

Network inference

What is a network

Nodes: genes, proteins, biological processes

Edges: interactions between them

How to reconstructing a gene regulatory network from high-throughput data?

Weighted correlation network analysis

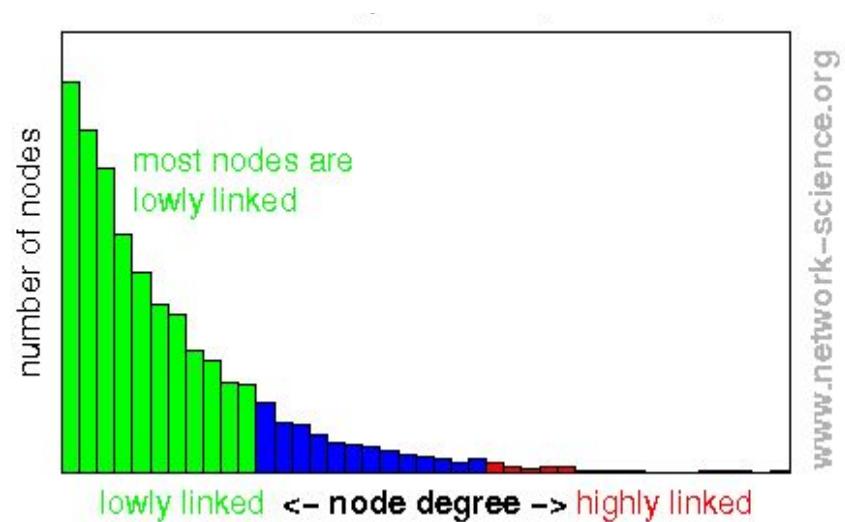
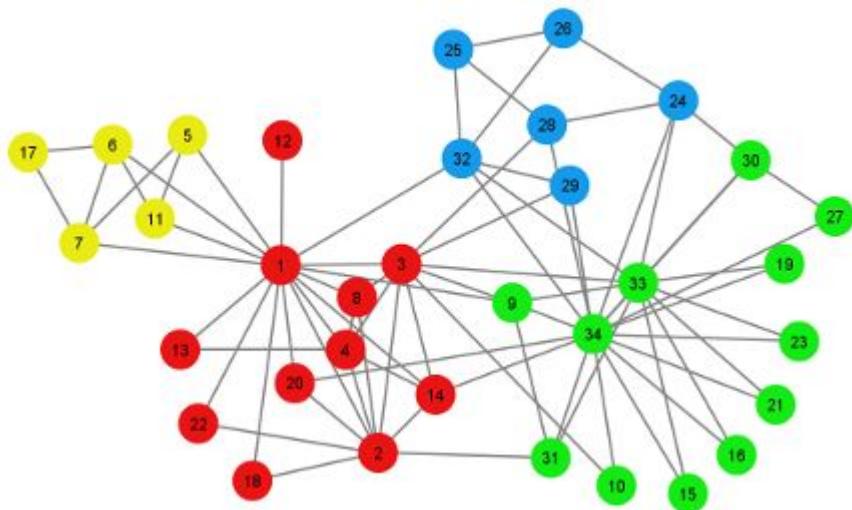
Correlation is a statistical technique that can show whether and how strongly pairs of variables are related. (There are a lot of correlation measures)

If there is a strong (positive or negative) correlation in the expression levels of two genes there might be a regulatory interaction between them

Data intensive, you need a lot of samples (50+)

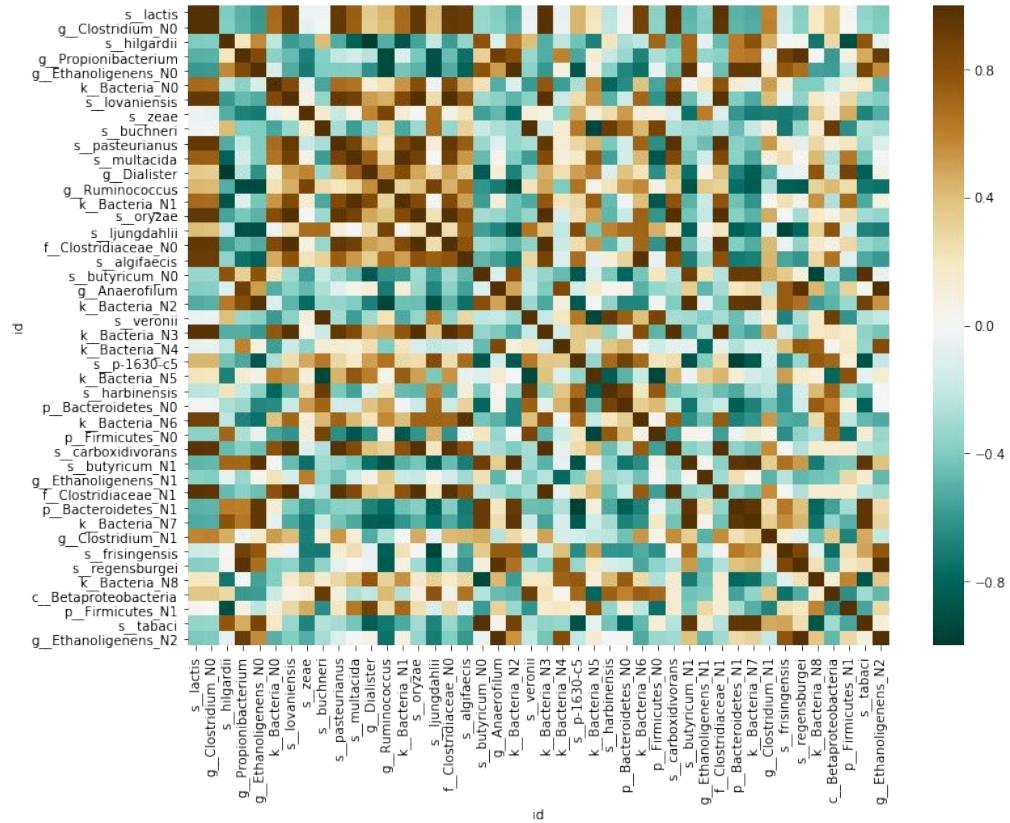
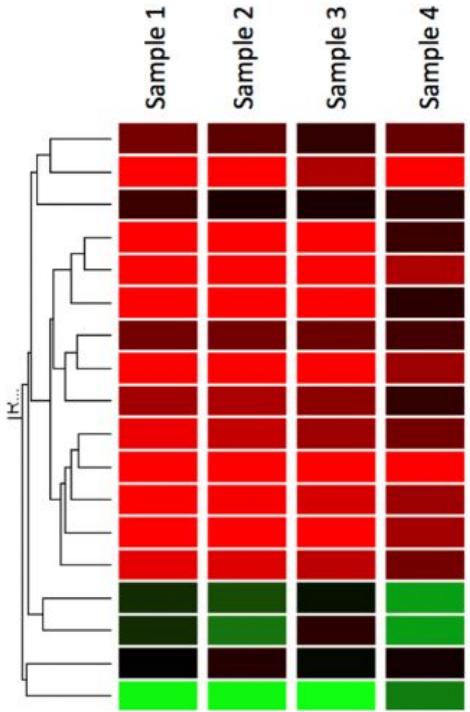
Correlation does not imply causation!

Degree distribution, hubs and modules

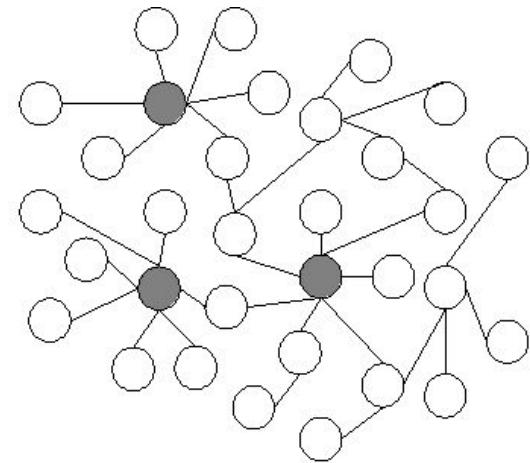
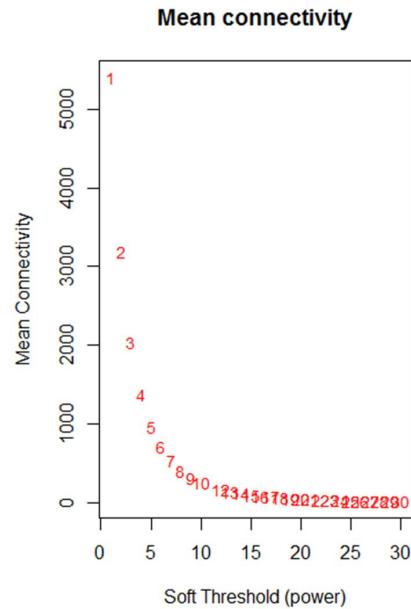
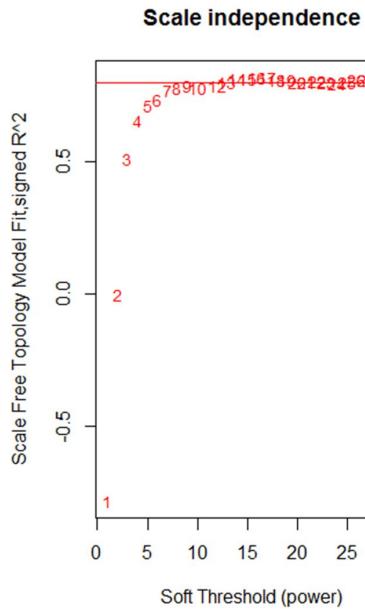


The colors are not related!

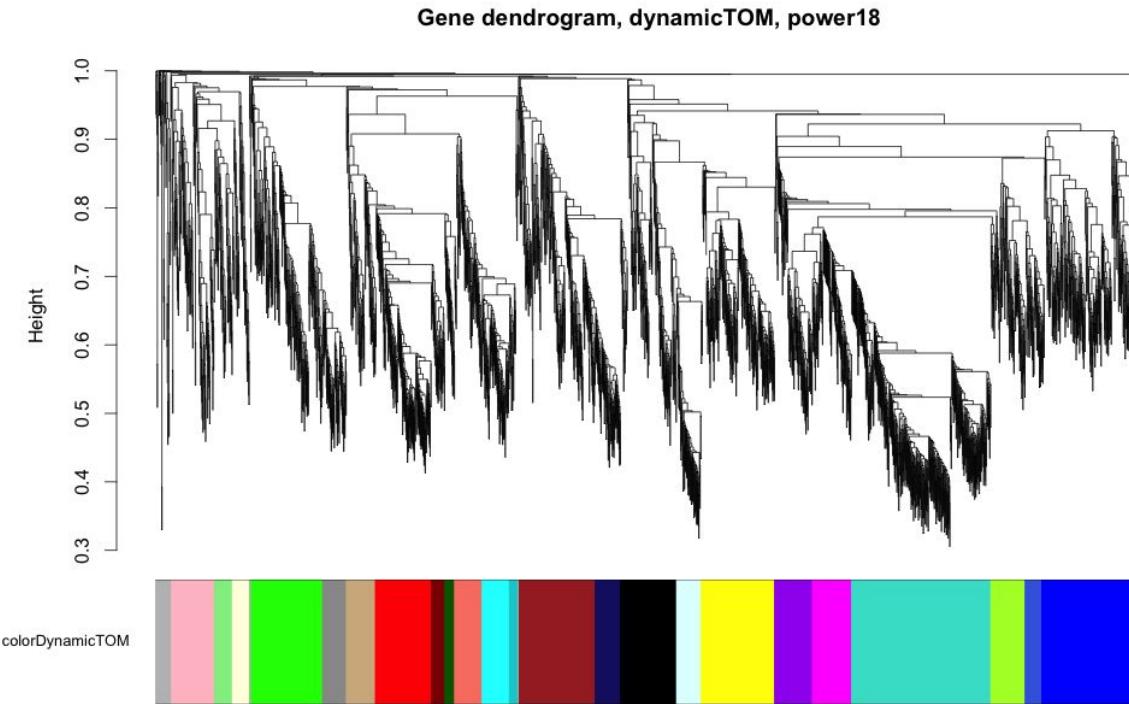
Correlation table



Determine threshold

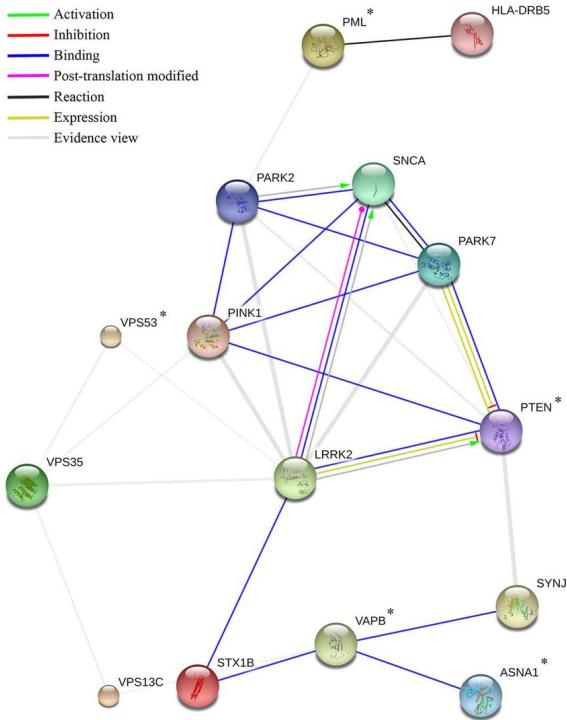


WGCNA Modules

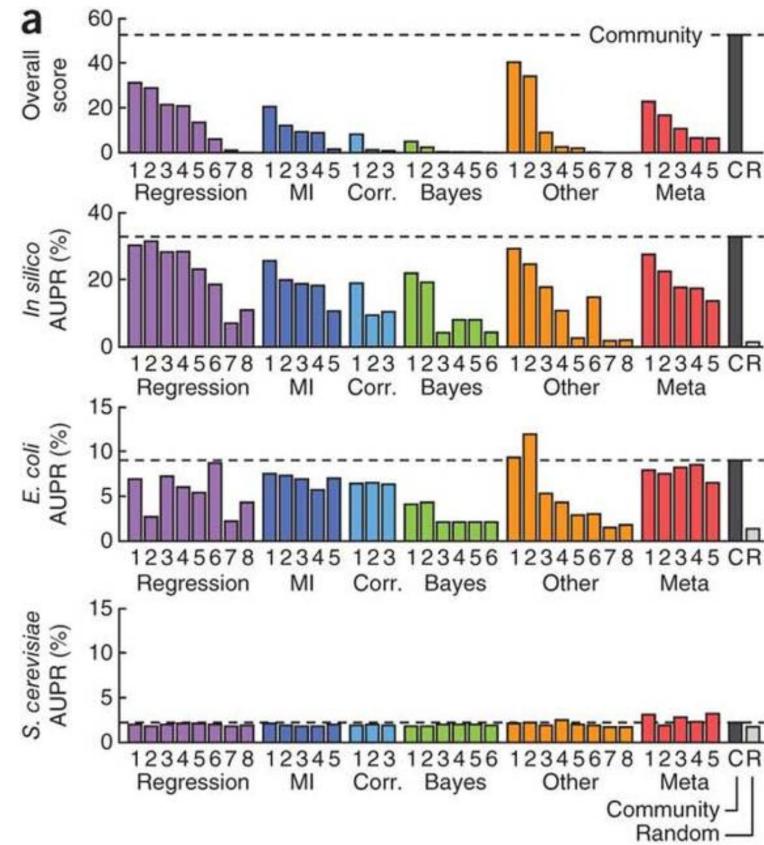


<https://labs.genetics.ucla.edu/horvath/CoexpressionNetwork/Rpackages/WGCNA/>

Other methods



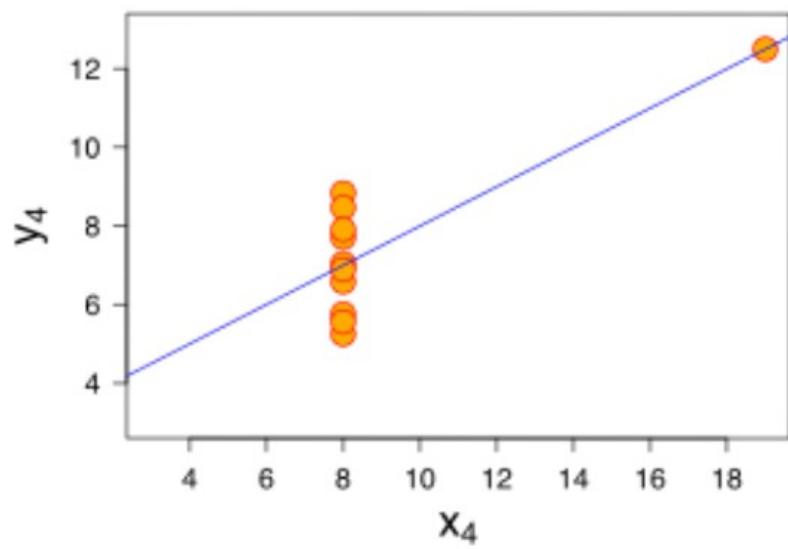
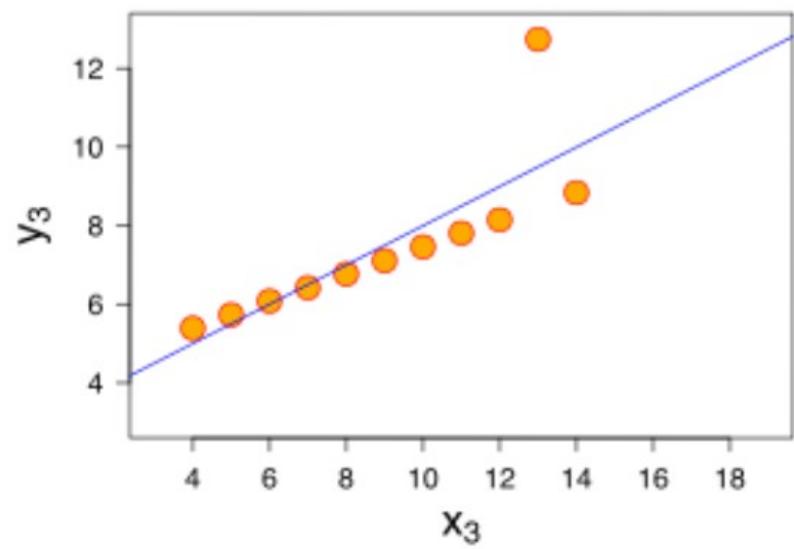
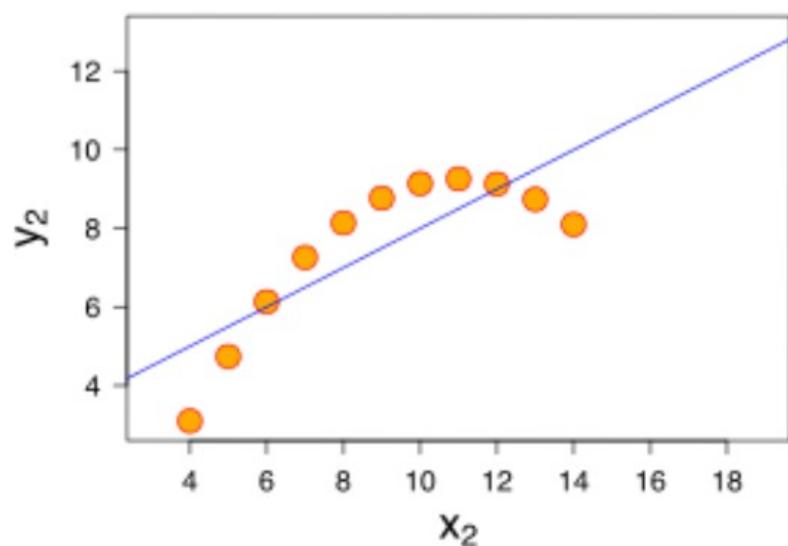
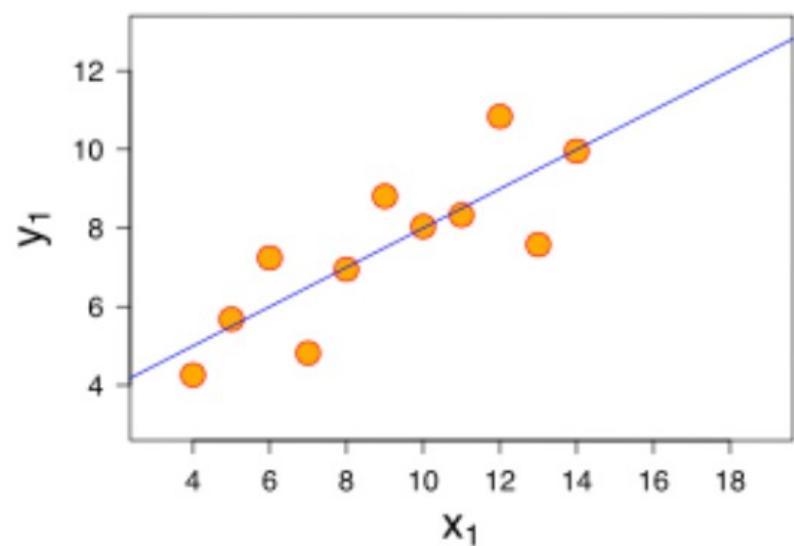
From: Wisdom of crowds for robust gene network



Anscombe's quartet

I		II		III		IV	
x	y	x	y	x	y	x	y
10.0	8.04	10.0	9.14	10.0	7.46	8.0	6.58
8.0	6.95	8.0	8.14	8.0	6.77	8.0	5.76
13.0	7.58	13.0	8.74	13.0	12.74	8.0	7.71
9.0	8.81	9.0	8.77	9.0	7.11	8.0	8.84
11.0	8.33	11.0	9.26	11.0	7.81	8.0	8.47
14.0	9.96	14.0	8.10	14.0	8.84	8.0	7.04
6.0	7.24	6.0	6.13	6.0	6.08	8.0	5.25
4.0	4.26	4.0	3.10	4.0	5.39	19.0	12.50
12.0	10.84	12.0	9.13	12.0	8.15	8.0	5.56
7.0	4.82	7.0	7.26	7.0	6.42	8.0	7.91
5.0	5.68	5.0	4.74	5.0	5.73	8.0	6.89

Property	Value	Accuracy
Mean of x	9	exact
Sample variance of x	11	exact
Mean of y	7.50	to 2 decimal places
Sample variance of y	4.125	plus/minus 0.003
Correlation between x and y	0.816	to 3 decimal places
Linear regression line	$y = 3.00 + 0.500x$	to 2 and 3 decimal places, respectively
Coefficient of determination of the linear regression	0.67	to 2 decimal places

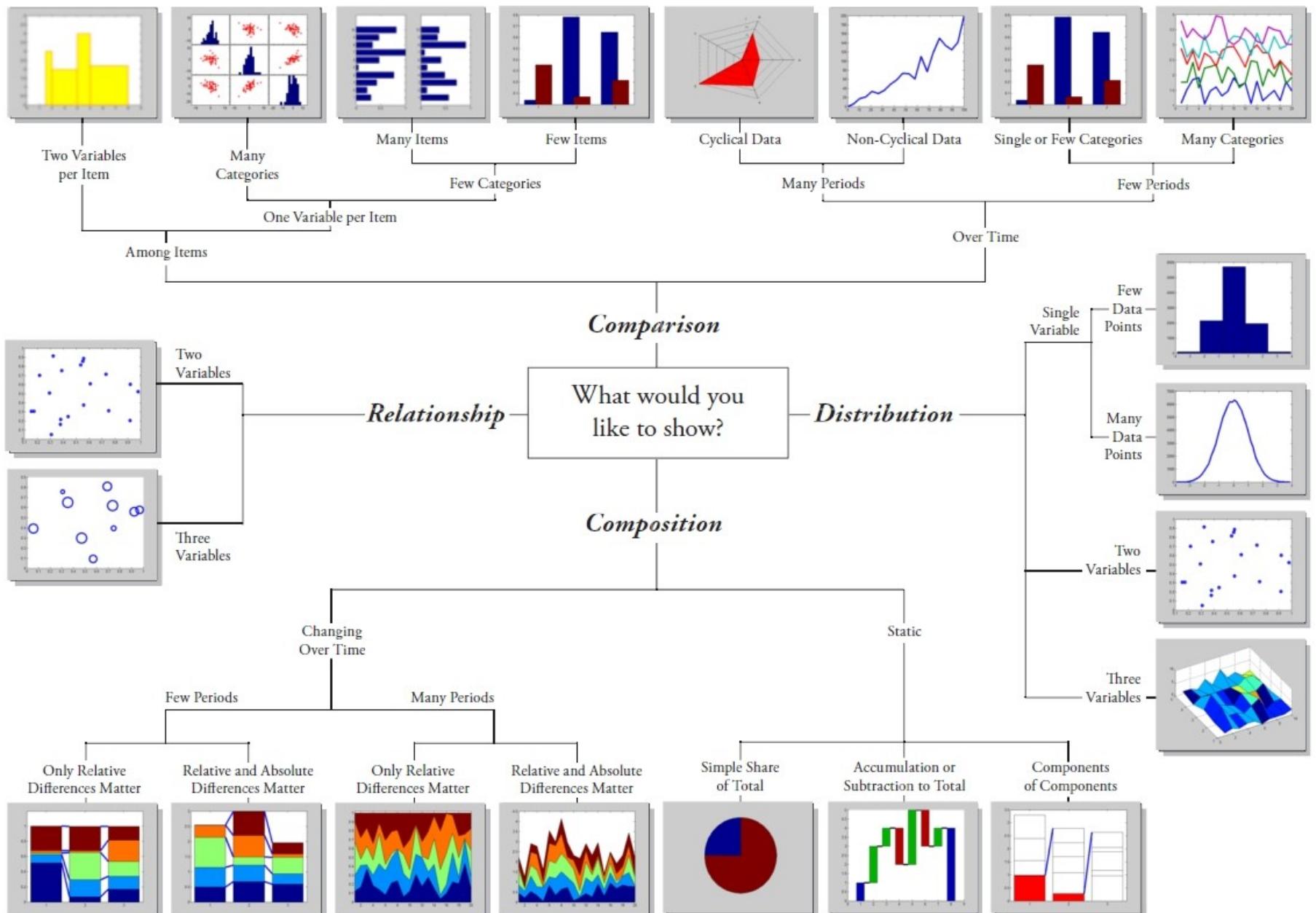


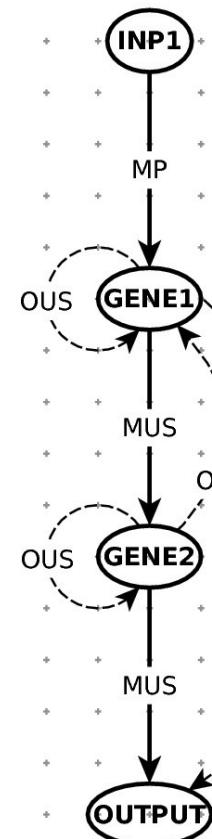
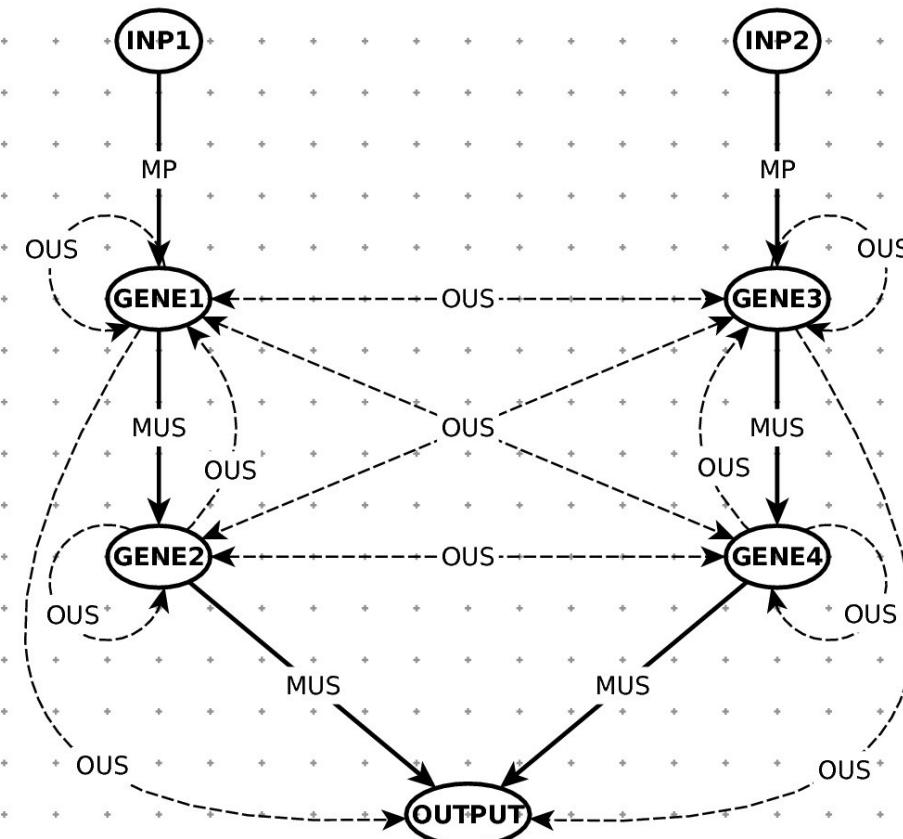
Encoding

Cleveland and McGill studied what people are able to decode most accurately and ranked them in the following :

- 1) Position along a common scale e.g. scatter plot
- 2) Position on identical but nonaligned scales e.g. multiple scatter plots
- 3) Length e.g. bar chart
- 4) Angle & Slope (tie) e.g. pie chart
- 5) Area e.g. bubbles
- 6) Volume, density, and color saturation (tie) e.g. heatmap
- 7) Color hue e.g. newsmap

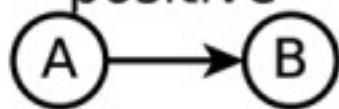
Chart Suggestions—A Thought-Starter



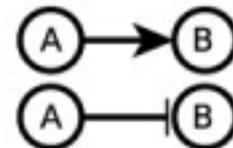
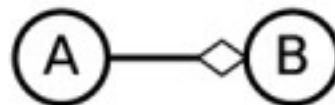
A**B****C**

G

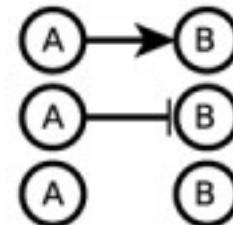
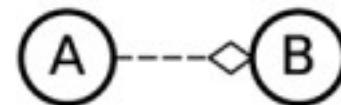
MP: mandatory positive



MUS: mandatory of unknown sign

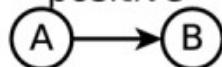


OUS: optional of unknown sign

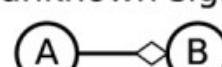


G

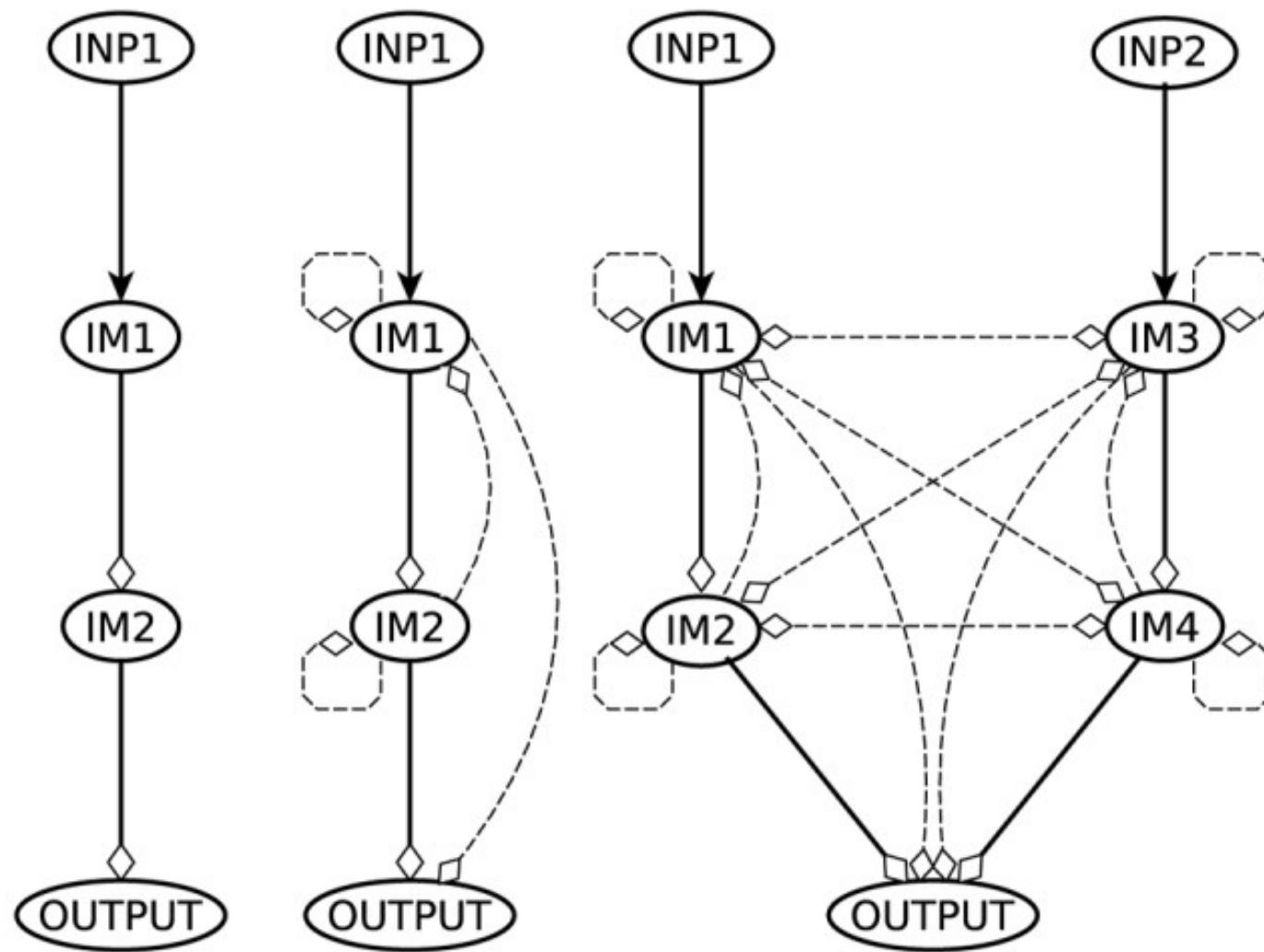
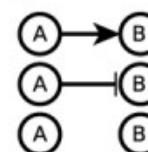
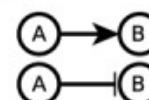
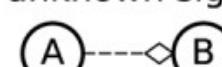
MP: mandatory positive



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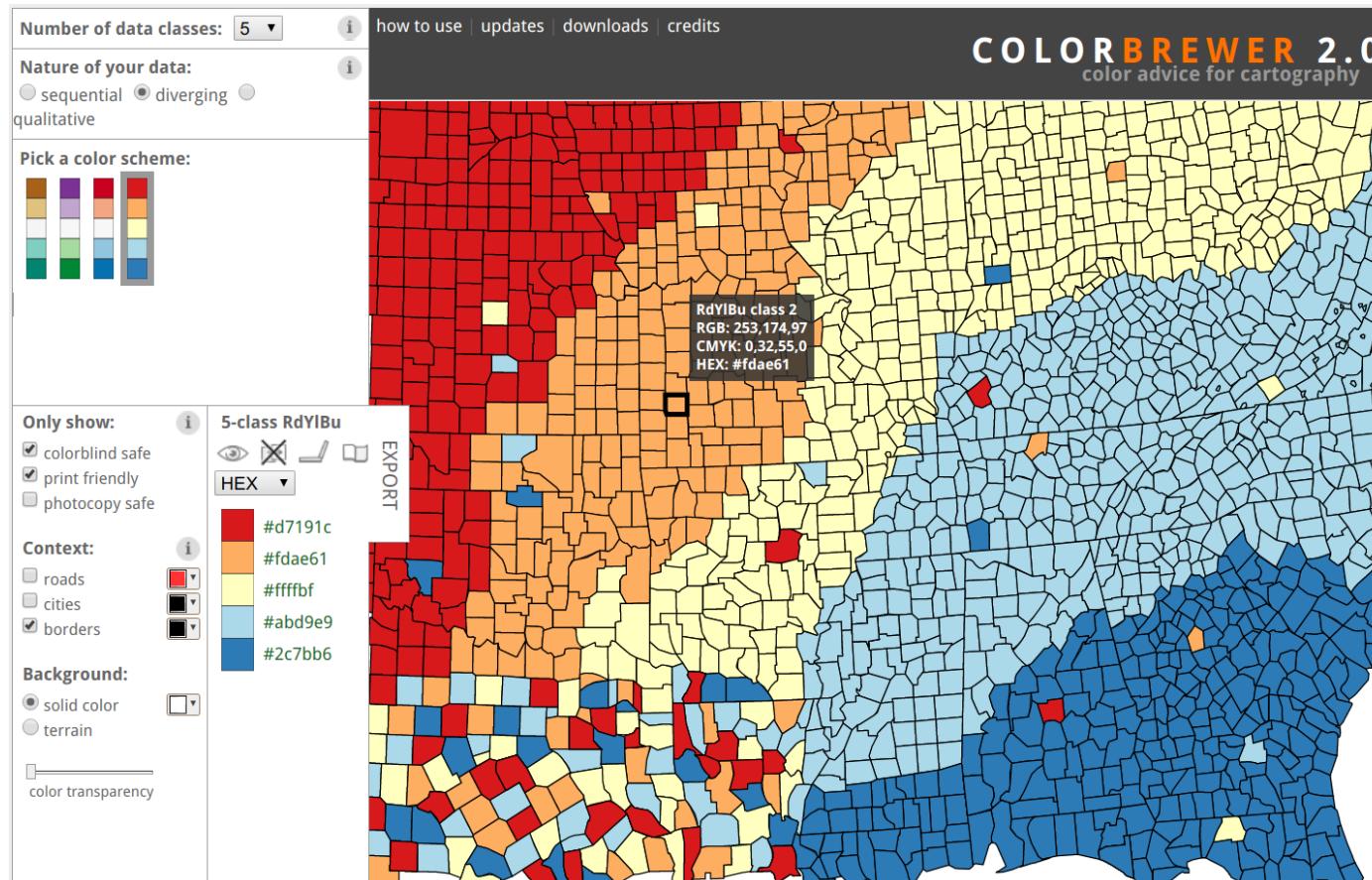


OUS: optional of unknown sign



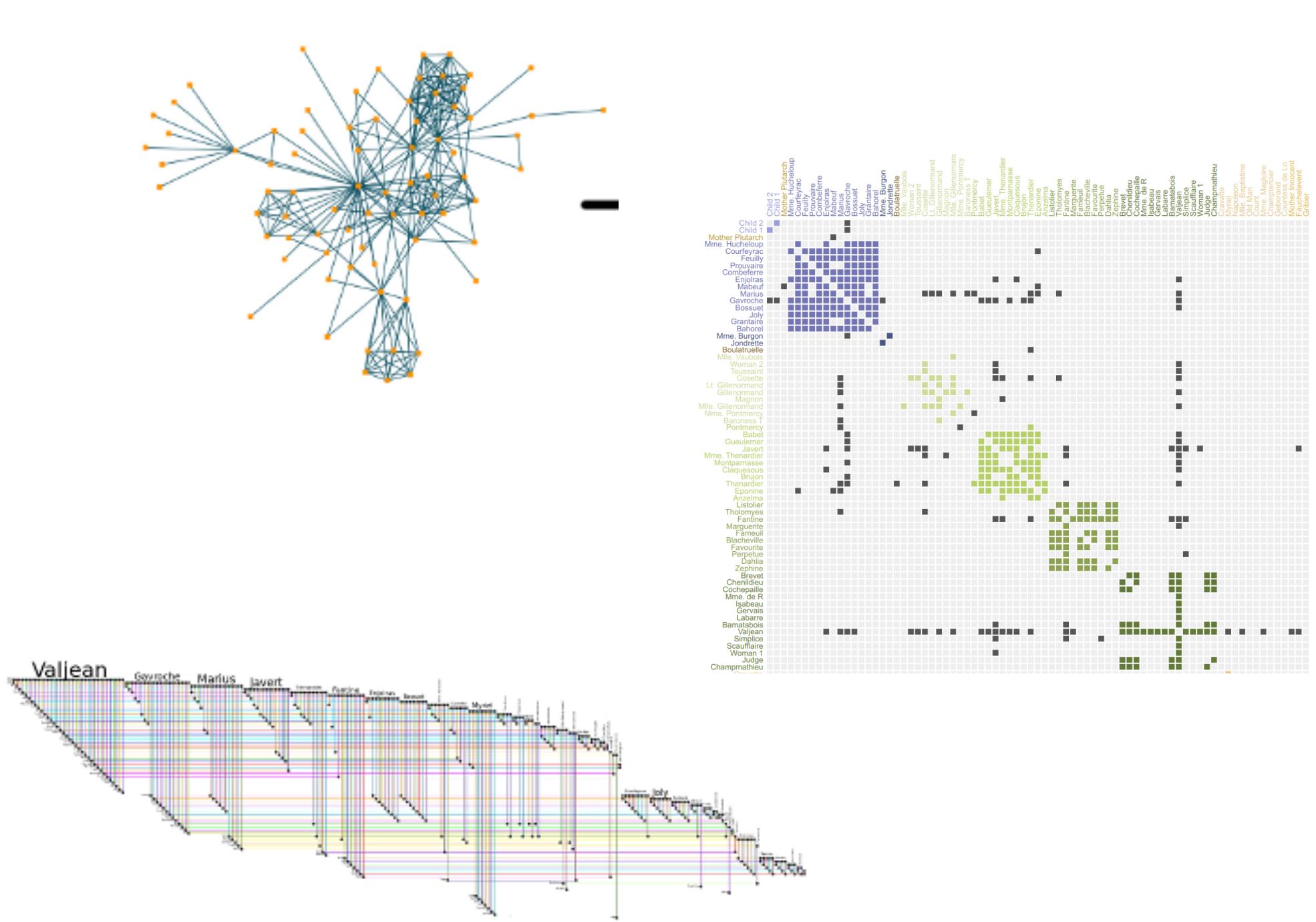
Color

- Color suggestions: <http://colorbrewer2.org>
- Saturated colors are used to highlight

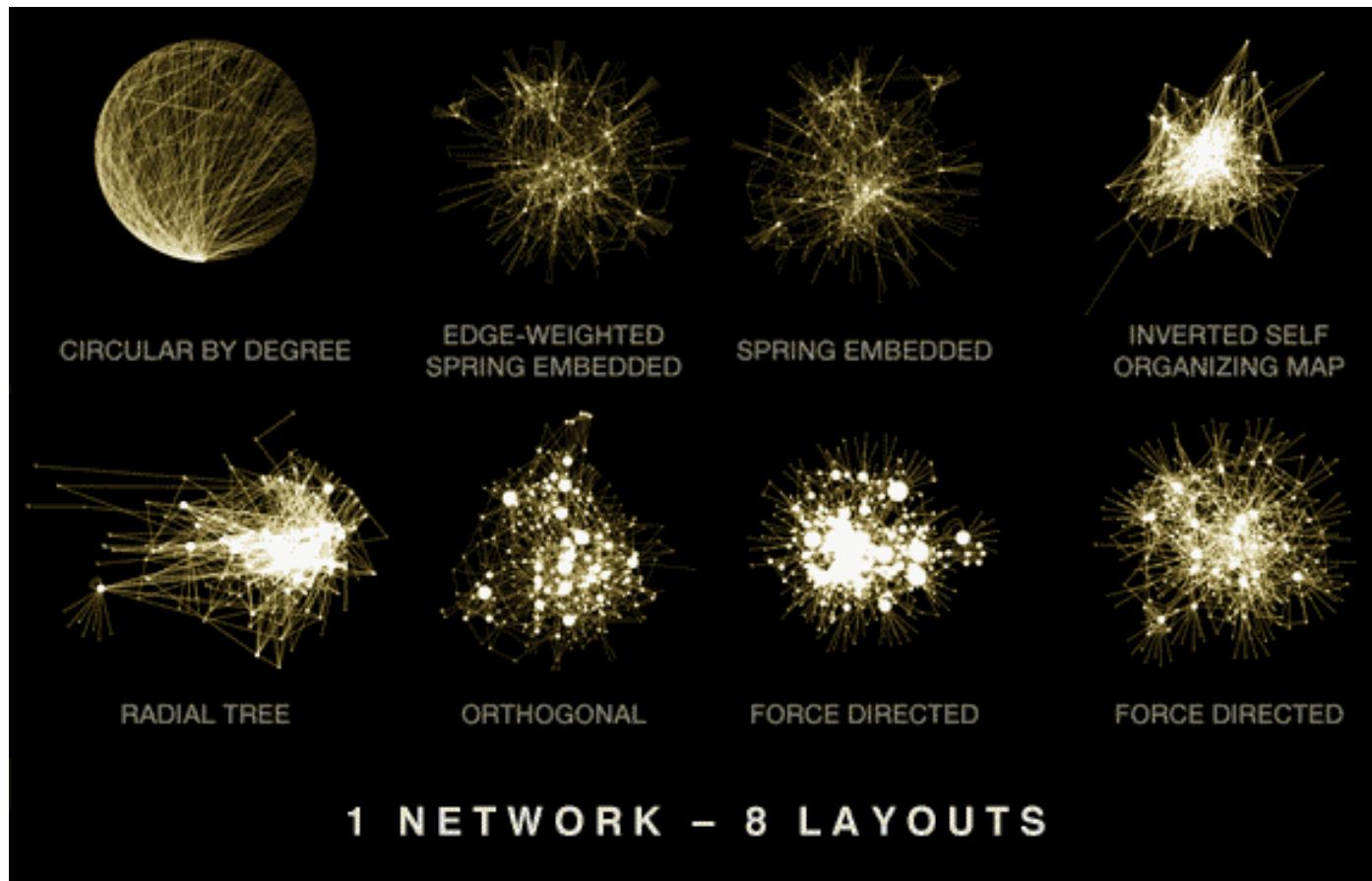
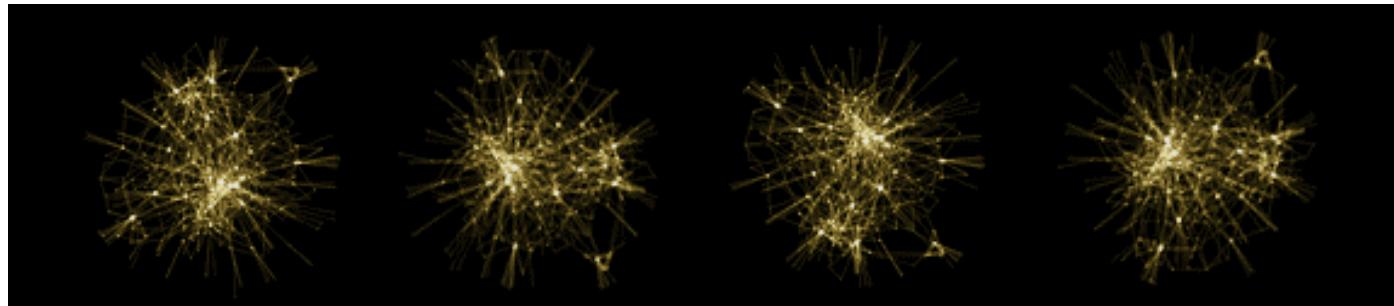


Network

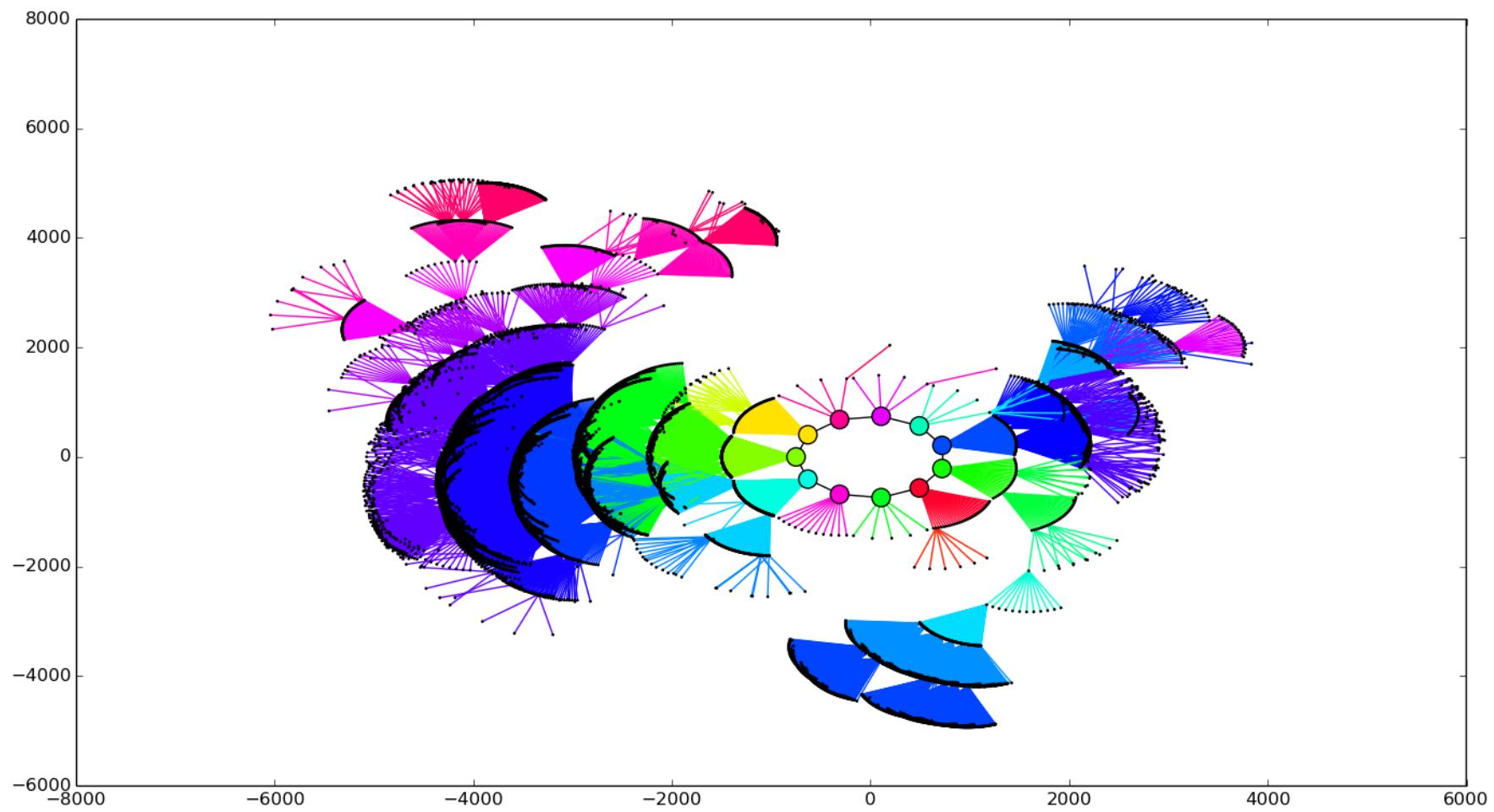
- Represent interactions
- Can have multiple types of nodes and edges

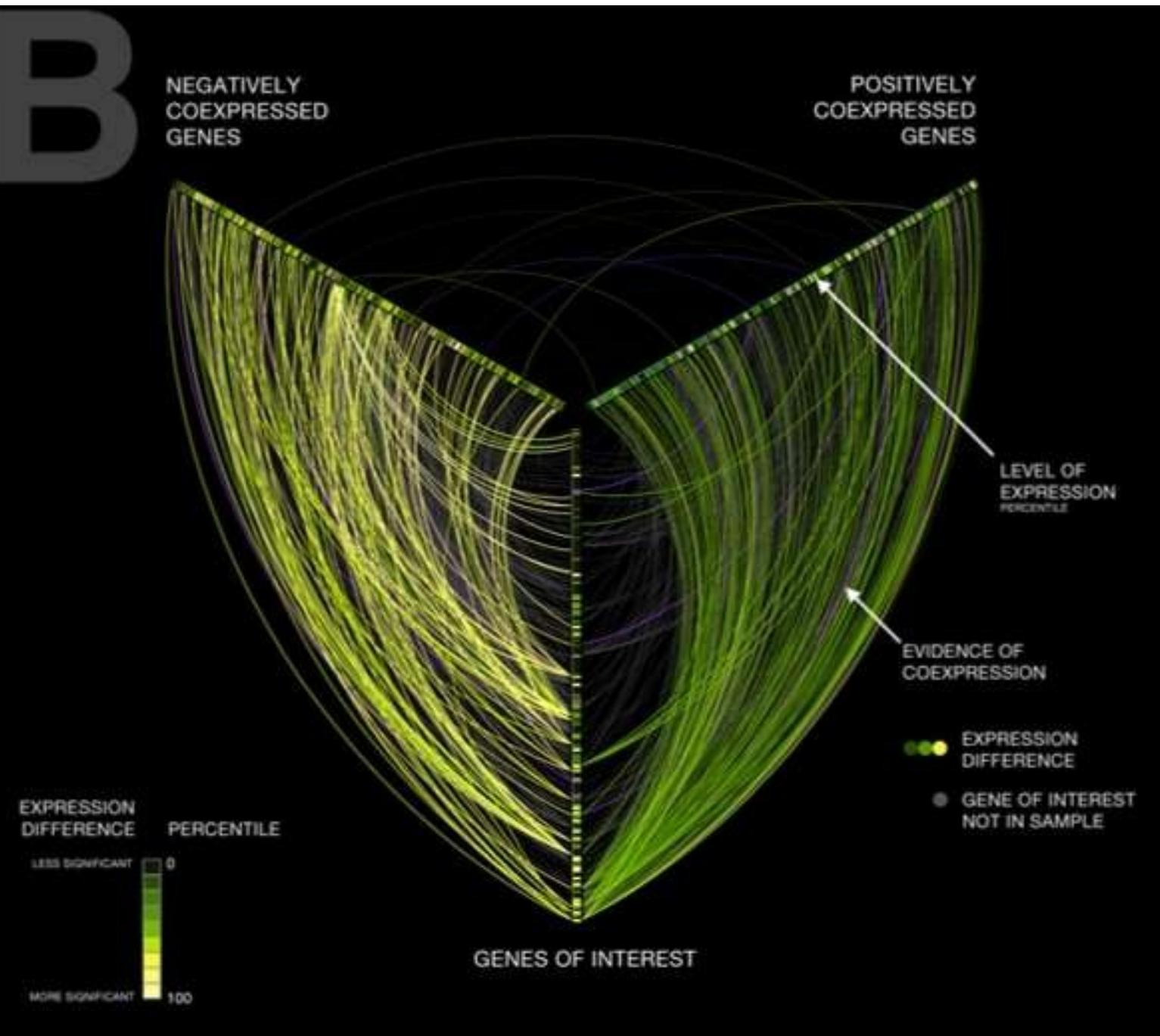


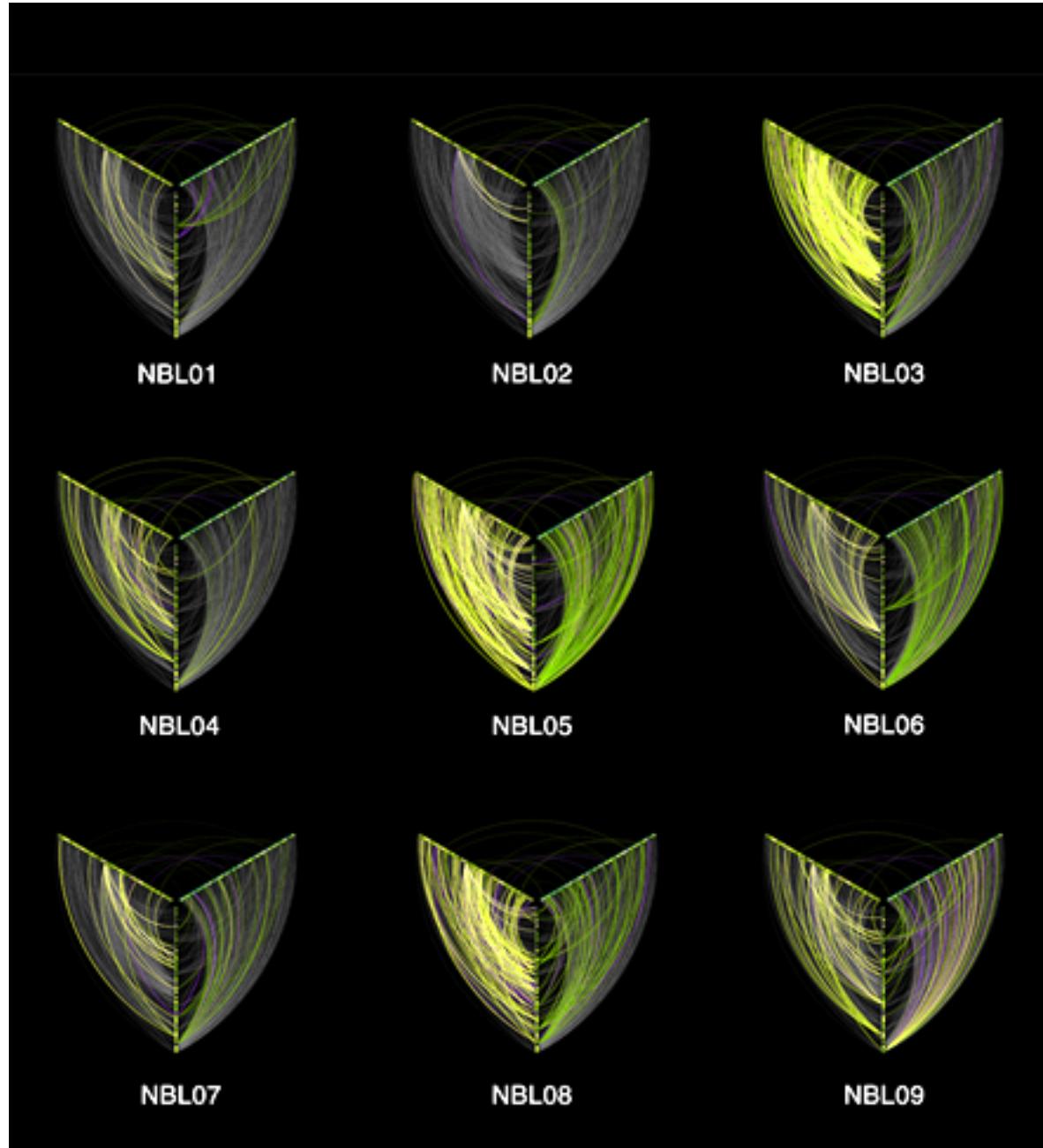
An idea is as good as the ability to communicate it



1 NETWORK – 8 LAYOUTS



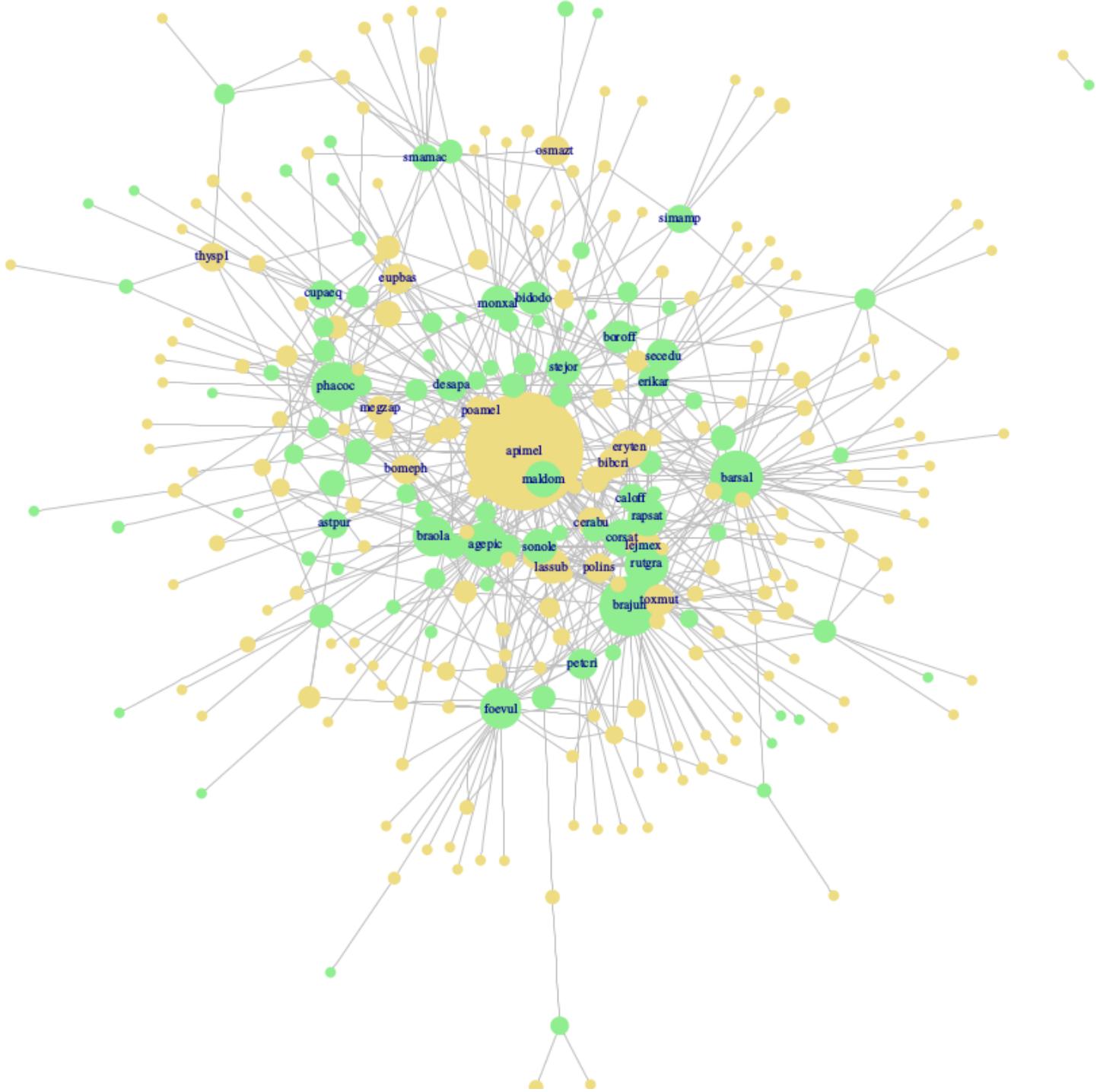




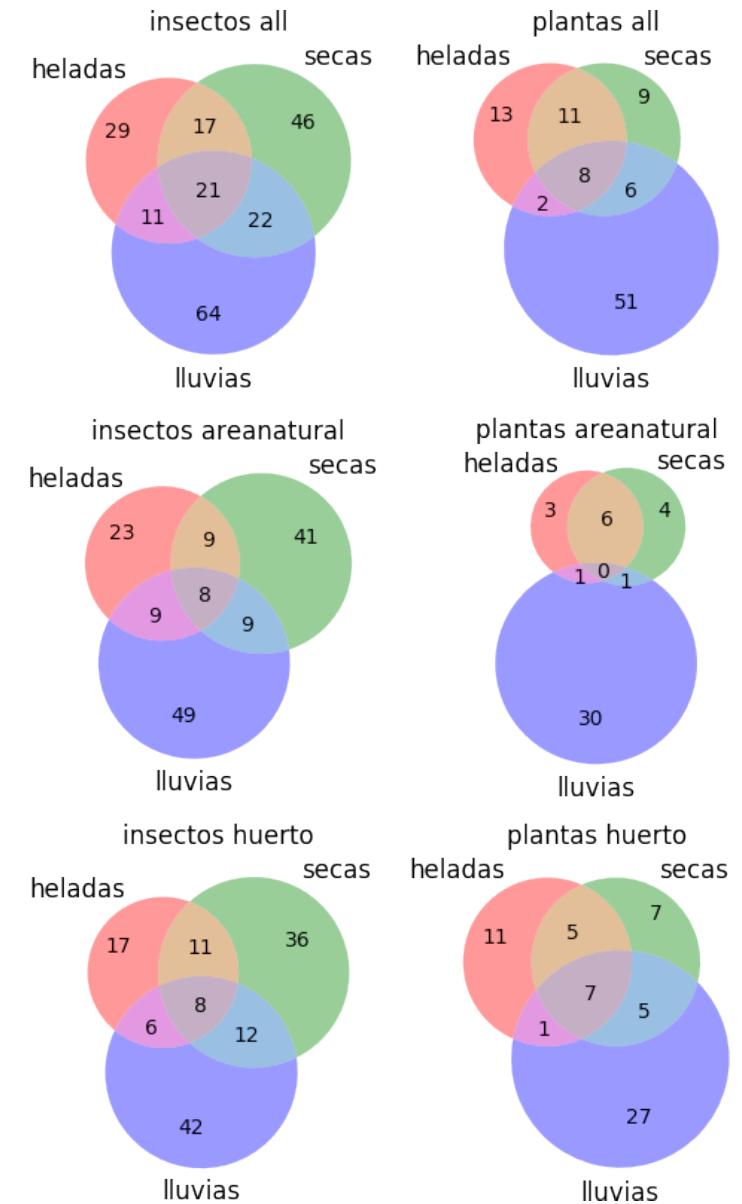
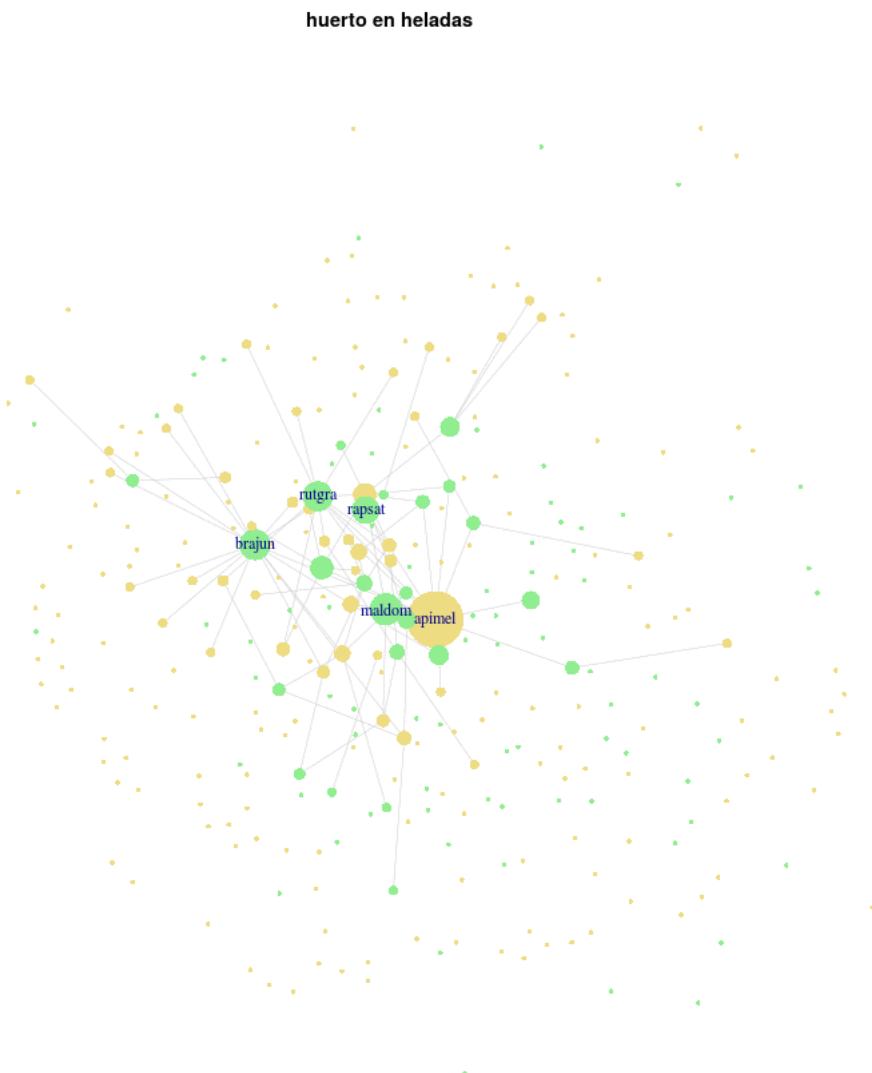
Network

- Represent interactions
- Can have multiple types of nodes and edges

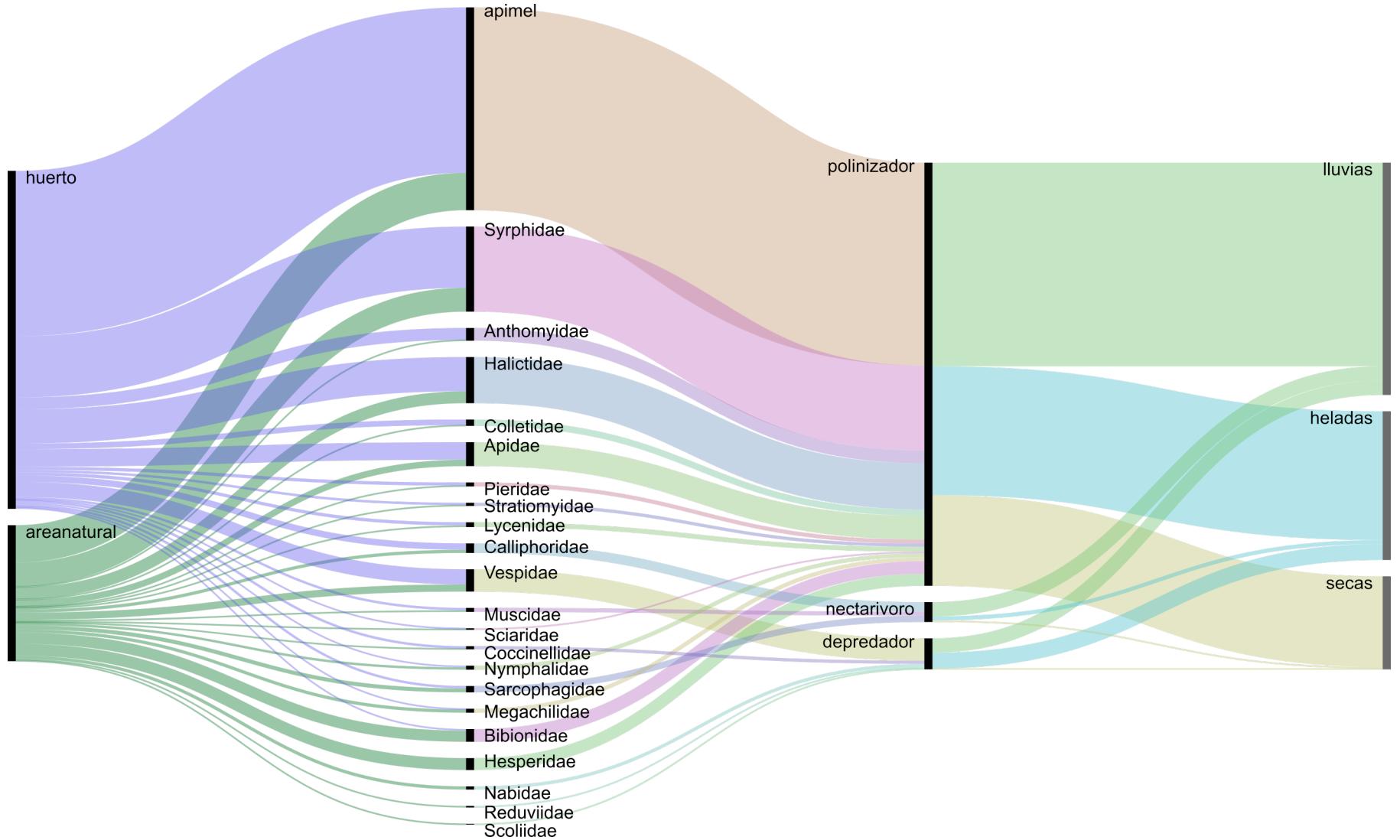
habitat	muestreot	guild	genero	especies_fir	abundancia	spvegabrev	nativa
huerto	secas	nectarivoro	Calliphoridae	callsp5	1	petcri	no
huerto	secas	nectarivoro	Calliphoridae	callsp5	1	petcri	no
huerto	secas	nectarivoro	Calliphoridae	callsp5	1	petcri	no
huerto	secas	nectarivoro	Calliphoridae	callsp4	1	brajun	no
huerto	secas	nectarivoro	Calliphoridae	callsp5	1	foevul	no
areanatural	secas	nectarivoro	Muscidae	musc1	1	barsal	si
areanatural	secas	nectarivoro	Muscidae	musc2	1	barsal	si
areanatural	secas	nectarivoro	Muscidae	musc2	1	barsal	si
areanatural	secas	nectarivoro	Muscidae	musc1	1	euppyc	si
huerto	secas	nectarivoro	Muscidae	musc1	1	petcri	no
huerto	secas	nectarivoro	Muscidae	musc4	1	rutgra	no

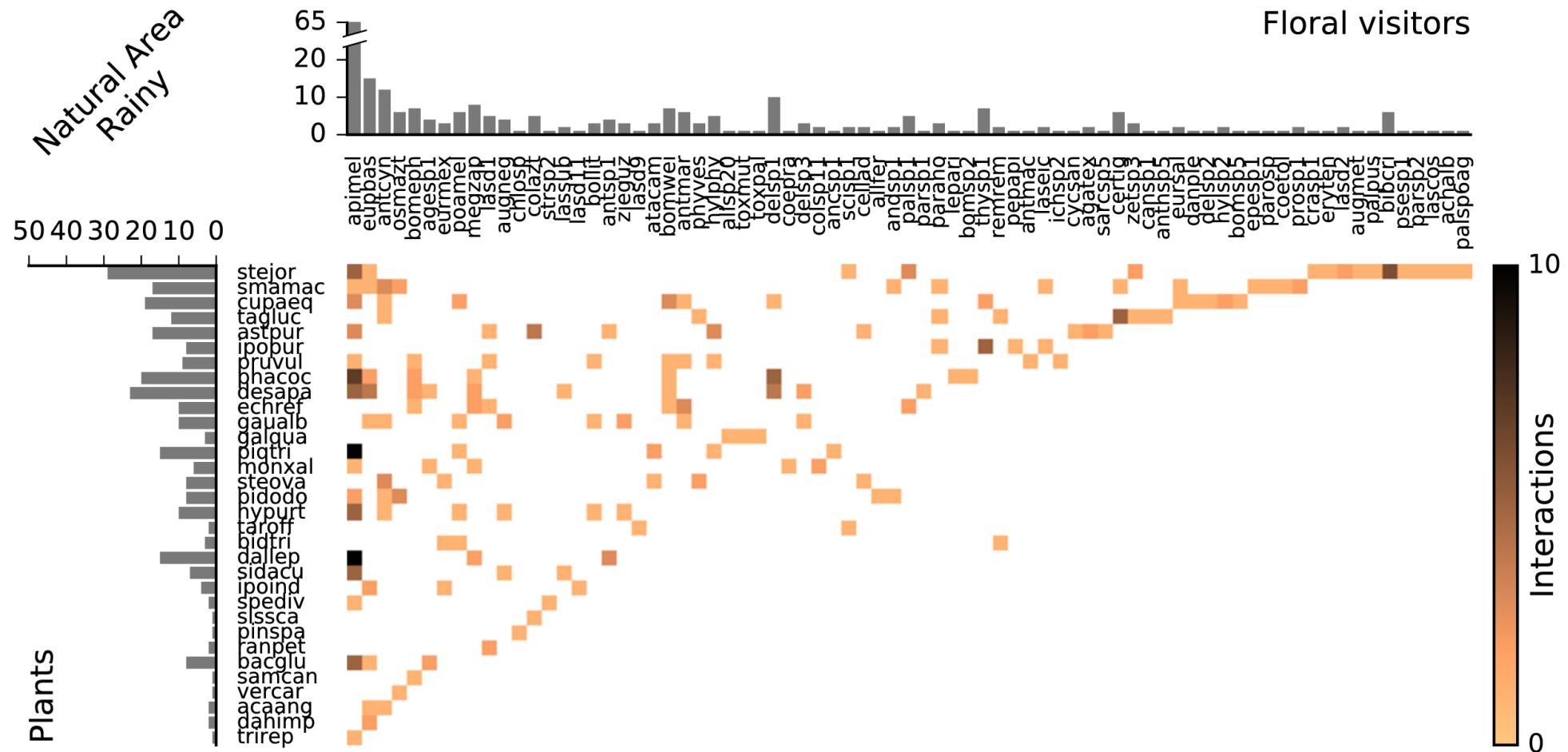


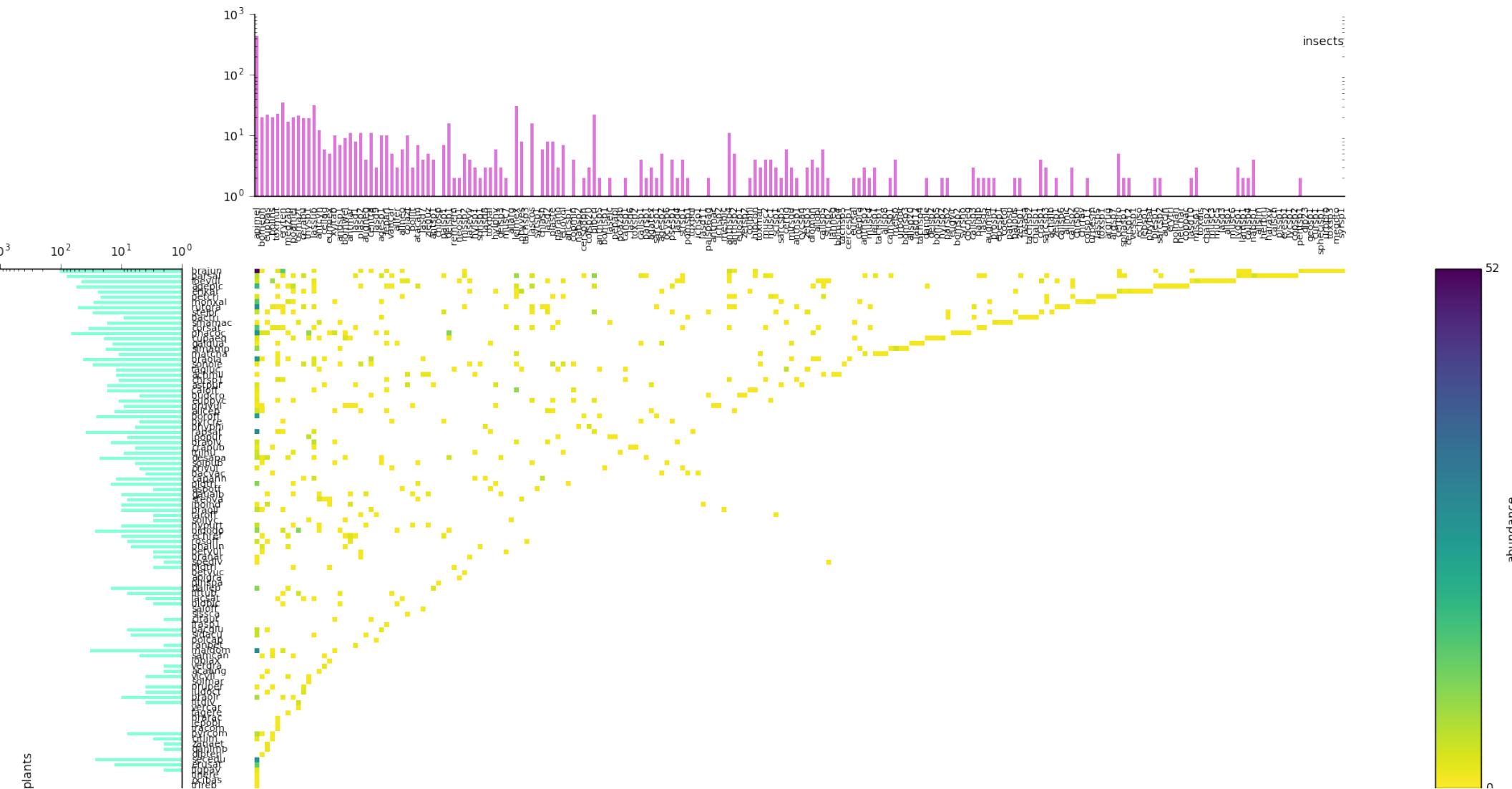
Visualizing larger networks as giant hairballs is less helpful than providing charts that show key characteristics of the graph



Metadata







What if I really need to plot my network?

- Determine key properties
- Divide in groups
- Select symbols and color scales
- First order nodes, then edges

Recursos

- Visualización:

<https://classroom.udacity.com/courses/ud507/>

- Redes

<http://kateto.net/network-visualization>

- Recursos

<http://app.rawgraphs.io>

<http://www.hiveplot.com/>

<http://colorbrewer2.org/>

<http://www.cytoscape.org/>

<https://www.yworks.com/products/yed>