

Some Takeaways from *Manuscript Connections*: Temporal Network Analysis and Similarity Metrics

Alex Brey

Wellesley College

ab4@wellesley.edu

Maeve Doyle

Eastern Connecticut State University

doylemae@easternct.edu

Pre-check

Full Link:

https://colab.research.google.com/drive/1x43l3_xaUgd_A9xiKjNA9q_VApdBgIO?usp=sharing

Short Link: <https://tinyurl.com/nzy4kchr>

Click the “play” button in the first block of code (install.packages("sna")...)

Does everyone have Cytoscape installed?

Before I begin

Several people mentioned mapping in their research interests, so I want to sure people know about the excellent Visone tutorial by Daniel Weidele and Tom Brughmans, which includes a section on overlaying a network onto a map

<https://visone.ethz.ch/wiki/images/6/67/VisoneTutorial-archeology.pdf>

Palladio is already good for mapping networks quickly, although much less sophisticated:

<https://hdlab.stanford.edu/palladio-app/#/upload>

Plan for the Morning

Part 1: Change over Time - Temporal Network Analysis

- Introduce some key concepts
- Example in Google Colab

Part 2: Networks from Features - Similarity Metrics and Similarity Networks

- Introduce some key concepts
- Example in Cytoscape

Project Team

Maeve Doyle
Domain specialist

Areas of expertise:

- Medieval art & architecture
- History of the book
- Database management



Alex Brey
Technologist

Areas of expertise:

- Early Islamic art & architecture
- Digital art history
- R programming language (I basically learned it for this project)

Project Team



Maeve Doyle
Domain specialist

Areas of expertise:

- Medieval art & architecture
- History of the book
- Database management



Alex Brey
Technologist

Areas of expertise:

- Early Islamic art & architecture
- Digital art history
- R programming language



Carolyn Anderson
Technologist

Areas of expertise:

- Corpus Linguistics
- Machine Learning
- Multimodal Models for Computer Vision

A SURVEY OF MANUSCRIPTS ILLUMINATED IN FRANCE

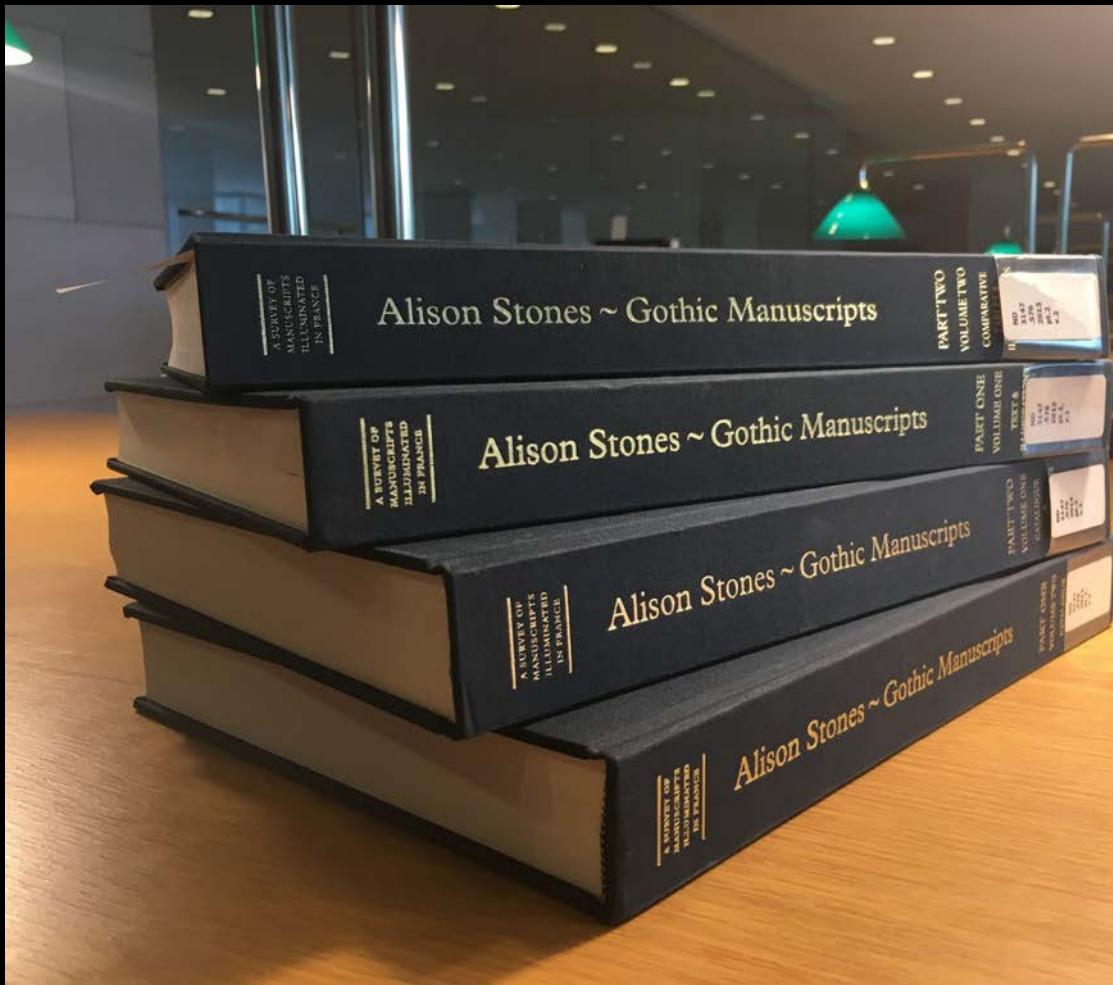
ALISON STONES
Gothic Manuscripts
1260-1320



PART ONE

VOLUME ONE – TEXT & ILLUSTRATIONS

HARVEY MILLER PUBLISHERS



SUMMARY LIST OF MANUSCRIPTS

Catalogue entries are numbered in approximate chronological order within broad stylistically-based groups. The symbol # means the manuscript is included in a comparative table. Square brackets around the second appearance of a manuscript indicate that it has been listed above, as is the case where more than one artist participated.

I-1-64. PARIS AND PROVINCE OF SENS

For a fuller survey of the early material up to c. 1280, see Branner, *Manuscript Painting*.

c. 1260-75 (Branner's) Corpus, Dominican, and Sainte-Chapelle Groups

- I-1. #Padua, Bibl. del Seminario, 353, Psalter
- I-2. Stralsund, Wismarerischer Landesmus. Inv. no. 1958-21 a-b, Throne of Wisdom Drawing
- I-3. Paris, BNF lat. 12936, Gospels of the Sainte-Chapelle'

Copenhagen, KB 393, 2, Justinian, *Corpus*, copied by Richard (several artists)

Gdańsk, Biblioteka Gdyńska PAN 1816, *Gratian, Decretum*

Oxford, Balliol College 233, Miscellany of Boethius and Aristotle, *Corpus vetustus*

Paris, BNF lat. 12953, Aristotle, *Corpus vetustus* (several artists)

Città del Vaticano, Vat. lat. 2071, Aristotle,

Corpus vetustus

I-4. Nîmes, Pub. Lib. 69, Johannes de Sacrobosco, *Opera*

I-5. Paris, BNF fr. 20118, Justinian, *Digesta in French*

I-6. Paris, BNF lat. 12593, Miscellany of Miracles of the Virgin, in Latin

I-7. Tours, Bibl. mun. 355, Peter Lombard, *Sententiae*

I-8. Besançon, Bibl. mun. 457, Aviscenna, *Liber quinque canonis medicinae*, tr. Gerard of Cremona (with Branner's Du Prat artist)

Admont, Stiftsbibl. 646, Gregory IX, *Liber decretalium*

Paris, BNF lat. 12953, Aristotle

Tor. Genova, BPU latin 76, Aristotle, *Corpus vetustus*, see I-26 below

I-9. #Cambridge, Univ. Lib. Ee.4.24, Psalter

#London, BL Royal 2 B.1, Psalter

#St Petersburg, Academy of Sciences Q.188, Psalter

#Bordeaux, Bibl. mun. 3, Psalter

Baltimore, Walters Art Museum W. 43, Psalter

I-10. Paris, BNF fr. 2186, *Roman de la Poire*

Assisi, BSC 347, St Bonaventura, *Legenda minor*, foliate initials (commissioned for the Friars of San Francesco, Assisi, c. 1266)

Assisi, BSC 98, Theological miscellany, foliate initials only (donation of Matteo d'Acquasparta, Cardinal, to Assisi in 1287)

Città del Vaticano, BAV Vat. lat. 9666, Peter Lombard, *Sententiae* (donation of Matteo d'Acquasparta, Cardinal, to Assisi in 1287)

Cleveland Museum of Art, J.H. Wade Fund 1954.1, Fragment containing a Table of Con-

sanguinity

#Le Mans, Méd. mun. 262, Bible, first artist

For Cambridge, Sidney Sussex 100, Bestiary in Latin, see Reims, III-2

For the Dominican Bible, Paris, BNF lat. 16721, and related manuscripts, see Branner, *Manuscript Painting*.

I-1. #Paris, BNF lat. 10525, Psalter, with other artists (ff. 25-28; ff. 67-78)

Third artist, BNF lat. 10525 (ff. 67-78)

I-2. Paris, Bibl. Arsenal 702, Aristotle, *Metaphysica*, with other artists (see the St Denis Master, I-14 below)

Isabelle Psalter Master

I-3. #Paris, BNF lat. 10525, Psalter-Hours of Isabelle

[I-11. Paris, BNF lat. 10525, Psalter, ff. 25-28]

c. 1270-1285

Saint-Denis Missal Master and assistants

I-4. Paris, BNF lat. 1107, Missal of Saint-Denis, with assistant artists

Metropolitan Museum, New York (1981.322) and the Fitzwilliam Museum, Cambridge (Marlay Collection Fr. 1)

Rome, Bibl. Casanatense 603 (BJ.25), Unnoted Missal of Saint-Denis

Munich, BSB, Clm 28160, Henricus de Segusio, *Summa*

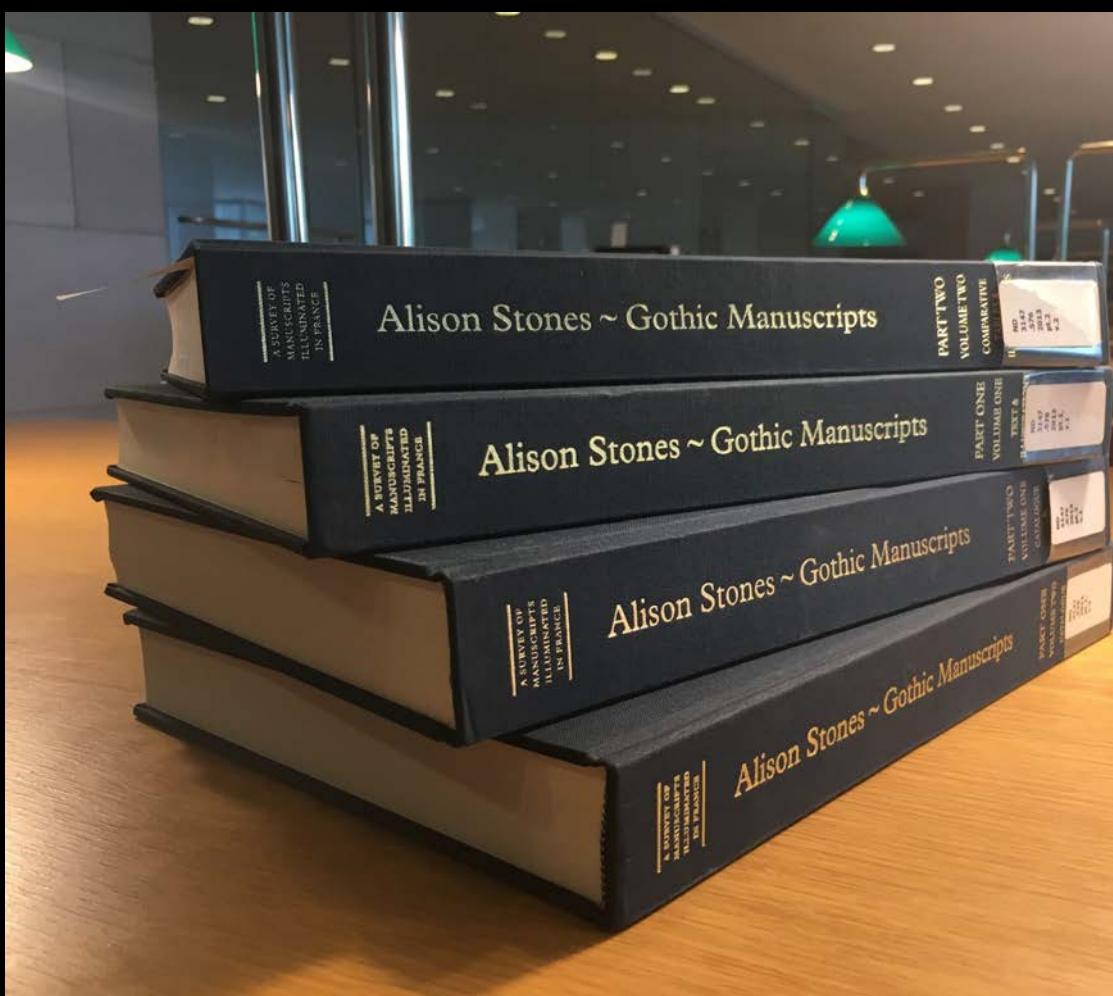
Oxford, Lincoln College, Lat. 150, Missal fragment (see Cat. III-98)

#Le Mans Bibl. mun. 262, Bible, third and fourth artist

Paris, BNF lat. 13233, Breviary of Paris (with later additions)

[I-12. Paris, Bibl. Arsenal 702, Aristotle, *Metaphysica* (with other artists, see above and below)]

[I-18. #New York, The Pierpoint Morgan Library, M.101, Psalter of Beauvais, by the

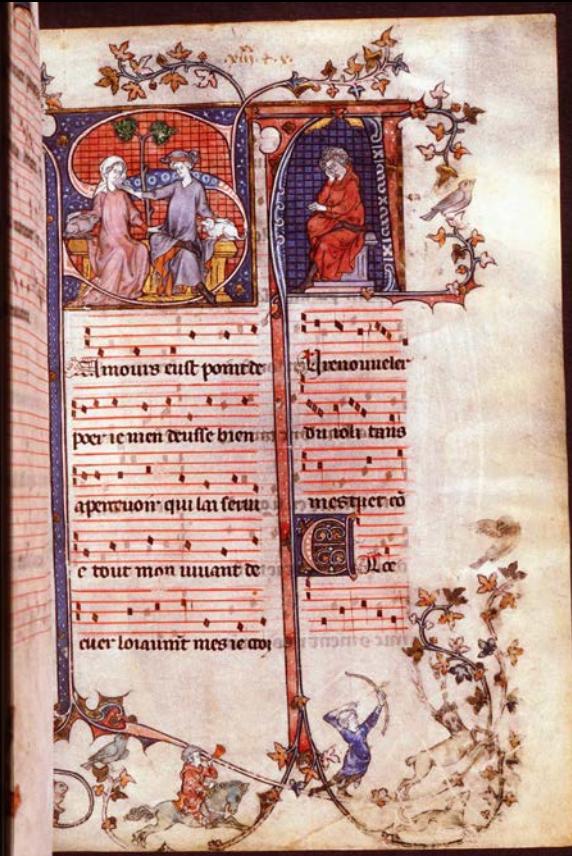


Montpellier Chansonnier, BIU Séc. Méd. MS H 196

Phase I: St-Denis Missal Master & Cholet Master, late 1270s-1280s



Phase II: Artist in the orbit of "Master Honoré," ca. 1290s



Phase III: later artist, 14th century

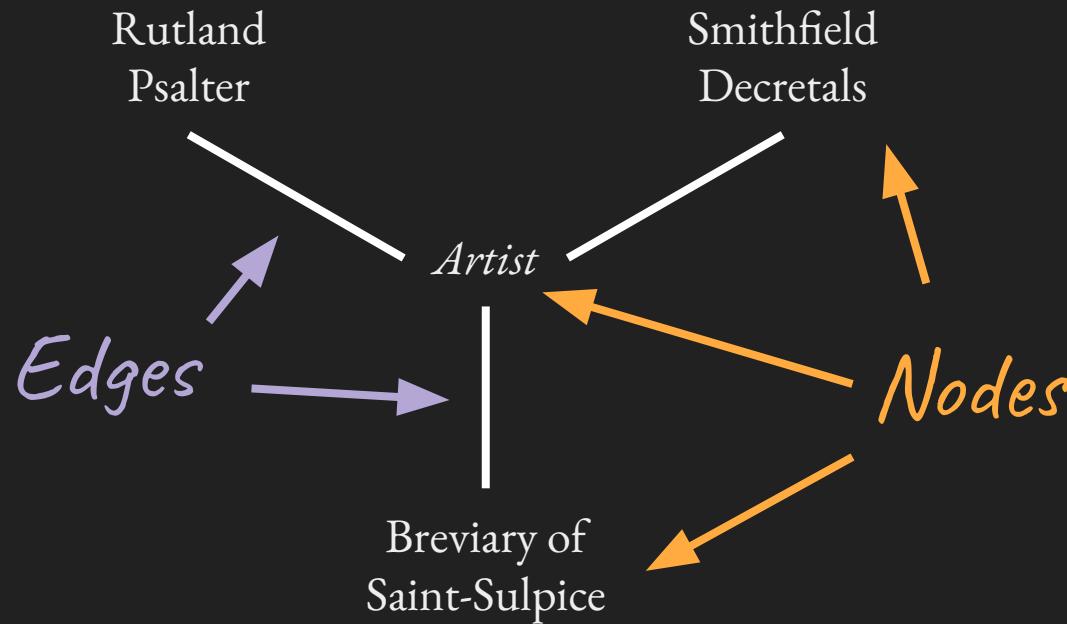


Chansonnier
Montpellier
BIU Séc. Méd.
MS H 196

	Phase I Late 1270s - 1280s	Phase II 1290s	Phase III Early 14th century
Fascicle I		Montpellier Phase II	
Fascicle II	Cholet Master		
Fascicle III	Saint-Denis Missal Master	Additions by Montpellier Phase II	
Fascicle IV	Cholet Master		
Fascicle V	Saint-Denis Missal Master	Additions by Montpellier Phase II	
Fascicle VI	Saint-Denis Missal Master		
Fascicle VII		Montpellier Phase II	
Fascicle VIII			14th-century artist

Formal Network Analysis

A network represents relationships (edges) between variables (nodes).



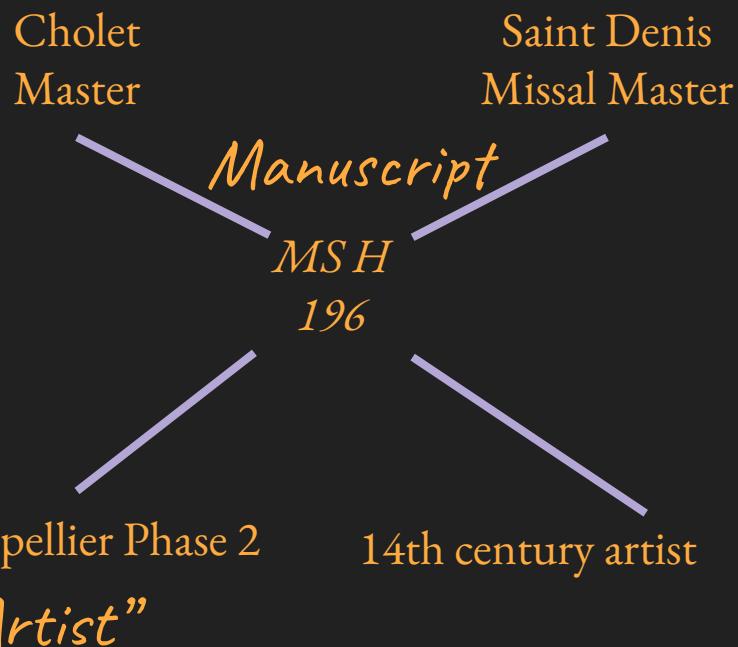
UID	Artist_Working	Manuscript ID Corrected	Manuscript ID Original	Region	LatLong
1	Paris ca. 1260-1275	Padua, Bibl. del Seminario, 353, Psalter	Padua, Bibl. del Seminario, 353, Psalter	Paris and Province of Sens	48.8567,2.3508
2	Paris ca. 1260-1275	Stuttgart, Wurttembergischer Landesmus. Inv. no. 1958-21 a-b	Stuttgart, Wurtembergischer Landesmus.	Paris and Province of Sens	48.8567,2.3508
3	Paris ca. 1260-1275	Paris, BNF lat. 17326, Gospels 'of the Sainte-Chapelle'	Paris, BNF lat. 17326	Paris and Province of Sens	48.8567,2.3508
4	Paris ca. 1260-1275	Copenhagen, KB 393, 2, Justinian, Corpus	Copenhagen, KB 393, 2, Justinian, Corpus	Paris and Province of Sens	48.8567,2.3508
5	Paris ca. 1260-1275	Gdansk, Biblioteka Gdanska PAN 1816, Gratian, Decretum	Gdansk, Biblioteka Gdanska PAN 1816, Gr:	Paris and Province of Sens	48.8567,2.3508
6	Paris ca. 1260-1275	Oxford, Balliol College 253, Miscellany of Boethius and Aristotle, Corpus vetustiu	Oxford, Balliol College 253, Miscellany of	Paris and Province of Sens	48.8567,2.3508
7	Paris ca. 1260-1275	Paris, BNF lat. 12953, Aristotle, Corpus vetustius	Paris, BNF lat. 12953, Aristotle,	Paris and Province of Sens	48.8567,2.3508
8	Paris ca. 1260-1275	Città del Vaticano, Vat. lat. 2071, Aristotle, Corpus vetustius	Città del Vaticano, Vat. lat. 2071, Aristotle,	Paris and Province of Sens	48.8567,2.3508
9	Paris ca. 1260-1275	New York, Pub. Lib. 69, Johannes de Sacrobosco, Opera	New York, Pub. Lib. 69, Johannes de Sacro	Paris and Province of Sens	48.8567,2.3508
10	Paris ca. 1260-1275	Paris, BNF fr. 20118, Justinian, Digeste in French	Paris, BNF fr. 20118, Justinian,	Paris and Province of Sens	48.8567,2.3508
11	Paris ca. 1260-1275	Paris, BNF lat. 12593, Miscellany of Miracles of the Virgin, in Latin	Paris, BNF lat. 12593, Miscellany of Mirac	Paris and Province of Sens	48.8567,2.3508
12	Paris ca. 1260-1275	Tours, Bibl. mun. 355, Peter Lombard, Sententiae	Tours, Bibl. mun. 355, Peter Lombard,	Paris and Province of Sens	48.8567,2.3508
13	Paris ca. 1260-1275	Besançon, Bibl. mun. 457, Avicenna, Libri quinque canonis medicinae, tr. Gerard	Besancon, Bibl. mun. 457, Avicenna, Libri	Paris and Province of Sens	48.8567,2.3508
14	Paris ca. 1260-1275	Admont, Stiftsbibl. 646, Gregor IX, Liber decretalium	Admont, Stiftsbibl. 646, Gregor IX, Liber d	Paris and Province of Sens	48.8567,2.3508
15	Paris ca. 1260-1275	Paris, BNF lat. 12953, Aristotle, Corpus vetustius	Paris, BNF lat. 12953, Aristotle	Paris and Province of Sens	48.8567,2.3508
16	Paris ca. 1260-1275	Geneva, BPU latin 76, Aristotle, Corpus vetustius	Geneva, BPU latin 76, Aristotle,	Paris and Province of Sens	48.8567,2.3508
17	Paris ca. 1260-1275	Cambridge, Univ. Lib. Ee.4.24, Psalter	Cambridge, Univ. Lib. Ee.4.24,	Paris and Province of Sens	48.8567,2.3508
18	Paris ca. 1260-1275	London, BL Royal 2 B.ii, Psalter	London, BL Royal 2 B.ii,	Paris and Province of Sens	48.8567,2.3508
19	Paris ca. 1260-1275	St Petersburg, Academy of Sciences Q. 188, Psalter	St Petersburg, Academy of Sciences Q.188	Paris and Province of Sens	48.8567,2.3508
20	Paris ca. 1260-1275	Bordeaux, Bibl. mun. 7, Psalter	Bordeaux, Bibl. mun. 3, Psalter	Paris and Province of Sens	48.8567,2.3508
21	Paris ca. 1260-1275	Baltimore, Walters Art Museum W. 43, Psalter	Baltimore, Walters Art Museum W. 43,	Paris and Province of Sens	48.8567,2.3508
22	Paris ca. 1260-1275	Paris, BNF fr. 2186, Roman de la Poire	Paris, BNF fr. 2186, Roman de la Poire	Paris and Province of Sens	48.8567,2.3508

This looks sort of like an edge list.

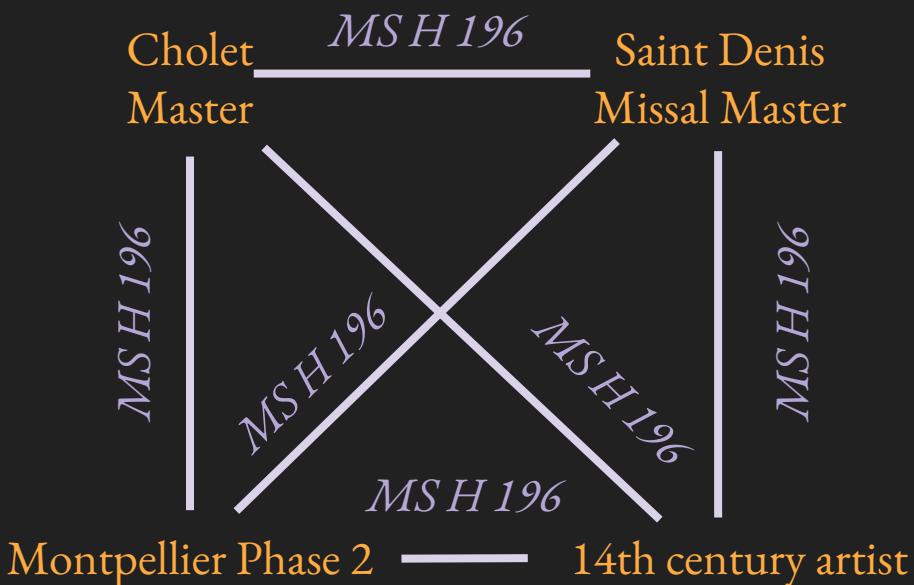
We can model this as a static, bimodal network of artists and manuscripts

A network represents relationships (edges) between variables (nodes).

Multimodal Network



Projected Unimodal Network



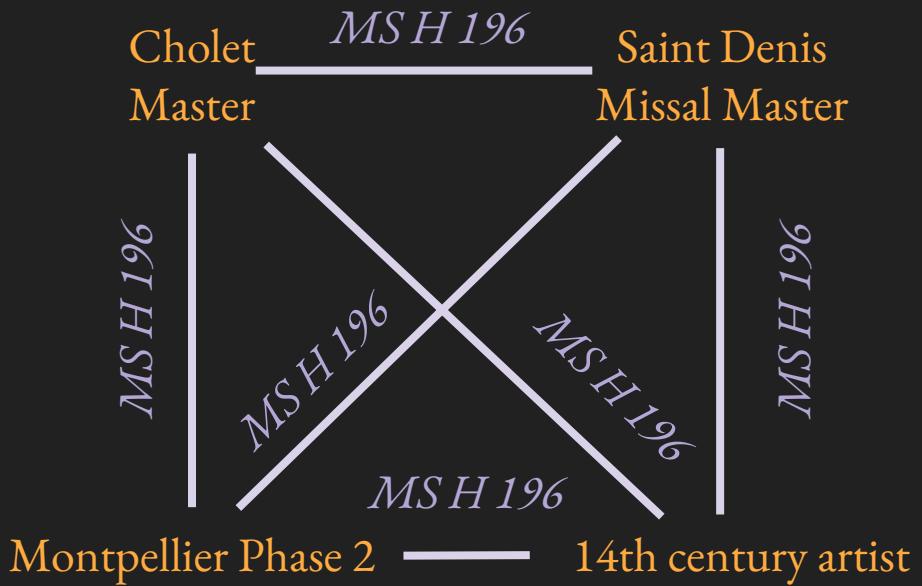
A network represents relationships (edges) between variables (nodes).

What are the **advantages** of projecting from bimodal to unimodal?

What are **potential problems** with this?

What are your **questions** so far?

Projected Unimodal Network



from	to	weight
Paris ca. 1260-1275	Saint-Denis Missal M	1
Paris ca. 1260-1275	Cholet Master	1
Paris ca. 1260-1275	Reims, Parisianising	1
St Louis Psalter Mast	Third artist in lat. 105	1
St Louis Psalter Mast	Isabelle Psalter Mast	1
Third artist in lat. 105	Isabelle Psalter Mast	1
Third artist in lat. 105	Saint-Denis Missal M	1
Saint-Denis Missal M	Cholet Master	4
Saint-Denis Missal M	Beauvais, Cambrai?	1
Saint-Denis Missal M	Master Honore and w	1
Saint-Denis Missal M	Hospitaller Master	1
Saint-Denis Missal M	Montpellier Chanson	1
Saint-Denis Missal M	Vie de saint Denis M	1
Hospitaller Master	Cholet Master	1
Hospitaller Master	Master of BNF lat. 83	1
Hospitaller Master	Charlemagne Master	1
Hospitaller Master	Meliacin Master	1

Most network metrics are designed for unimodal networks (one kind of node)

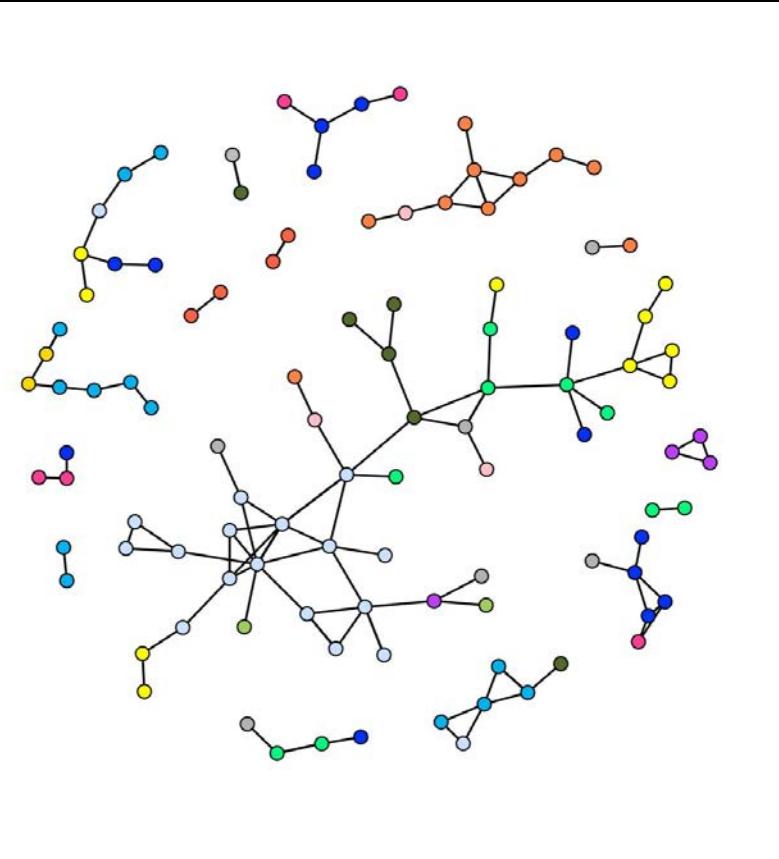
So we convert it to a unimodal network using projection

Data storage and editing: Google Sheets

Data Manipulation (Projection): R

Contact Manuscripts Network

from	to	weight
Paris ca. 1260-1275	Saint-Denis Missal M	1
Paris ca. 1260-1275	Cholet Master	1
Paris ca. 1260-1275	Reims, Parisianising	1
St Louis Psalter Mast	Third artist in lat. 105	1
St Louis Psalter Mast	Isabelle Psalter Mast	1
Third artist in lat. 105	Isabelle Psalter Mast	1
Third artist in lat. 105	Saint-Denis Missal M	1
Saint-Denis Missal M	Cholet Master	4
Saint-Denis Missal M	Beauvais, Cambrai?	1
Saint-Denis Missal M	Master Honore and w	1
Saint-Denis Missal M	Hospitaller Master	1
Saint-Denis Missal M	Montpellier Chanson	1
Saint-Denis Missal M	Vie de saint Denis M	1
Hospitaller Master	Cholet Master	1
Hospitaller Master	Master of BNF lat. 83	1
Hospitaller Master	Charlemagne Master	1
Hospitaller Master	Meliacin Master	1



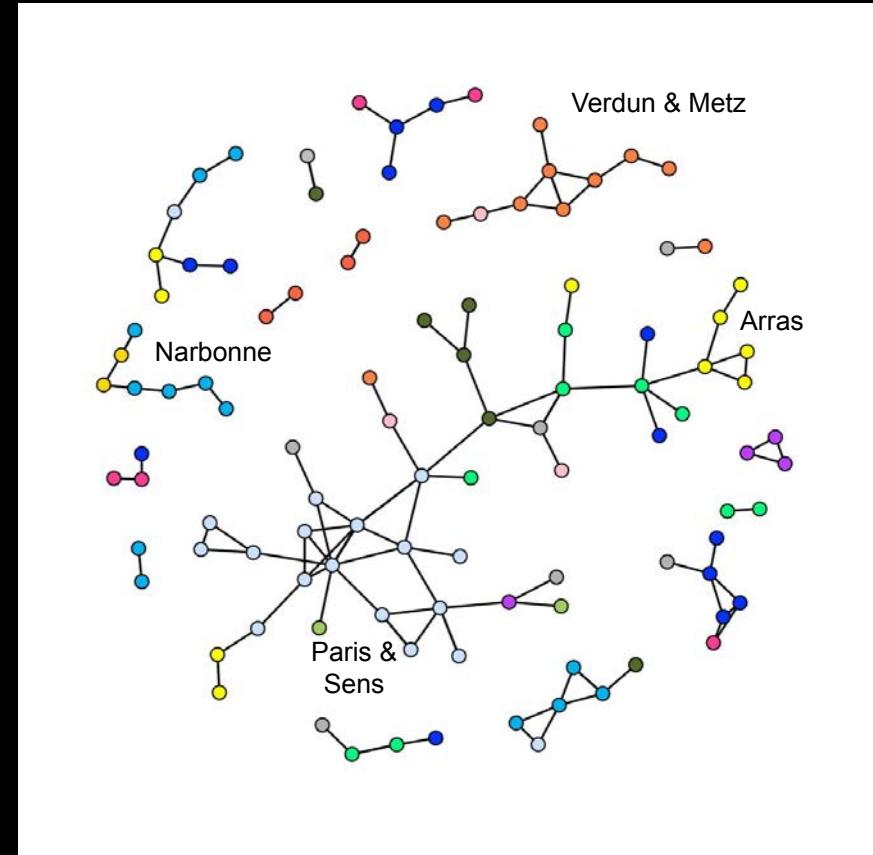
Static view of
the temporal
network,
1260–1320

Contact Manuscripts Network

Mapping links between geographic centers (Palladio)



Connections between artists (R)



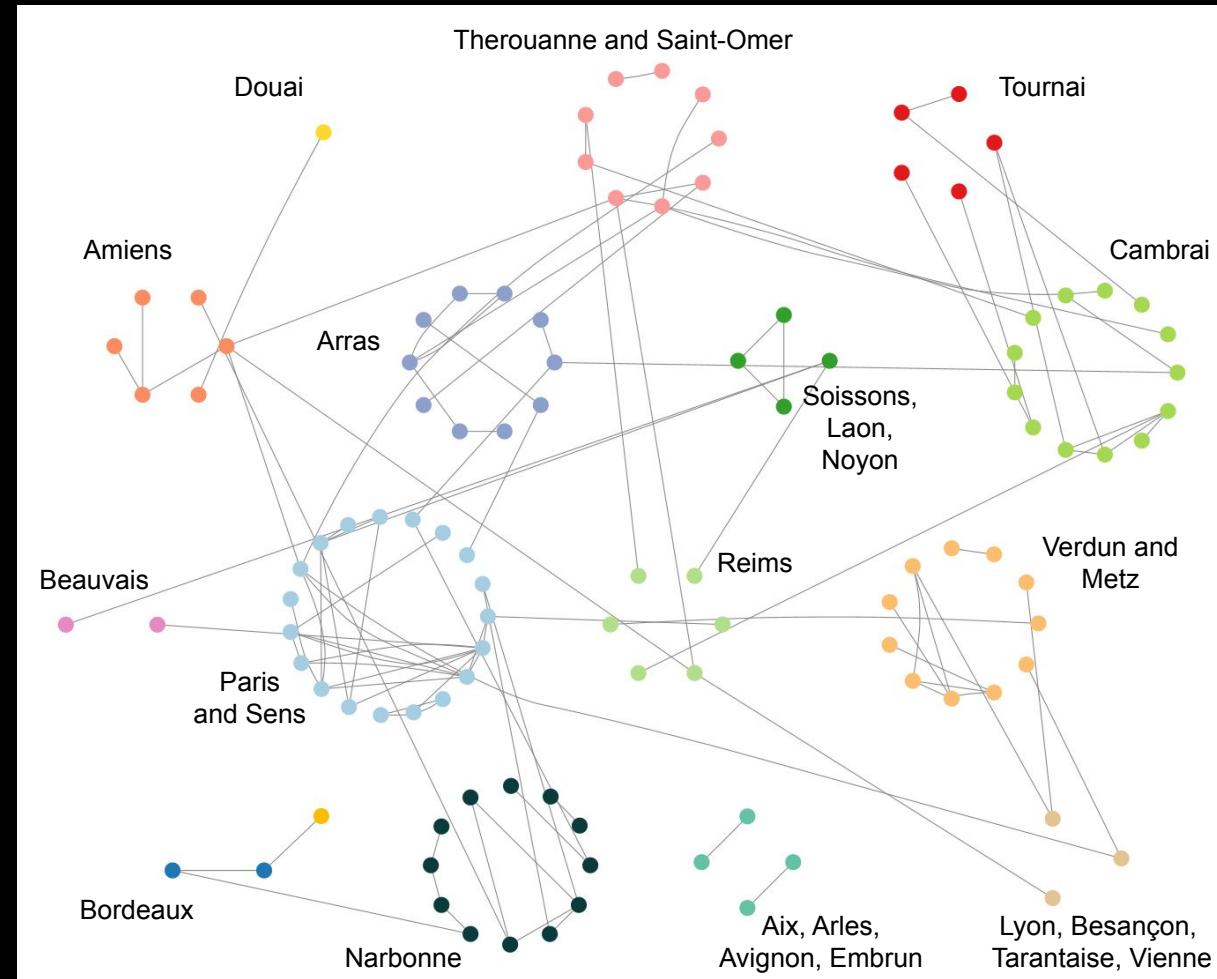
Contact Manuscripts Network

Connections between
artists/workshops by geography

Layout generated with
cytoscape (*cise* layout)

What do you **observe**?

What **hypotheses** could
you generate based on
this visualization?



What About Time?

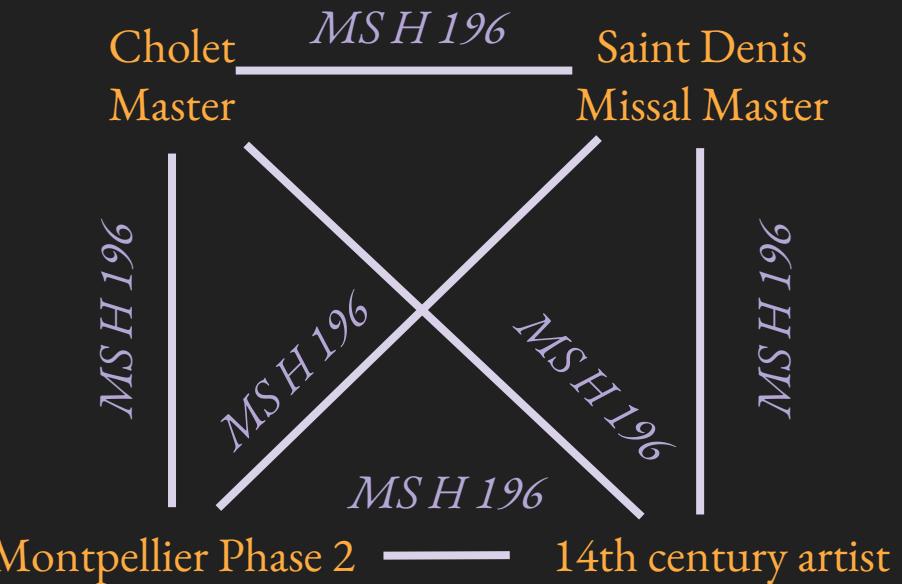
If we ignore time, the network on the right makes sense

Does it make sense to say that the Cholet Master and the 14th century artist are connected?

How could we factor in time?

How could we deal with uncertainty about time?

Projected Unimodal Network



What About Time?

By giving nodes and edges a start and a stop time, we can selectively visualize and analyze relationships and actors that exist **at the same time**

In temporal network analysis, these are referred to as the **onset** and **terminus** of nodes/edges

1270s-1280s



What About Time?

By giving nodes and edges a start and
a stop time, we can selectively
visualize and analyze relationships
and actors that exist **at the same time**

1290s

In temporal network analysis, these
are referred to as the **onset** and
terminus of nodes/edges

Montpellier Phase 2

What About Time?

By giving nodes and edges a start and a stop time, we can selectively visualize and analyze relationships and actors that exist **at the same time**

In temporal network analysis, these are referred to as the **onset** and **terminus** of nodes/edges

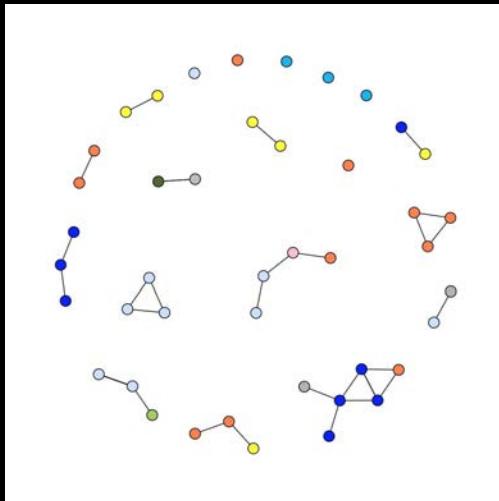
Early 14th century

14th century artist

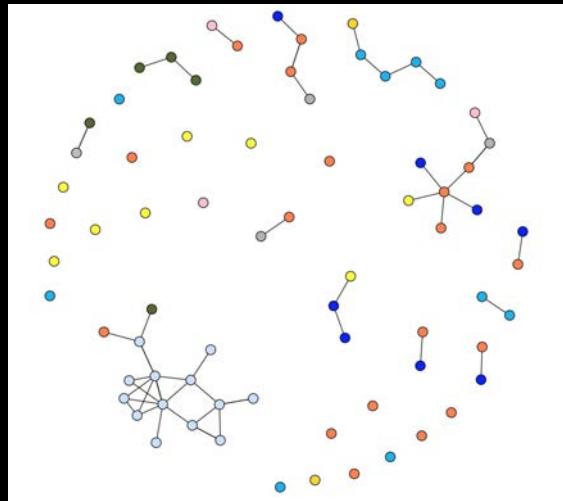
Temporal Network Analysis

- Nodes and edges appear and disappear over time

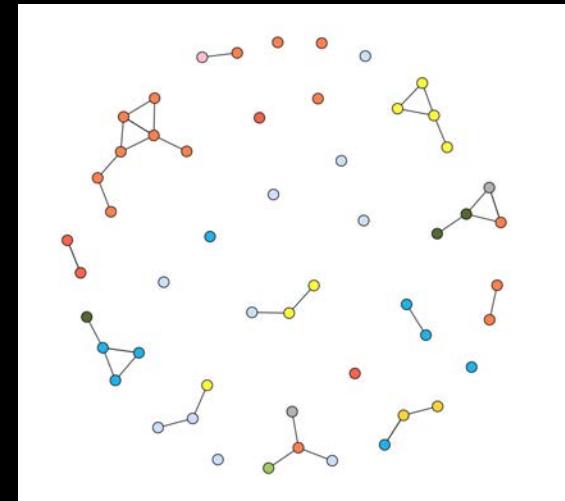
1260-1280

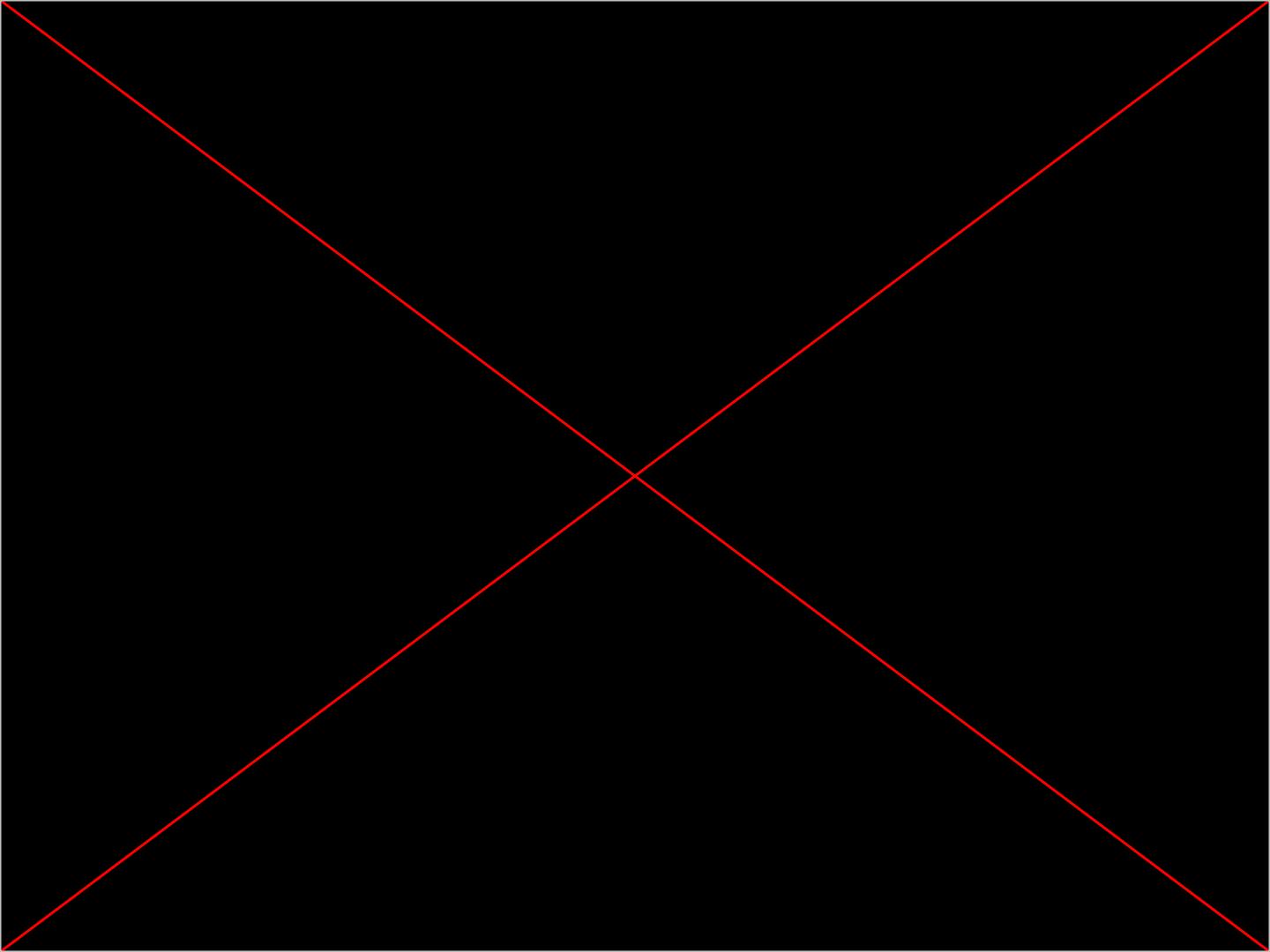


1280-1300



1300-1320





What About Time?

Instead of just nodes and edges, we need terminus and onset dates for each node and each edge:

Edge List:

Node 1	Node 2	Onset	Terminus
A	B	1270	1280

Node List:

Node	Onset	Terminus
A	1250	1280
B	1260	1290

What About Time?

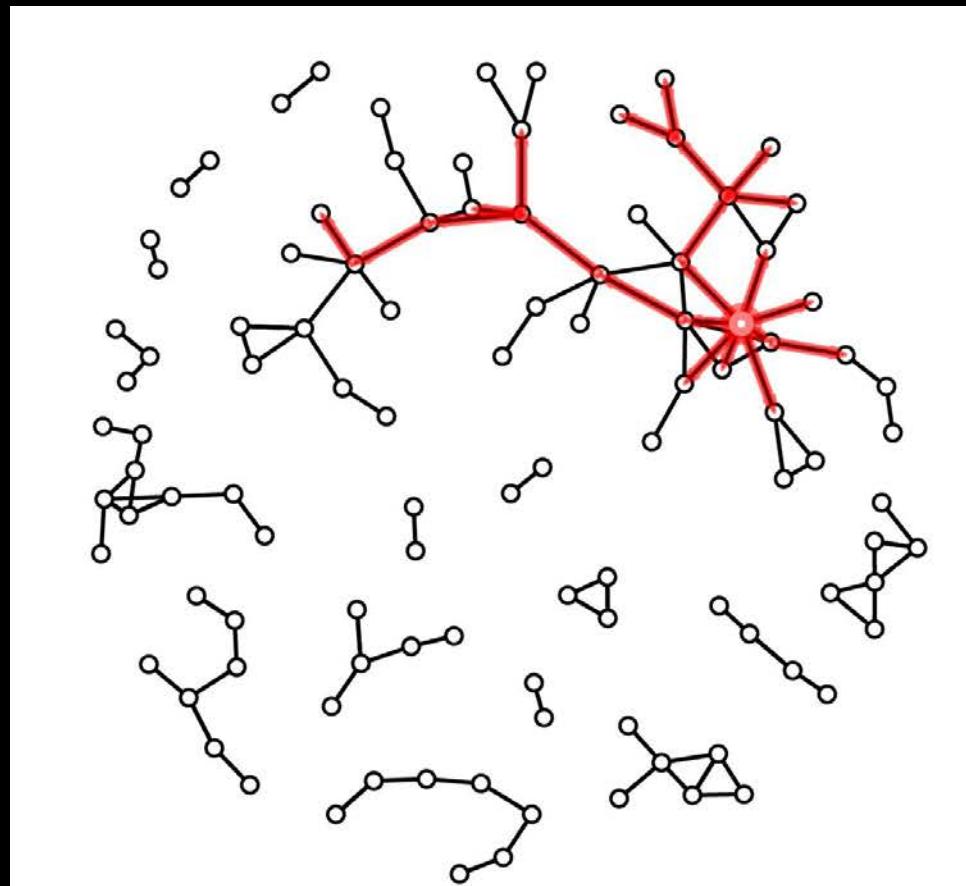
Full Link:

https://colab.research.google.com/drive/1x43l3_xaUgd_A9xiKjNA9q_VApdBgIO?usp=sharing

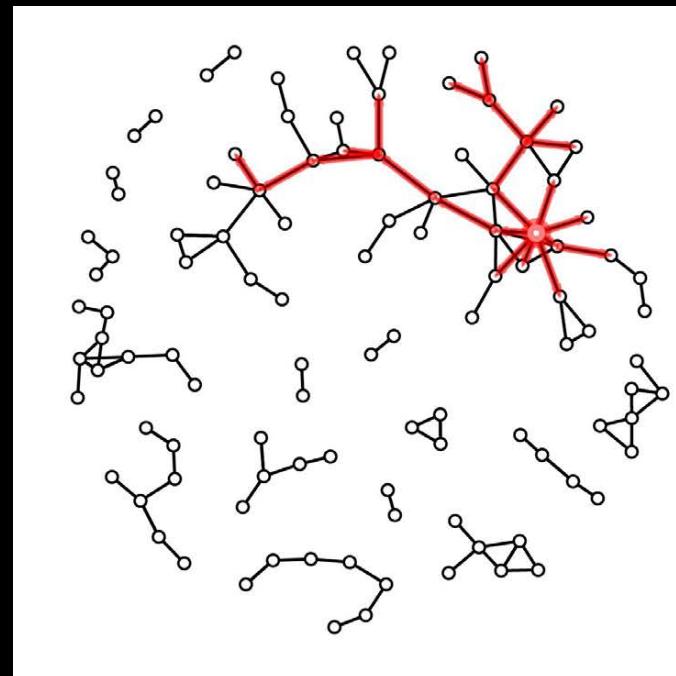
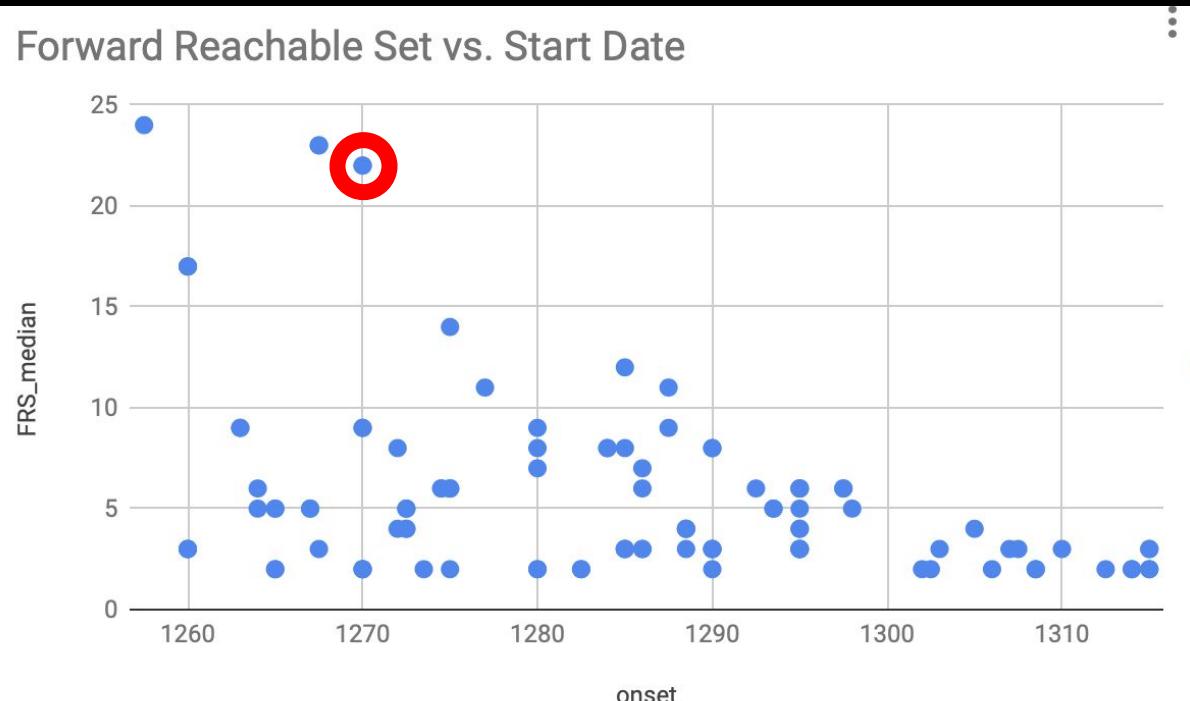
Short Link: <https://tinyurl.com/nzy4kchr>



Saint Denis Missal Master, ca. 1270s-80s
One variant of the median forward reachable set

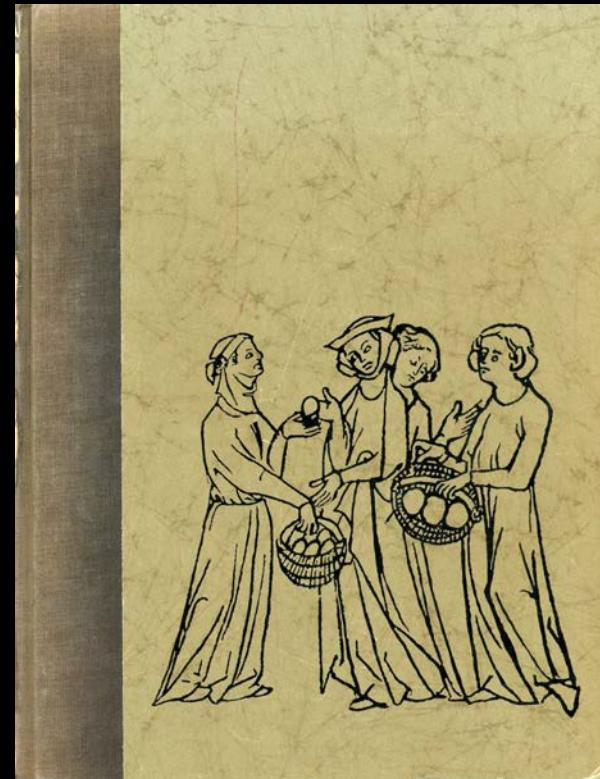
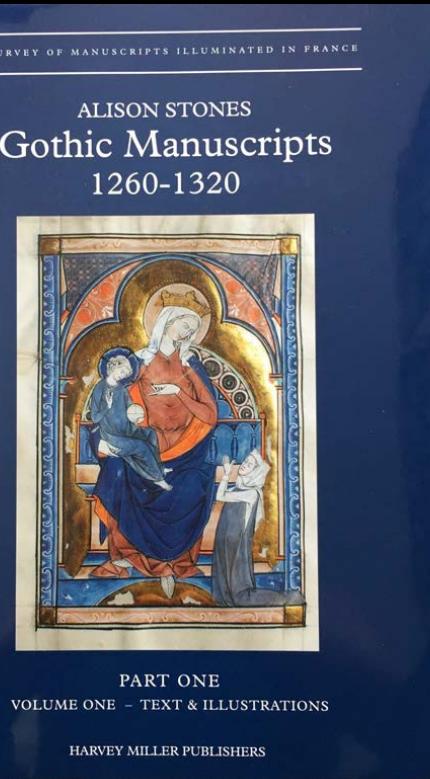


Structural Advantages and Geographic Location



Saint Denis Missal Master, ca.
1270s-80s
One variant of the median forward
reachable set

Artist attributions, dating,
and localizations



Artists' selections of
marginal iconography

IMAGES
IN THE
MARGINS OF
GOTHIC
MANUSCRIPTS

LILIAN M. C. RANDALL

UNIVERSITY OF CALIFORNIA PRESS
BERKELEY AND LOS ANGELES
1966

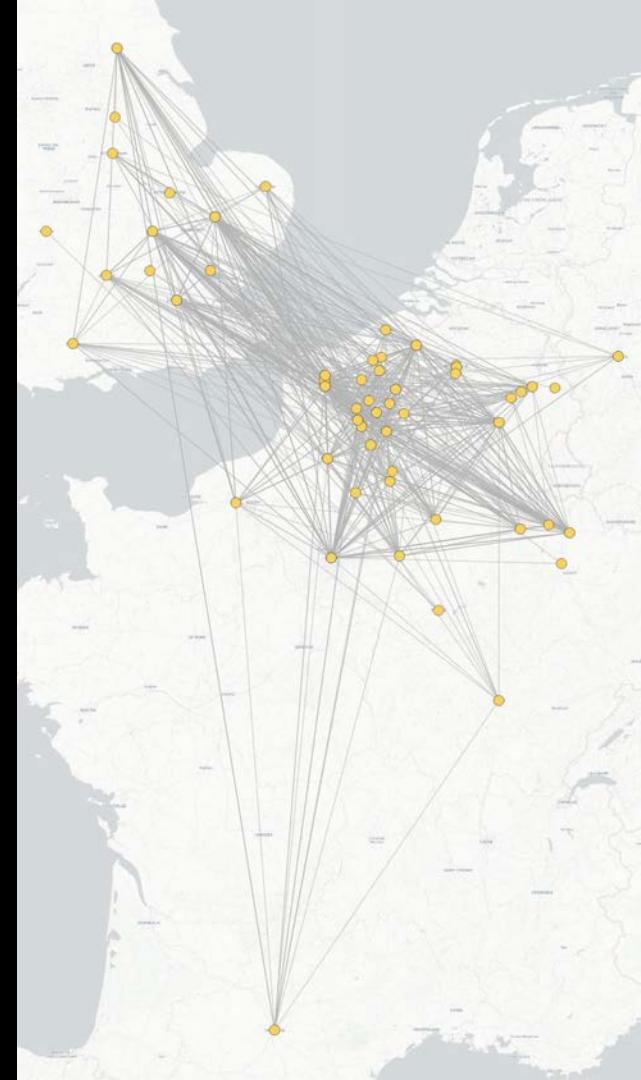
Contact Manuscripts Network

Based on data from Stones,
Gothic Manuscripts



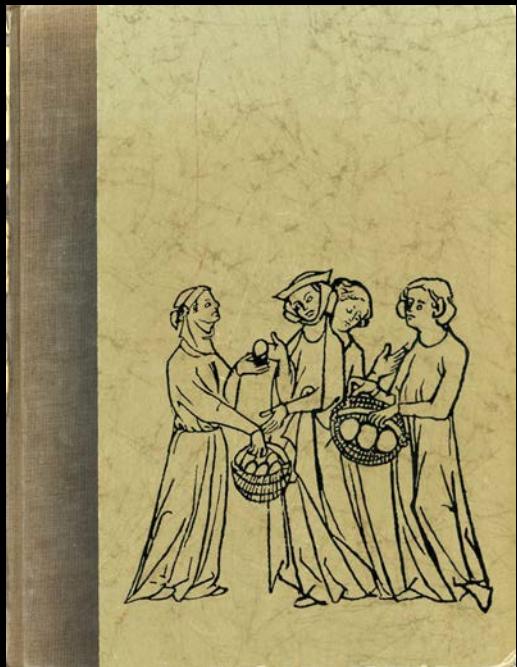
Iconographic Similarity Network

Based on data from Randall,
Images in the Margins



Lilian M. C. Randall, *Images in the Margins of Gothic Manuscripts* (1966)

Index of iconographic themes and their representation in 13th/14th-century manuscripts



IMAGES IN THE MARGINS OF GOTHIC MANUSCRIPTS

LILIAN M. C. RANDALL

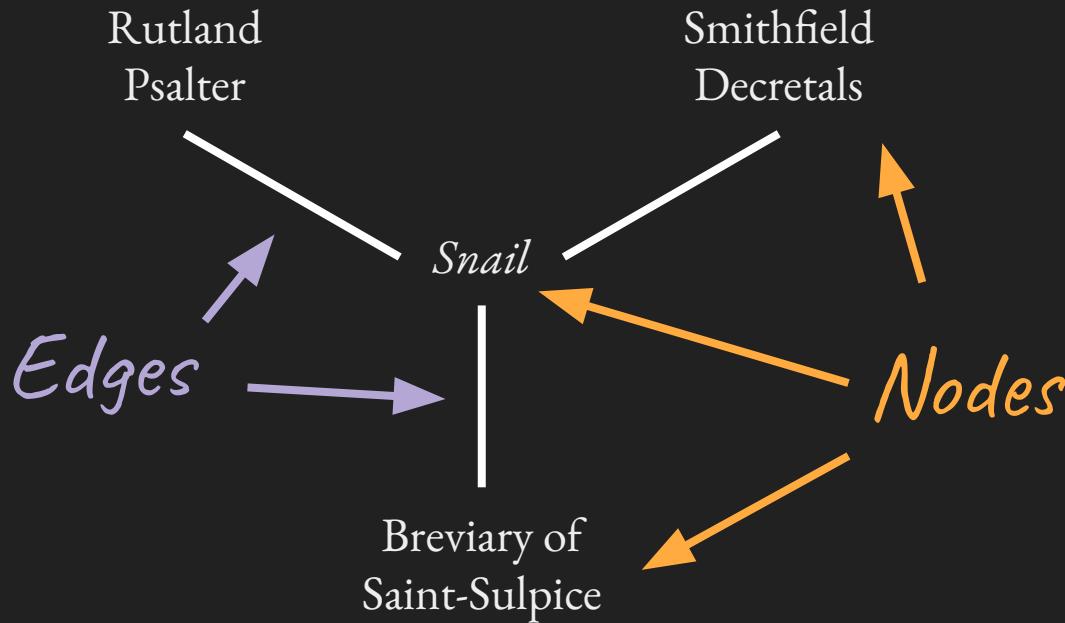
UNIVERSITY OF CALIFORNIA PRESS
BERKELEY AND LOS ANGELES
1966

- Ape winding rope tied between two stakes: Douce 6, f. 153 (fig. 52)
Ape winding wool *see* Ape with reel
Ape with arrow in mouth: M. 149, f. 293v (f. 294, owl)
Ape with arrows (two) seated on column flanked by two apes pierced with arrows (Eros parody?): Hague 78.D.40, f. 28
Ape with asperge and stulta (*see also* Ape as cleric; Procession; School): Yale MS., ff. 267, 298v
Ape with ax
approaching burrow from which hare looks out: Trinity B.11.22, f. 137v
chopping down small tree: W. 87, f. 27
chopping firewood: BBR II 988, vol. II, f. 217v; Glazier 24, f. 163v
pruning *see* Ape pruning
whetting (?) on table: Trinity B.11.22, f. 63 (2)
Ape with bagpipe: Add. 49622, f. 43v; Stowe 17, f. 157v; W. 110, f. 36v; Yale MS., f. 14
ape balancing two basins on sticks: Add. 24686, f. 17v (man with vielle) (fig. 52); C.B. 64, f. 52v
ape dancing: Fitz, 298, f. 3v (two); G.K.S. 3384, f. 228 (man with vielle); Tournai Ps., f. 218v (two)
ape tumbling: fr. 25526, f. 3v (handstand); Stowe 17, f. 35v
ape with hand organ, another with pipe and tabor, with ape-physician: Cambridge Dd. 5.5, f. 239
ape with shawm, basket on back containing apes: fr. 95, f. 237 (2)
ape with trumpet (*see also* Woman nude, and goon): Tournai Ps., f. 204v
apes fighting with swords and bucklers: Tournai Ps., f. 3
apes playing with hood: Tournai Ps., f. 235 (three apes)
apes tilting on foot, ape with pipe and tabor: Tournai Ps., f. 247
as bishop, approaching ape-physician seated with stick and rattle: W. 87, ff. 37v-38
dog with pipe and tabor: Tournai Ps., f. 31
dog with staff: Douce 6, f. 191v
hybrid couple dancing: Tournai Ps., f. 89
hybrid woman dancing: Douce 118, f. 21v
lion dancing: Tournai Ps., f. 216v (at R., ape with bird on brow)
supporting bent trumpet played by hybrid man: Tournai Ps., f. 207v
- Ape with ball, playing (*cf.* Handball): Harley 6563, f. 76v
Ape with basket (*cf.* Beggar)
beckoning to man holding fish: G.K.S. 3384, f. 156 (above, man with basket and end)
containing small yellow round objects (picked off border?): latini 10483, f. 20 (one hand on border stalk)
picking gold balls off border: Douce 6, f. 48
Ape with basket on back containing
ape: W. 82, f. 195 (hybrid ape); W. 87, f. 41 (with staff)
apes with bagpipe and trumpet: fr. 95, f. 237
apes, with staff, confronting one-legged man with bagpipe: fr. 95, f. 64v
cranes: Y.T., 8, f. 171v
Ape with bell *see* Ape ringing; Ape with hand bells
Ape with bell tied to stick: Melbourne 1254/3, f. 72v (at L., hybrid man with sword and buckler)
Ape with bellied peaked hood: W. 87, f. 39v
Ape with bellows (*see also* Ape playing; — pumping): M. 754, ff. 69v (blowing fire), 104v (the same); W. 87, f. 69
Ape with bone *see* Apes, seated
Ape with book (*see also* Ape as cleric; School): Add. 36684, ff. 125 (2), 132; Harley 9157, f. 181; G.K.S. 3384, f. 305; M. 155, f. 119; M. 754, f. 17v; Princeton 44-18, f. 109; W. 45, f. 129; W. 90, ff. 77, 194 (seated on chair, pointing to page in book)
at lectern: BBR 9391, f. 125v
at lectern, crowned; before him two apes, one with book: fr. 25526, f. 48v
following man with book, approaching two apes reading: Bodley 264, f. 96
reading: Arras 47, f. 7; BBR II 988, vol. II, f. 244 (seated in chair); Bodley 264, f. 96 (2, following man with book); Yale MS., f. 40v
seated before ape with switch: W. 88, f. 38v
seated before hybrid man playing psaltery with rake: M. 754, f. 46v
Ape with bow: W. 87, f. 33
Ape with bowl (nest?) containing bird (*cf.* Bird in nest; Man and dragon, astride, with bowl): Tournai Ps., f. 165
Ape with buckets (two) on pole over shoulder: Add. 20253, f. 210v; Douce 5, f. 5v; Trinity B.11.22, f. 53
Ape with castle *see* Castle

A

Formal Network Analysis

A network represents relationships (edges) between variables (nodes).



A network represents relationships (edges) between variables (nodes).

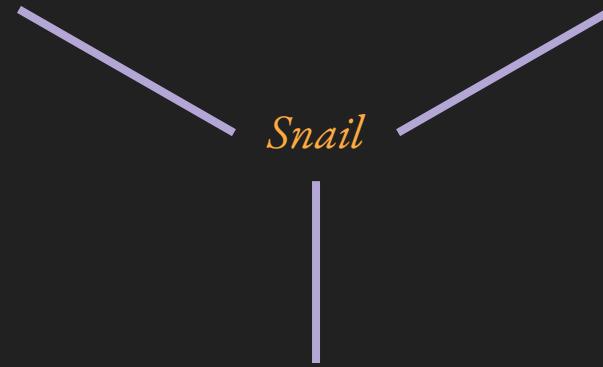
Multimodal network

Rutland
Psalter

Arthurian
miscellany

Luttrell Psalter

Snail



Unimodal network

Rutland
Psalter

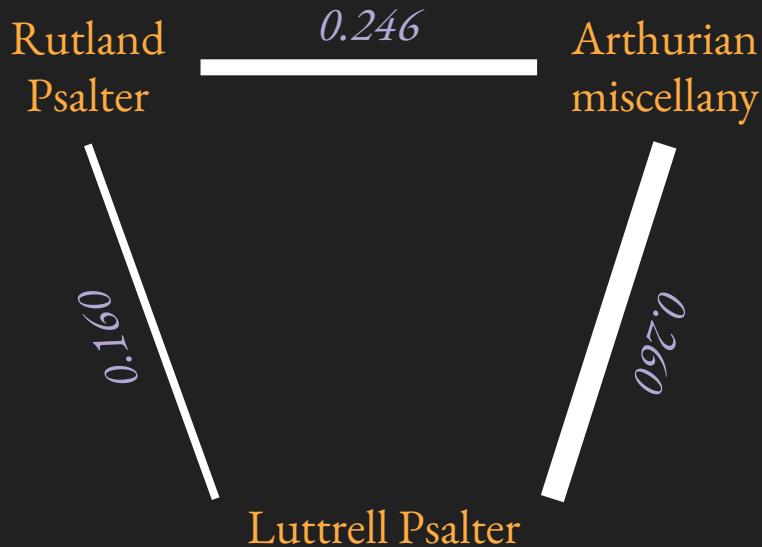
Snail

Arthurian
miscellany



A network represents relationships (edges) between variables (nodes).

Similarity network



Snail (*see also* Ape and; Centaur and; Cleric and; Crane and; Dog and; Dragon and; Fox and; Hare and; Hybrid bishop and; Hybrid knight and; Hybrid man and; Knight and; Man and; Man nude and; Pea pods; Ram and; Woman and): Add. 42130, ff. 159, 160; Cloisters 54.1.2, ff. 81v, 83v, 130
 ascending ladder: Add. 36684, f. 61v; Add. 42130, f. 160 (3)
 atop ladder: M. 754, f. 70v (beside beast with lit taper)
 atop stairs: Add. 36684, f. 64v (2, with monstrous heads)
 balancing on crossbar: M. 754, f. 22v
 beside bird's nest, lion: Cambrai 102, f. 436v
 confronting snail: BBR 10607, f. 240v
 labeled "limasconn": BBR 329-41, f. 198v
 labeled "Lymasoun": M. 812, f. 27
 on stilts: Add. 36684, f. 55v
 preceding boat *see* Man in boat
 pulling wine keg on cart: M. 88, f. 177v (at R., stork)
 sitting on wall: M. 754, f. 44 (3; at L., pond)

1	Theme	Subtheme	Manuscript Abbrev.	Folio
11959	Snail	NA	Add. 42130	159
11960	Snail	NA	Add. 42130	160
11961	Snail	NA	Cloisters 54.1.2	81v
11962	Snail	NA	Cloisters 54.1.2	83v
11963	Snail	NA	Cloisters 54.1.2	130
11964	Snail	ascending ladder	Add. 36684	61v
11965	Snail	ascending ladder	Add. 42130	160
11966	Snail	atop ladder	M. 754	70v
11967	Snail	atop stairs	Add. 36684	64v
11968	Snail	balancing on crossbar	M. 754	22v
11969	Snail	beside bird's nest, lion	Cambrai 102	436v
11970	Snail	confronting snail	BBR 10607	240v
11971	Snail	labeled "limasconn"	BBR 329-41	198v
11972	Snail	labeled "Lymasoun"	M. 812	27
11973	Snail	on stilts	Add. 36684	55v
11974	Snail	pulling wine keg on cart	M. 88	177v
11975	Snail	sitting on wall	M. 754	44

13,234 images categorized under 2,002 themes over 240 manuscripts

THE SNAIL IN GOTHIC MARGINAL WARFARE

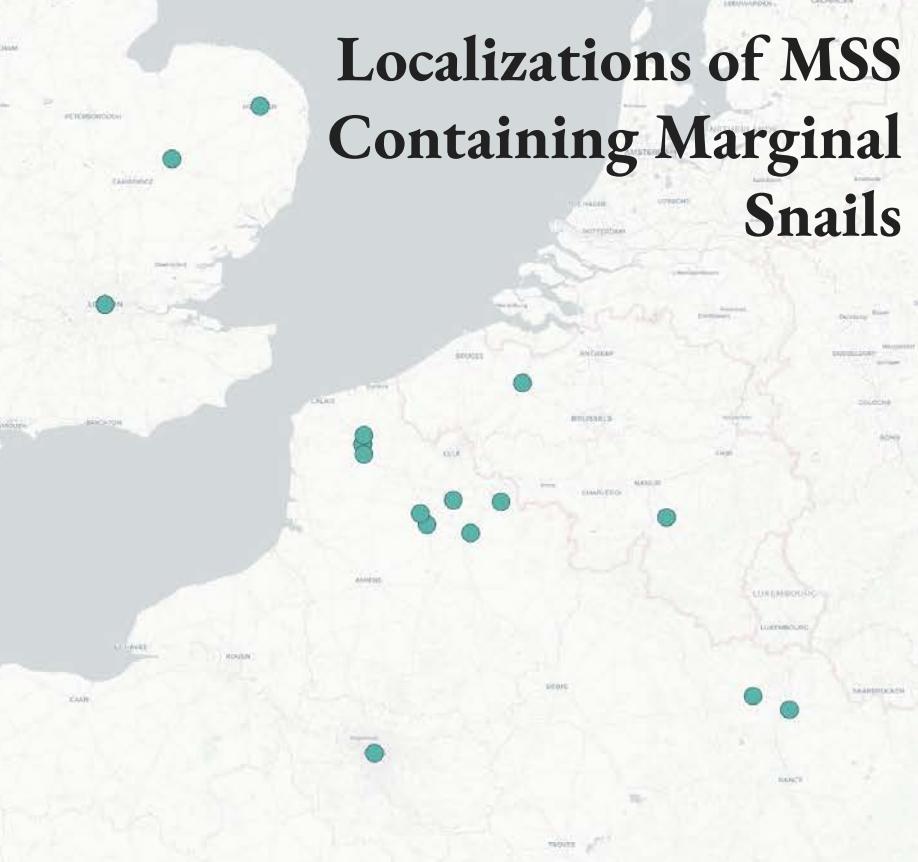
By LILIAN M. C. RANDALL

TOWARDS the end of the thirteenth century there emerged in the margins of North French illuminated manuscripts a motif whose meaning and origin have not yet been fully clarified. The motif depicts a man combatting a snail (Fig. 1). Appearing a few years later also in Flemish and English marginal illumination, the theme and variants thereof were represented with notable frequency throughout the first quarter of the fourteenth century. Its humorous and satirical implications, perfectly adapted to the predominant spirit of Gothic *drôleries*, do not suffice to explain its popularity, particularly since its introduction into the margins marked the beginning of an artistic tradition which persisted throughout the Middle Ages.

Considered for the present study are over seventy marginal representations of the theme culled from twenty-nine manuscripts.¹ Of these, the majority — eleven North French, seven Franco-Flemish, and four English examples — were produced between about 1290 and 1310. Of the remainder, illuminated between about 1310 and 1325, three are Flemish, three are English, and only one is North French, reflecting a waning of interest in the motif, particularly in France. The manuscripts, which include psalters, hours, breviaries, pontificals, and decretals as well as a *Lancelot du Lac*, a *Tristram*, and a *Recueil de poésies morales*, range in artistic quality from relatively provincial works with limited ornamentation to superb productions with elaborate marginal programs. A feature common to both groups of manuscripts, however, is a distinct preference for travesty, genre, and literary themes rather than for fantastic imagery or grotesquerie. Although apparently unrelated to immediately adjoining illustrations or textual passages, the motif often appears in marginal programs dominated by *monde renversé* themes involving men and hares.² This is the case, for instance, in the first volume of the

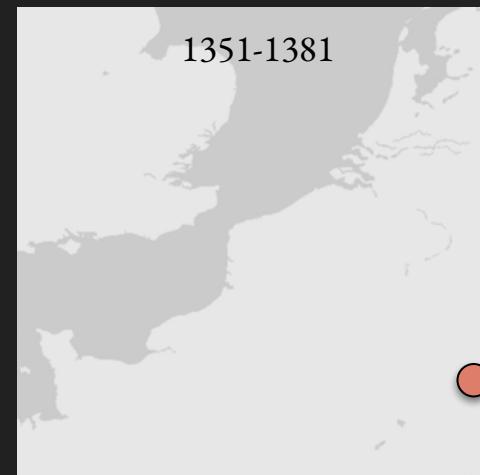
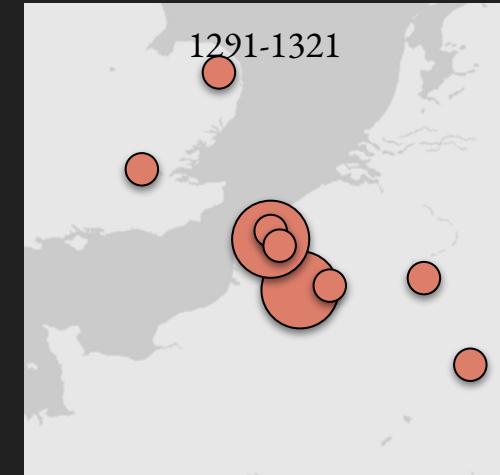
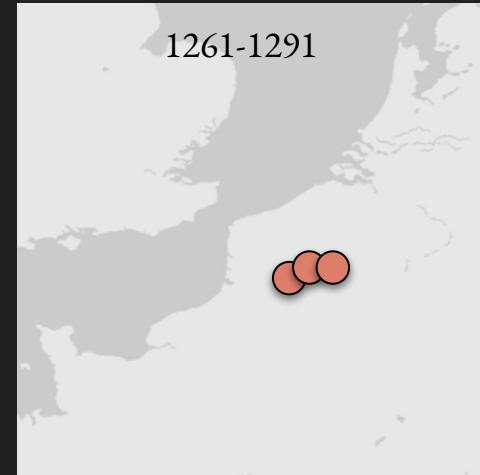


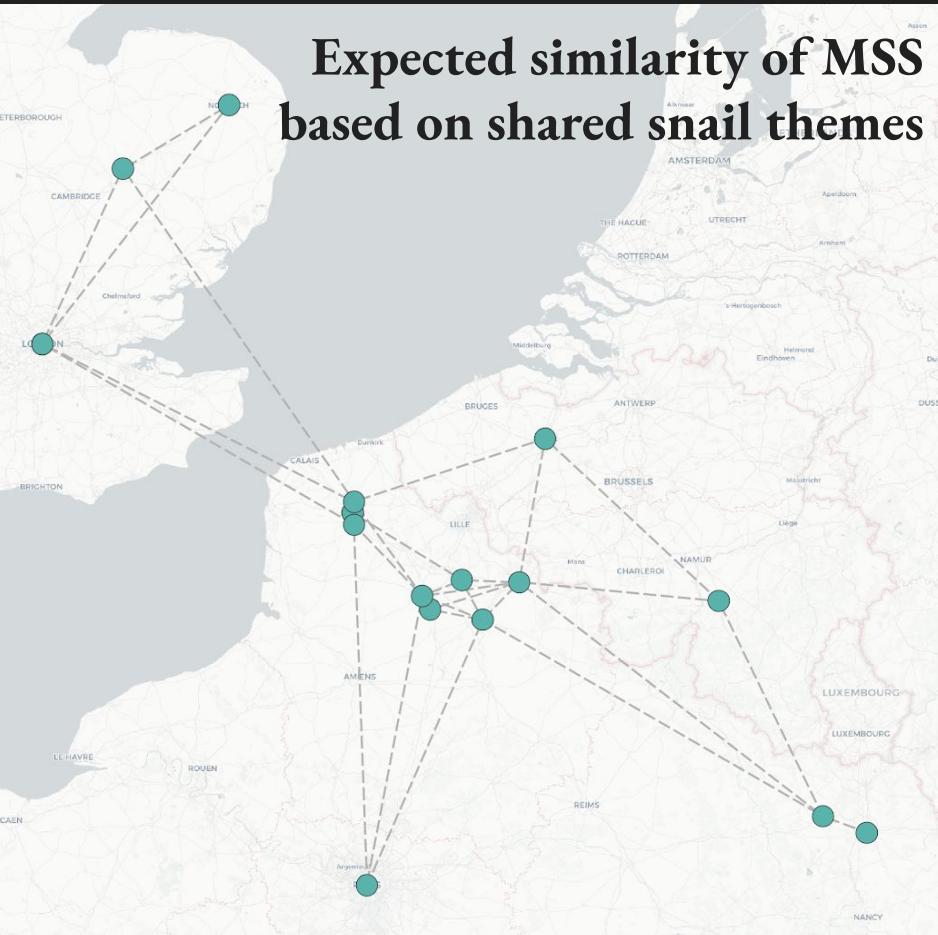
Localizations of MSS Containing Marginal Snails



Snails in manuscripts from England, France, and Flanders, ca. 1260–1340
Beinecke 229, fol. 169r; Add. 36684, fol. 61v; Cambrai 102, fol. 273r; Add. 62925,
fol. 48r; Add. 49622, fol. 185v; Cambrai 103, C, fol. 42r; Add. 42130, fol. 160r

Manuscripts with Snails





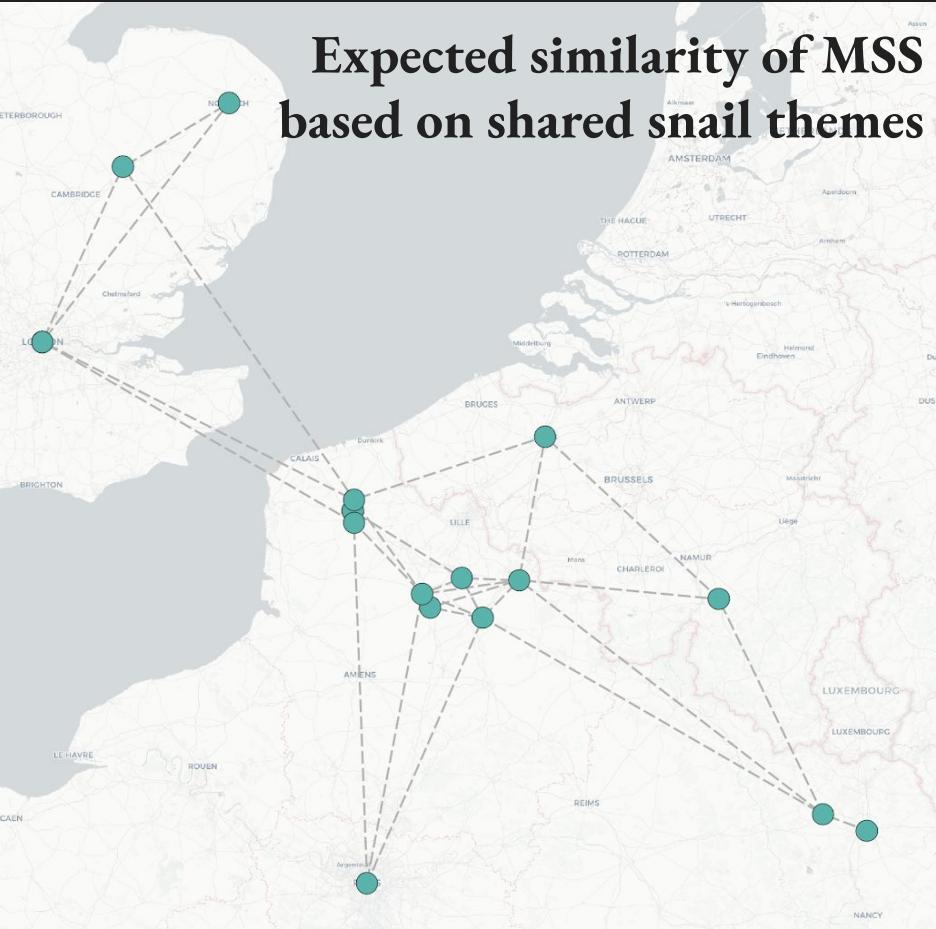
Expected similarity of MSS based on shared snail themes

Develop and test **hypotheses** articulable in quantitative terms

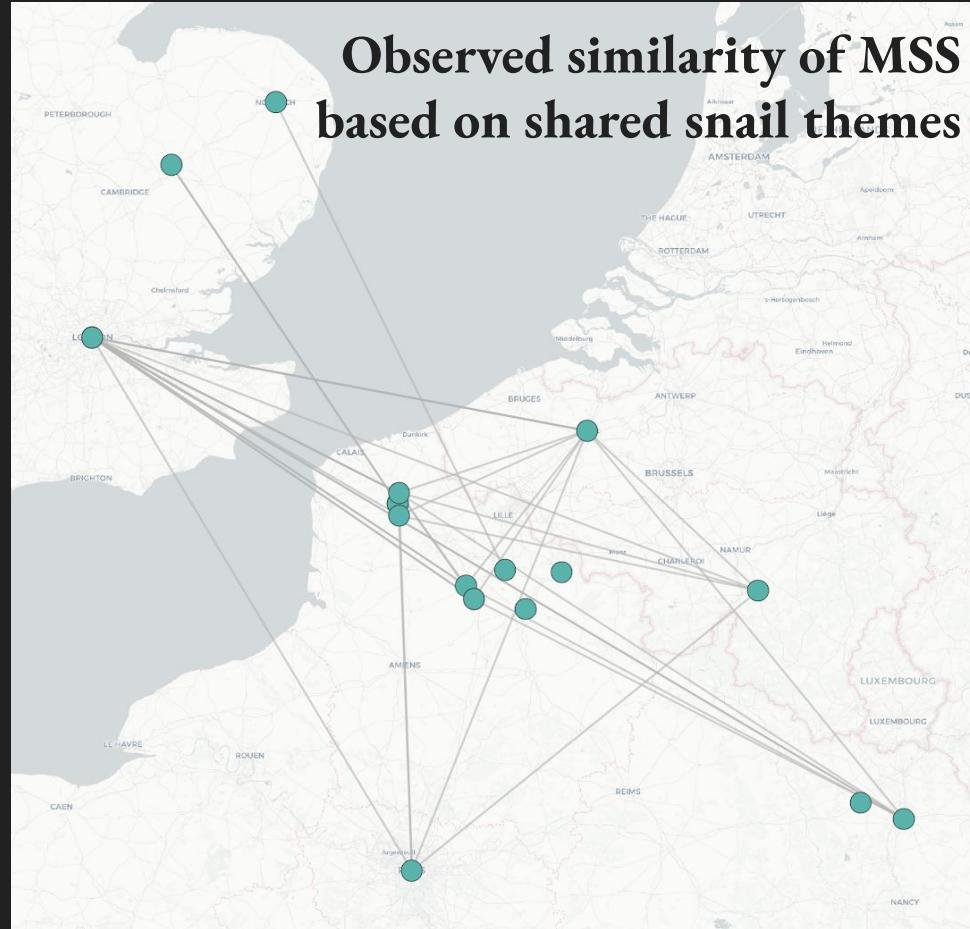
- Map MSS based on where they were produced
- Hypothesis: MSS produced nearby should be more similar in terms of their marginal iconography
- Draw lines connecting nodes to their 2-3 nearest neighbors to create a hypothetical diffusion model
- Compare hypothetical diffusion model with observed similarity

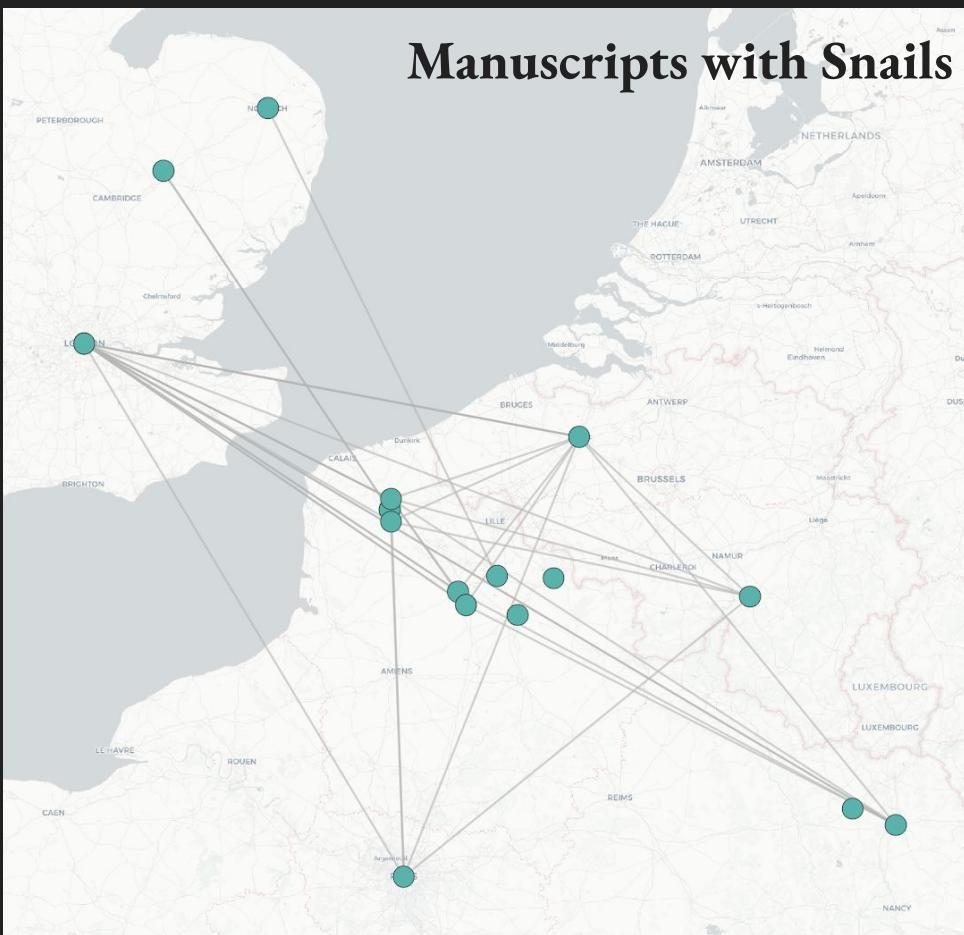
Map made with Visone

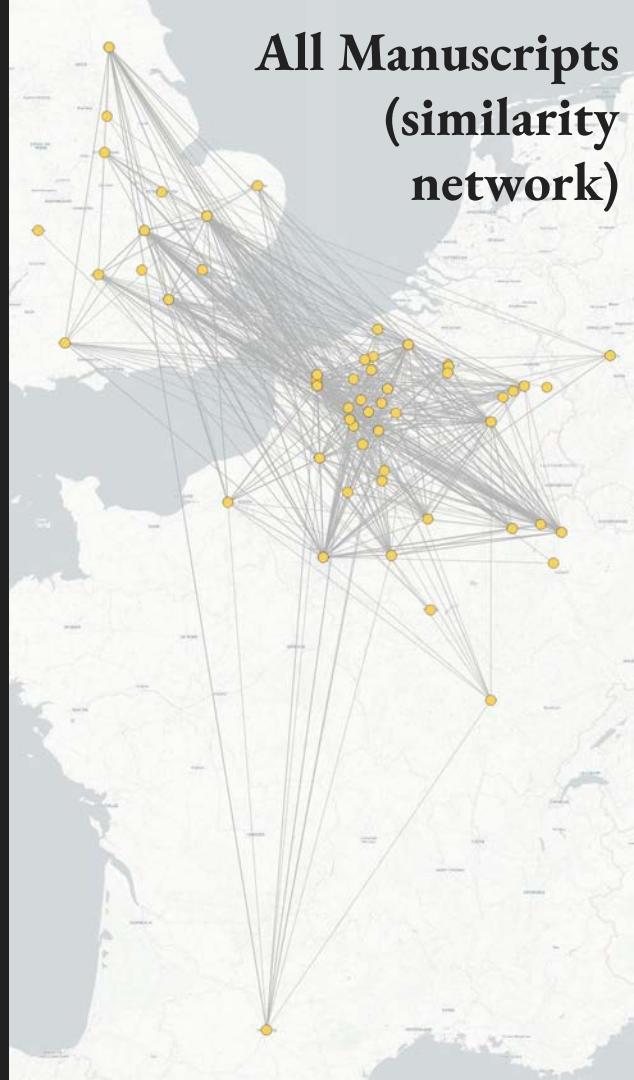
Expected similarity of MSS based on shared snail themes



Observed similarity of MSS based on shared snail themes







Similarity network

Rutland
Psalter

0.246

Arthurian
miscellany

0.160

Luttrell Psalter

0.260

High-Similarity Pair:

Hours for Cambrai (W. 88) & Gorleston Psalter (Add. 49622)



**Book of Hours with
Office of the Dead for Cambrai Use**

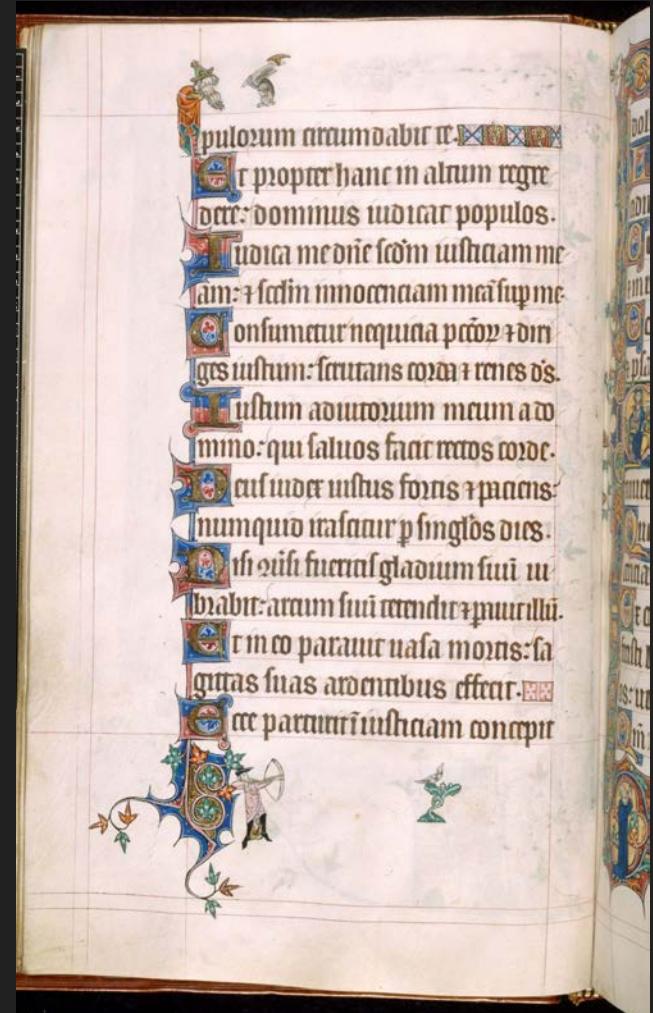
117 x 84 mm

Cambrai, ca. 1300-1310

Baltimore, Walters Art Museum

MS W. 88, fol. 82v

Gorleston Psalter
325 x 235 mm
East Anglia, ca. 1310-1324
London, British Library Add. MS
49622, fol. 13v



Theme	W. 88	Add. 49622
Cleric	1	2
Man and bird	4	1
Falconer	1	1
Man with bagpipe	2	1
Ape and horse	1	1
Hybrid man with bellows	1	1
Man chopping wood	1	1
Man and hare	1	1
Hybrid man and man	1	1
Wrestling	1	1
Obscaena	2	3

Theme Overlap between Hours for Cambrai (W.88) & Gorleston Psalter (Add. 49622)



= Total overlap of **12 images**

Man and bird



Hours for Cambrai
WAM W. 88, fols. 82v,
21r, and 171r

Gorleston Psalter
BL Add. 49622,
fol. 13v

Ape and horse



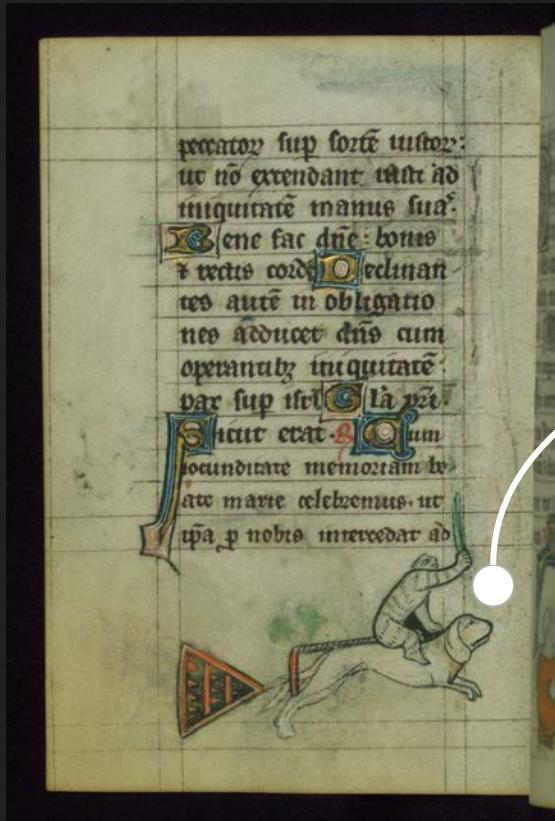
Gorleston Psalter
BL Add. 49622, fol. 142r



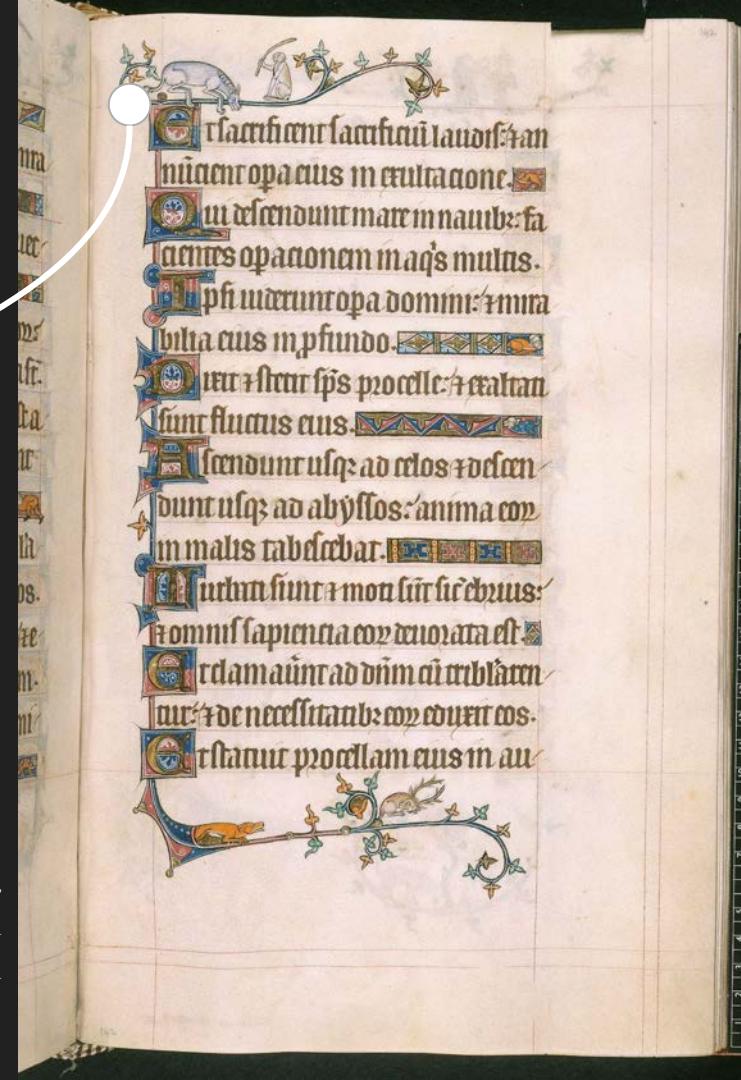
(not a horse!)

Hours for Cambrai
WAM W. 88, fol. 85v

Book of Hours for Cambrai
Baltimore, Walters Art Museum
MS W. 88, fol. 82v



Gorleston Psalter
London, British Library
Add. MS 49622, fol. 13v



Similarity Metrics in Action

Binary Attributes

	Attribute 1	Attribute 2	Attribute 3
Hagia Sophia	0	1	1
Hosios Loukas	1	1	0
Panagia Kapnikarea	1	1	1

Quantitative Attributes

	Attribute 1	Attribute 2	Attribute 3
Chludov Psalter	0	2	24
Paris Psalter	80	4	0
Theodore Psalter	60	65	1020

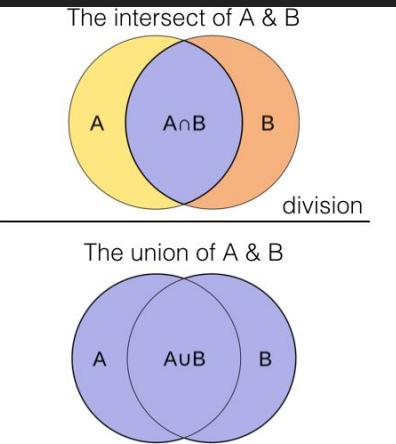
Similarity Metrics in Action

Binary
Attributes

	Attribute 1	Attribute 2	Attribute 3
Object 1	0	1	1
Object 2	1	1	0

Jaccard
Similarity

$$J(A,B) =$$



Jaccard similarity is a way to compress multiple binary attributes into a single measure of similarity.

It's defined as the **intersection** of two sets divided by the **union** of the two sets

Or: the overlap divided by the total possible overlap

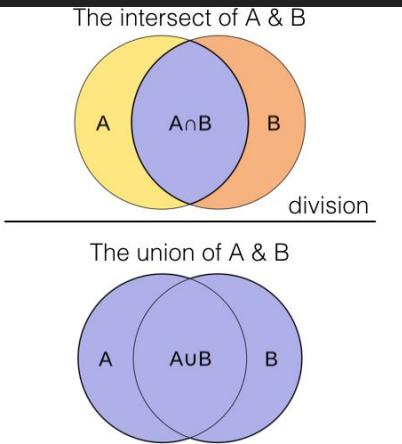
Similarity Metrics in Action

Binary
Attributes

	Cross-in-Square	Central Dome	Buttresses
Hagia Sophia	0	1	1
Hosios Loukas	1	1	0

Jaccard
Similarity

$$J(A,B) =$$



HS and HL share Attribute 2, so their intersection is 1 attribute

HS and HL together have 3 attributes they could share, so the union is 3 attributes

So, their Jaccard similarity is 1/3

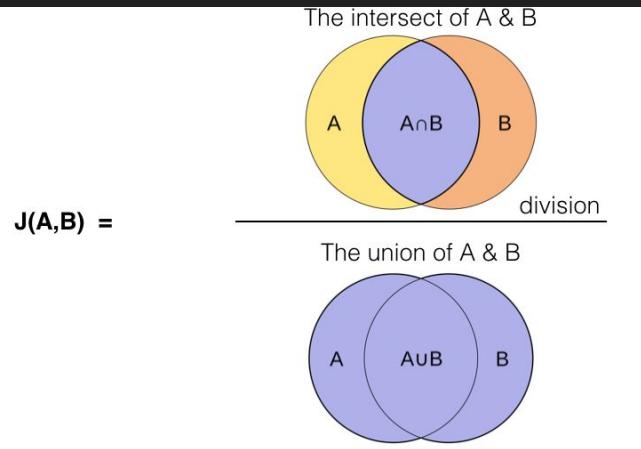
Similarity Metrics in Action

Binary
Attributes

	Attribute 1	Attribute 2	Attribute 3
Hagia Sophia	0	1	0
Hosios Loukas	1	1	0
Chora	1	1	1

Similarity
Matrix
(Adjacency
Matrix?)

	HS	HL	C
HS			
HL			
C			



Similarity Metrics

Calculate a few by hand to get intuition for how they work and what they emphasize.

Different similarity metrics exist

- Habiba et al., “[Social networks and similarity of site assemblages](#),” *Journal of Archaeological Science*, 2018
- Brey and Doyle, “[Beyond Comparative Analysis: Making Arguments with Similarity Metrics and Structured Manuscript Data, with a Case Study in Marginal Iconography](#)” Manuscript Studies, 2023)

Analyze a Similarity Network

Full URL:

<https://docs.google.com/document/d/1eWDzIPVoyx3uA6UIuhJC5ruO7CTDAqcGF0anKkJao8w/edit?usp=sharing>

Short URL: <https://tinyurl.com/5665tf4t>

Similarity Metrics

To scale up, use a programming language (Python or R) and a library that has predefined functions to calculate standard metrics.

Or, use a large language model, which can easily write the code to calculate them.

Byzantine Networks Features				
	monument	cross_in_square	basilica_plan	domed_basilica
1	A1	True	False	False
2	A2	True	True	False
3	A3	True	False	True
4	A4	False	False	False
5	A5	True	False	True
6	A6	True	True	True

I attach here some features of Byzantine churches. Can you help me construct a similarity matrix using the Jaccard similarity metric?

Similarity Metrics

To scale up, use a programming language with a library that has predefined functions to calculate standard metrics.

Or, use a large language model, which can easily write the code to calculate them.

Byzantine Church Jaccard Similarity				
	monument	A1	A2	A3
1	A1	1.0	0.27272727272727	0.4
2	A2	0.27272727272727	1.0	0.4
3	A3	0.4	0.4	1.0
4	A4	0.4	0.4	0.555555555555556

I've generated an interactive Jaccard-similarity matrix for the churches, visible just above. You can also grab the full CSV here:

[Download the similarity matrix](#)

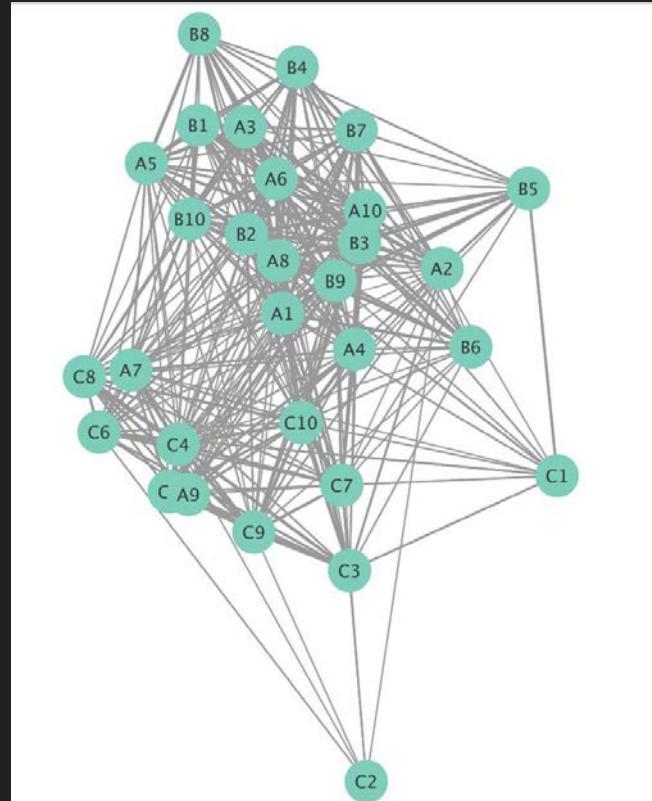
What's next?

If you'd like to:

- threshold the matrix to create a network,
- convert it to an edge-list or adjacency-list form (or Cytoscape/Gephi, or

Similarity Metrics in Practice

Networks made with similarity metrics tend to be more densely connected than typical networks (more edges), but you can filter to show only the strongest edges



Similarity Metrics in Practice

Can you help me create a synthetic dataset to model how artistic connections would or would not be visible in a similarity network? The theme should be Byzantine monuments. I want to simulate 3 workshops, two of which are very similar and one is fairly distinct. First we'll use probabilistic models to create a synthetic list of monuments and binary features. Then we'll convert that into a similarity matrix that we can analyze using cytoscape.



Thought for 14 seconds ▾

- The user wants help creating a synthetic dataset to model artistic connections with Byzantine monuments. They're simulating 3 workshops—two similar, one distinct—and want to analyze it in Cytoscape. I'll need to generate a dataset using probabilistic models and then convert it into a similarity matrix for analysis. I'm thinking of using Python or R code, depending on which the user prefers. Python is probably easier for this task,

Big Ideas

Keep it **unimodal/unipartite** for interpretability

Visualize often to spot errors and patterns

Develop and test **hypotheses** articulable in quantitative terms

Make **change over time** part of your analysis

Use **similarity metrics** to turn properties or features of texts/objects into proxies for historical relationships. But be careful and intentional!

Accept that networks have **limitations** as models of phenomena, and you can complement them with other approaches