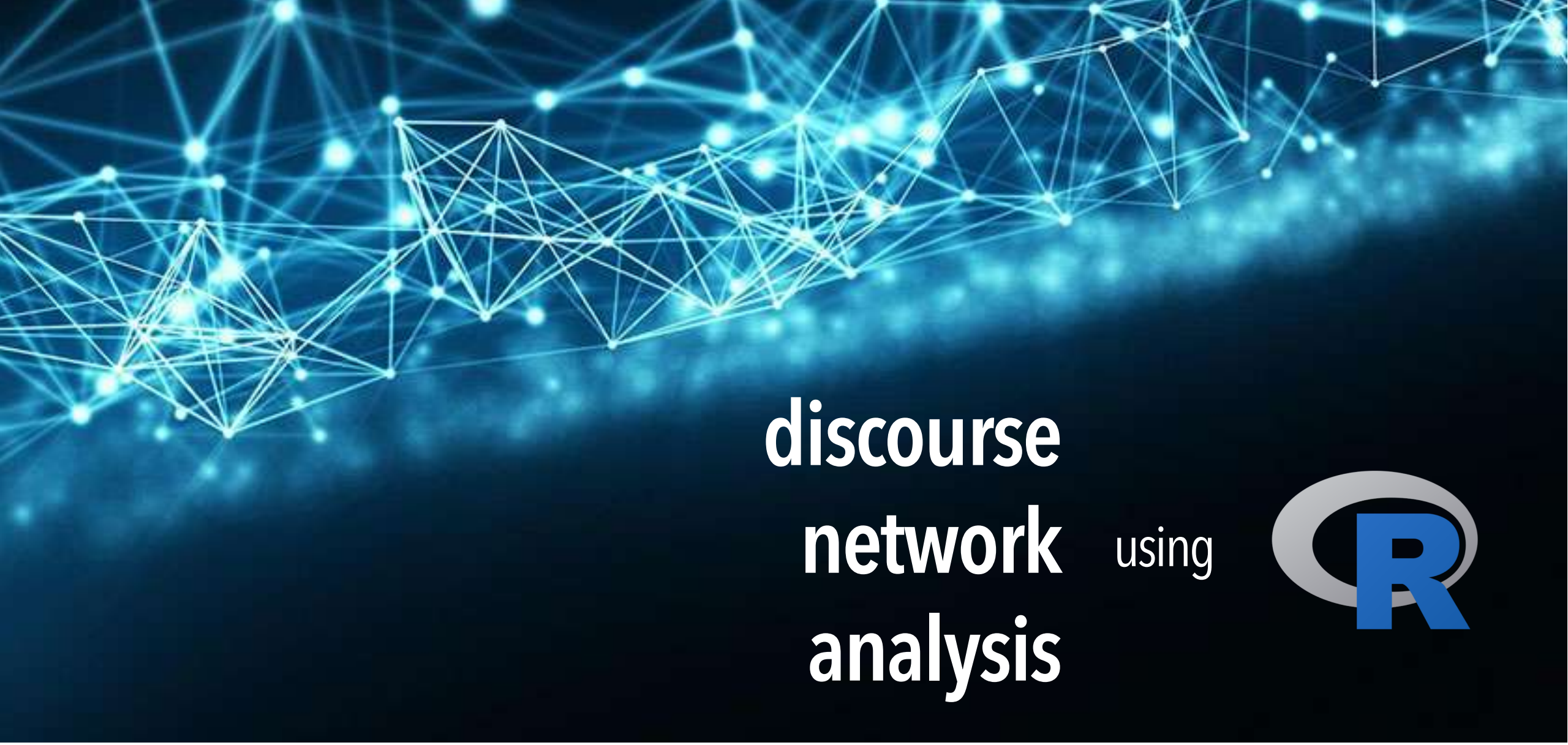


discourse network analysis using R

github.com/brunosj/

Bruno St-Jacques
15 June 2019

WHY DISCOURSE NETWORK ANALYSIS?

- Explore the debate surrounding the most recent EU Copyright Directive (approved in March 2019) using a quantitative approach
- DNA provides a two-dimensional approach, both on the level of *content* and *agents* (actors)
- DNA allows the comprehensive mapping of the discourse coalitions engaged in this process and the analysis of their characteristics

qualitative content analysis

DISCOURSE NETWORK ANALYSIS

social network analysis

Article 13 Open let
Monitoring and Filt
Internet Content i

October 16, 2017 · by LibertiesEU

Here is the open letter from 57 signator
Article 13 of the new proposal on copyr

Liberties and EDRi initiated an open lette
Parliament to withdraw Article 13 from t
signed by 57 human rights and digital ri

TRIBUNE OF EUROPEAN FILMMAKERS

TRIBUNE OF EUROPEAN
FEBRUARY 19TH, 2018

Your internet is under threat. Here's why you should care about European Copyright Reform

Wikimedia Policy · Follow
Sep 4, 2018 · 4 min read

By María Sefidari Huici, Chair, Wikimedia Foundation

You can also read this post in Spanish and in French and in Italian.

Back in 2001, the European Parliament came together to pass regulations and set up copyright laws for the internet, a technology that was just finding its footing after the dot com boom and bust. Wikipedia had just been b
there were 29 million websites. No one could imagine the
rapidly growing ecosystem—and today, the inte
Over a billion websites, countless mobi
users. We are more interconn
But 17 years later, th
kept up wit

The Copyright Directive: Misinformation and Independent Enquiry

Statement from European Academics to Members of the European Parliament in advance of the Plenary Vote on the Copyright Directive on 5 July 2018

We have worked with legal, economic and social scientists to bring an independent academic perspective to the public debate surrounding the Proposed Directive on Copyright in the Digital Sing
supported by 25 leading research

CALL TO HONOURABLE MEMBERS OF THE EUROPEAN
CREATIVE SECTORS ASK FOR
UPHOLD THE MANDATE ON COPYRIGHT IN PLENARY V

We represent 4.5% of EU GDP and 12 million European jobs. We
On July 5 we ask for you to back the mand
There is a

The final version of the EU Copyright Directive is an improvement, but we remain concerned.

Article 17 (formerly Article 13) could still have unintended consequences that may harm Europe's creative and digital economy.

BA urges MEPs to support controver
copyright law

Published July 5, 2018 by Katherine Cowdrey

Share

Tim Godfray, executive chairman of the Booksellers Association, h
publishers in their fight against copyright infringement by voting fo
form of the new Copyright Directive.

The BA's efforts join those of the Publishers Association, which h
in support of approval.

According to the BBC, the new law proposed would put greater
infringement of copyright, meaning they must have means to as
per Article 13 of the Directive).

It also raises the possibility of a "link tax", which in the interests
would prevent online content-sharing platforms and news aggr
(per Article 11 of the Directive). According to Axel Voss, a Germ
"for a private purpose" would be exempt.

Supporters have said the introduction of the new draft Copyrig
intellectual property protection rules. In a letter, former Beatle
Directive and its Article 13 would "address the value gap and
ecosystem and its creators, fans and digital music services al

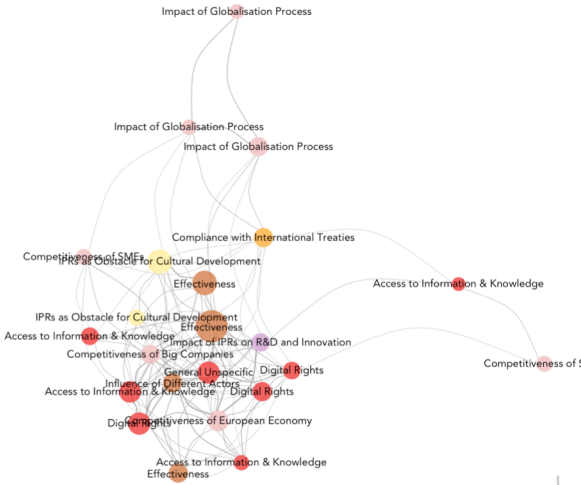
JOINT STATEMENT:
THE EU URGENTLY NEEDS REMUNERATION RULES FOR AUTHORS AND PERFORMERS

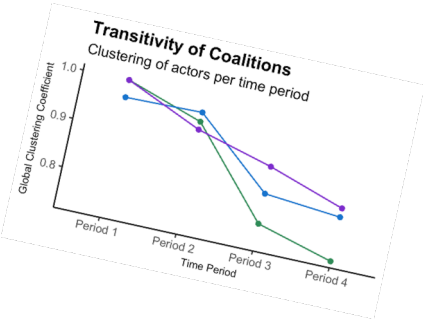
European and international authors and performers' organisations from all sectors urge Member States to support the much-needed Article -14 providing for fair and proportionate remuneration for authors and performers in the Directive on Copyright in the Digital Single Market.

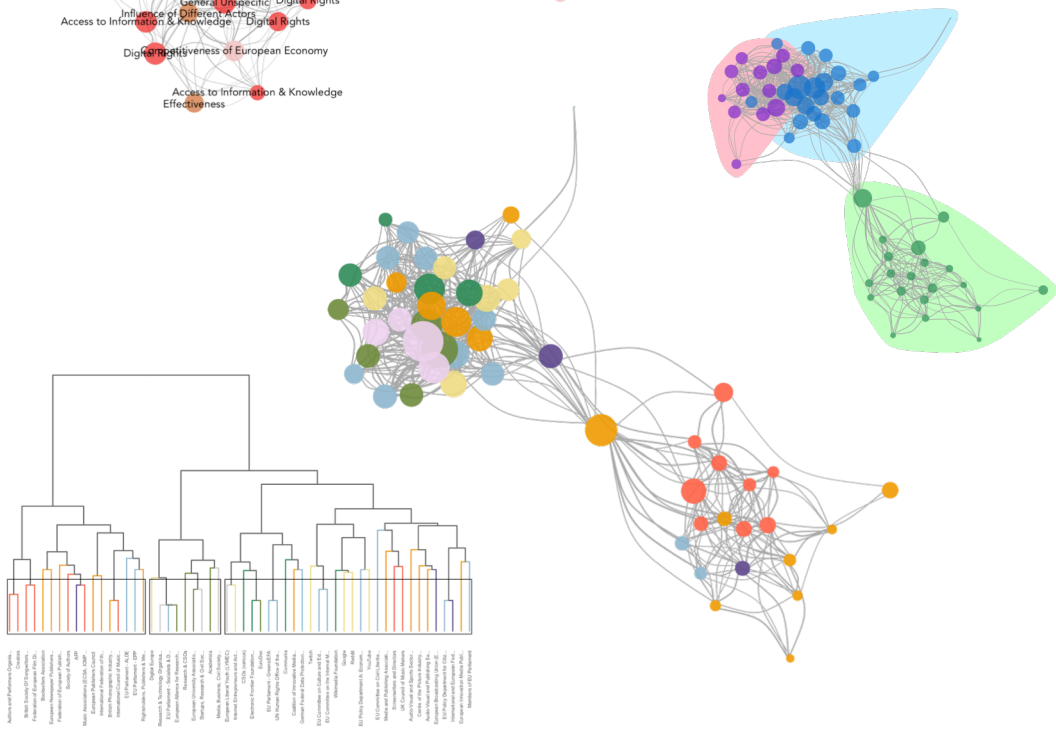
Proposed by the European Parliament and backed by a large majority of its members on 12 September, the opening provision in Chapter 3 sets a fundamental guiding principle for the remuneration of authors and performers, which should be fair and proportionate to the potential and actual value of the transferred or licensed rights.

Capital and business in the cultural and creative industries have long enjoyed a dominant position over authors and creators, who are grossly underpaid for their work and can barely sustain a decent living as freelancers or employees. The overall regulatory environment does not adequately protect them, as the weakest party, it mostly supports the industry.

=







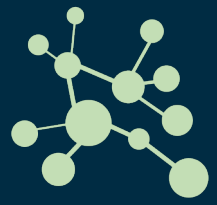
... and much more!

4 EASY STEPS

Collect and select text sources

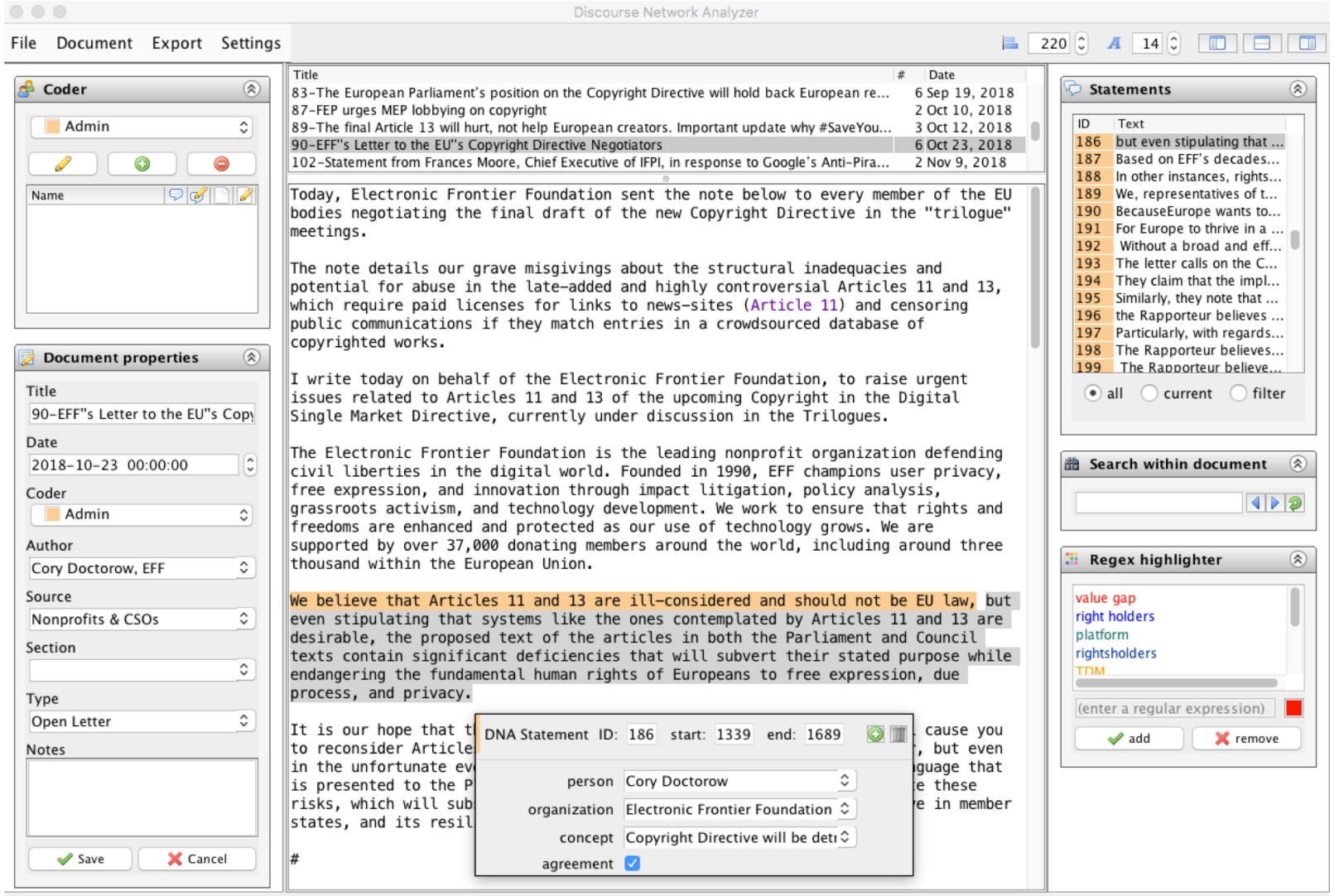
Import the structured data in R using the package rDNA

Annotate raw text using the *Discourse Network Analyzer* (DNA) software



Explore, visualise and interpret the data using the toolbox of network analysis

MEET YOUR NEW FRIEND, *DNA*



4 coded variables:

1. person
2. organisation
3. concept
4. agreement (binary)

+

additional information to facilitate grouping of actors/concepts

*"We believe that **Articles 11 and 13 are ill-considered and should not be EU law** [...] they will subvert their stated purpose while **endangering the fundamental human rights of Europeans** to free expression, due process, and privacy."*

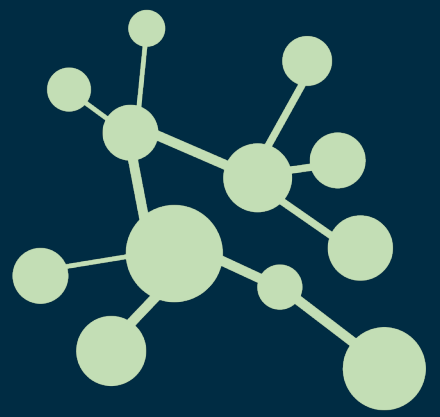
PERSON:	Cory Doctorow	Cory Doctorow
ORGANIZATION:	Electronic Frontier Foundation (EFF)	Electronic Frontier Foundation (EFF)
CONCEPT:	Article 11 and 13 should be included in the final proposal	Copyright Directive will be detrimental to fundamental rights and freedoms
AGREEMENT:	0	1

the DNA and R can indeed communicate, great.

but what are **networks**?

why are they **useful**?

```
> # 1. initialize JVM
> .jinit()
[1] 0
> # 2. retrieve the Java-version
> .jcall("java/lang/System", "S", "getProperty", "java.version")
[1] "1.8.0_202"
> # 3. retrieve JAVA_HOME location
> .jcall("java/lang/System", "S", "getProperty", "java.home")
[1] "/Library/Java/JavaVirtualMachines/jdk1.8.0_202.jdk/Contents/Home/jre"
> # 4. retrieve Java architecture
> .jcall("java/lang/System", "S", "getProperty", "sun.arch.data.model")
[1] "64"
> # 5. retreive architecture of OS (This should have 64 in it if step 4 displays # "64")
> .jcall("java/lang/System", "S", "getProperty", "os.arch")
[1] "x86_64"
> # 6. retrieve architecture of R as well (This should again have 64 in it if # step 4 and 5 display 64)
> R.Version()$arch
[1] "x86_64"
> # 7. load library
> library("rDNA")
> # 8. initialise DNA
> dna_init()
Jar file: /Library/Frameworks/R.framework/Versions/3.5/Resources/library/rDNA/extdata/dna-2.0-beta24.jar
> # open database from rDNA
> set.seed(12345)
> copyright <- dna_connection("copyrightreform.dna", verbose = FALSE)
> # retrieve network matrix
> nw_full <- dna_network(copyright)
(1/5): Processing network options... Done.
(2/5): Filtering statements...
       425 out of 426 statements retained.
(3/5): Compiling node labels...
       56 entries for the first and 45 entries for the second variable.
(4/5): Computing network matrix... Done.
(5/5): Retrieving results.
>
```

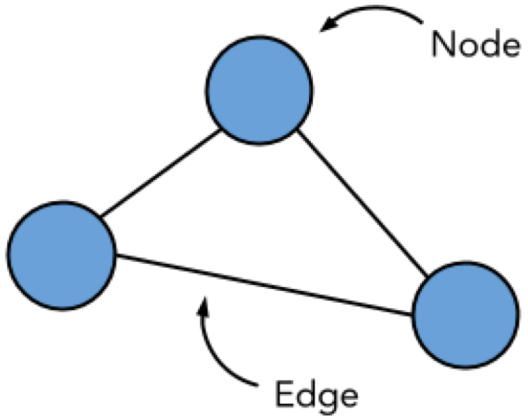
WHY  ?

very complex and incomprehensible **amounts of connections** can be made clear and structured

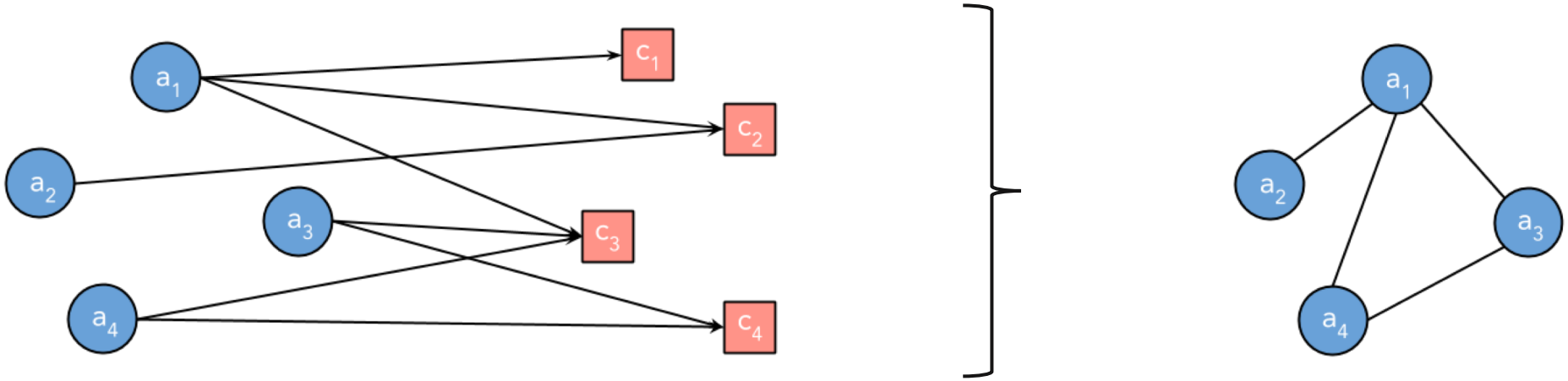
the **relationships between entities** can be measured and interpreted

combined with discourse analysis, the **structure** and **dynamics** of **policy debates** can be revealed

NETWORKS BASICS



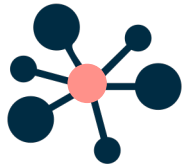
At its most simplest form, a network is a collection of points (**nodes** or **vertices**) joined together by pairs of lines (**edges**)



Relations between two different sets of nodes (e.g. '**actors**' and '**concepts**') can be modelled using a **bipartite network**...

...from which **congruence** or **conflict** networks can be inferred, allowing to focus on the connections between **actors** (determined by their agreement vis-à-vis **concepts**)

(SOME) NETWORKS PROPERTIES



Centrality

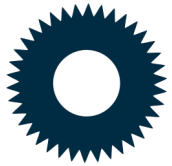
the number of edges connected to an invidual node

Transitivity

a measure of the clustering in a network, based on the relative number of triangles in the graph

Modularity

a measure of the structure of networks, designed to measure the strength of division of a network into modules



Density

a measure of the connectedness in a network, defined as the actual number of ties expressed as a proportion of the maximum possible number of ties

WHEN R TAKES OVER

- The **DNA** can be launched from R to allow data modification/entry
- It is possible to determine which **type of network** (and its related parameters) will be retrieved from the R console

```
#-----------------------------------------------------------------
# RETRIEVE NETWORKS FROM THE DNA
#-----------------------------------------------------------------

# compute congruence network (agreement/disagreement b/w organizations)
congruence_A <- dna_network(copyright,
                            networkType = "onemode",
                            statementType = "DNA Statement",
                            normalization = "average",
                            variable1 = "organization",
                            variable2 = "concept",
                            qualifier = "agreement",
                            qualifierAggregation = "congruence",
                            duplicates = "document")

# convert to igraph object
net_igraph <- dna_toIgraph(congruence_A, weighted = TRUE)

# retrieve actors attributes
attr_A <- dna_getAttributes(copyright,
                            statementType = "DNA Statement",
                            variable = "organization")
```

Two-mode (bipartite) network matrix

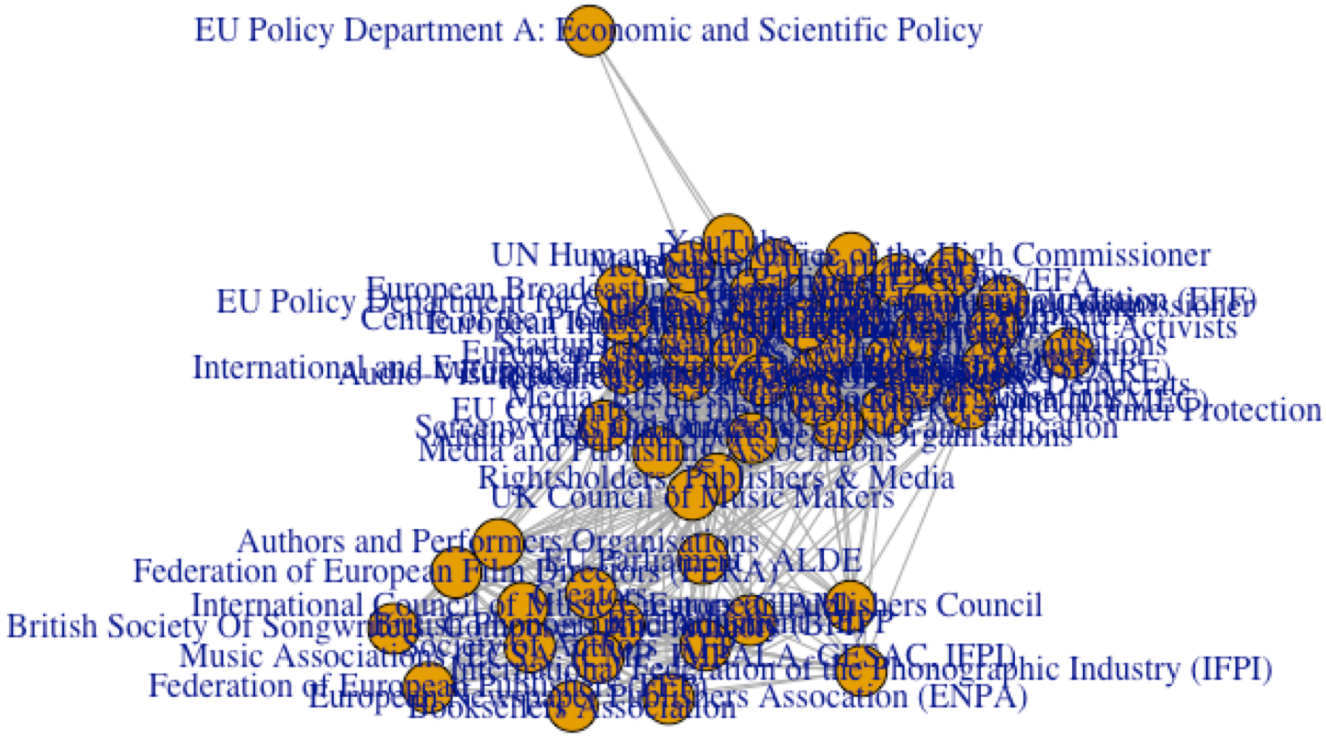
	Article 11 (Neighbouring Right) should be deleted	Article 11 (Neighbouring Right) should be modified	Article 11 (Neighbouring Right) will add another layer of complexity to licensing deals	Arti (Nei Righ imp free info
AFP	0	0	0	
Academics	0	2	0	
Audio-Visual and Publishing Sectors Organisations	0	0	0	
Audio-Visual and Sports Sectors Organisations	0	0	0	
Authors and Performers Organisations	0	0	0	
Booksellers Association	0	0	0	
British Phonographic Industry (BPI)	0	0	0	
British Society Of Songwriters, Composers And Au...	0	0	0	
CSOs (various)	0	0	0	
Centre of the Picture Industry (CEPIC)	0	0	0	
Coalition of Innovative Media Publishers	0	1	0	
Communia	0	1	0	
Creators	0	0	0	
Digital Europe	0	1	0	
EU Committee on Civil Liberties, Justice and Home ...	0	0	0	
EU Committee on Culture and Education	0	1	0	
EU Committee on the Internal Market and Consum...	0	1	1	
EU Parliament - ALDE	0	0	0	
EU Parliament - EPP	0	0	0	
EU Parliament - Greens/EFA	0	0	0	
EU Parliament - Socialists & Democrats	0	0	0	
EU Policy Department A: Economic and Scientific P...	0	0	0	
EU Policy Department for Citizens' Rights and Con...	0	1	0	
Electronic Frontier Foundation (EFF)	1	0	0	

One-mode (congruence) network matrix

	AFP	Academics	Audio-Visual and Publishing Sectors Organisations	Audio-Visual and Sports Sectors Organisations	Aut Per Org
AFP	0.0000000	0.00000000	0.00000000	0.1538462	
Academics	0.0000000	0.00000000	0.62857143	0.1935484	
Audio-Visual and Publishing Sectors Organisations	0.0000000	0.62857143	0.00000000	0.4444444	
Audio-Visual and Sports Sectors Organisations	0.1538462	0.19354839	0.44444444	0.0000000	
Authors and Performers Organisations	0.1818182	0.00000000	0.00000000	0.0000000	
Booksellers Association	0.5000000	0.00000000	0.00000000	0.0000000	
British Phonographic Industry (BPI)	0.4615385	0.00000000	0.11111111	0.2857143	
British Society Of Songwriters, Composers And Au...	0.2222222	0.00000000	0.00000000	0.0000000	
CSOs (various)	0.0000000	0.64705882	0.47619048	0.3529412	
Centre of the Picture Industry (CEPIC)	0.0000000	0.48275862	0.62500000	0.3333333	
Coalition of Innovative Media Publishers	0.0000000	0.55172414	0.50000000	0.1666667	
Communia	0.0000000	0.46666667	0.00000000	0.0000000	
Creators	0.4000000	0.00000000	0.00000000	0.1818182	
Digital Europe	0.0000000	0.46666667	0.35294118	0.1538462	
EU Committee on Civil Liberties, Justice and Home ...	0.0000000	0.00000000	0.00000000	0.0000000	
EU Committee on Culture and Education	0.1428571	0.43750000	0.31578947	0.1333333	
EU Committee on the Internal Market and Consum...	0.1333333	0.60606061	0.30000000	0.1250000	
EU Parliament - ALDE	0.3076923	0.06451613	0.00000000	0.0000000	
EU Parliament - EPP	0.4705882	0.00000000	0.09090909	0.2222222	
EU Parliament - Greens/EFA	0.0000000	0.35714286	0.26666667	0.3636364	
EU Parliament - Socialists & Democrats	0.0000000	0.46666667	0.35294118	0.1538462	
EU Policy Department A: Economic and Scientific P...	0.0000000	0.00000000	0.00000000	0.0000000	
EU Policy Department for Citizens' Rights and Con...	0.0000000	0.30769231	0.30769231	0.2222222	
Electronic Frontier Foundation (EFF)	0.0000000	0.40000000	0.23529412	0.1538462	
EuroDoc	0.0000000	0.21428571	0.26666667	0.1818182	
European Alliance for Research Excellence (EARE)	0.0000000	0.57894737	0.48000000	0.2857143	
European Broadcasting Union (EBU)	0.0000000	0.22222222	0.71428571	0.2000000	

VISUALISATION WITH IGRAPH

```
plot(net_igraph)
```



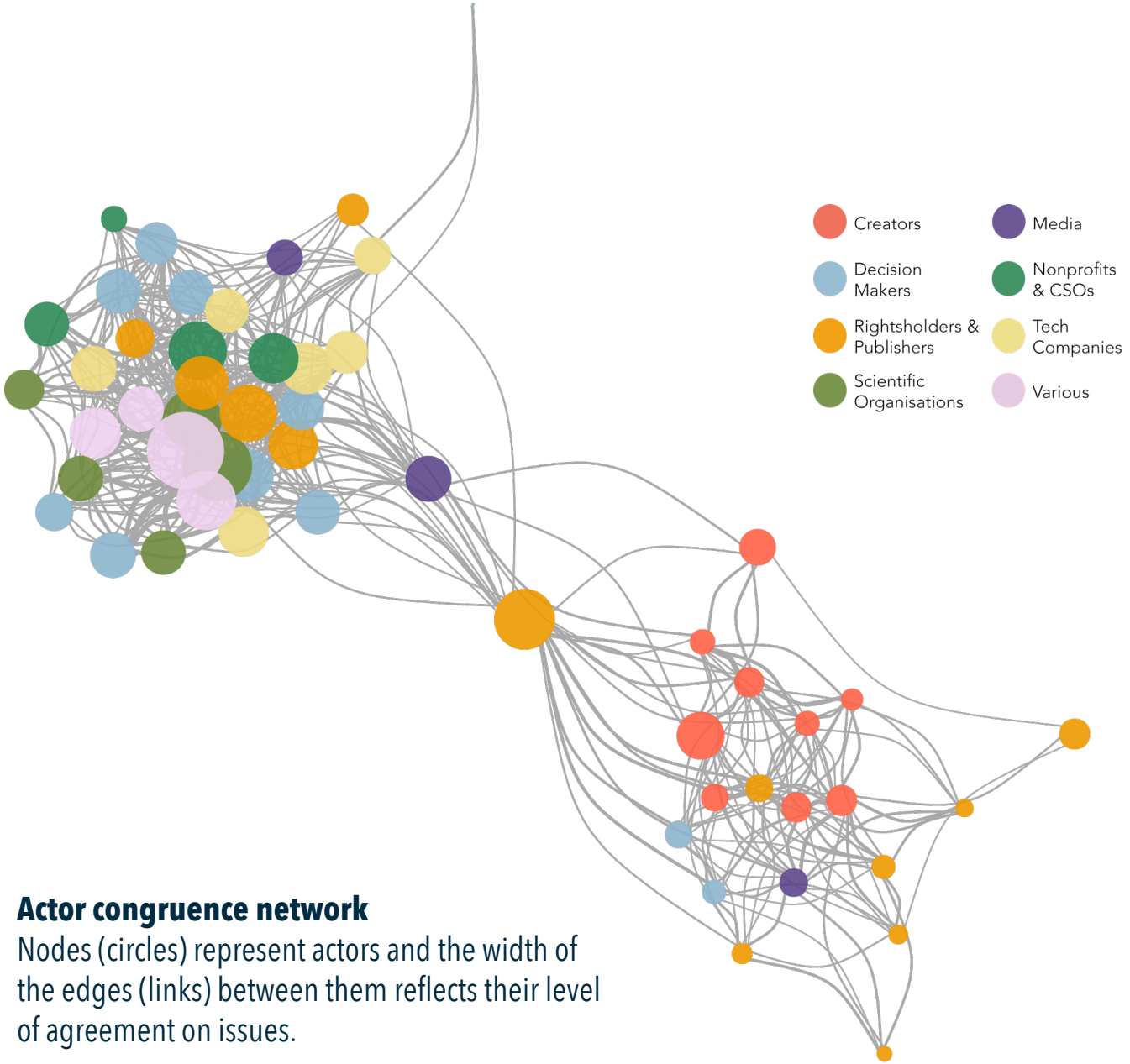
... some transformations are needed!

Transformations:

- simplify graph
- set node size and edge width
- add edge threshold
- assign node colours according to actor type
- plot graph with additional aesthetic tweaks

```
#-----------------------------------------------------------------
# VISUALISATION WITH IGRAPH
#-----------------------------------------------------------------

# simplify graph (remove loops)
net <- simplify(net_igraph, remove.multiple = F, remove.loops = T)

# compute node degrees (weighted) and use this value to set node size:
deg <- igraph::graph.strength(net, mode="all")
V(net)$size <- deg

# set edge width based on weight:
E(net)$width <- E(net)$weight

# edge threshold to remove low-intensity ties
summary(E(net)$weight)
net <- igraph::delete.edges(net, which(E(net)$weight <0.30769)) # median value of edges

# set attributes to igraph object (retrieved from the previous attribute object from the DNA)
net <- set_vertex_attr(net, "type", index = V(net), as.character(attr_A$type))

# generate colors based on actor type:
V(net)$color <- V(net)$type
V(net)$color=gsub("Creators","tomato",V(net)$color)
V(net)$color=gsub("Decision Makers","lightskyblue3",V(net)$color)
V(net)$color=gsub("Media", "mediumpurple4",V(net)$color)
V(net)$color=gsub("Nonprofits & CSOs","seagreen4",V(net)$color)
V(net)$color=gsub("Rightsholders & Publishers","orange2",V(net)$color)
V(net)$color=gsub("Scientific Organisations","darkolivegreen4",V(net)$color)
V(net)$color=gsub("Tech Companies","lightgoldenrod2",V(net)$color)
V(net)$color=gsub("Various","thistle2",V(net)$color)
colors.vect <- as.factor(V(net)$color)

# plot new version of graph
plot.igraph(net,
            vertex.label=NA,
            edge.color = "darkgrey",
            vertex.color = adjustcolor(colors.vect, alpha.f = .9),
            edge.curved=.5,
            vertex.frame.color = NA,
            layout=layout_with_fr)
```

et voilà!

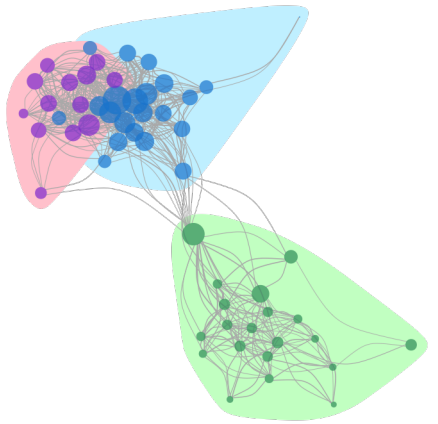


Actor congruence network
Nodes (circles) represent actors and the width of the edges (links) between them reflects their level of agreement on issues.

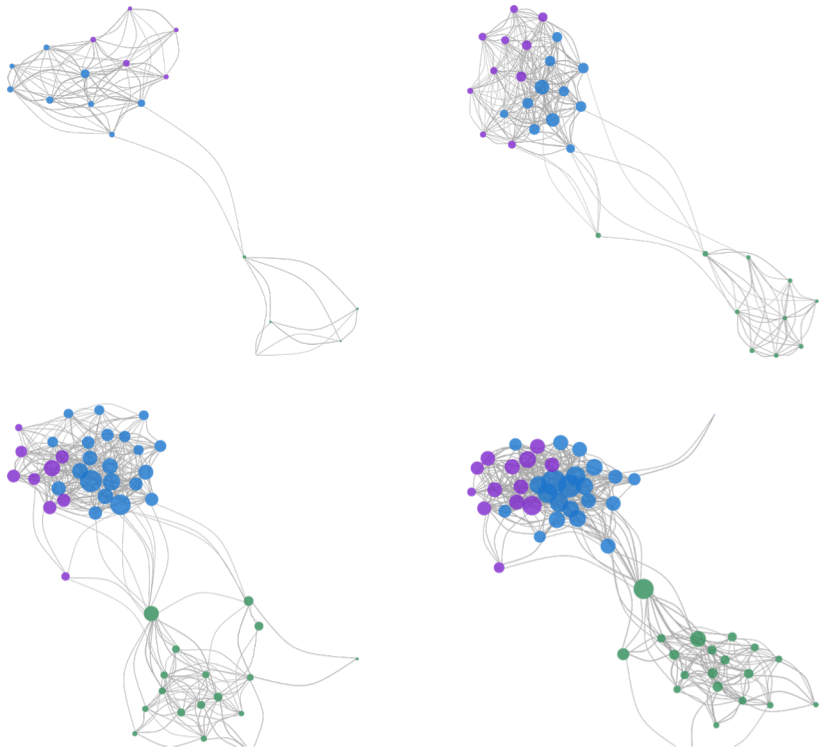
COMMUNITY DETECTION

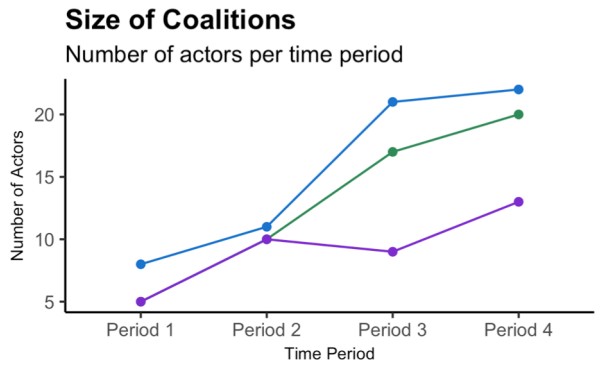
- There are dozens of community detection algorithms (cluster optimal, fast greedy, edge betweenness, multilevel, random walk, etc.)
- They try to find dense subgraphs in graphs, by optimising some criteria and usually using heuristics
- Using the cluster optimal algorithm, 3 communities were identified, with respectively 20, 22 and 13 actors

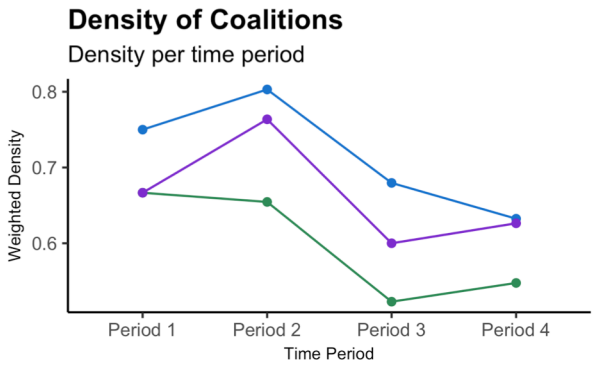
```
#-----------------------------------------------------------------
# COMMUNITY DETECTION
#-----------------------------------------------------------------

# community detection
clp <- cluster_optimal(net)
sizes(clp)

# set vertex community attribute according to membership
V(net)$community <- clp$membership

# plot graph with communities
colrs <- adjustcolor(c("seagreen4", "dodgerblue3","purple3"),
                     alpha=.9)[membership(clp)]
plot(clp, net,
     col=colrs,
     mark.border="black",
     mark.col=c("darkseagreen1", "lightblue1", "pink"),
     edge.curved=.5,
     vertex.label=NA,
     edge.arrow.size=.2,
     vertex.frame.color = "NA",
     layout=layout_with_fr)
```

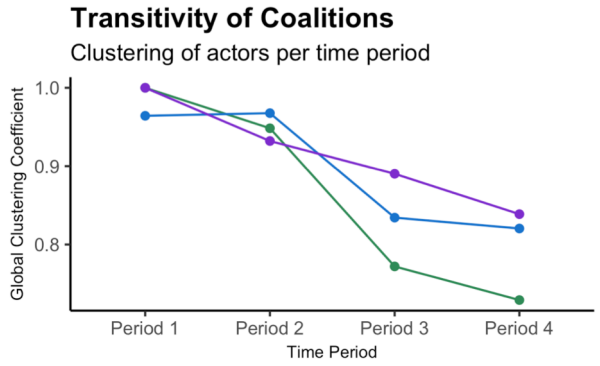


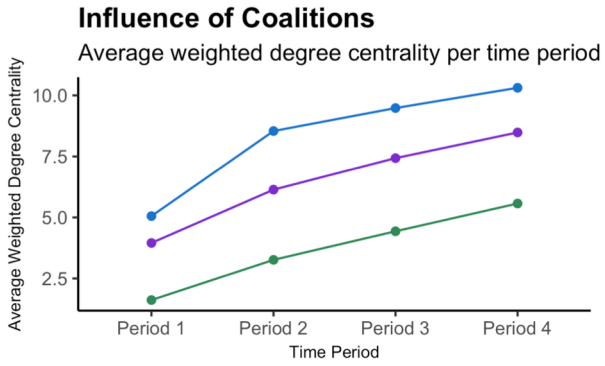
DYNAMIC EVOLUTION OF NETWORKS







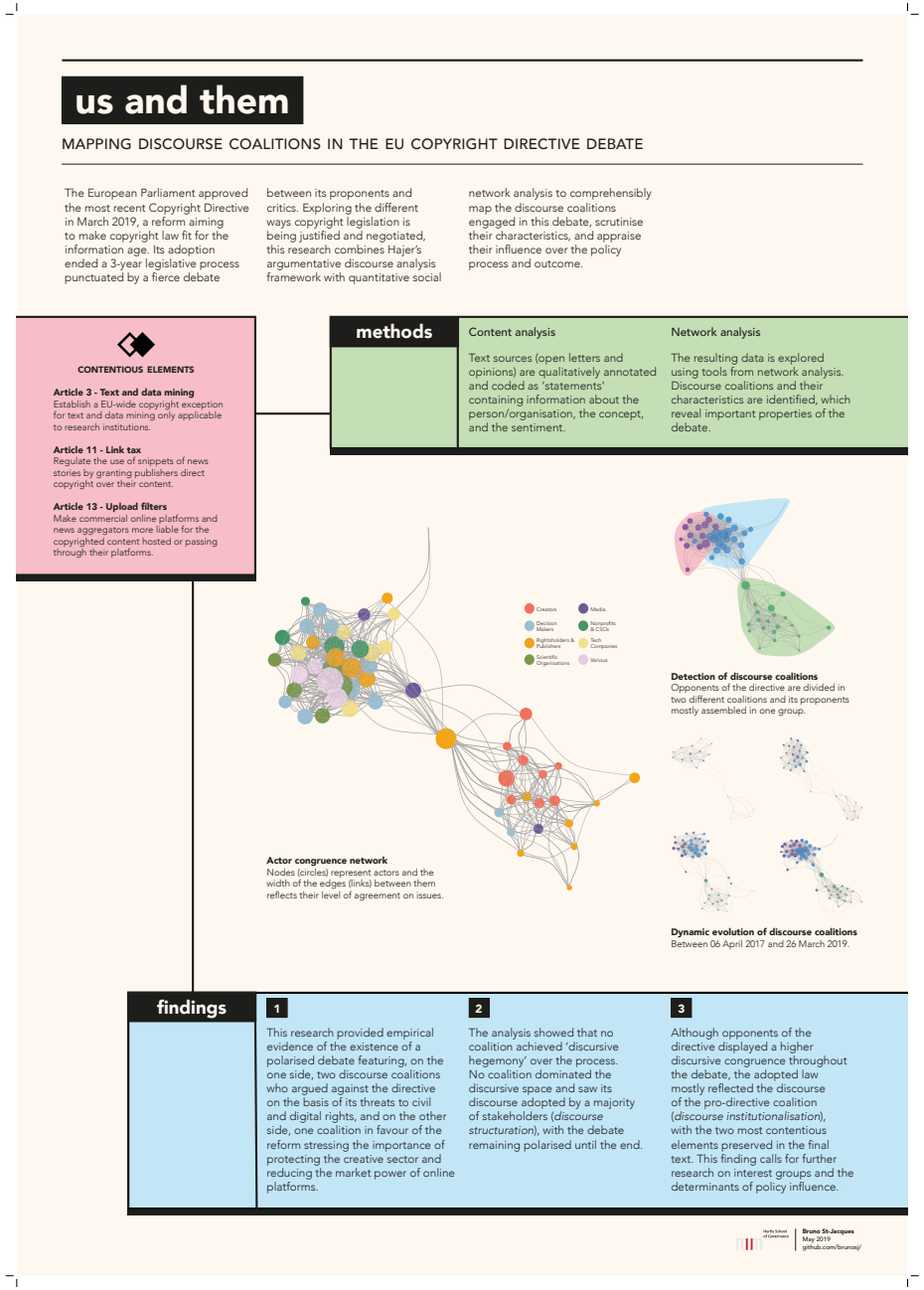




LEARN MORE

Head over to **github.com/brunosj/** to consult:

- replication materials
- thesis document + poster
- other projects!



THANKS !

github.com/brunosj/

bruno__sj

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15 June 2019
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