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UNIWERSYTET JAGIELLOŃSKI
W KRAKOWIE

COMPLEXITY IN PHONOGRAPHIC MARKET

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Agenda

- **Phonographic market as commodity (cultural) market**
- **Data - whole history of phonographic market (1966-2015):**

(1) annual critics album polls;

(2) album sales (the price of an album is fixed, so the value of an artist may be defined by weekly record sales. We analyze time series and design stochastic models of heterogeneous interacting agents representing real-world consumers, products (artists));

(3) singles highest rank in national charts (the epidemic and network model of popularity spread).

- **Does pop exist? How popularity spread?**

Ctitics and polls

We do a meta-analyze of the annual set of polls (data-mining) using standard statistical methods (median) that allows us to reveal the objective poll for each year.

Then, after using standard deviation, it is possible to detect global and local structure of the subjective music press that might specialize or generalize the music industry in the US and UK.

We have detected significant dependencies between subjective opinion polls and critics ethnicity (British, American, Afroamerican or Jewish) or music genres (pop, rock, heavy metal, soul, hip-hop, electronica, etc.).

Phonographic market

1) Analog era (1966-1987)
2) Digital era (1988-2003)
3) Internet Era (2004-20?)

- Phonographic market as a predictable system – in complexity and in particular for a single artist
- Record industry might be considered as a programmable system
- Even unpredictable recordings spread by the Internet do not break the equillibrium on the market (for example: Gangman style)
- The system might be unstable in case of artists death only

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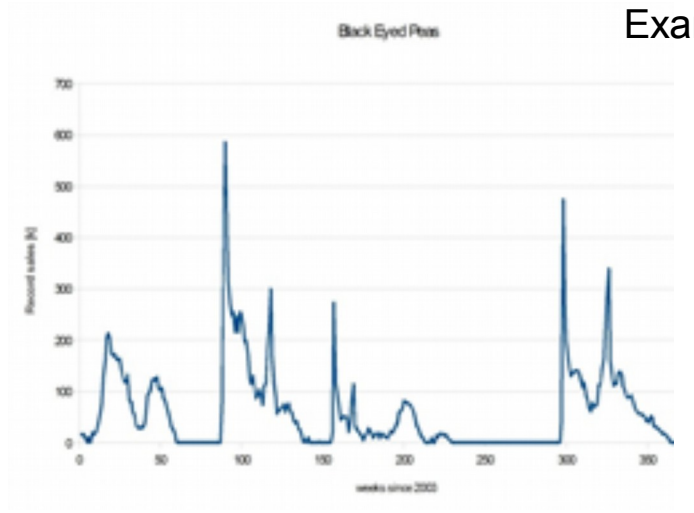
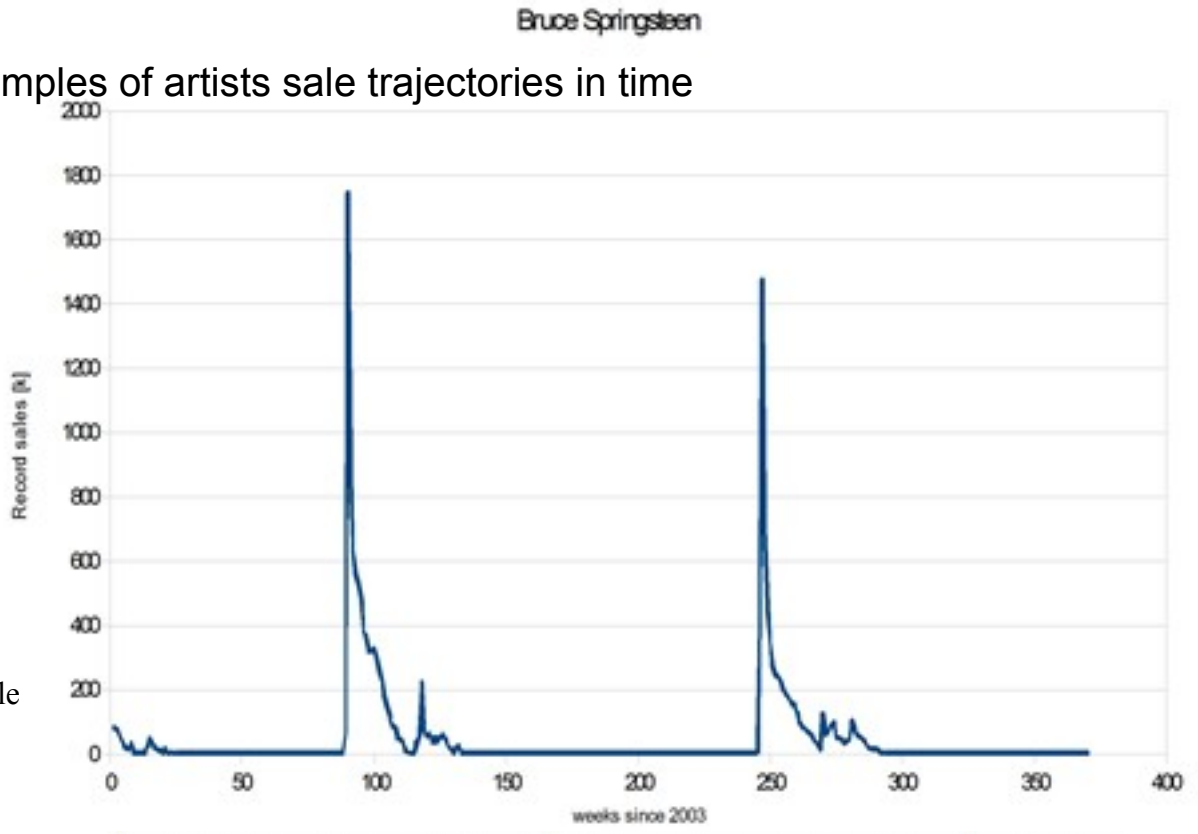
Phonographic market

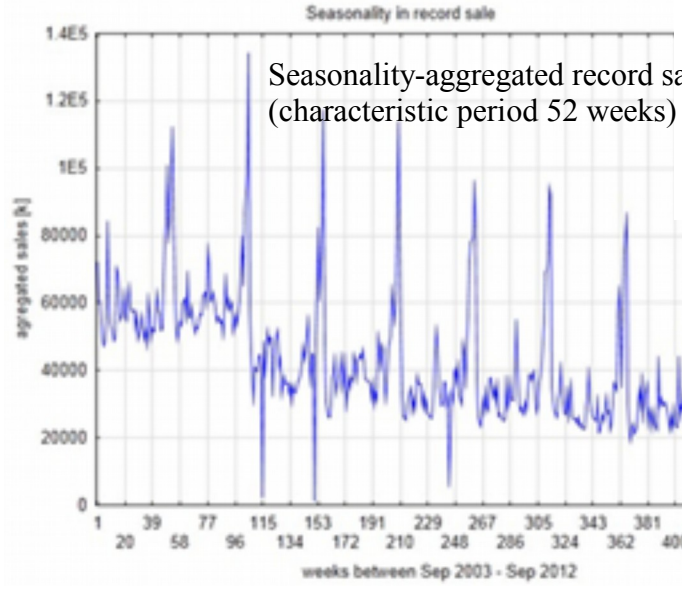
Financial market	Phonographic market
stock prices	weekly record sales/chart rank
interrest rate/price returns	change of record sales
correlation between stock prices	correlation between artists
distance between stocks	distance between artists
life time of products	life time of singles/albums
main indice portfolio	top selling artists
industry sectors and subsectors	music genres

Phonographic market

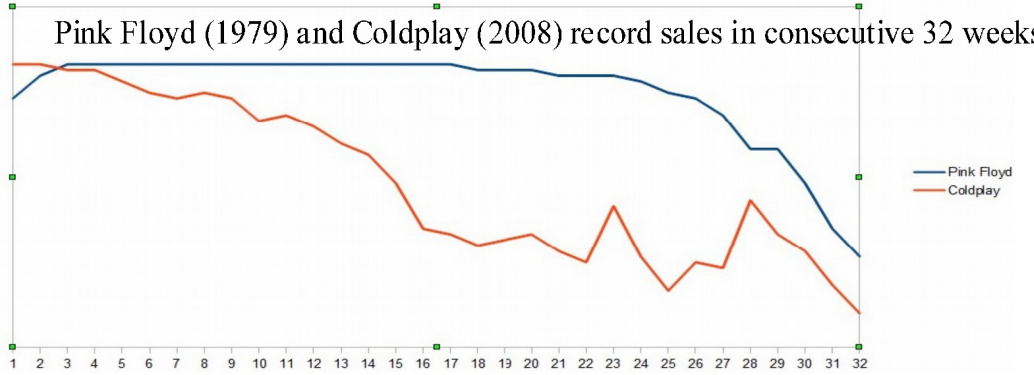
Examples of artists sale trajectories in time





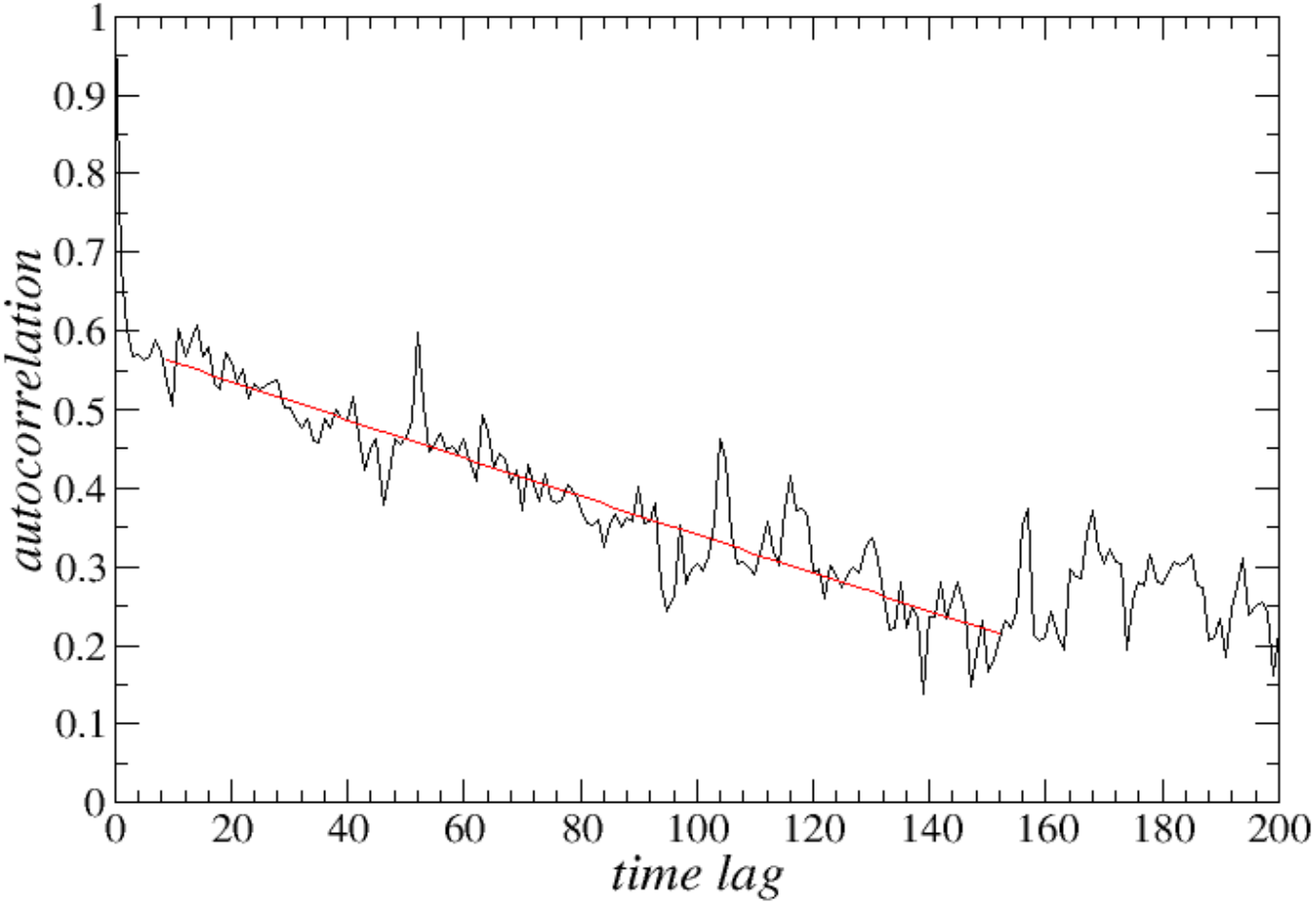


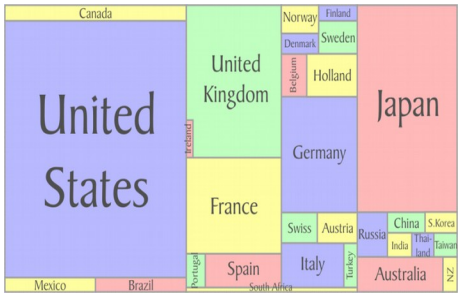
Seasonality-aggregated record sale (characteristic period 52 weeks)

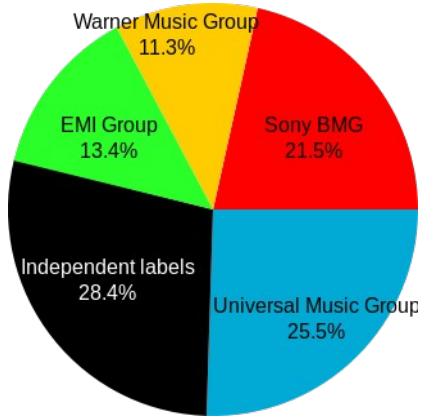


Pink Floyd (1979) and Coldplay (2008) record sales in consecutive 32 weeks

Phonographic market







Market shares

Mean-reverting process of record sales (Hurst exponent=0.39)

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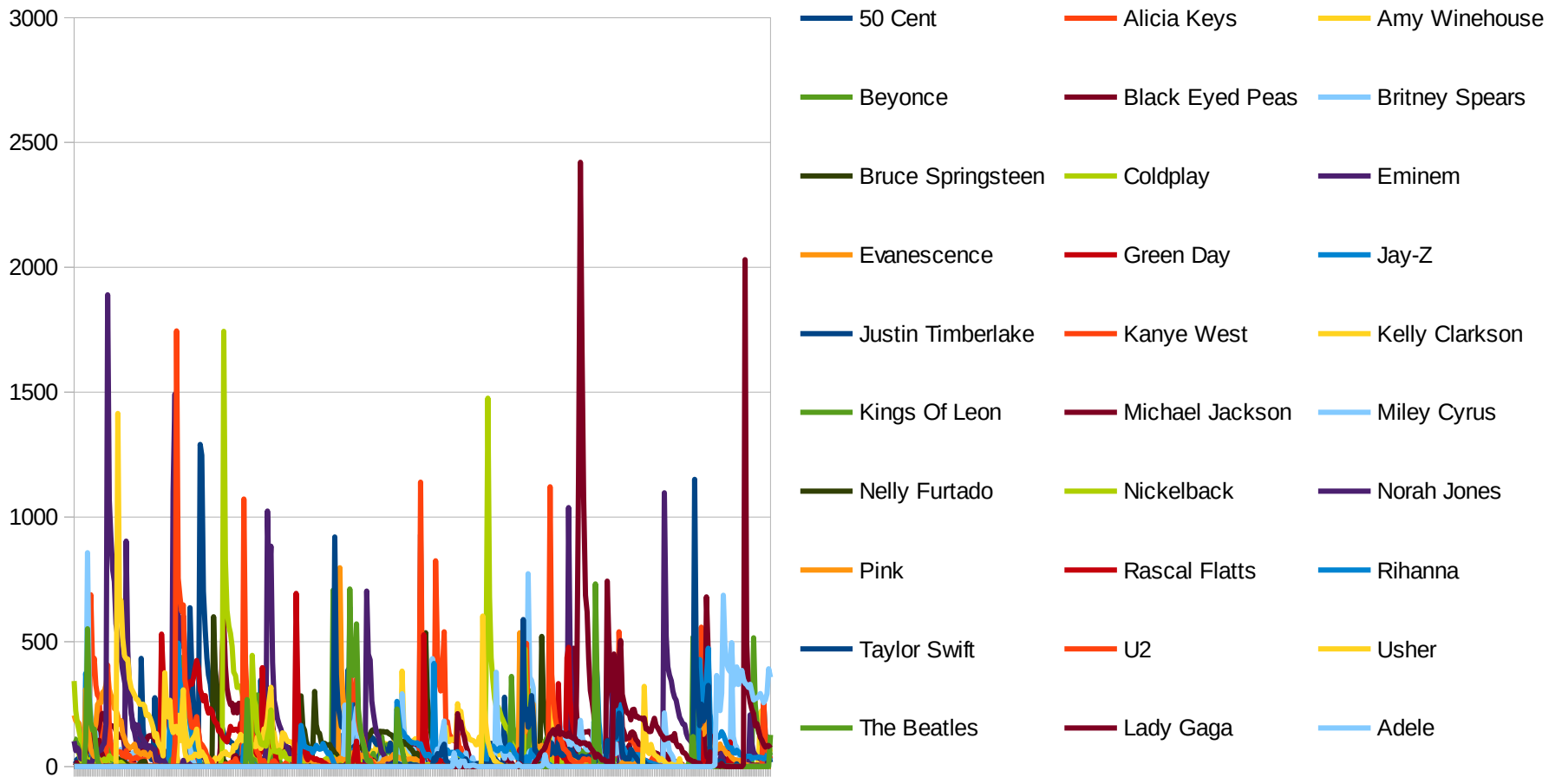
Top artists album sales



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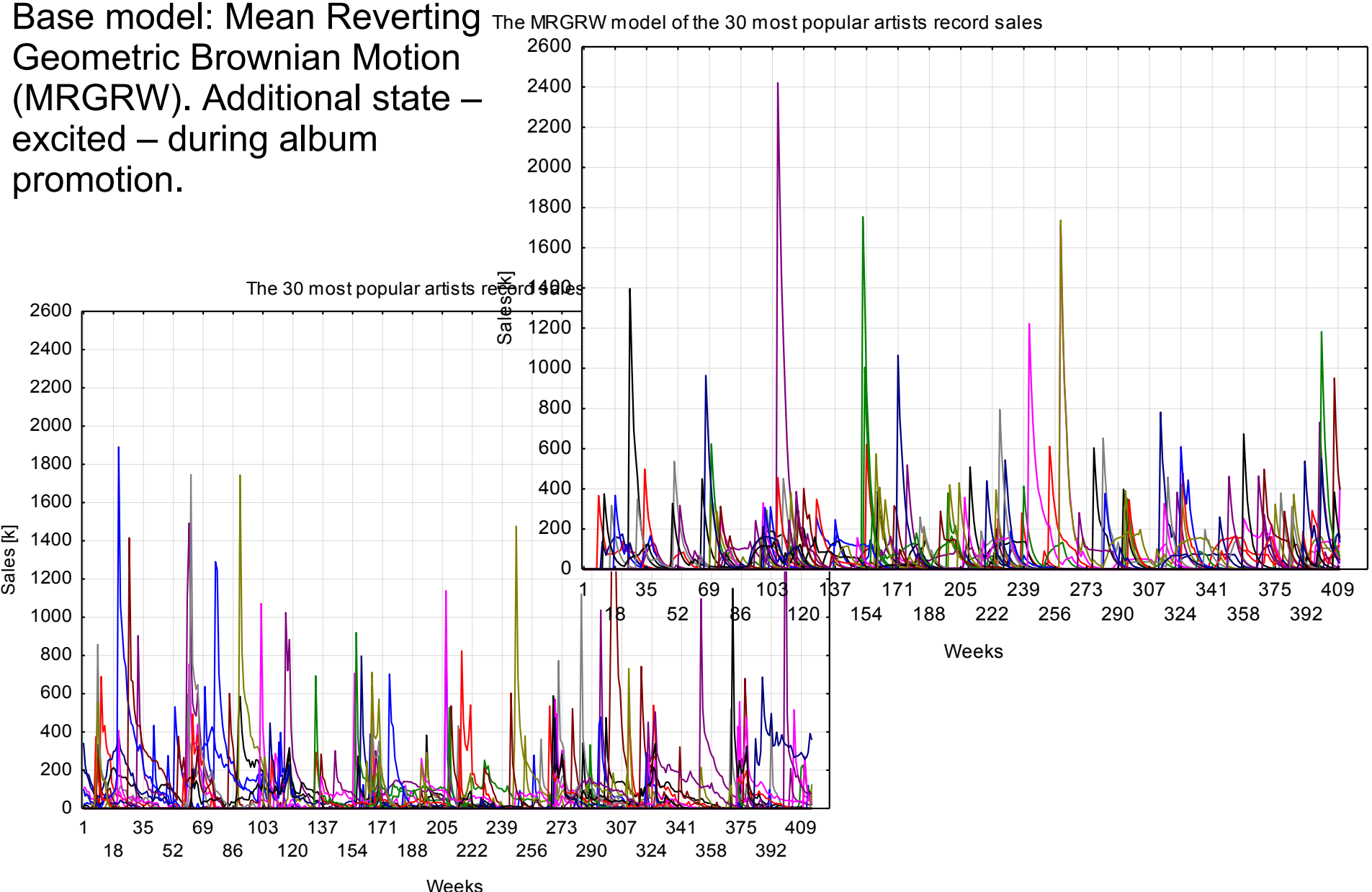
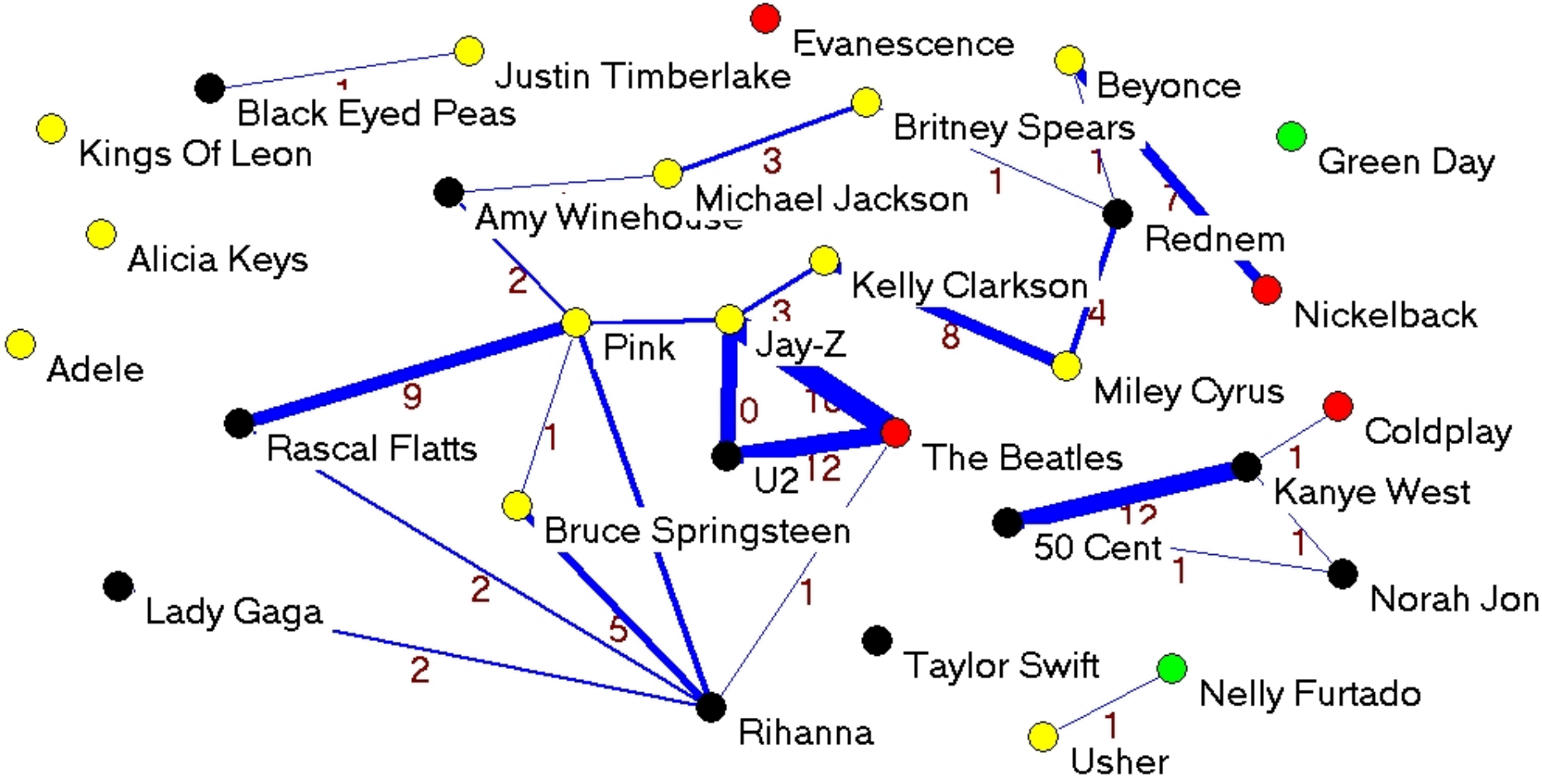
Top artists album sales (model)

Base model: Mean Reverting Geometric Brownian Motion (MRGRW). Additional state – excited – during album promotion.

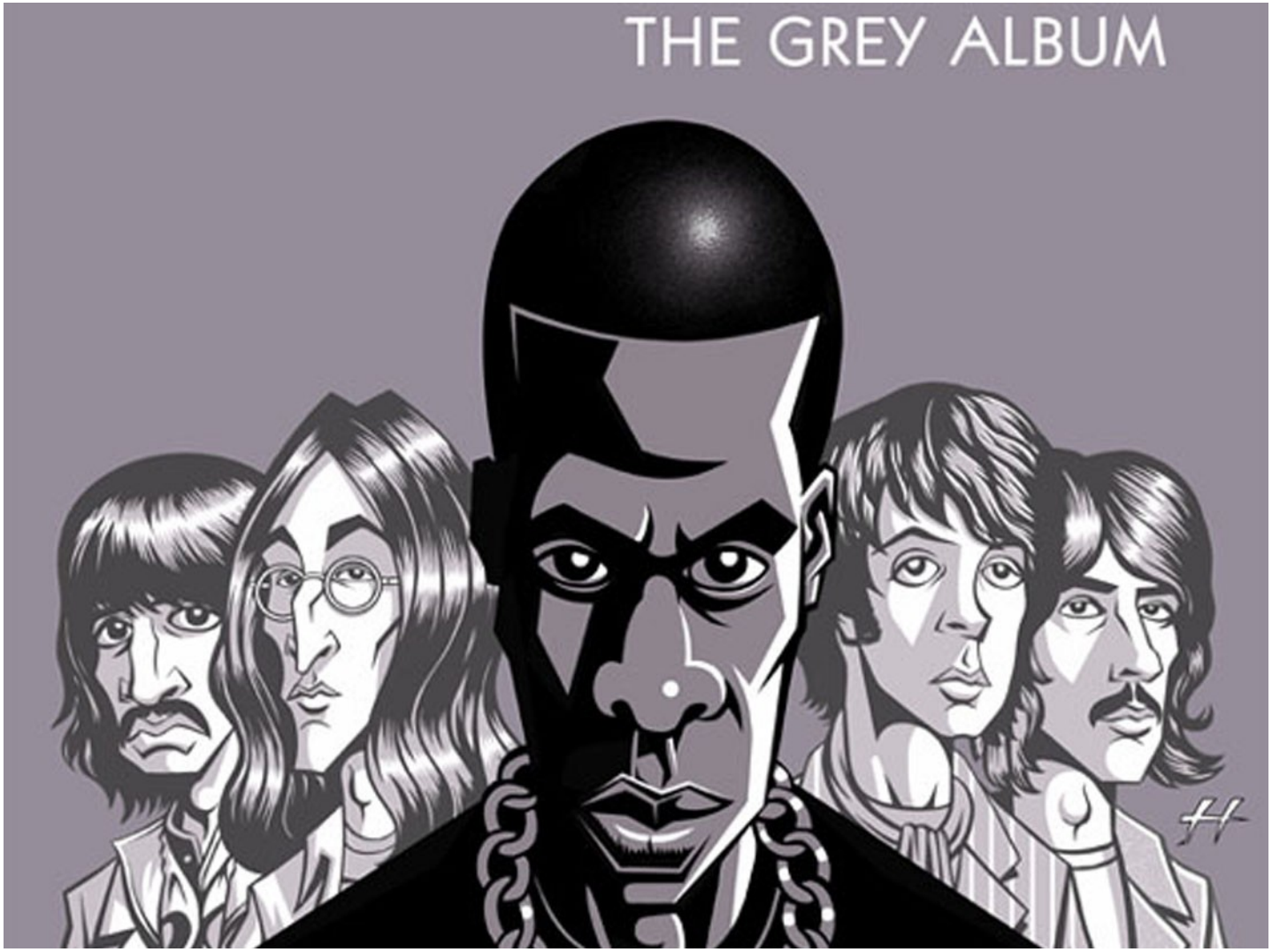


Music networks (positive correlations)



Music networks: POP?

The strongest correlated pair

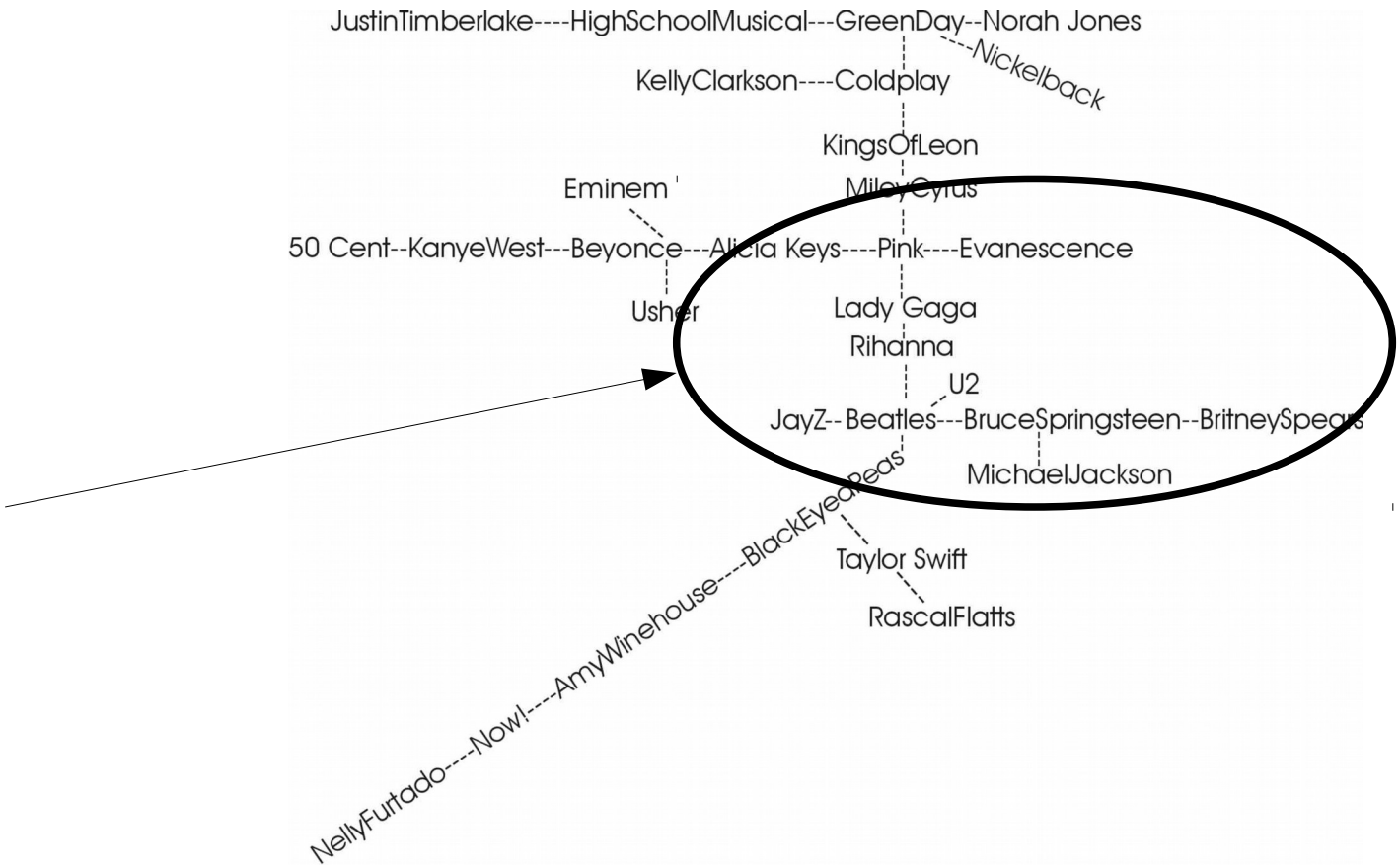


What do The Beatles and Jay-Z have in common?

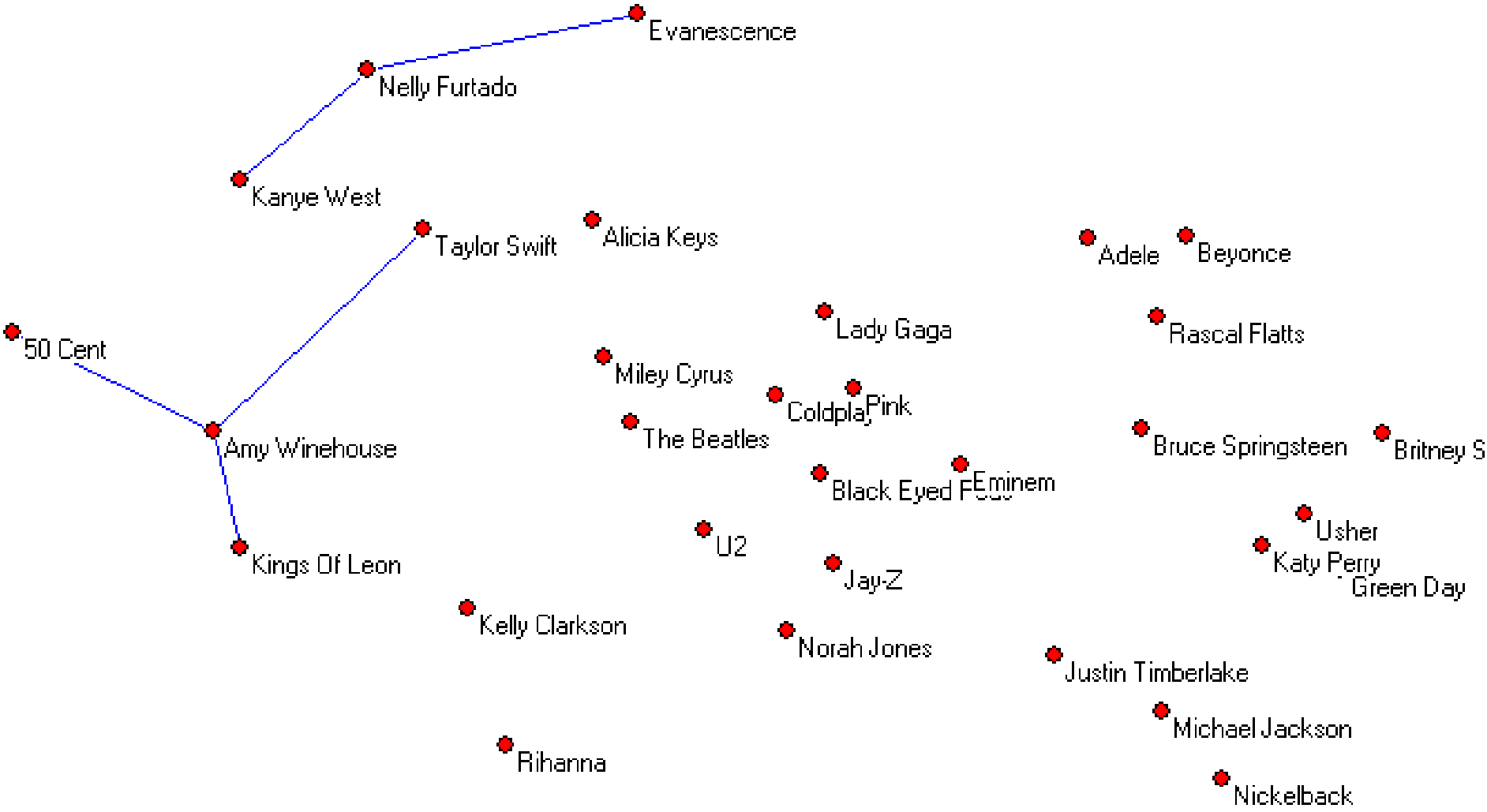
Music networks: POP?

MST

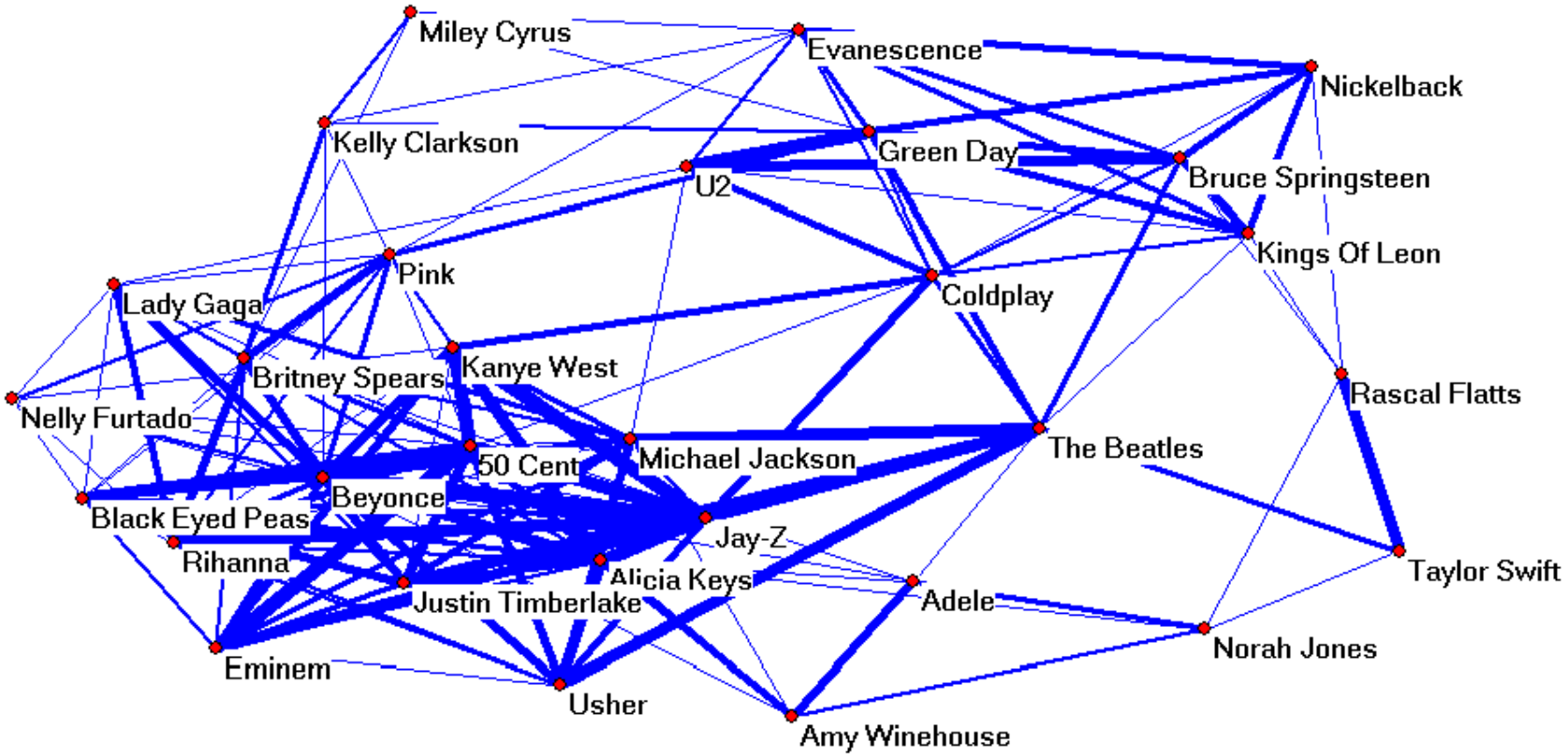
POP ?



Music networks (negative correlations)



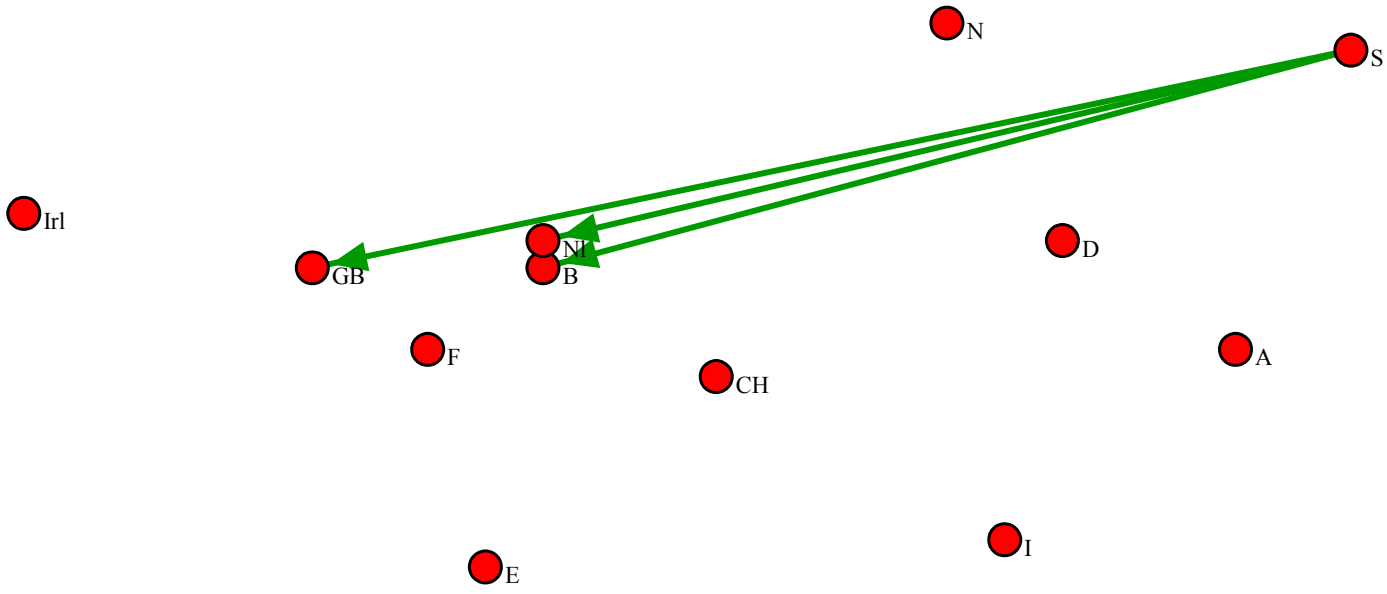
Music networks (allmusic.com)



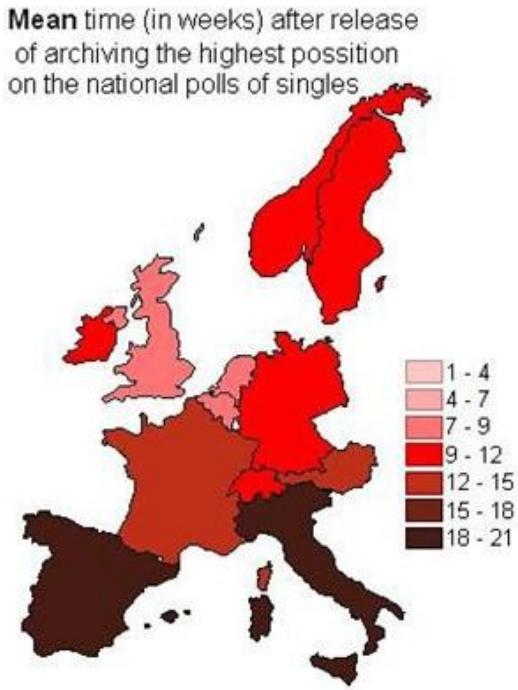
Popularity spread

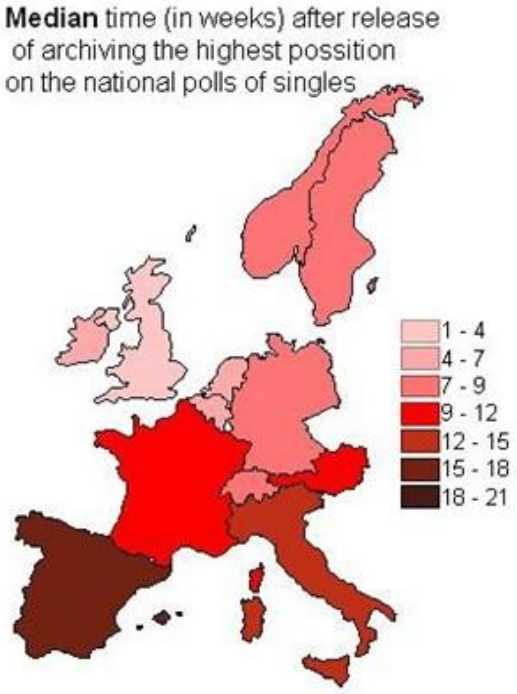
We explore patterns in European singles chart in long time period (1966-2015): the time delay *t* between record première and the peak of popularity (the highest position on chart).

single	year	A	B	CH	D	E	F	GB	I	Irl	N	Nl	S
ABBA - DANCING QUEEN	1975	12	2	7	5	26	7	2	52	5	4	2	1

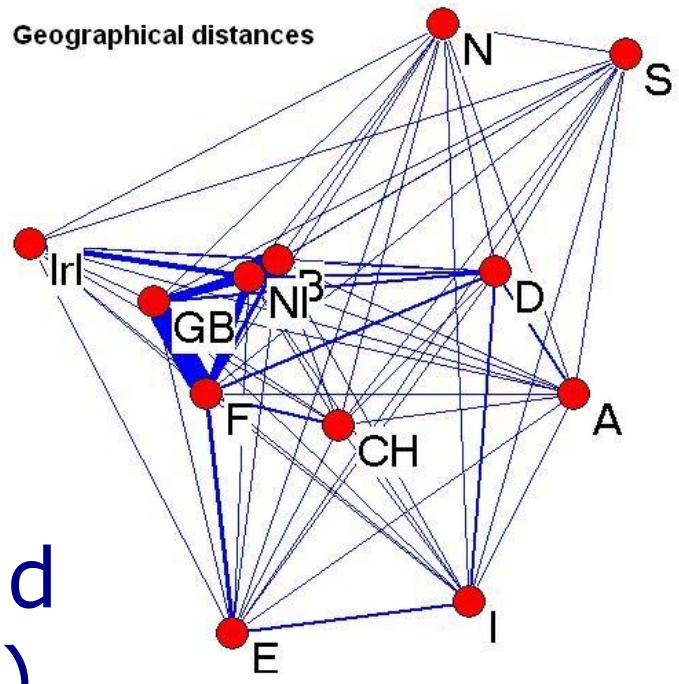


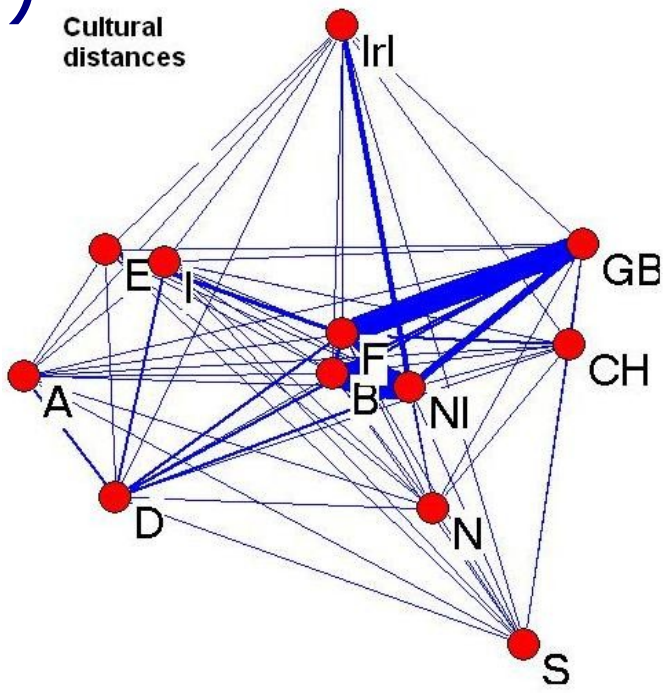
Diffusion



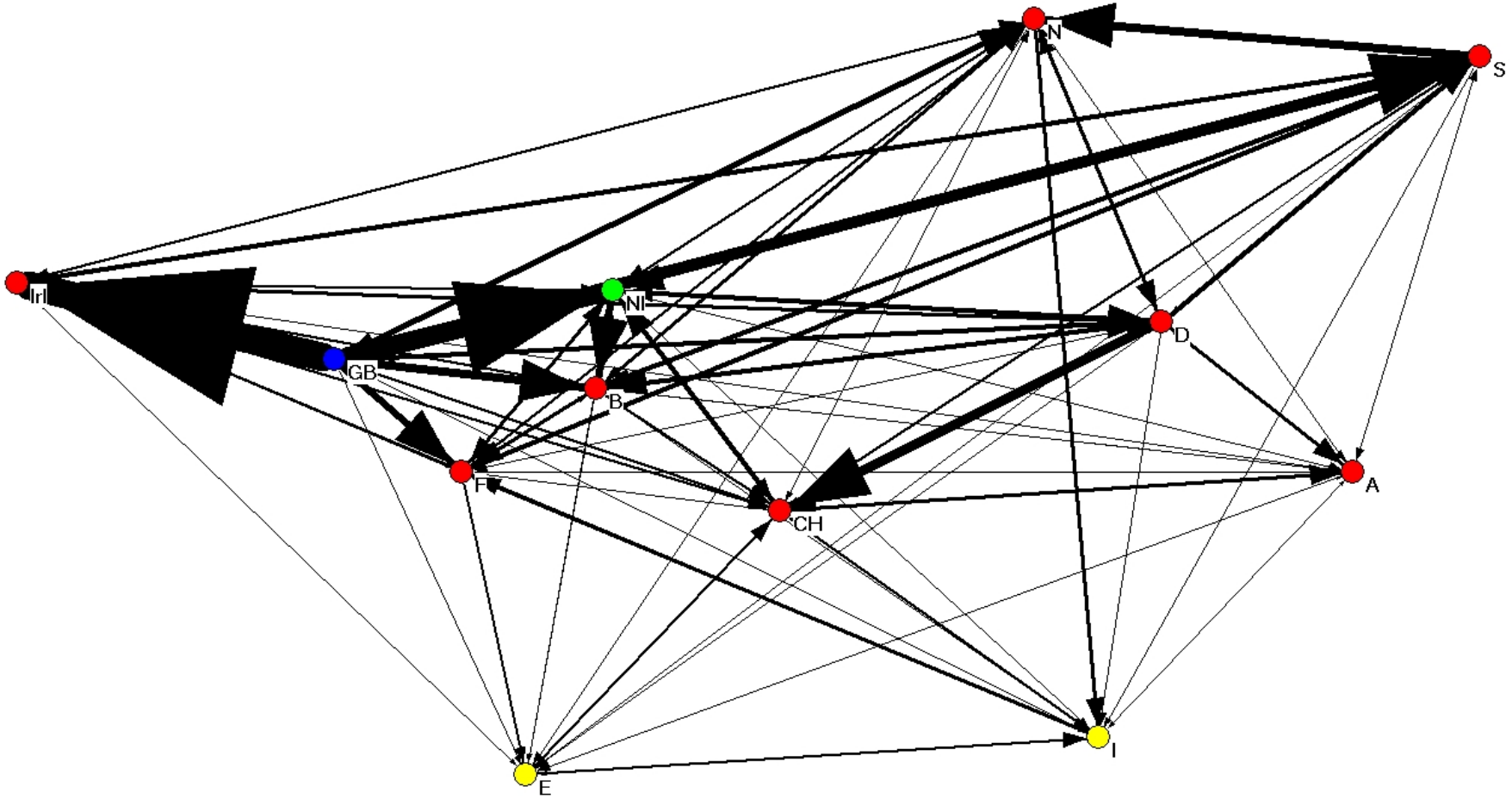


- Geography (distances)
- Culture (World Value Survey)
- Music (mean or median delays)



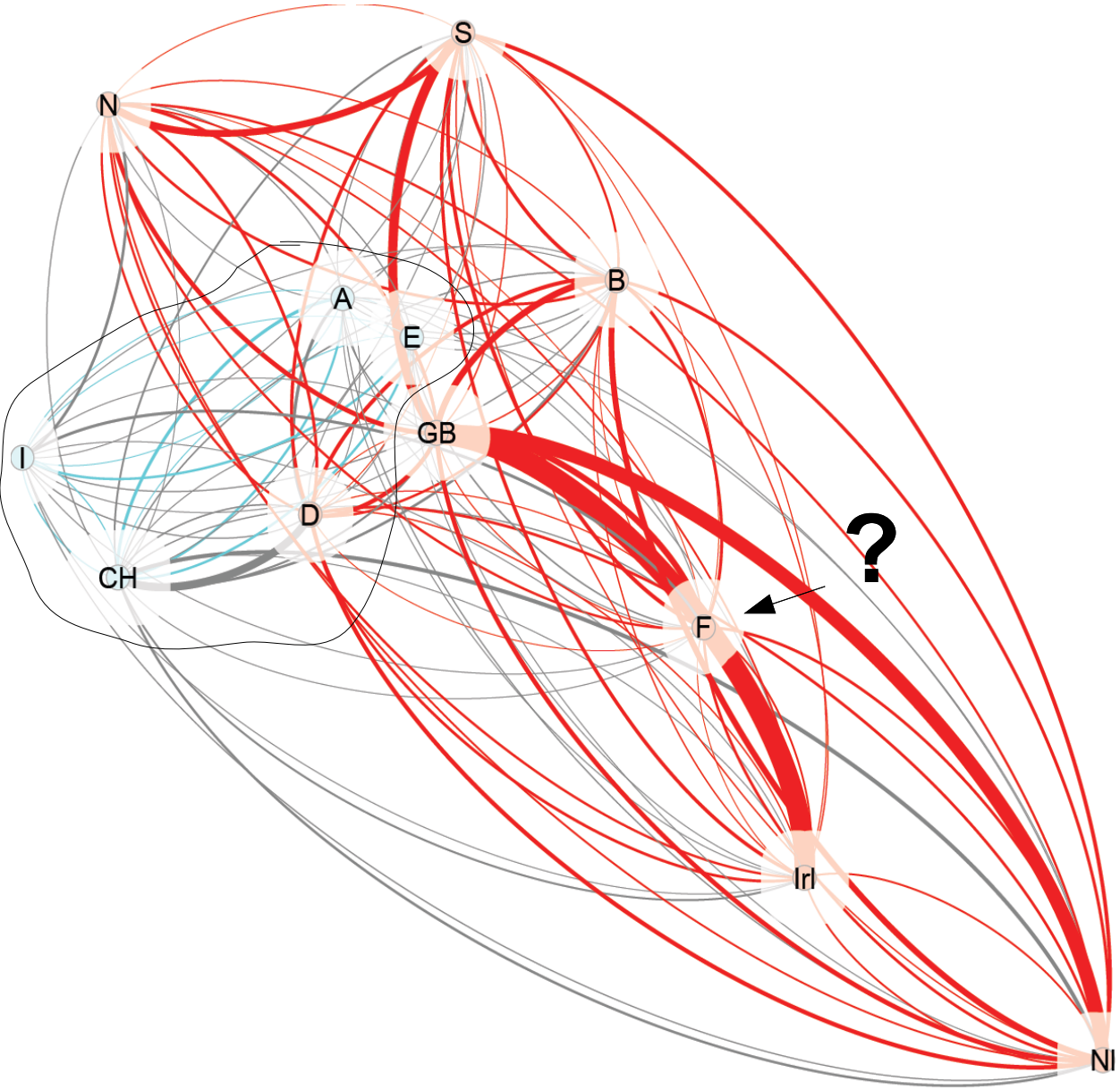


Popularity spread



We obtain network of popularity spread with: a **hub – the UK**, a **bridge – the Netherlands** and **outliers – Italy and Spain**.

Popularity spread



degree	out	in
A	23	36
B	60	65
CH	45	63
D	75	53
E	16	27
F	43	50
GB	192	36
I	17	36
Irl	43	89
N	49	65
Nl	74	94
S	55	78

Complexity

- **A collective behaviour is one of the most significant purposes of complex systems including commodity market as phonographic market. Except Eurovision Song Contest (which is extremely biased due to many circumstances), there are no quantitative analysis on this issue.**
- **By observing evolution of obtained popularity/prize relations from all studies, we also claim general conclusions on changes in music trends in last 50 years.**
- **A traditional meaning of „pop" music has been destroyed**

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Complexity in phonographic market

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[1] A. Buda, Does pop music exist? Hierarchical structure in phonographic market, Physica A: Statistical Mechanics and its Applications 391 (21), 5153-5159, 2012

[2] A. Jarynowski, A. Buda, Dynamics of popstar record sales on phonographic market – stochastic model, Acta Physica Polonica B (PS) 2 (7), 2014

[3] A. Buda, A. Jarynowski, Exploring patterns in European singles charts, Network Intelligence Conference (ENIC), pp 135-139, 2015

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Thank you for attention!