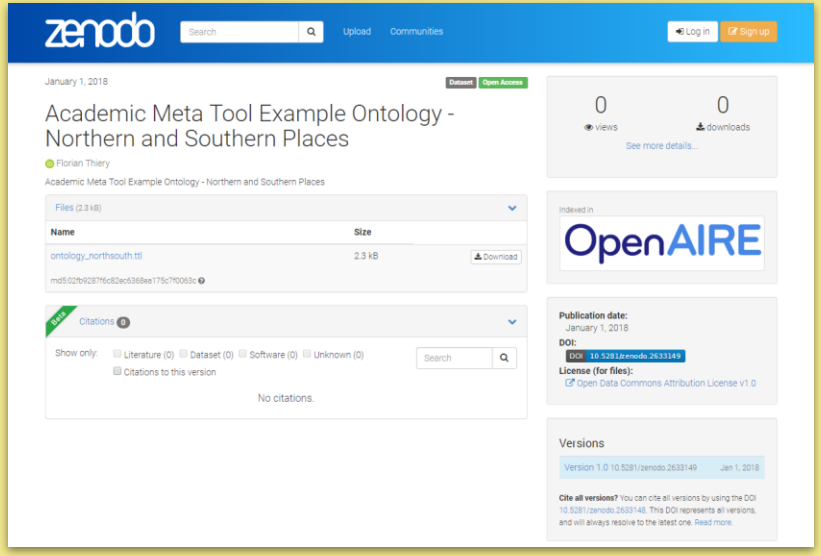
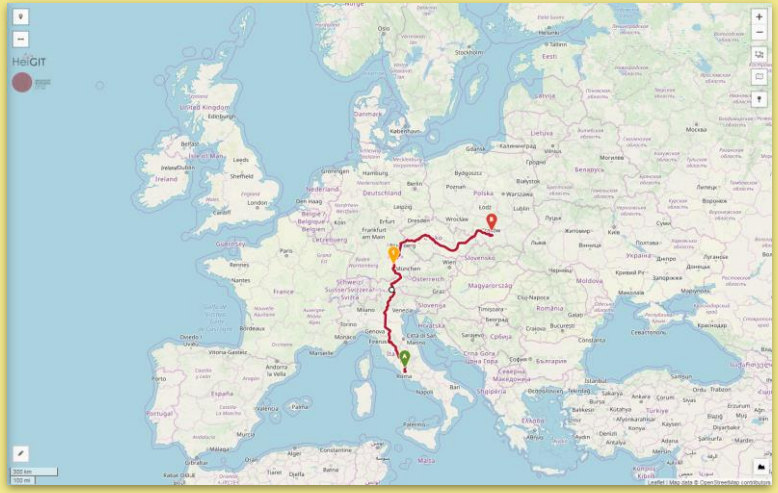
⇒ input RDF-File in triplestore



DOI 10.5281/zenodo.1469298

⇒ input data in triplestore

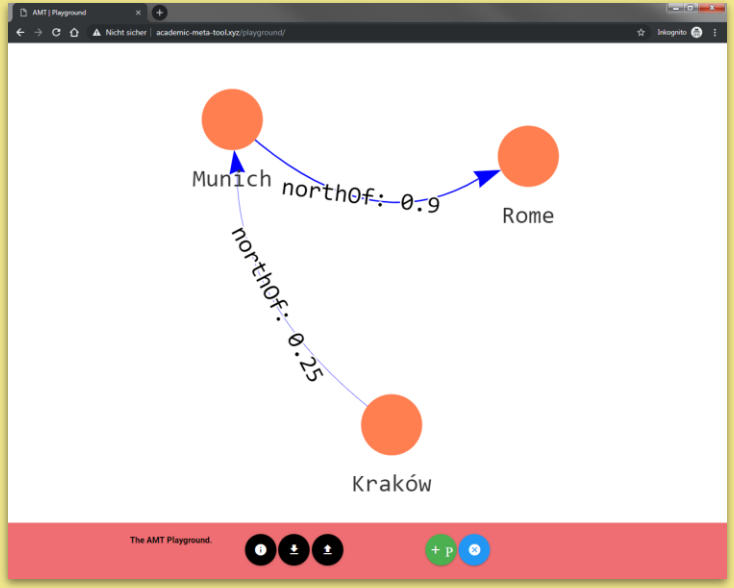


Kraków northOf Munich 0.25
Munich northOf Rome 0.90

DOI 10.5281/zenodo.2633162

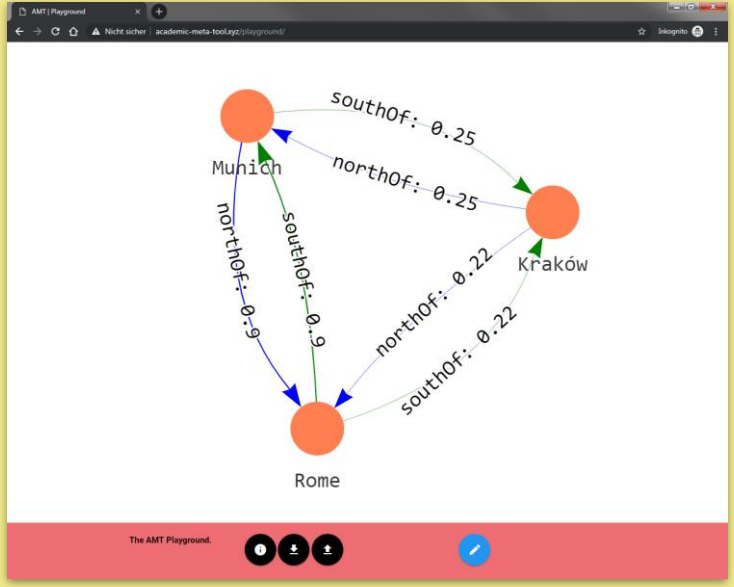
https://maps.openrouteservice.org/directions?n1=49.482401&n2=10.524902&n3=5&a=41.878243,12.52809,48.152126,11.544467,50.0469,20.0048&b=0&c=0&k1=en-US&k2=km

⇒ use JavaScript library for reasoning and visualisation



http://academic-meta-tool.xyz/playground/

⇒ use JavaScript library for **reasoning** and visualisation



http://academic-meta-tool.xyz/playground/

#alligator

Research Example:

Taming Time!

#AMT

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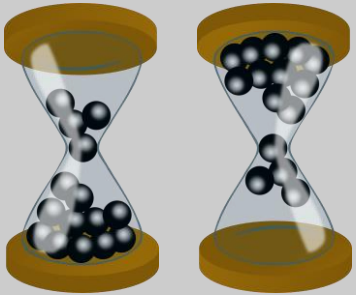
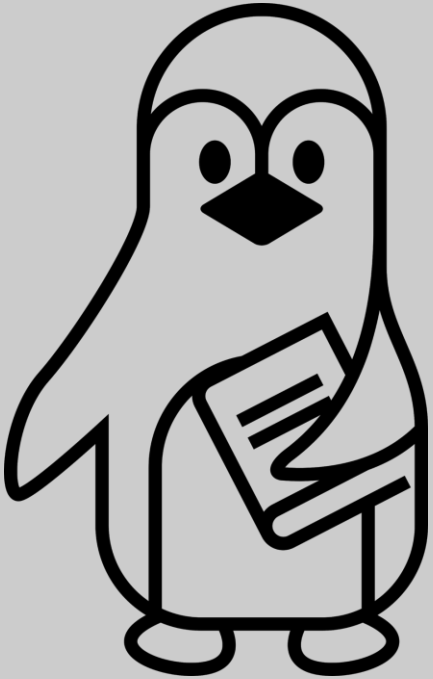
#alligator

Research Project:

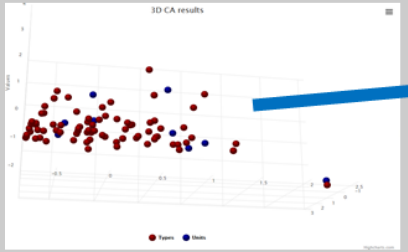
Dating Mechanisms





#AMT

Taming Time!

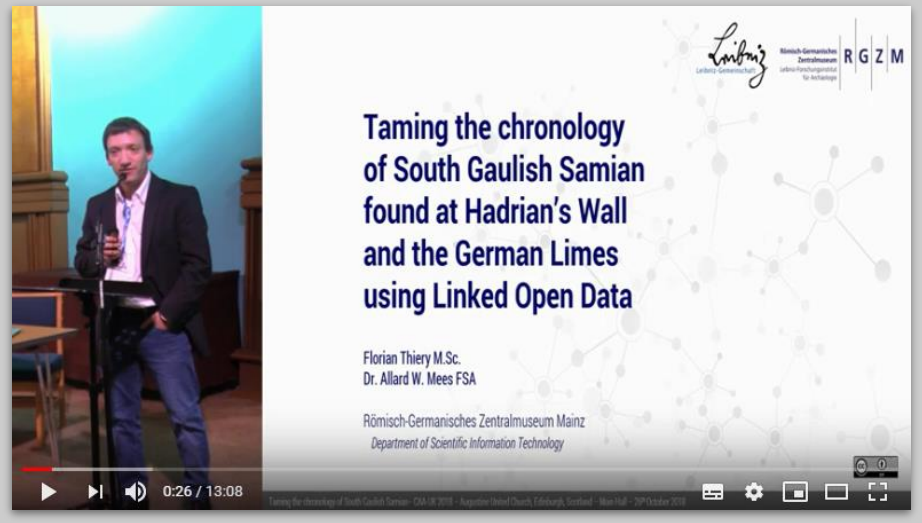


ALLIGATOR

ACADEMIC META TOOL

a data driven approach:
starting from a CA with time information ending in a relative chronology including temporal reasoning and weighted edges

Taming Time!



CAA United Kingdom Computer Applications & Quantitative Methods in Archaeology

@CAA-UK 2018, Edinburgh

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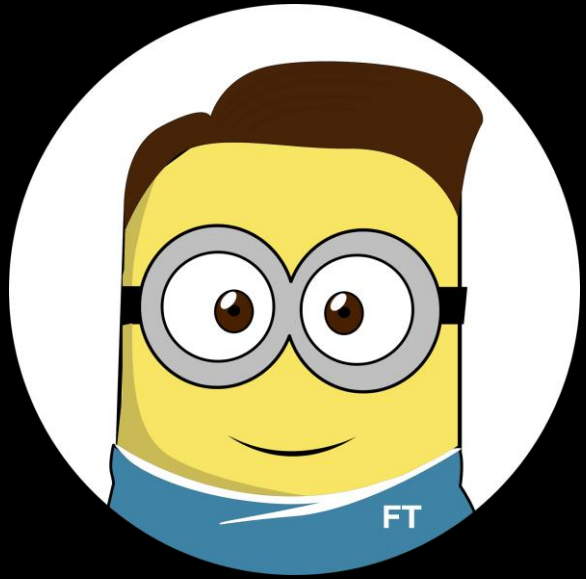
https://youtu.be/Yka1HpuOg5M

Thx!



Any questions?

you can find me on twitter **@fthierygeo**.

contact via mail **thiery@rgzm.de**.

ORCID **0000-0002-3246-3531**.

ALLIGATOR

ACADEMIC **META TOOL**

Literature & Talks

- Unold, M., Thiery, F., Mees, A. (2019). *Academic Meta Tool – Ein Web-Tool zur Modellierung von Vagheit*. In Andreas Kuczera, Thorsten Wübbena and Thomas Kollatz, Eds., Die Modellierung des Zweifels – Schlüsselideen und -konzepte zur graphbasierten Modellierung von Unsicherheiten, (Zeitschrift für digitale Geisteswissenschaften / Sonderbände, 4). http://dx.doi.org/10.17175/sb004_004 *(German only)*
- *Thiery, F., Mees, A. (2019). Dating Mechanism: Eine Linked Data Strategie zur interoperablen und nachvollziehbaren Modellierung relativer Chronologien am Beispiel südgallischer Terra Sigillata in Limes-Abschnitten*, Graphentechnologien 2019, Mainz, Germany, 18th January 2019. https://doi.org/10.5281/zenodo.2540373 *(German only)*
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- Thiery, F., Mees, A. (2018). *Taming Time – Modelling uncertainty as reproducible Linked Open Data*, 24th Annual Meeting of the European Association of Archaeologists (EAA2018), Barcelona, Spain, 08th September 2018. https://doi.org/10.5281/zenodo.1402509 *(English)*
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Literature & Talks

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- Unold, M. et al. (2017). Basic types of non-boolean description logics. http://unold.net/research/p_dls_20170320.pdf *(English)*
- Unold, M., Cruz, C. (2017). *How to enrich description logics with fuzziness*. 2017 Computing Conference, London, 2017, pp. 51-57. https://doi.org/10.1109/SAI.2017.8252080 *(English)*

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