

# A KNOWLEDGE BASE OF CHARTERS FOR GENERATING NETWORKS

Christian Knüpfer

International Medieval Congress  
Leeds, 02.07.2018



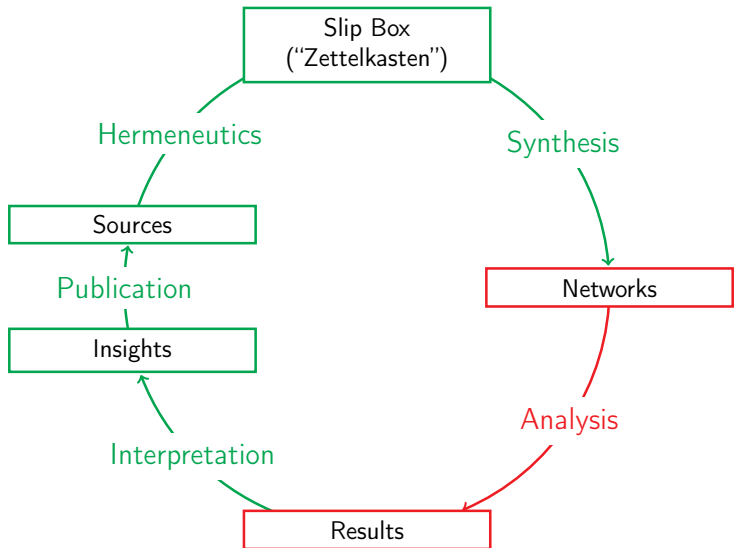
FRIEDRICH-SCHILLER-  
UNIVERSITÄT  
JENA

DHnet | JENA

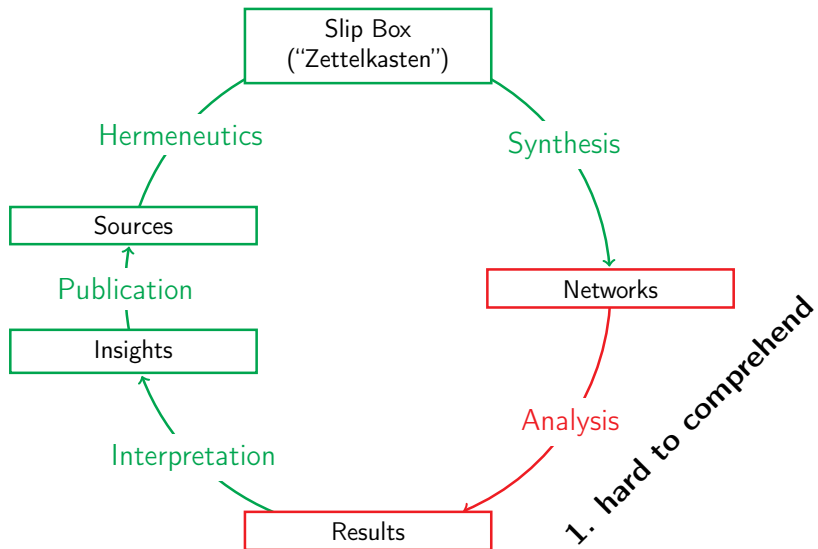
# Part I

## FROM SOURCES TO NETWORKS

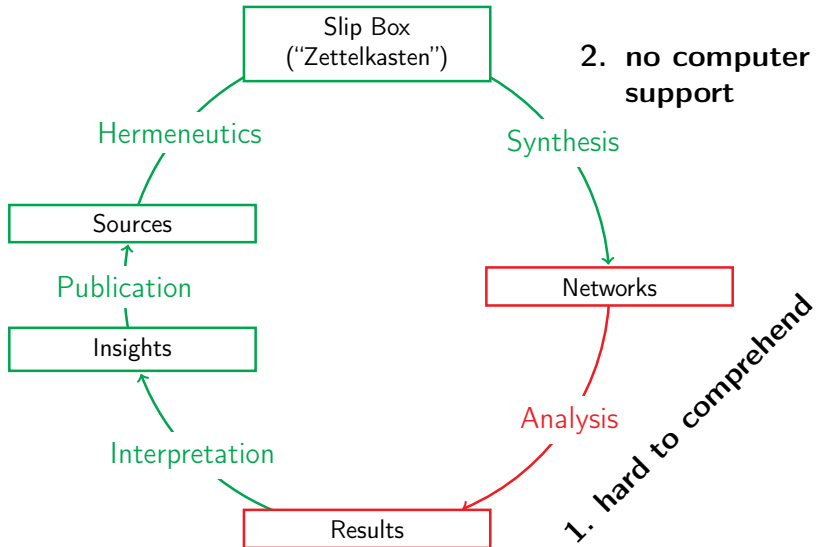
# HISTORICAL NETWORK RESEARCH



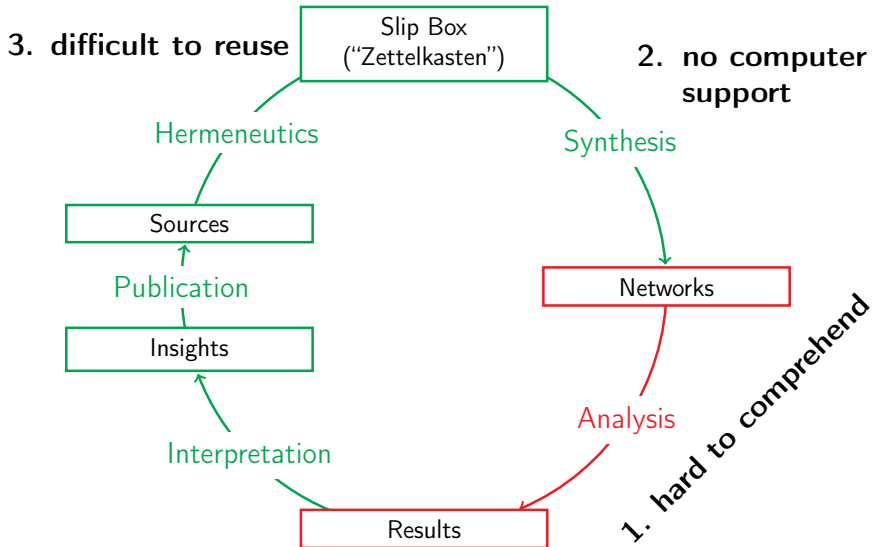
# HISTORICAL NETWORK RESEARCH



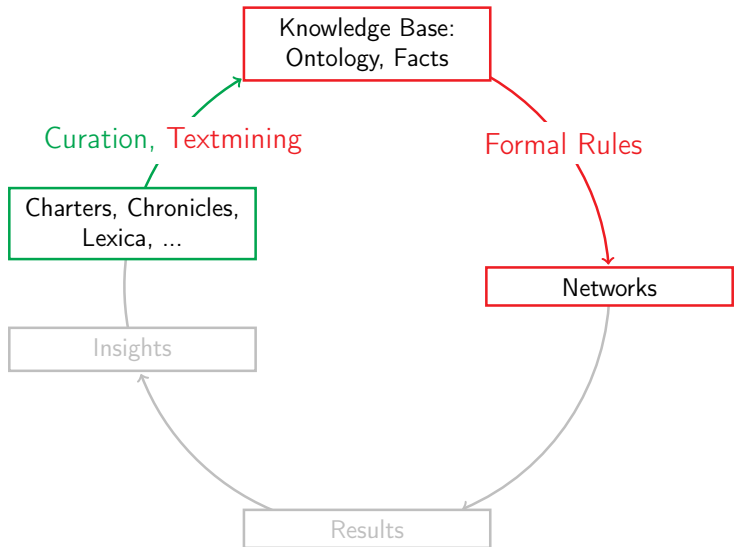
# HISTORICAL NETWORK RESEARCH



# HISTORICAL NETWORK RESEARCH

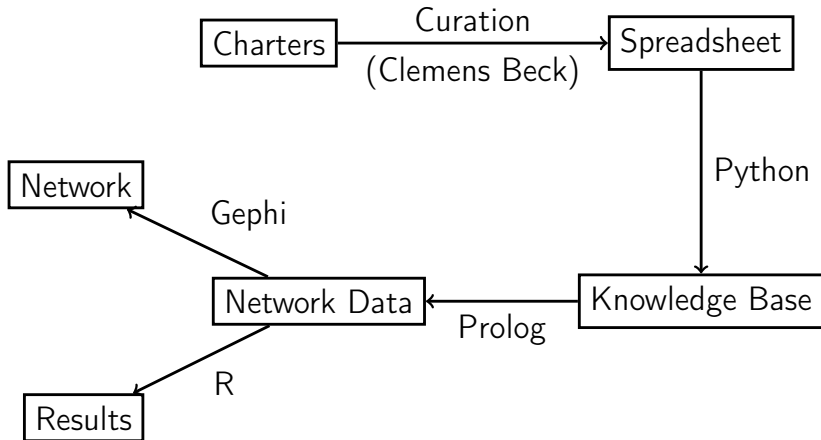


# RULE-BASED GENERATION OF NETWORKS



# PROOF OF CONCEPT

NETWORKS FROM CHARTERS OF THE HOLY ROMAN EMPIRE  
IN THE REIGN OF LATE FREDERICK I. AND HENRY VI. (1163-1198)





Part II

**KNOWLEDGE BASE**

# EXAMPLE CHARTER (REGEST)

Friedrich I. - RI IV,2,3 n. 2077

1174 Mai 23, Kaiserslautern

Friedrich schlichtet auf Intervention **Erzbischof Arnolds von Trier**, zugleich Kanonikers von Aachen, und auf Bitten des Dekans Stephan und der Brüder von Aachen die jährlich neu aufflammenden Streitigkeiten zwischen dem Kapitel des Marienstiftes zu Aachen und dessen **Propst** um die Einsetzung von Schultheißen in Gütern dieser Kirche [...] Z.: die Erzbischöfe Arnold von Trier und **Wichmann von Magdeburg**, die Elekten Reinhard von Würzburg, **Konrad von Worms** und Theoderich von Metz, Bischof Peter von Toul, Abt Gregor von Prüm, Herzog Matthäus (von Lothringen), die Grafen Hugo von Dagsburg und Heinrich von Diez, Werner von Bolanden.

# PERSONS

- ID: systematically chosen acronym
- title
- name
- rank

```
person('Kg', "Kaiser von Deutschland",  
      "Friedrich I. Barbarossa", 'Kaiser').
```

```
person('EBTr/A', "Erzbischof von Trier",  
      "Arnold I. Von Trier", 'Erzbischof').
```

```
person('BBambg/O', "Bischof von Bamberg",  
      "Otto II. Von Bamberg", 'Bischof').
```

```
person('EBMagd/W', "Erzbischof von Magdeburg",  
      "Wichmann von Magdeburg", 'Erzbischof').
```

```
person('BWorms/K2', "Bischof von Worms",  
      "Konrad II. Von Worms", 'Bischof', 188).
```

# CHARTERS

- ID: charter or regesta number
- region of issuing
- issuing date

```
charter('DFI 621', "Franken",  
        date("1174-05-23", "1174-05-23",  
            exact(day), certain)).
```

RI IV,2,3 n. 2077

regesta of charter with number **DF.I. 621** (Diplom Friedrich I.) from Monumenta Germaniae Historica (MGH).

# REPRESENTATION OF DATES

- always represented with start date and end date
- additional modifiers:
  - exact date or date range
  - accuracy: day, month or year
  - certain or uncertain

```
date("1174-05-23", "1174-05-23",  
    exact(day), certain))
```

```
date("1186-01-01", "1186-02-10",  
    range(month, day), certain)
```

```
date("1166-01-01", "1166-12-31",  
    exact(year), uncertain)
```

# RELATIONS BETWEEN PERSONS AND CHARTERS

issuer

```
issuer('Kg', 'DFI 621').
```

recipient

```
recipient('BBambg/0', 'DFI 621').
```

intervener

```
intervener('EBTr/A', 'DFI 621').
```

witness

```
witness('EBMagd/W', 'DFI 621').  
witness('BWorms/K2', 'DFI 621').  
...
```

# CURRENT STATE OF KNOWLEDGE BASE

- 990 persons
- 2068 charters
- 11335 relations
  - 2030 issuer (98 % of charters)
  - 504 recipient (24 % of charters)
  - 238 intervener (12 % of charters)
  - 8563 witness (4 per charter on average)

## Rank "Ontology"

- 12 ranks from **Kaiser** (*imperator*) to **Vogt** (*advocatus*)
- hierarchy: superior relations

```
superior('Erzbischof', 'Bischof').
```

# Part III

## RULE-BASED GENERATION OF NETWORKS



# DEFINITION OF A NETWORK

## EXAMPLE: "LOYALTY"

**node definition** Each relevant person is represented by a **node**.

**edge definition** There is an **loyalty edge** from each witness of a charter to its issuer.

**Prolog rules** (to read as reversed implications)

```
node(P) :- person(P).  
  
edge(P, I) :- node(P), node(I),  
               charter(C),  
               witness(P, C),  
               issuer(I, C).
```

# DEFINITION OF A NETWORK

## EXAMPLE: "LOYALTY"

**node definition** Each relevant person is represented by a **node**.

**edge definition** There is an **loyalty edge** from each witness of a charter to its issuer.

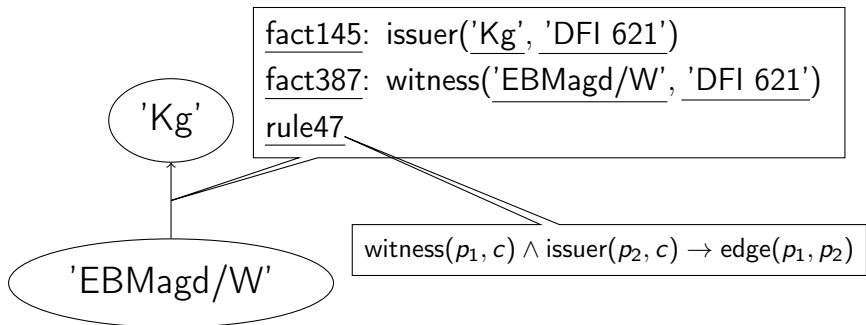
**Prolog rules** (to read the used implications)

```
node(P) :- person(P).  
edge(P, I) :- node(P), node(I),  
               charter(C),  
               witness(P, C),  
               issuer(I, C).
```

1. hard better to comprehend

# COMPREHENSIBILITY

- transparency: explicit facts and rules
- documentation (automatically generated)
- justifications:



- dependency on facts and rules (interactively)

# GENERATING NETWORKS

```
findall((P1, P2), loyalty(P1, P2), L).
```

- multiple edges between two persons P1 and P2
- **edge weight**: count edges between P1 and P2

```
'BBambg/E', 'Kg', 3
```

```
'BBambg/H', 'Kg', 9
```

```
'BBambg/O', 'Kg', 3
```

## Pre-Filter of Charters

- specific issuers
- date range

# GENERATING NETWORKS

```
findall((P1, P2), loyalty(P1, P2), L).
```

- multiple edges between two persons P1 and P2
- **edge weight**: count edges between P1 and P2

```
'BBambg/E', 'Kg'
```

```
'BBambg/H', 'K'
```

```
'BBambg/O'
```

2. no computer support

## Pre-Filter Charters

- specific issuers
- date range

# IMPLEMENTED EDGE DEFINITIONS

## edge between ...

co-certification two participants in a certification

co-witnessing two witnesses

endorsement recipient and issuer or  
witness and issuer/recipient

grant issuer and recipient

loyalty witness and issuer

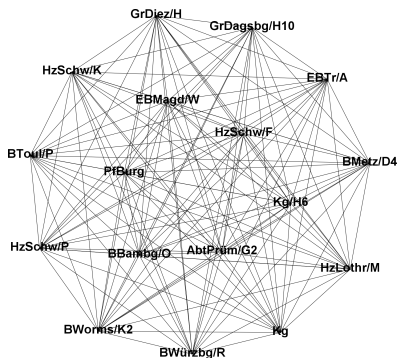
mediation intervener and issuer/recipient

solidarity witness and recipient

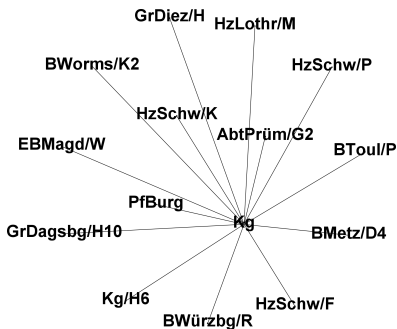
## ... of a charter

# GENERATED NETWORKS

## FOR SINGLE CHARTER DF.I. 621



co-certification

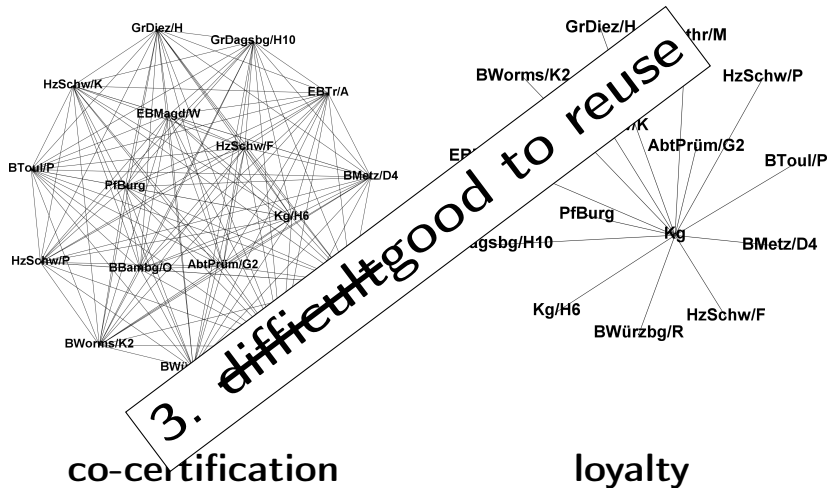


loyalty

*visualised with Gephi*

# GENERATED NETWORKS

## FOR SINGLE CHARTER DF.I. 621



visualised with Gephi



# REUSABILITY

## requirements

- meta data: references, provenance, annotations
- confidence in facts and results
- context-dependent views
- facts manually changeable
- standardisation: ontology, authority files

## challenges

- usability vs. reusability
- vagueness
- contradictions

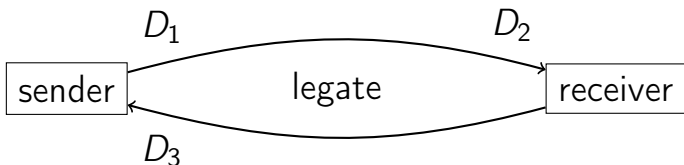
# COMPLEX PATTERNS IN CHARTERS

## EXAMPLE: LEGATION



# COMPLEX PATTERNS IN CHARTERS

## EXAMPLE: LEGATION



## Evidence

three certification events with **legate** as witness:

1. **sender is issuer** charter at date  $D_1$
2. **receiver is issuer** of charter at date  $D_2 > D_1$
3. **sender is issuer** charter at date  $D_3 > D_2$

within **two** years, i.e.  $D_3 - D_1 \leq 2a$

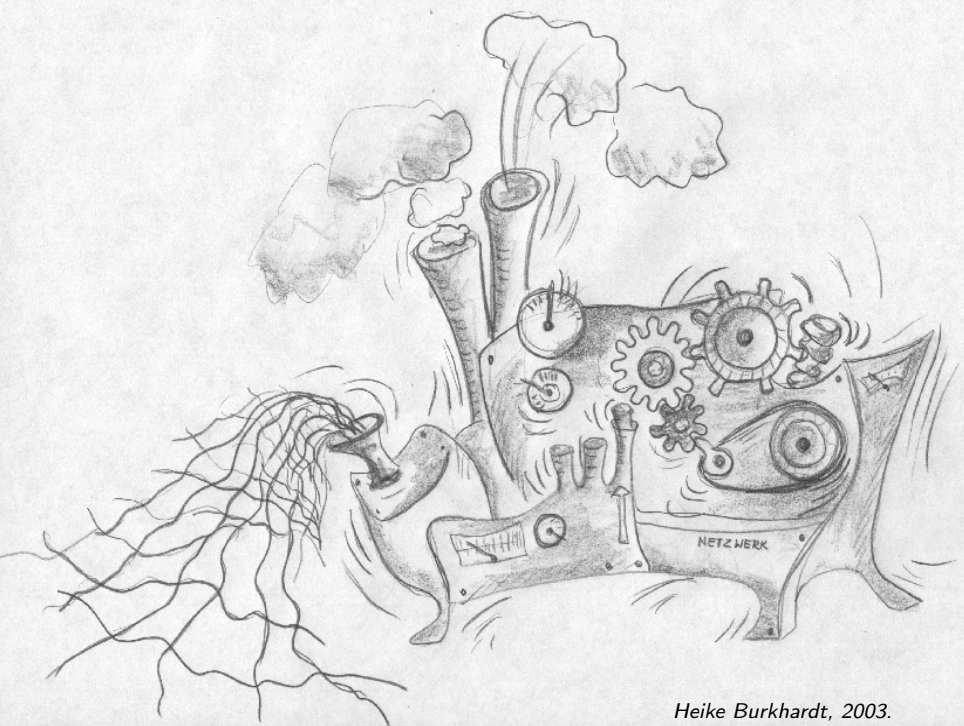
# OUTLOOK

## Reign of Frederick I.

- investigation of legation patterns
- explicit representation of events (e.g. Hoftage)
- use of geographical data: neighbourhood and travelling networks

## Computer Science

- links to authority files
- user interface: computer support for curation and querying
- justifications
- geographical visualisations
- ontology of medieval social and constitutional history



Heike Burkhardt, 2003.