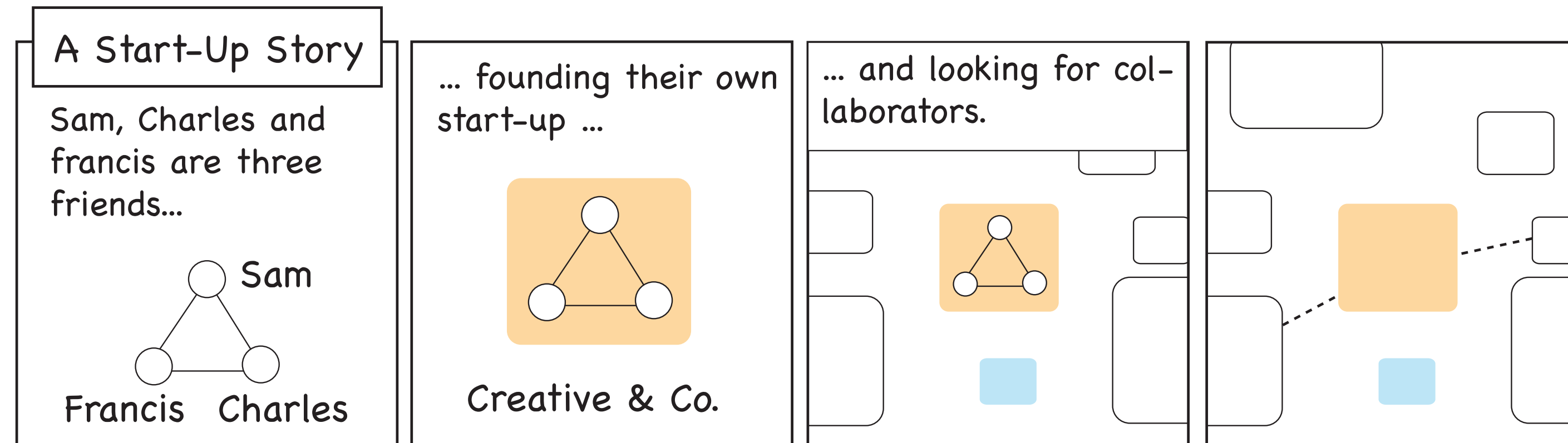
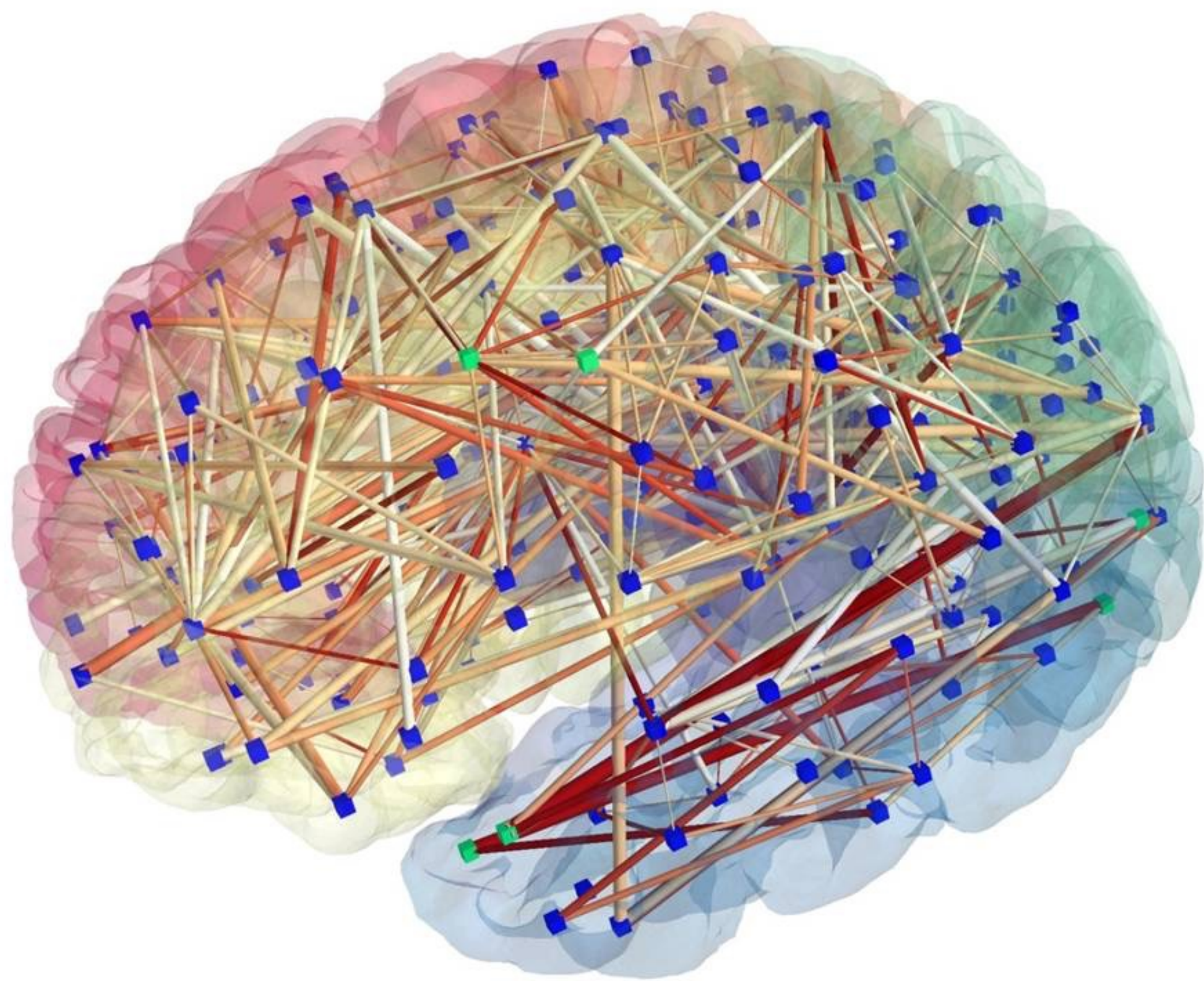
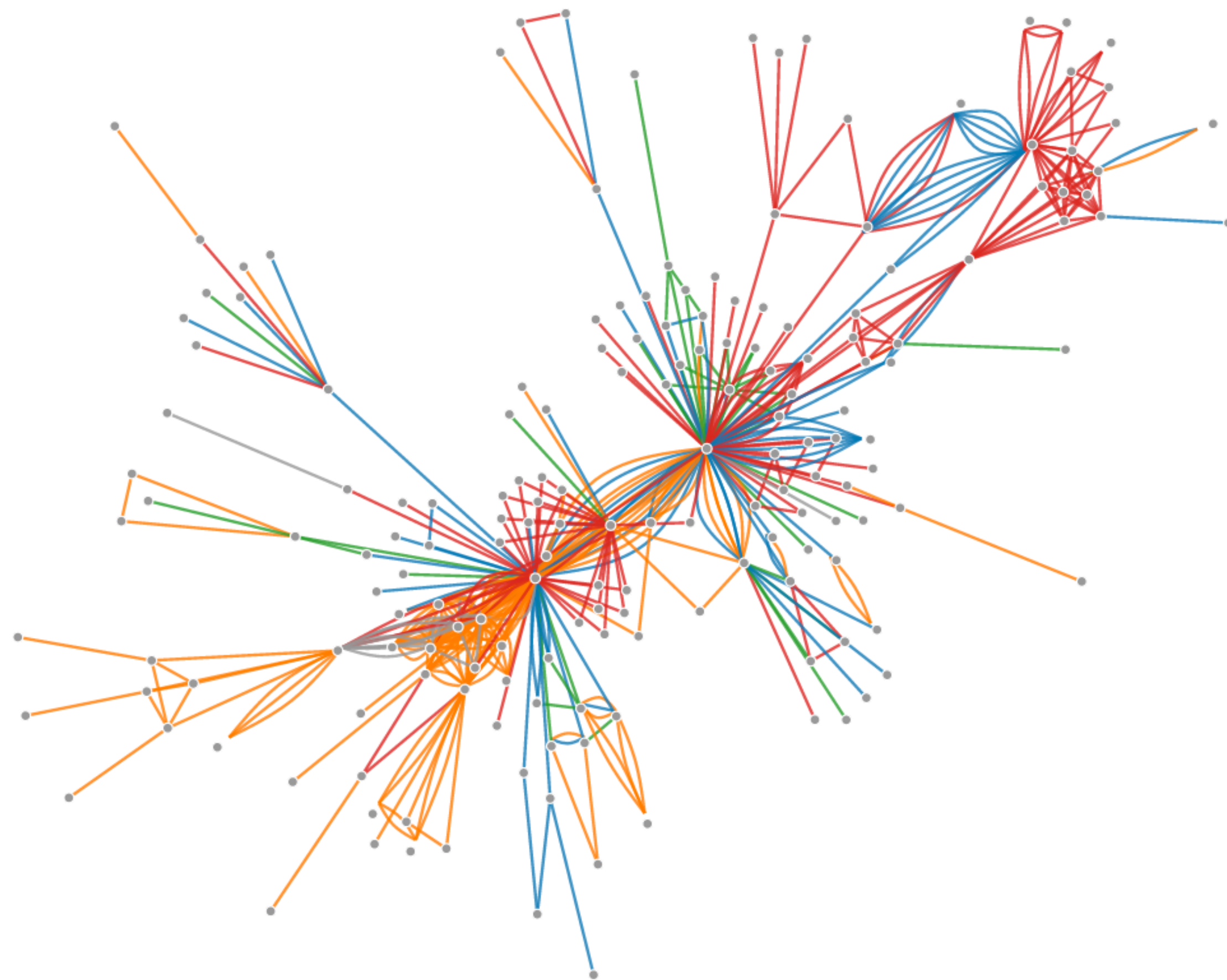
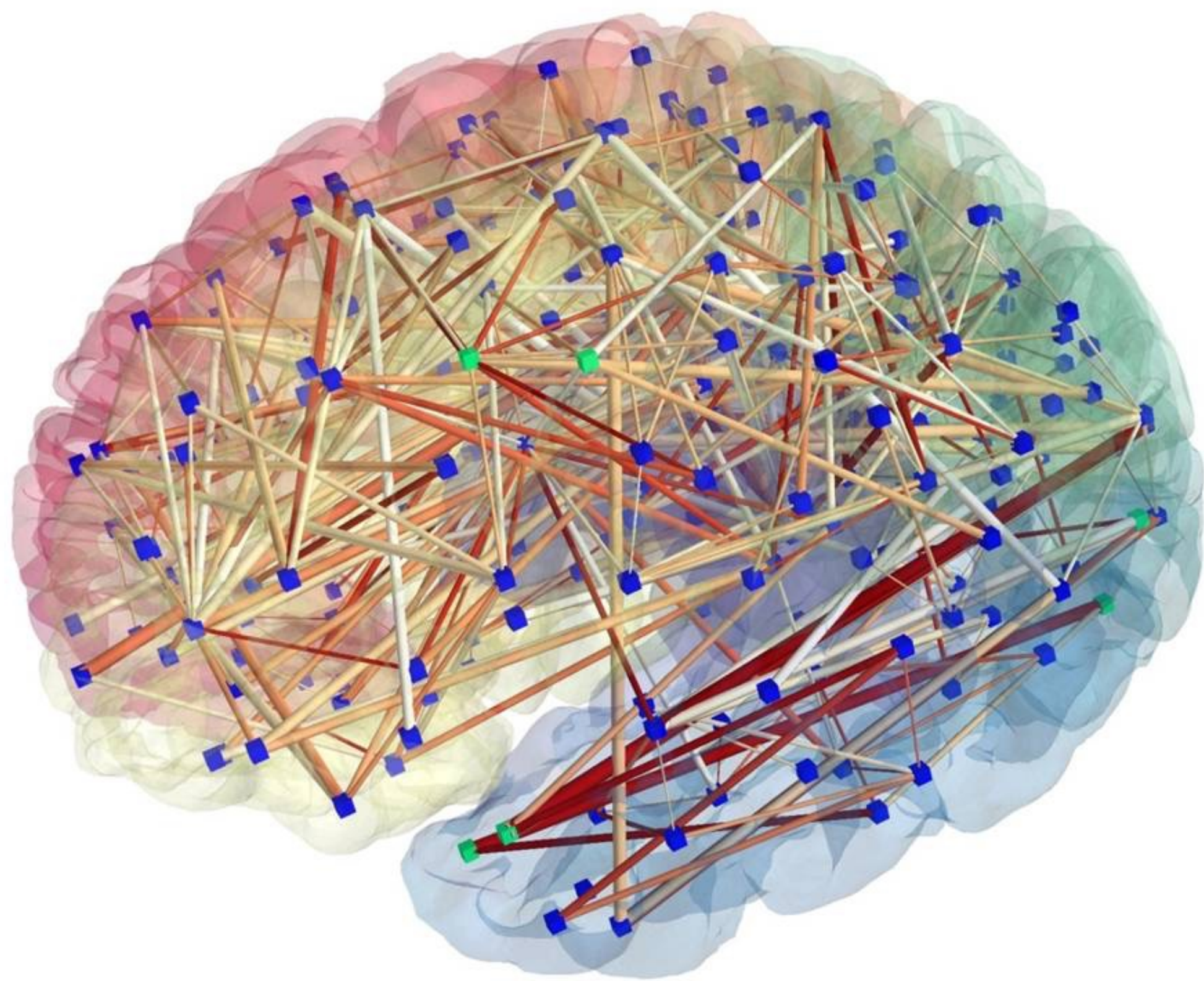


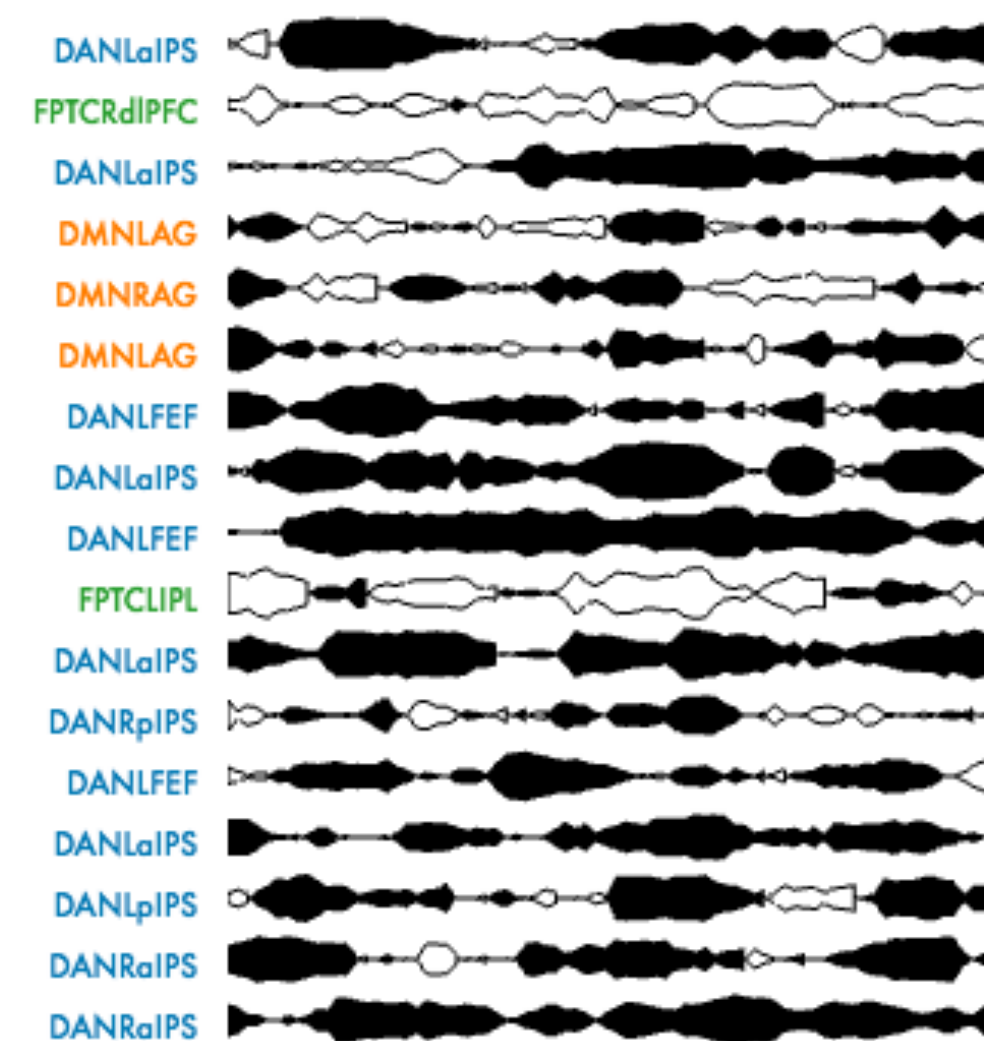
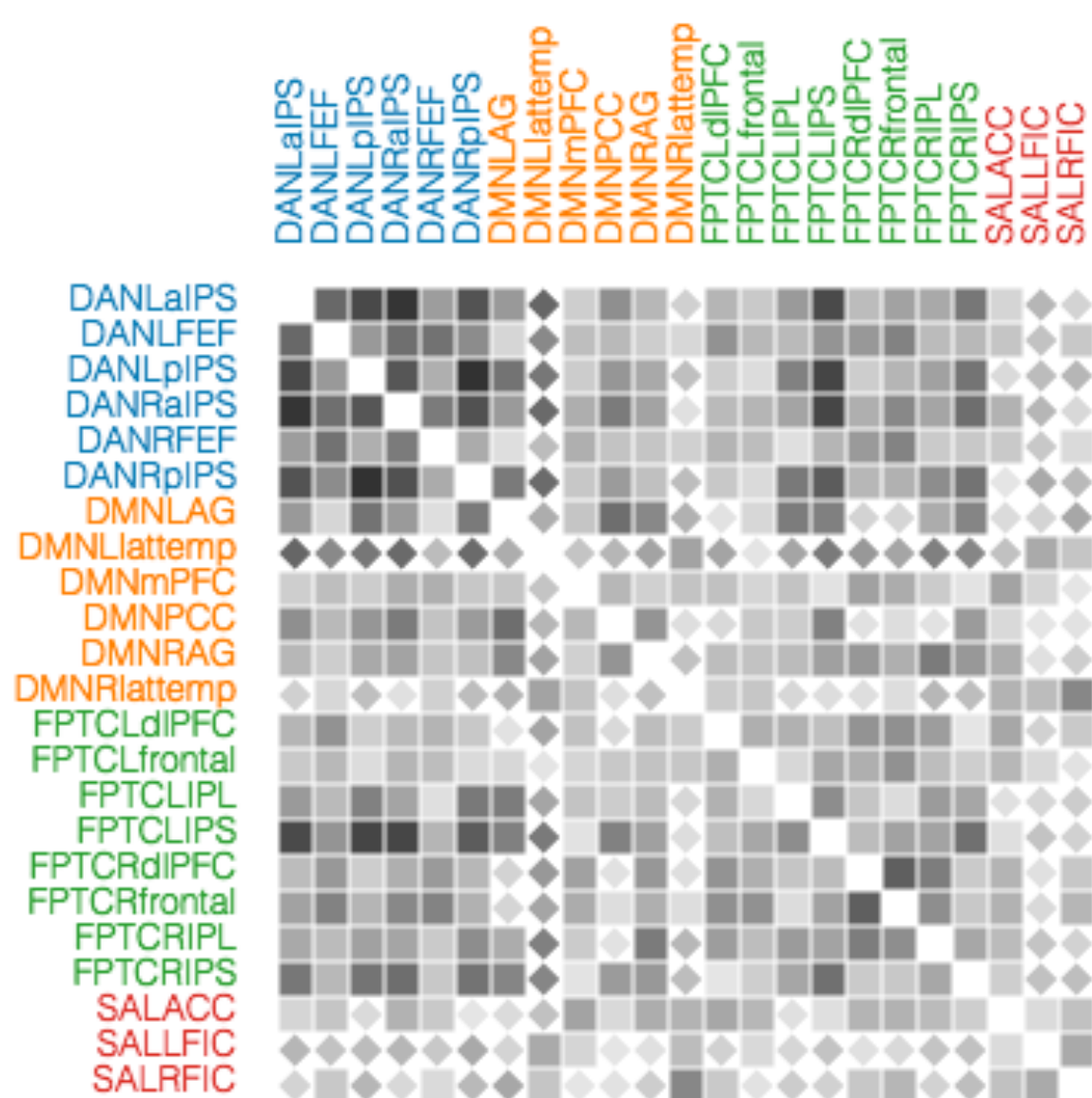
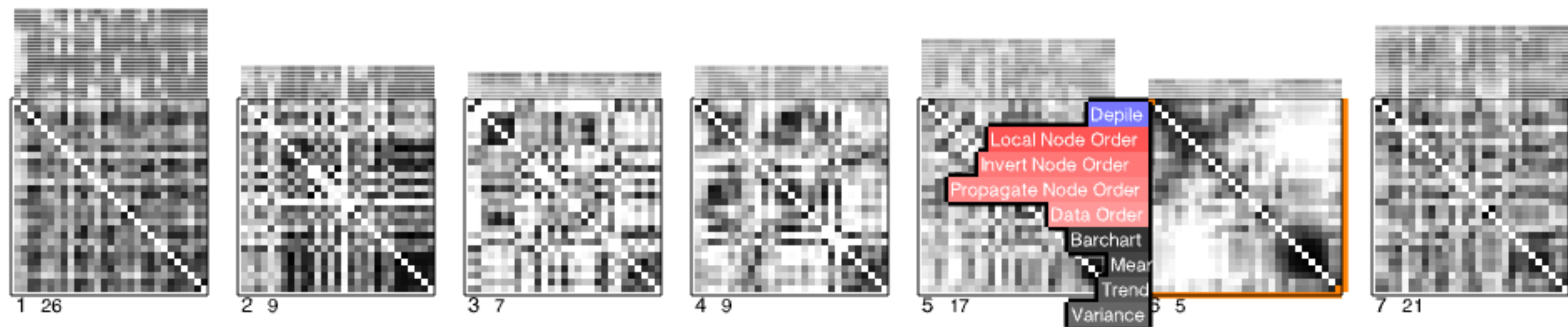
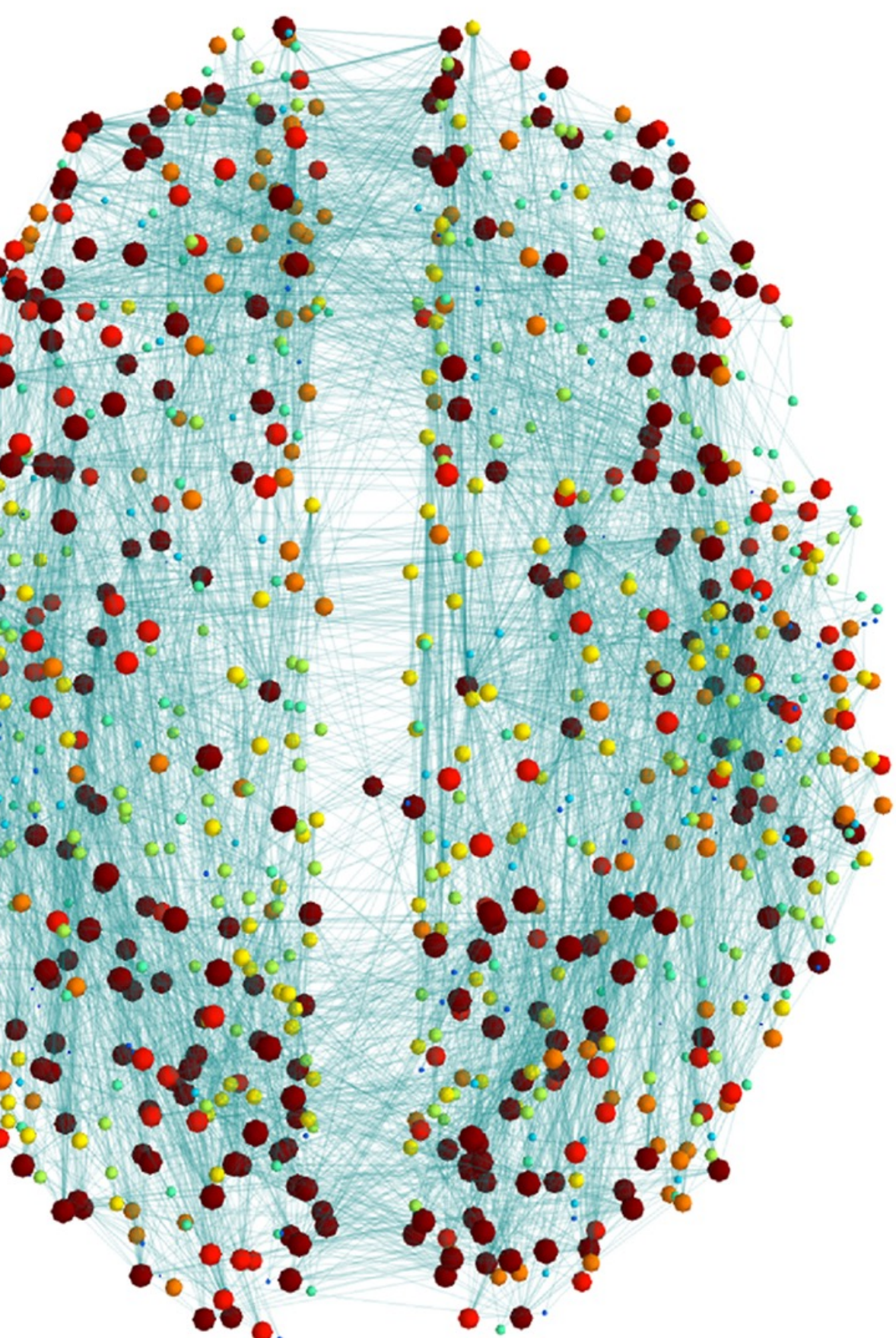
Telling Stories about Dynamic Networks with Graph Comics

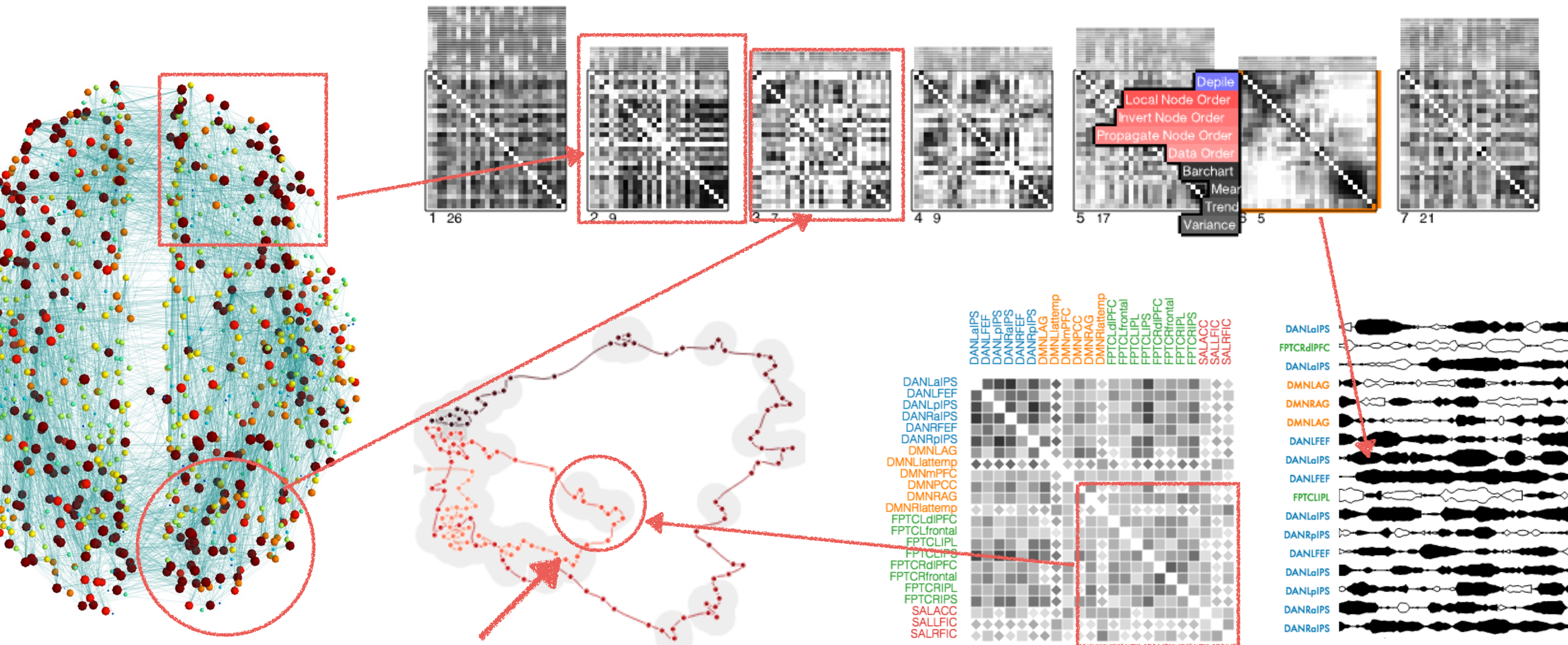


Benjamin Bach
Natalie Kerracher
Kyle Hall
Jessie Kennedy
Sheelagh Carpendale
Nathalie Henry Riche

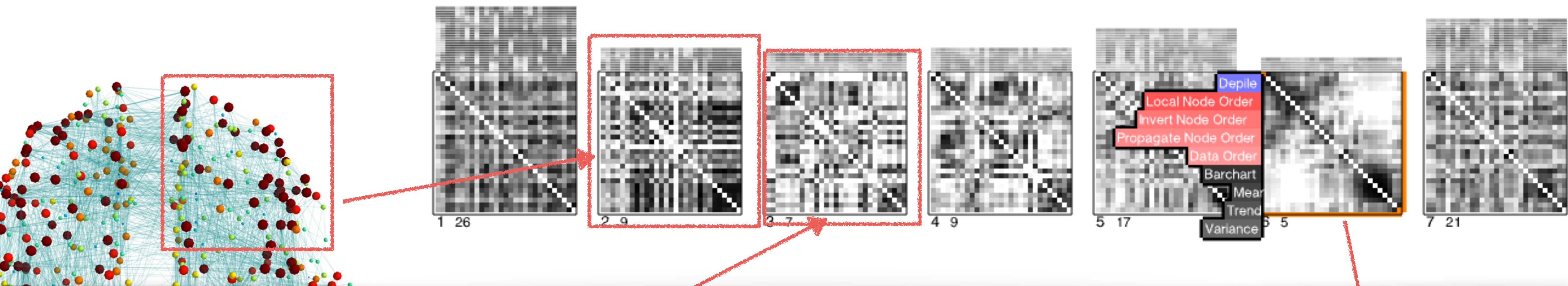




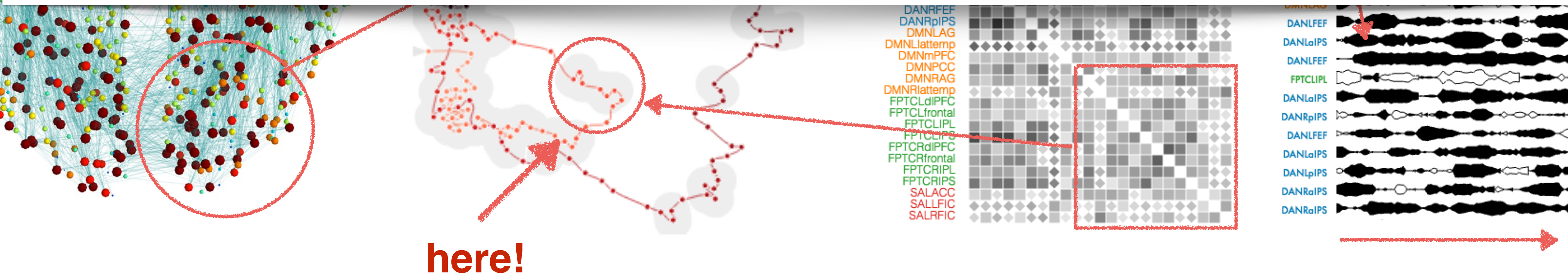


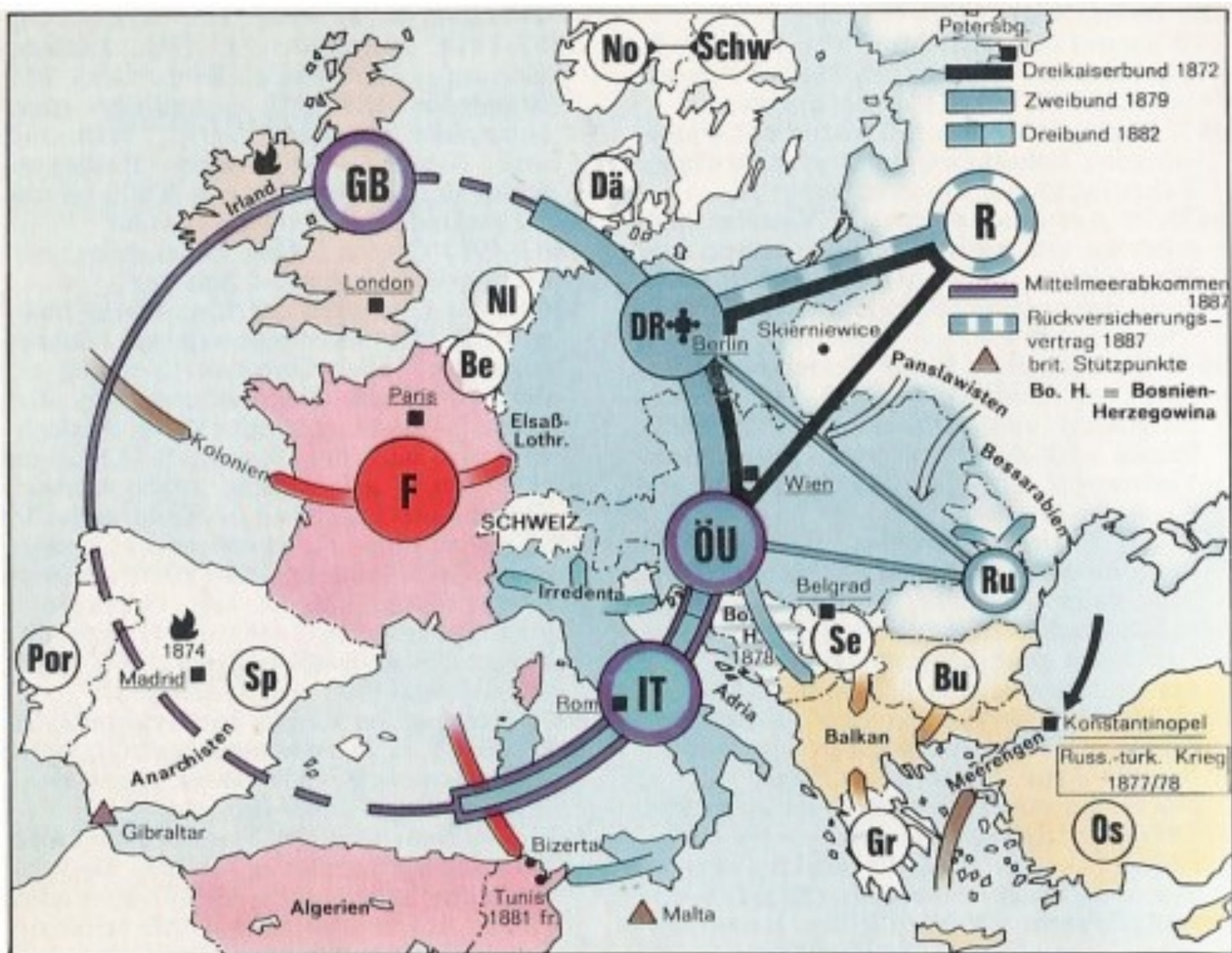


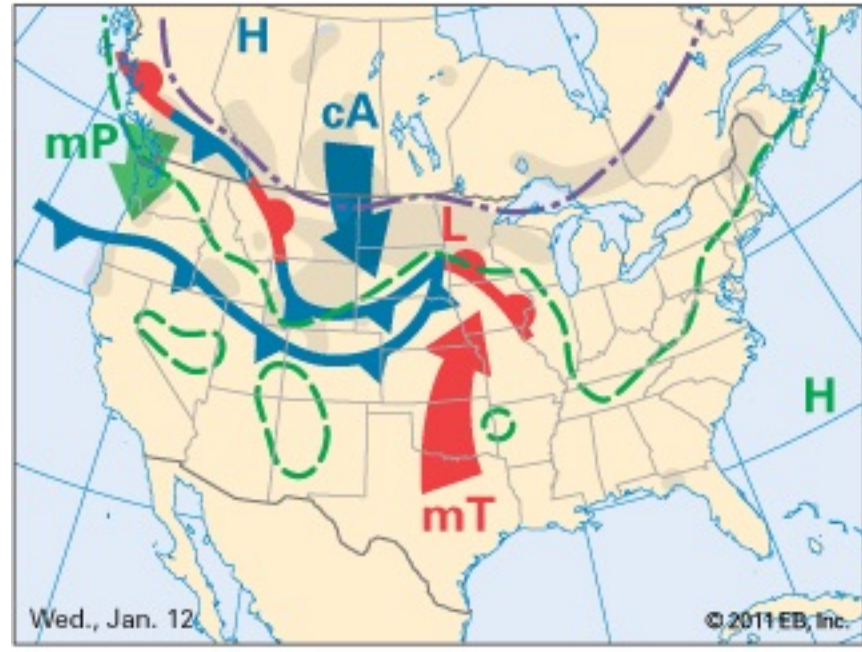
here!



How to communicate findings?



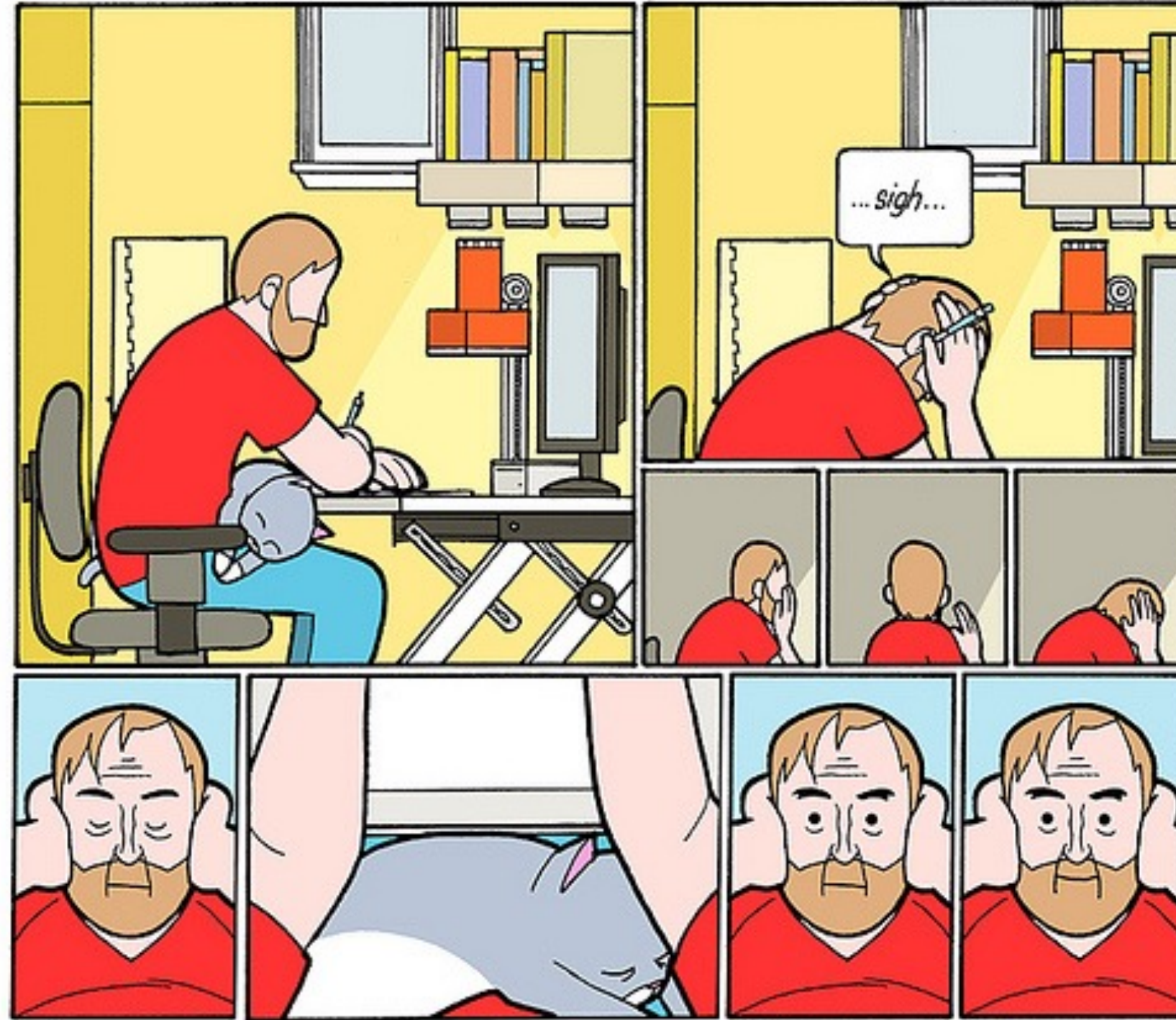




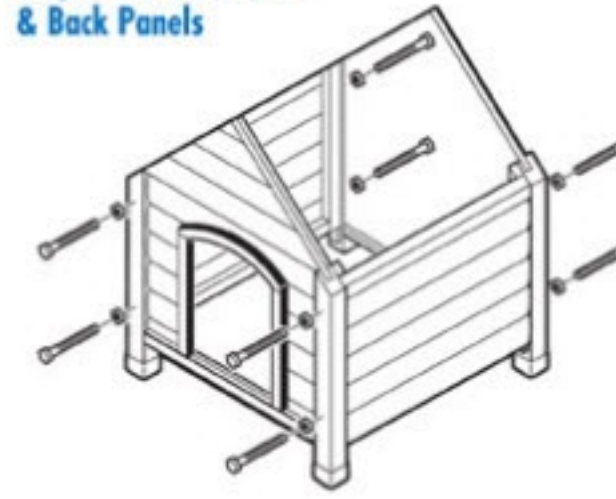
Day 1



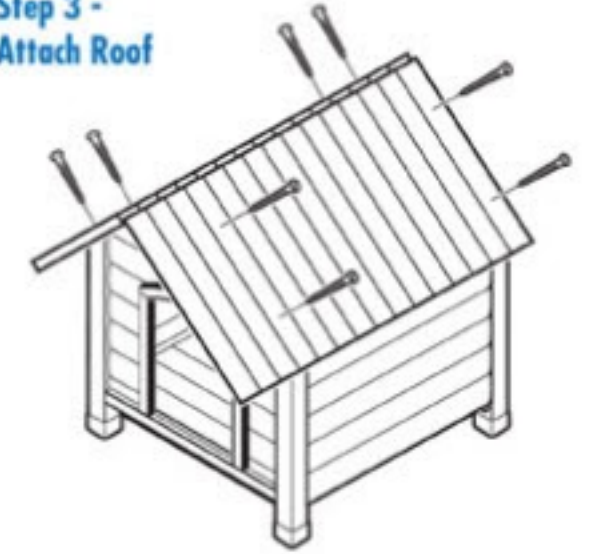
Day 4



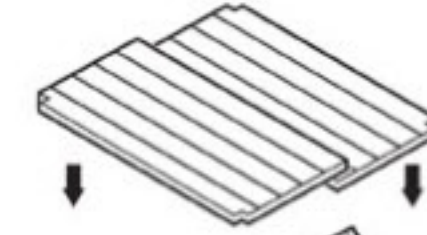
Step 1 - Secure Front & Back Panels



Step 3 - Attach Roof

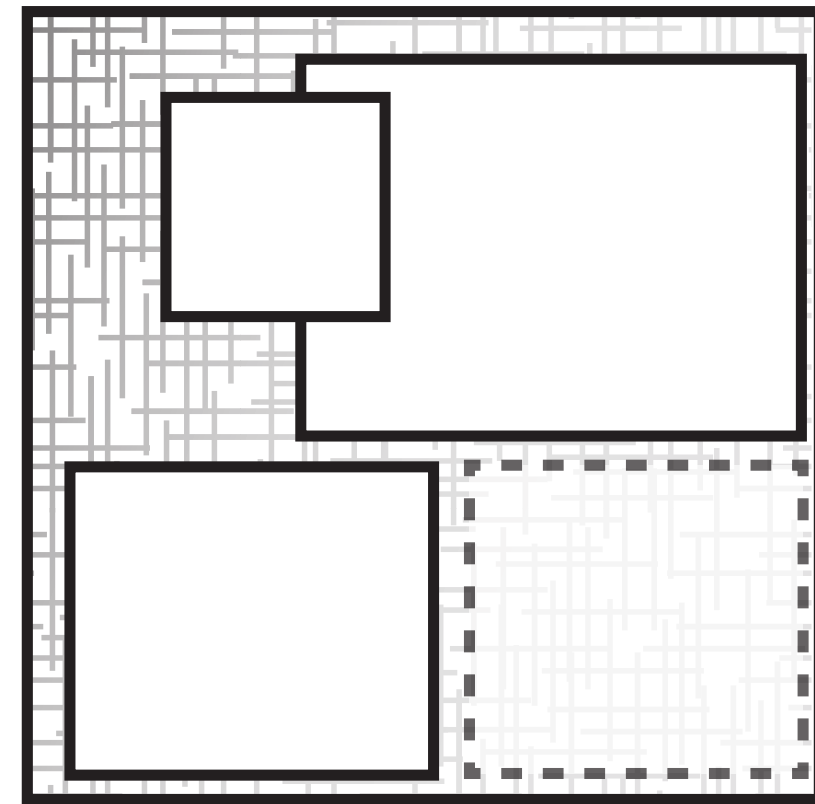


Step 2 - Drop in Floors

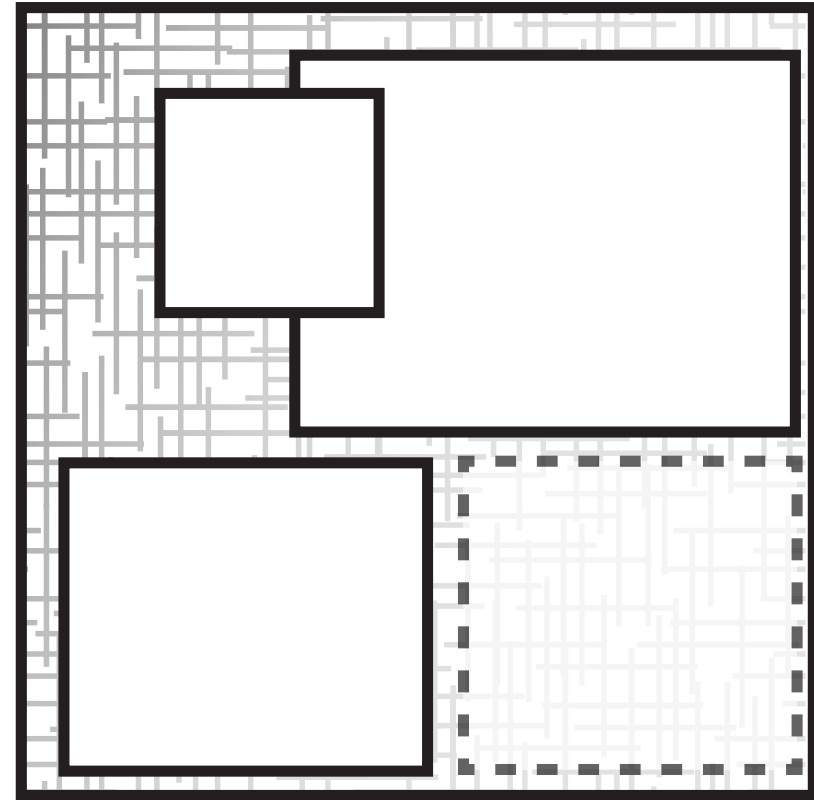


Step 4 - Secure Ridge Cap & Adjust Feet As Needed

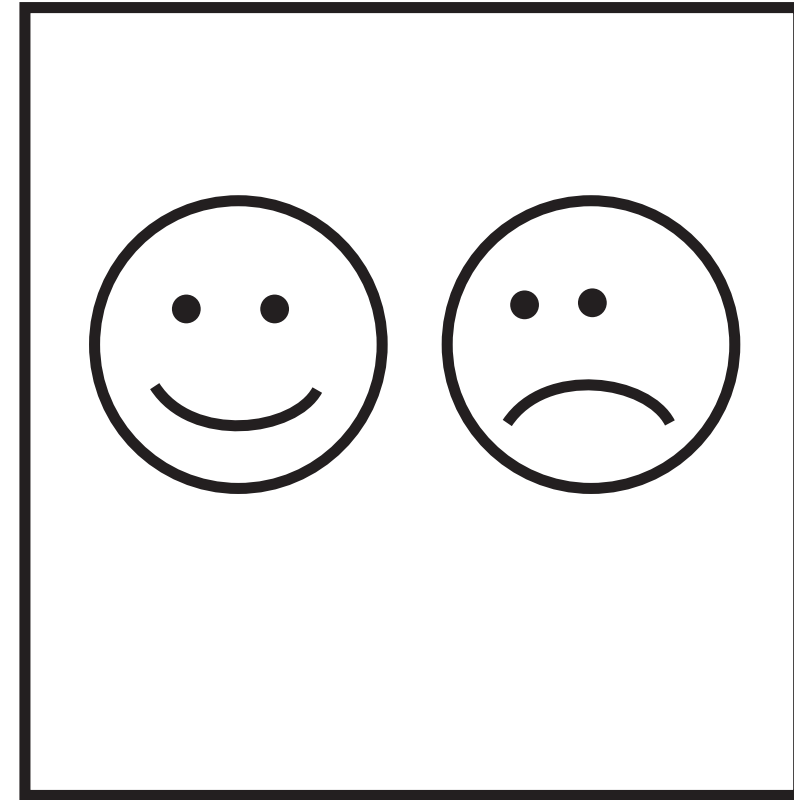




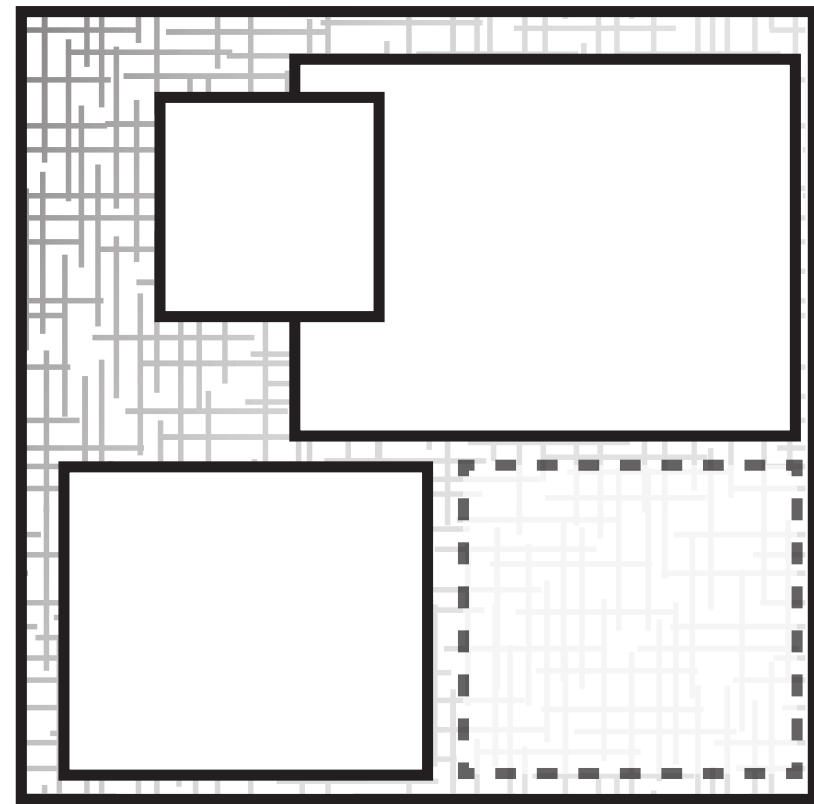
(a) Panels



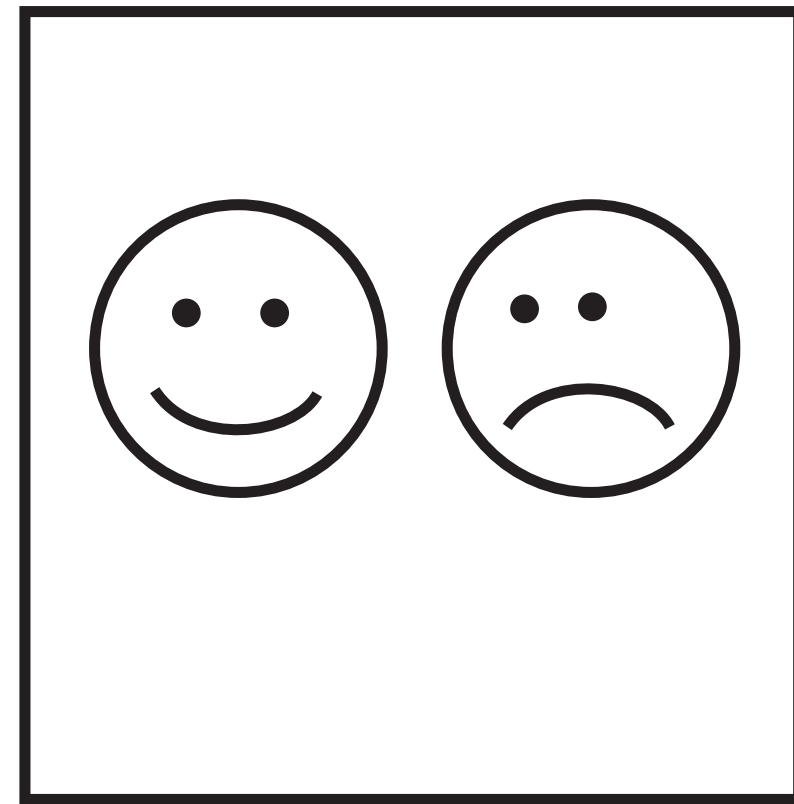
(a) Panels



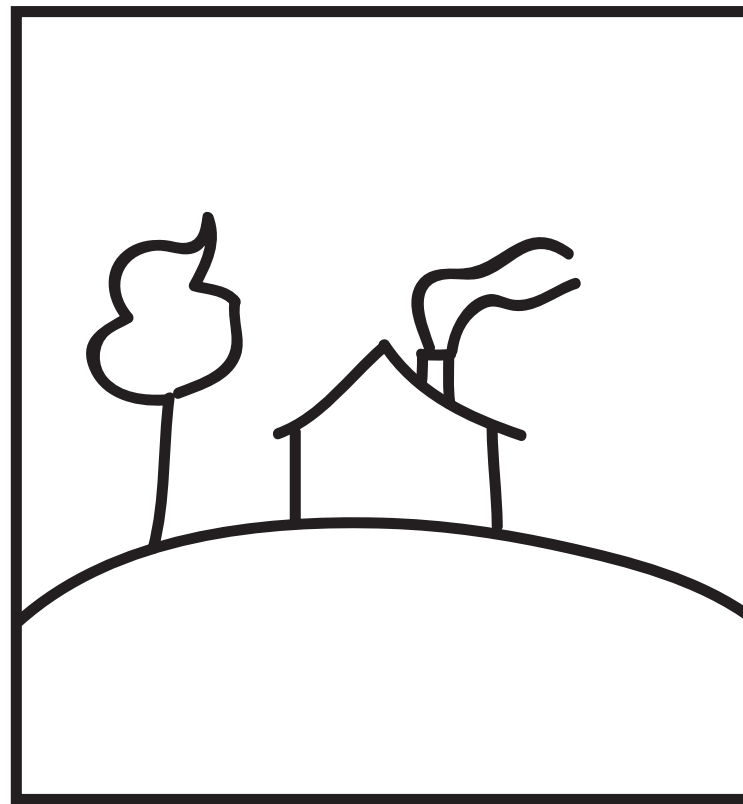
(b) Characters



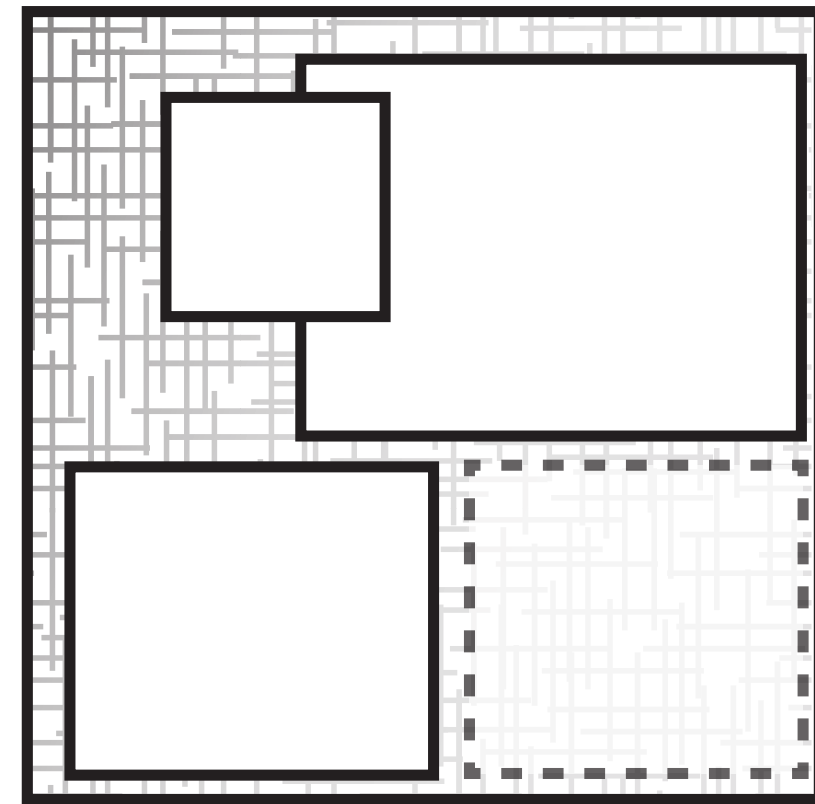
(a) Panels



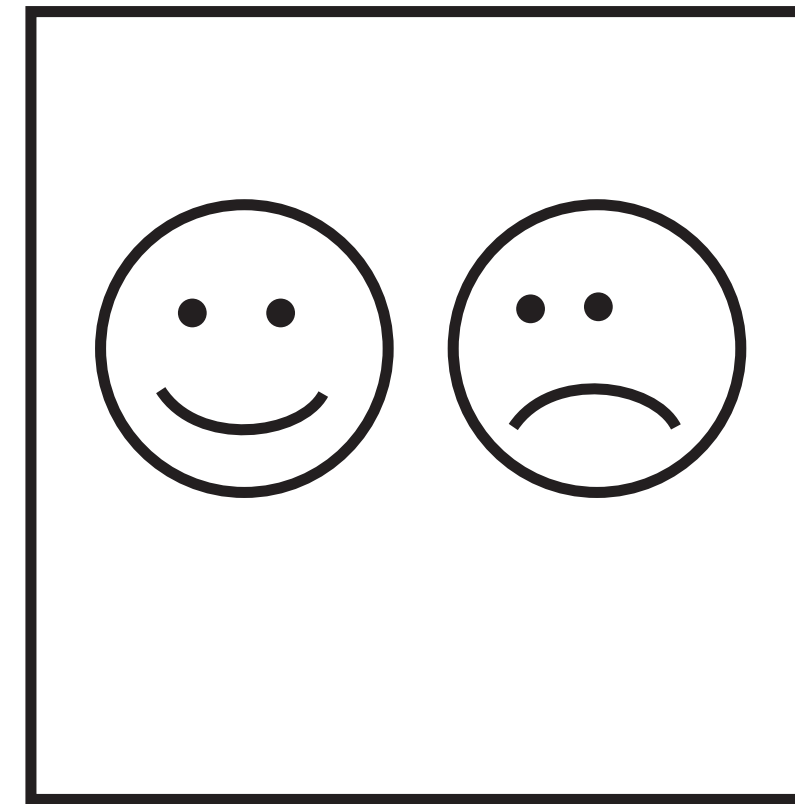
(b) Characters



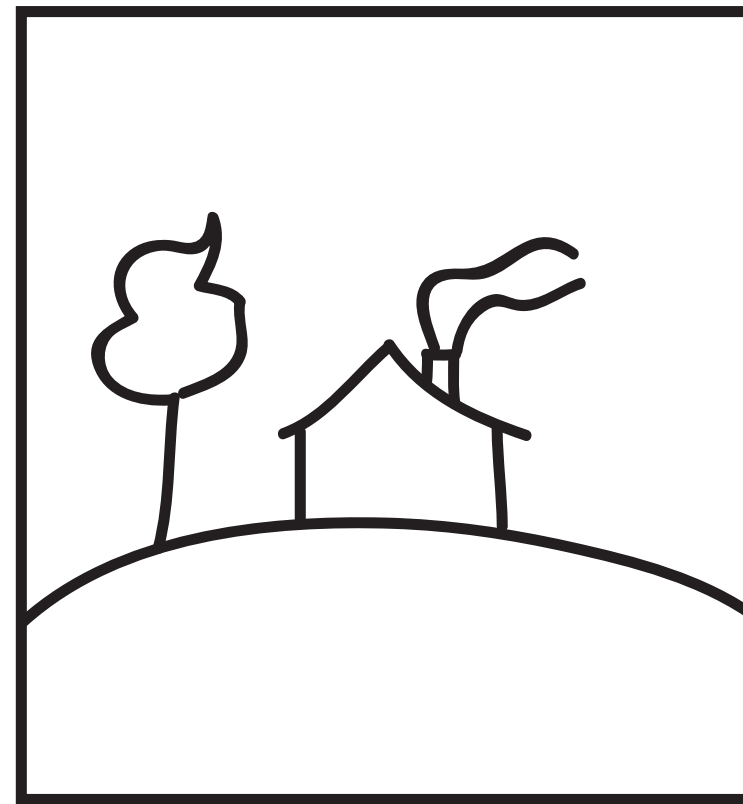
(c) World



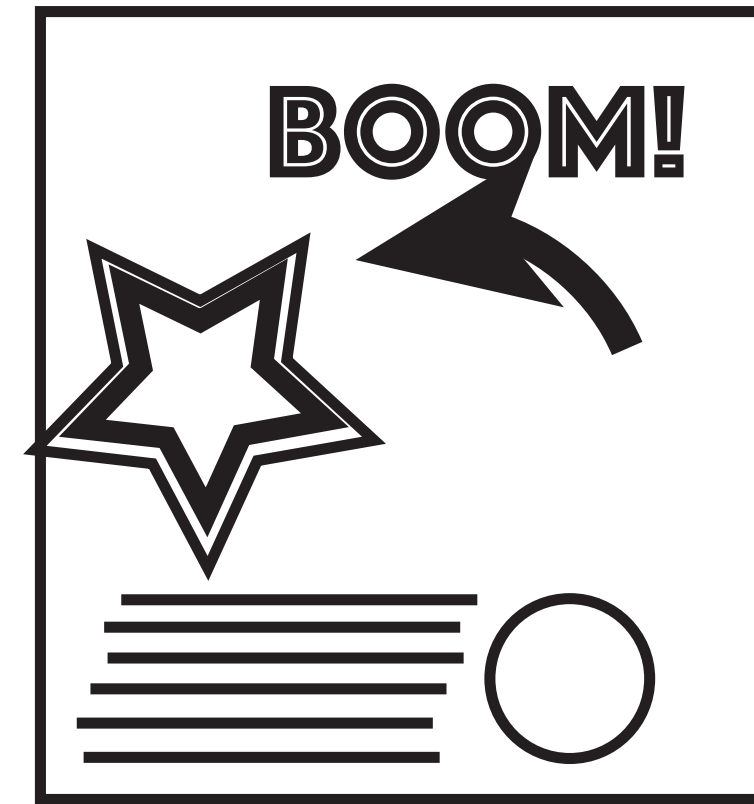
(a) Panels



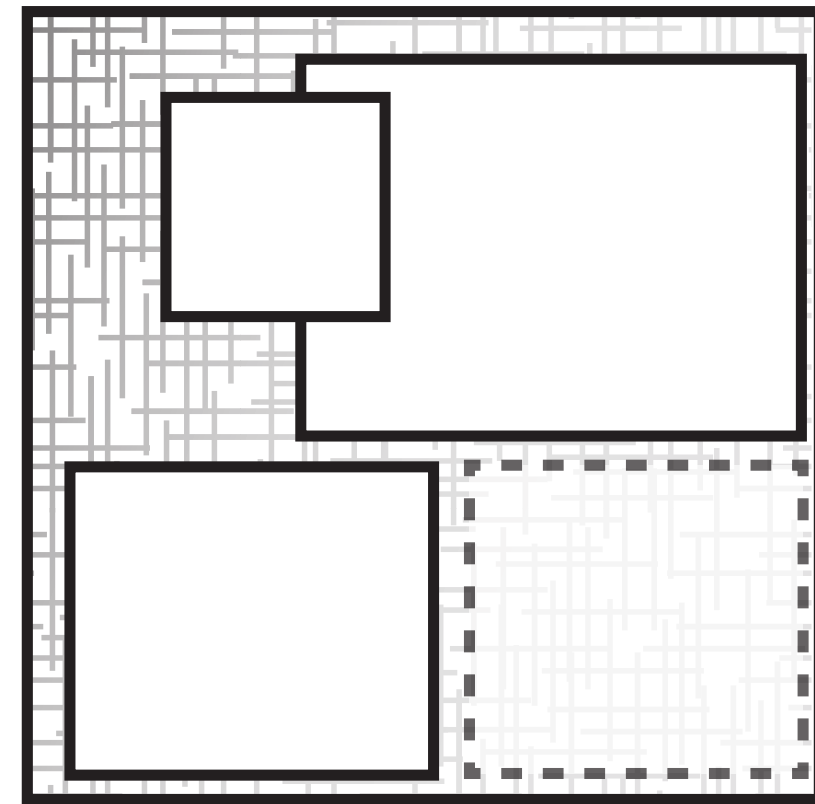
(b) Characters



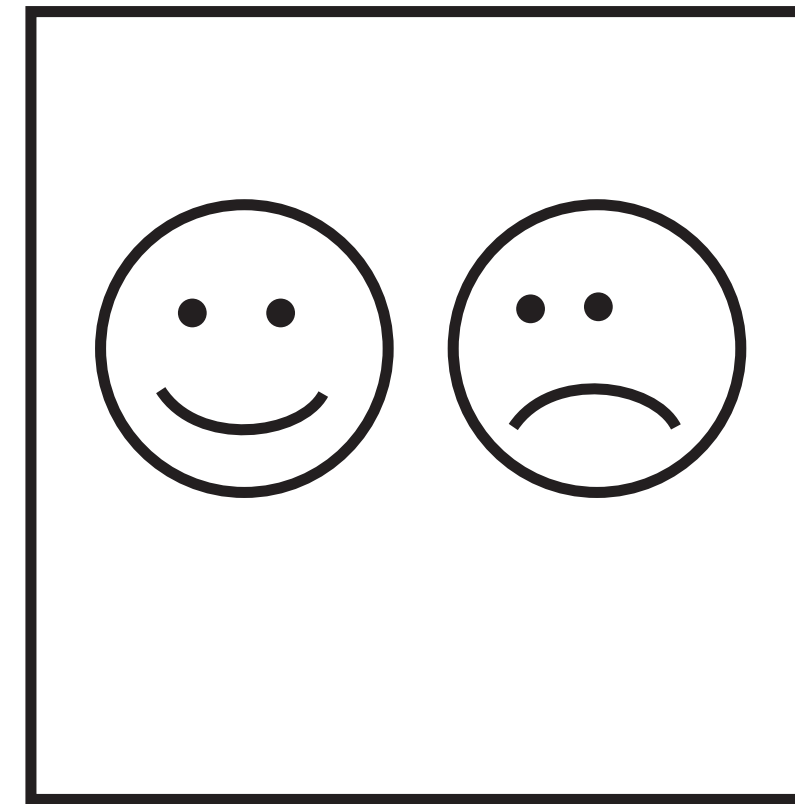
(c) World



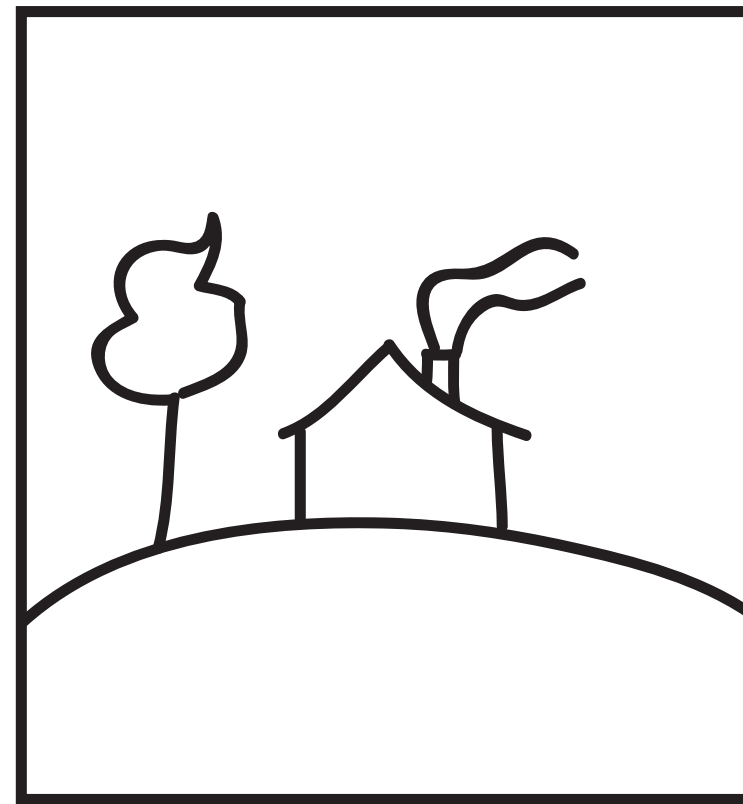
(d) Effects



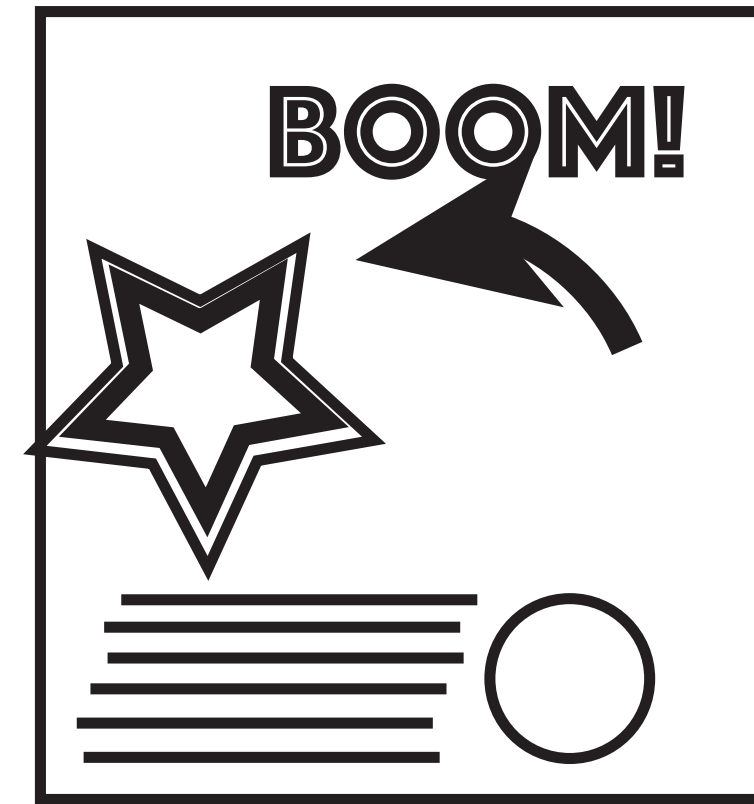
(a) Panels



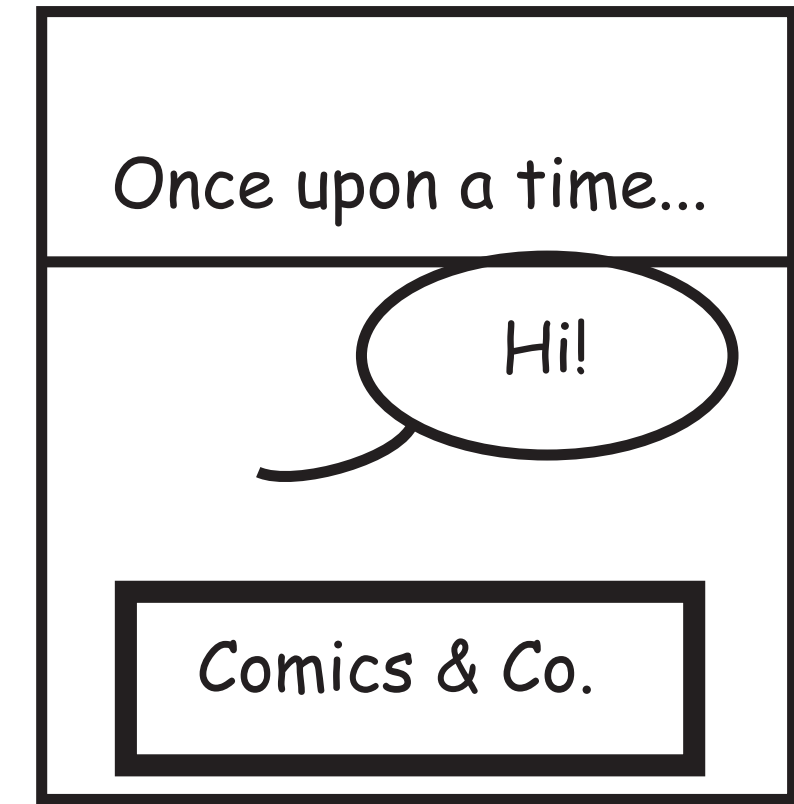
(b) Characters



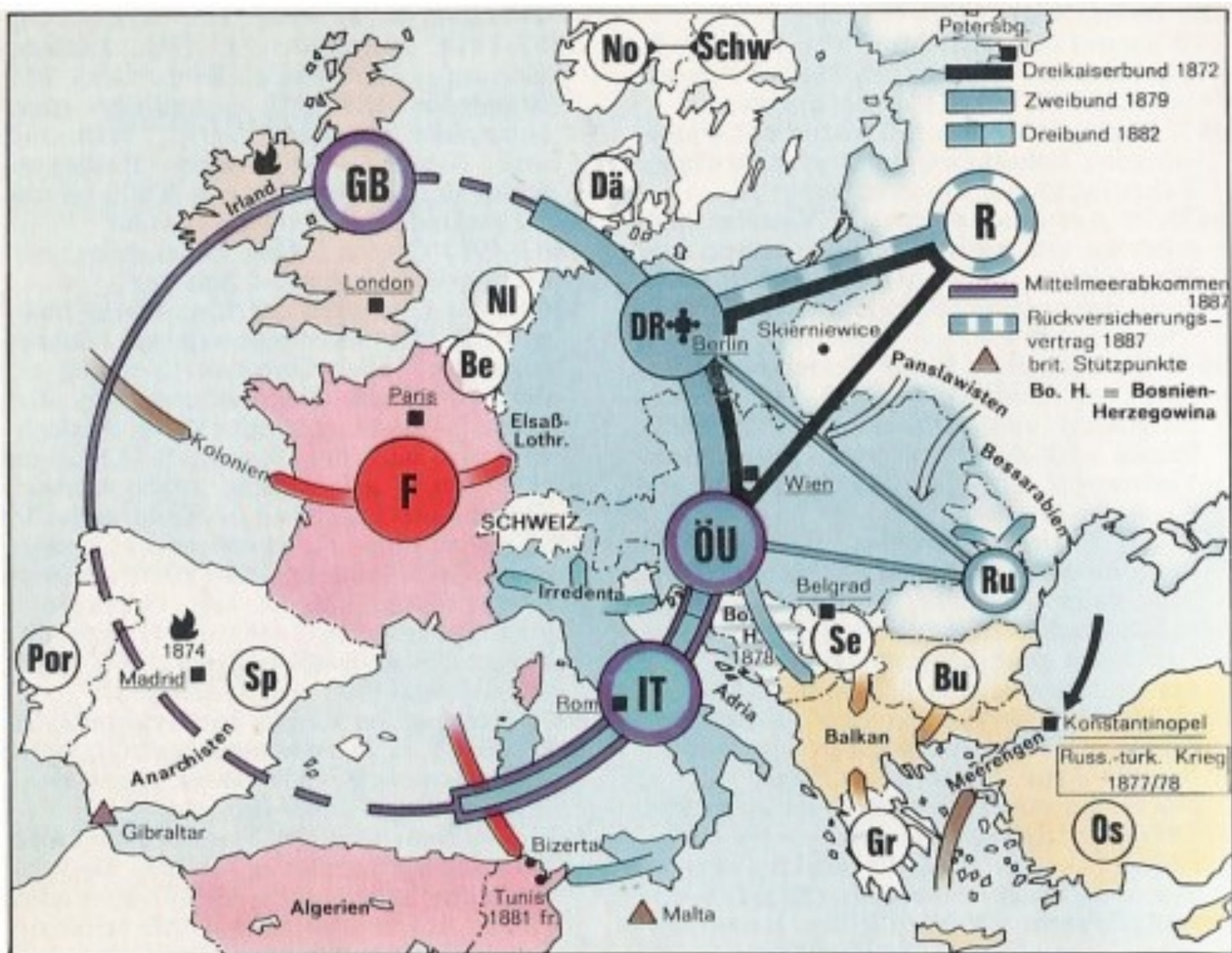
(c) World



(d) Effects



(e) Text



European Alliances before World War I (1836-1914)

| | | | |
|--|--|---|---|
| <p>1836 Imperial powers in Europe in the middle of the 19th century.</p> | <p>Britain signs a contract, supporting Belgium in case of violation of its neutrality.</p> <p>1837</p> | | |
| <p>German chancellor Bismarck manages ally Germany, Austria and Russia in the Three Emperors' Alliance, ...</p> <p>1873</p> | <p>... leaving France isolated against a well integrated Germany.</p> <p>1873 1879</p> | | |
| <p>However, increasing border disputes lead to the cancellation of that alliance, a few years later.</p> <p>1879</p> | <p>Dual Alliance</p> <p>1879</p> | <p>Triple Alliance</p> <p>1882</p> | |
| <p>France needs to escape isolation.</p> <p>1894</p> | <p>Franco-Russian Alliance</p> <p>1894</p> | <p>Entente Cordiale</p> <p>1904</p> | <p>Triple Entente</p> <p>1907</p> |

In 1907 the most important European powers are divided into major alliances. On the Balkan, Serbia, Austria Greece and the Ottoman empire gamble for influence.

1907

Triple Entente

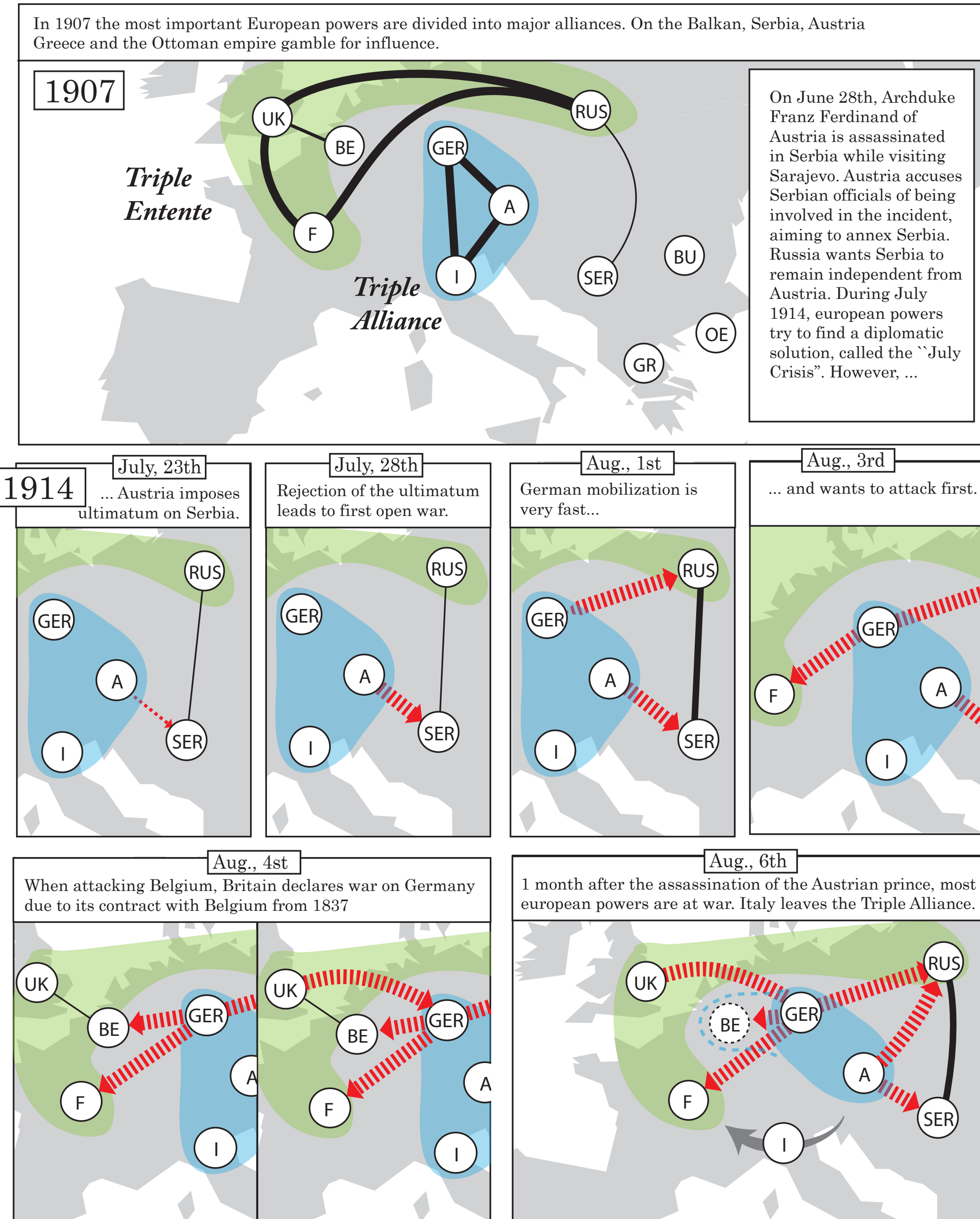
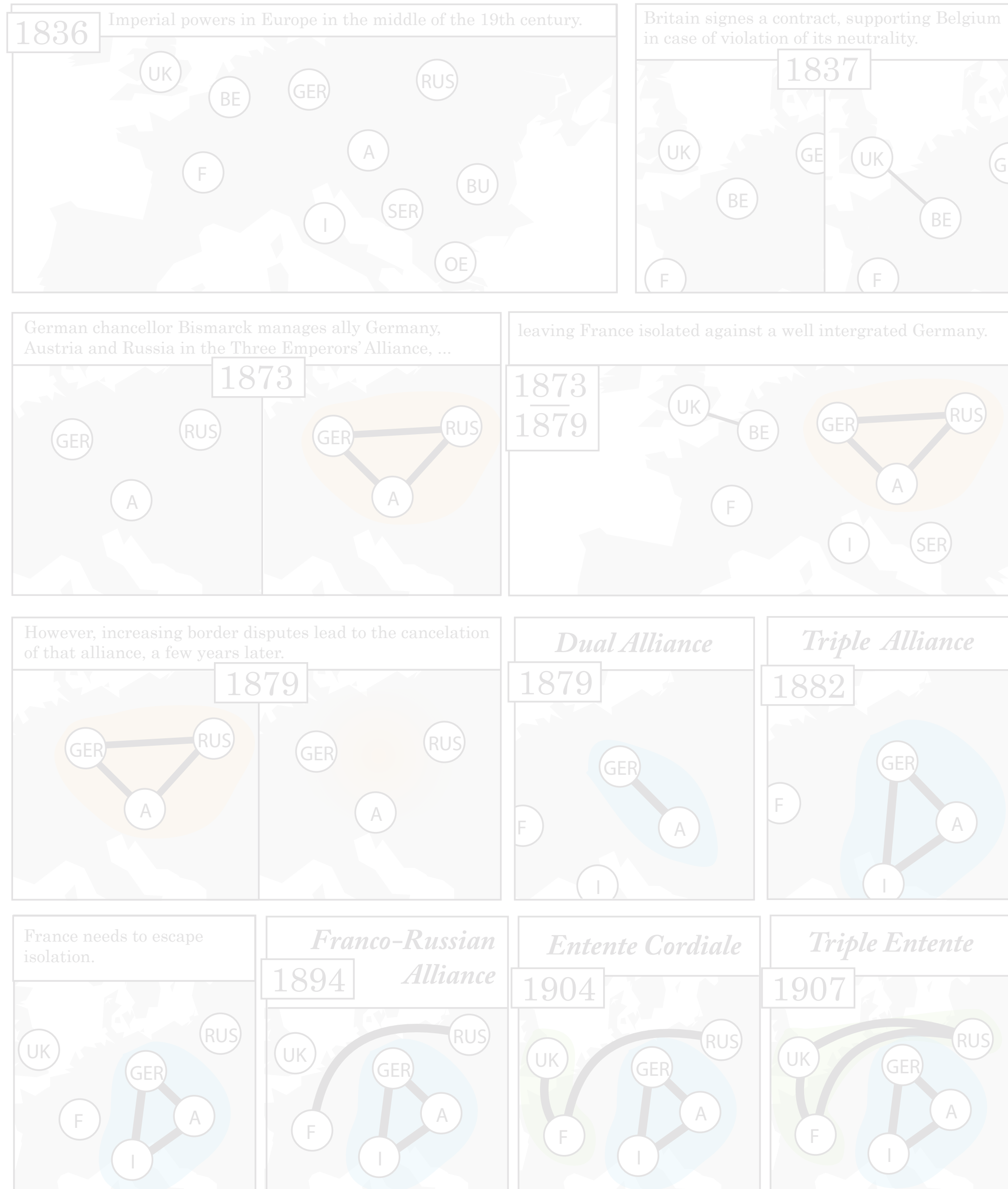
Triple Alliance

On June 28th, Archduke Franz Ferdinand of Austria is assassinated in Serbia while visiting Sarajevo. Austria accuses Serbian officials of being involved in the incident, aiming to annex Serbia. Russia wants Serbia to remain independent from Austria. During July 1914, european powers try to find a diplomatic solution, called the "July Crisis". However, ...

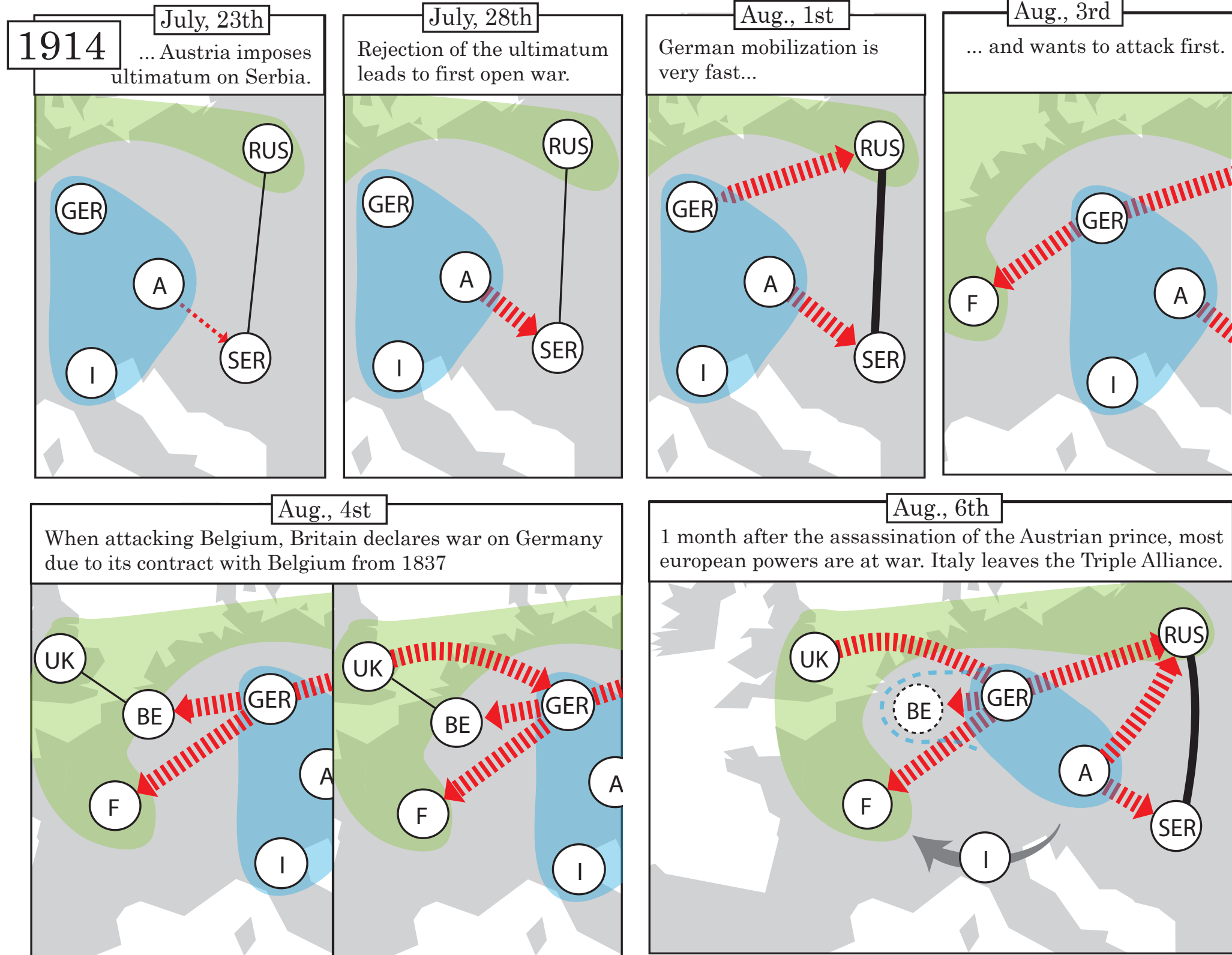
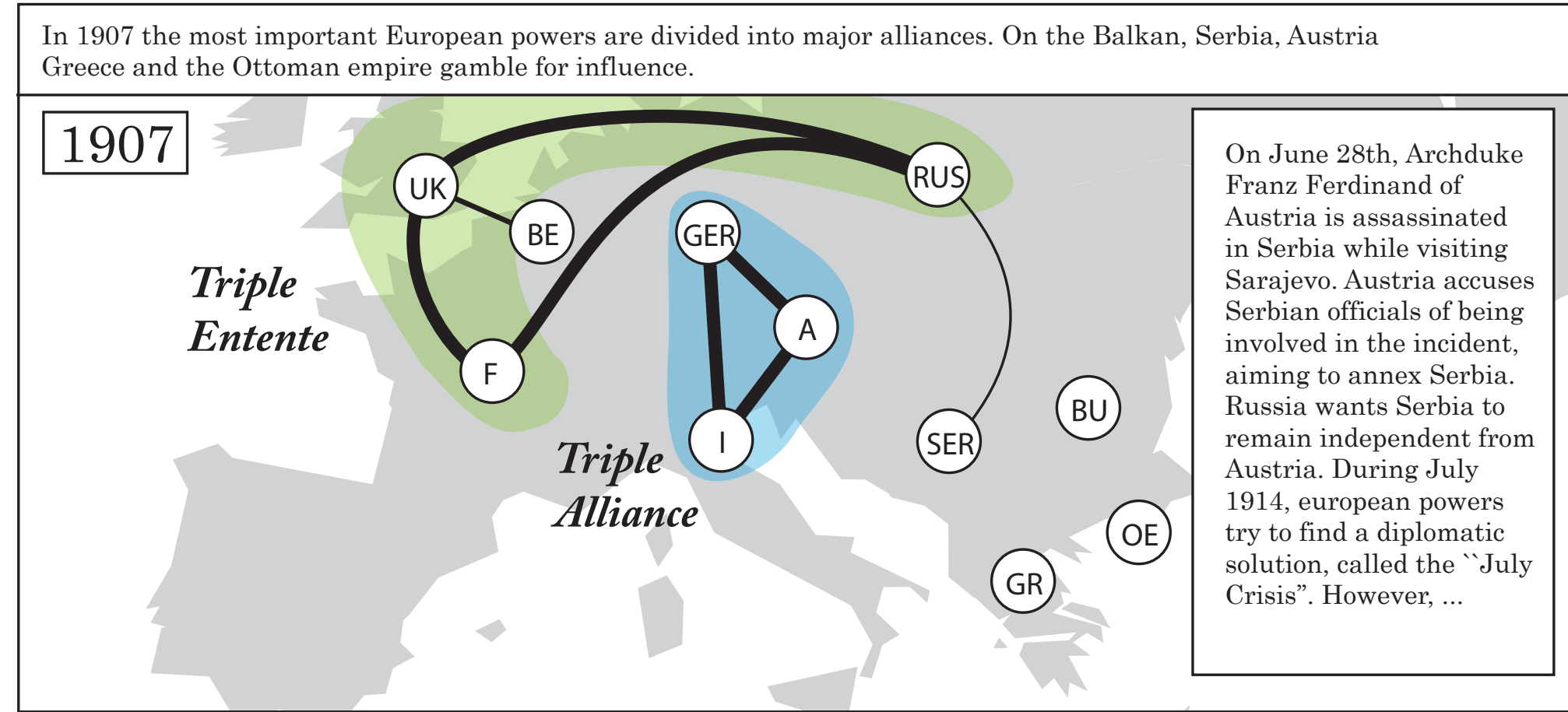
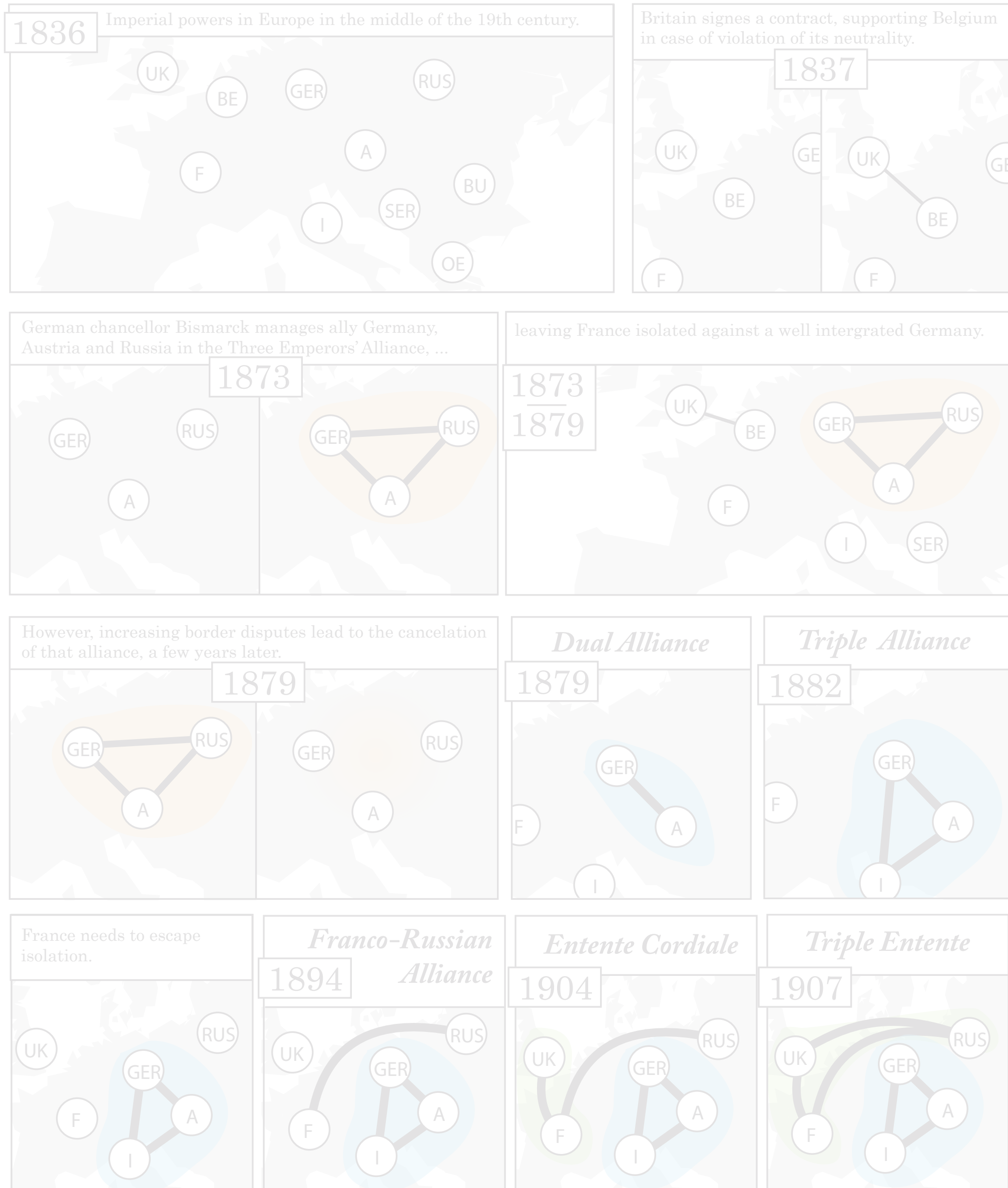
1914

| | | | |
|--|--|---|--|
| <p>July, 23th ... Austria imposes ultimatum on Serbia.</p> | <p>July, 28th Rejection of the ultimatum leads to first open war.</p> | <p>Aug., 1st German mobilization is very fast...</p> | <p>Aug., 3rd ... and wants to attack first.</p> |
| <p>Aug., 4th When attacking Belgium, Britain declares war on Germany due to its contract with Belgium from 1837</p> | <p>Aug., 6th 1 month after the assassination of the Austrian prince, most european powers are at war. Italy leaves the Triple Alliance.</p> | | |

European Alliances before World War I (1836-1914)

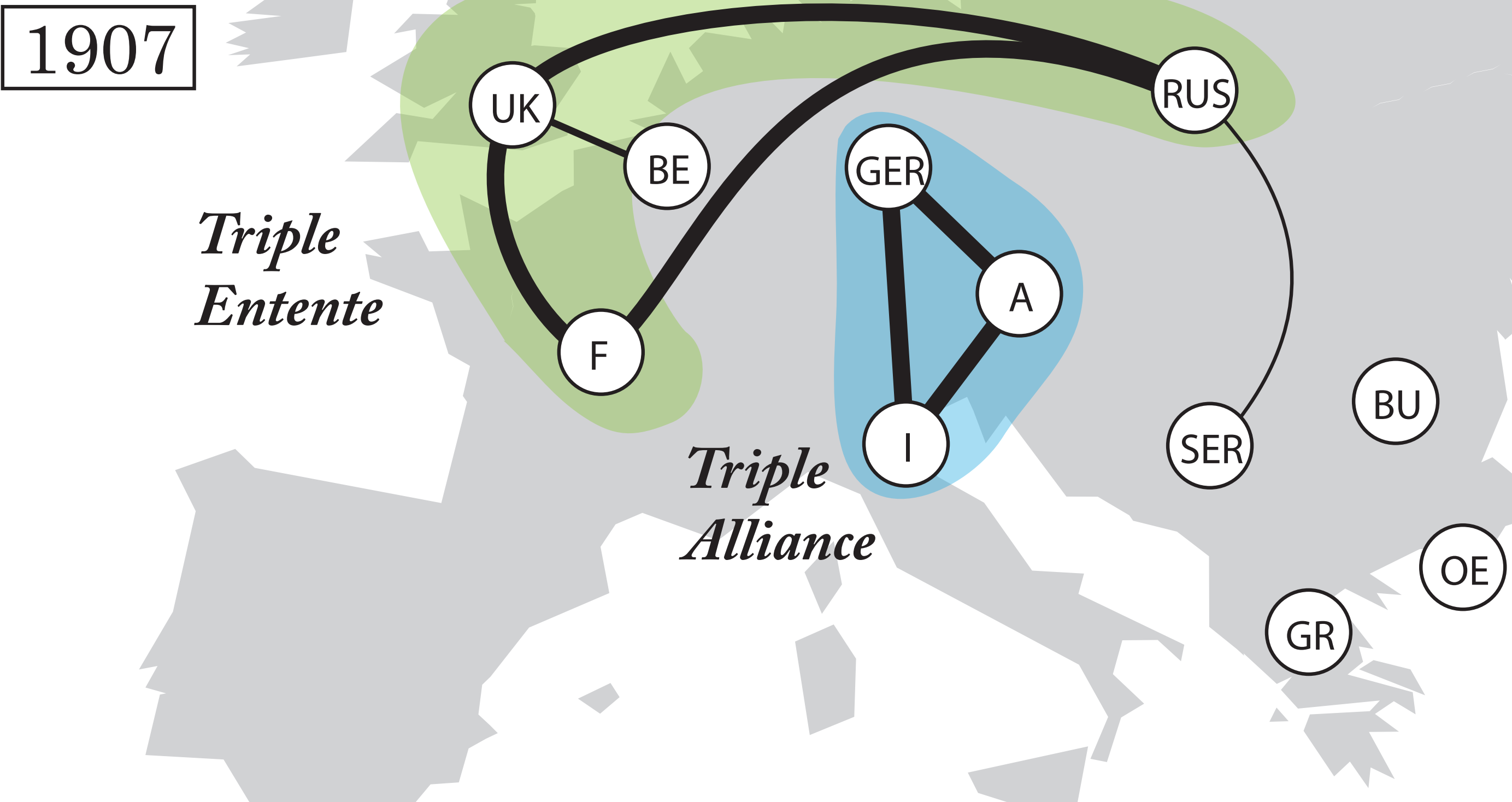


European Alliances before World War I (1836-1914)

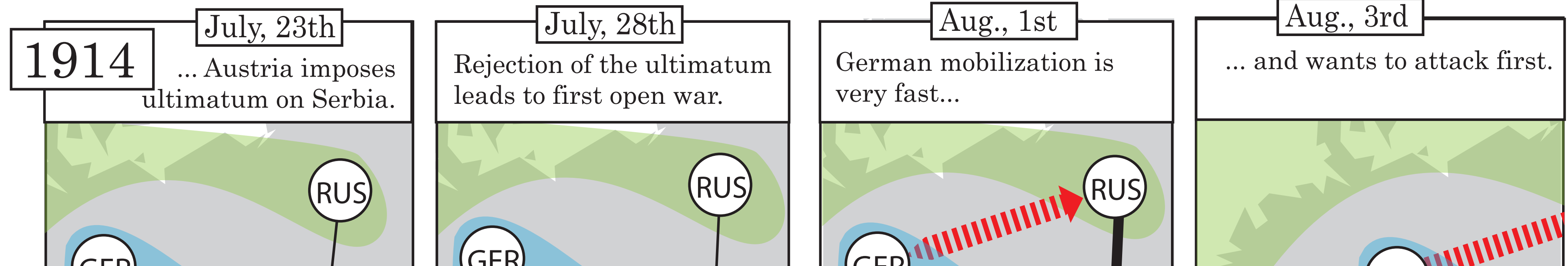


1906-1914)

In 1907 the most important European powers are divided into major alliances. On the Balkan, Serbia, Austria Greece and the Ottoman empire gamble for influence.



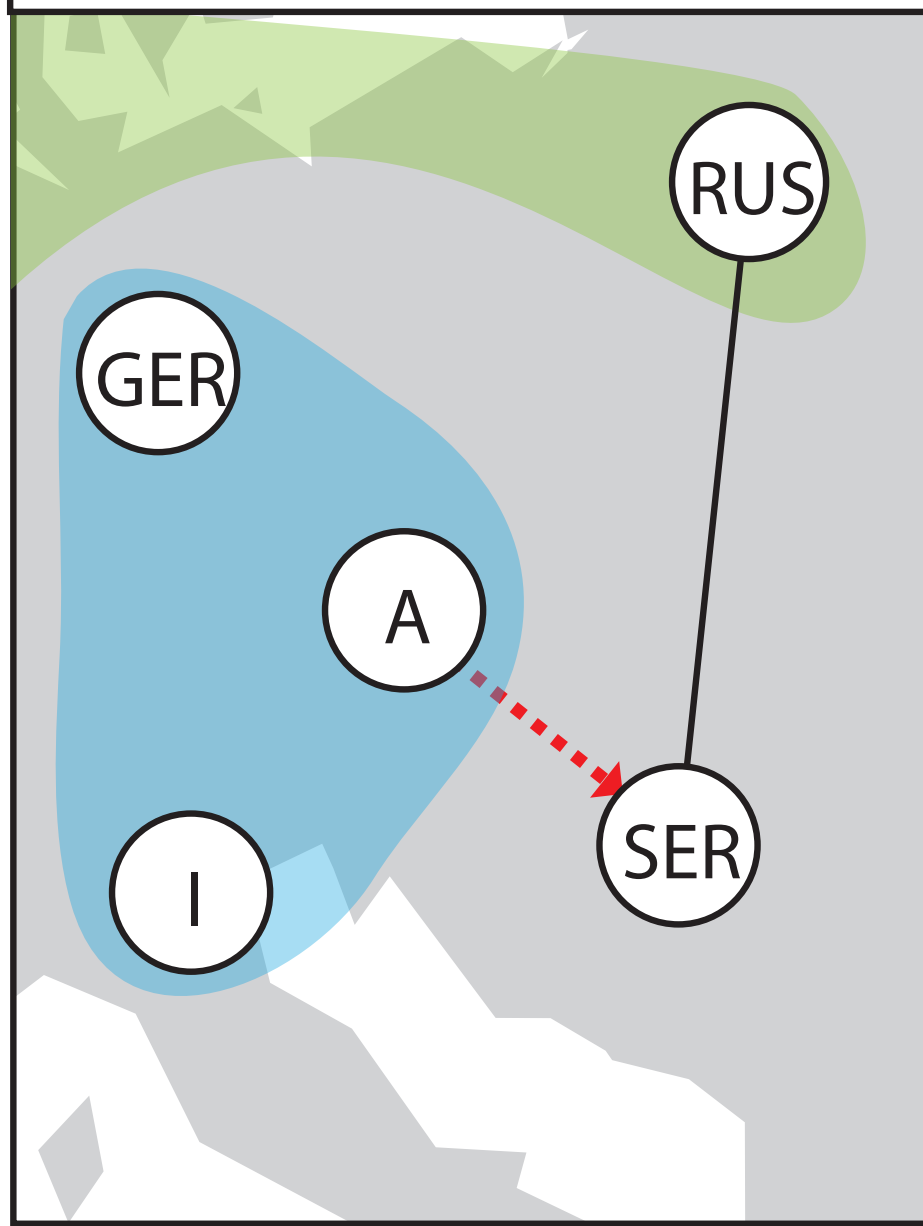
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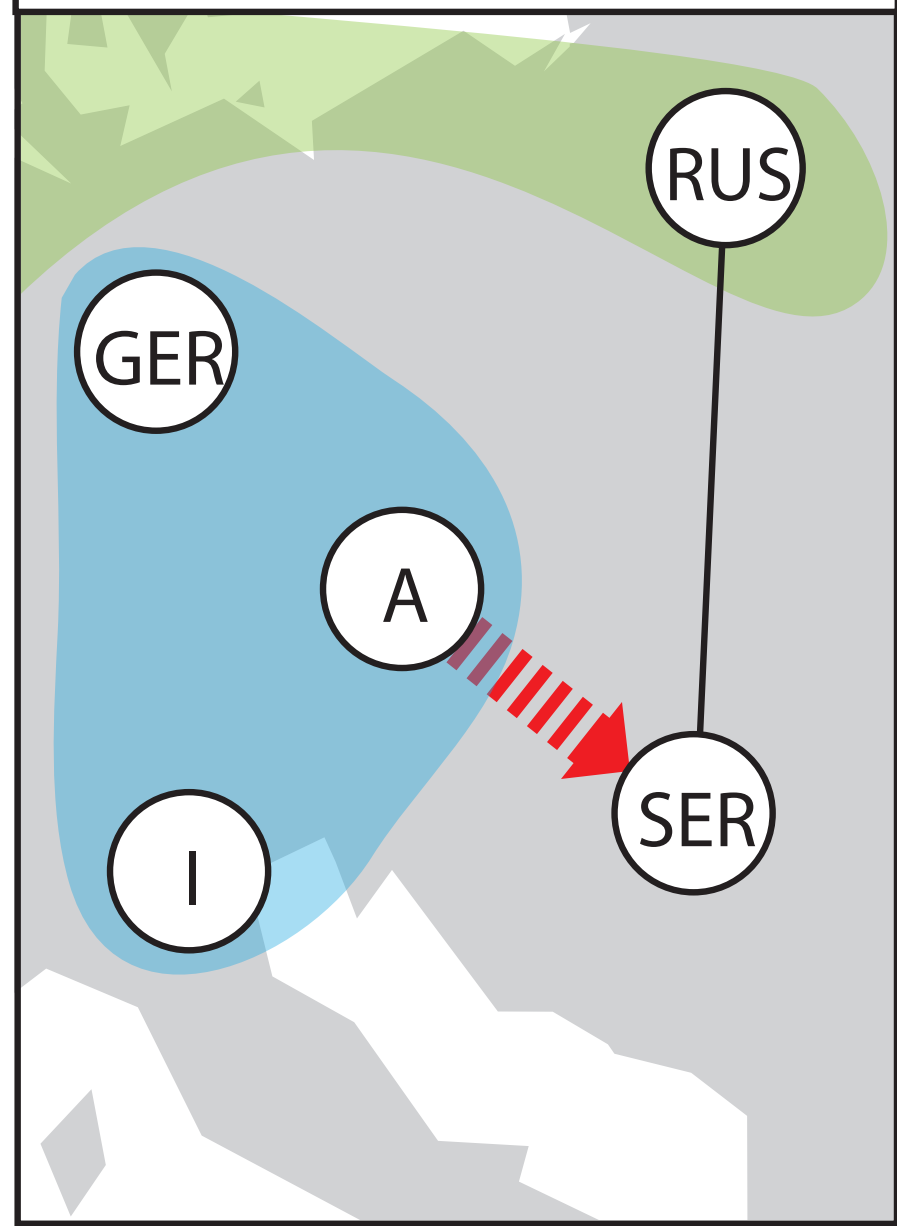
Triple Alliance

Russia wants Serbia to remain independent from Austria. During July 1914, european powers try to find a diplomatic solution, called the "July Crisis". However, ...

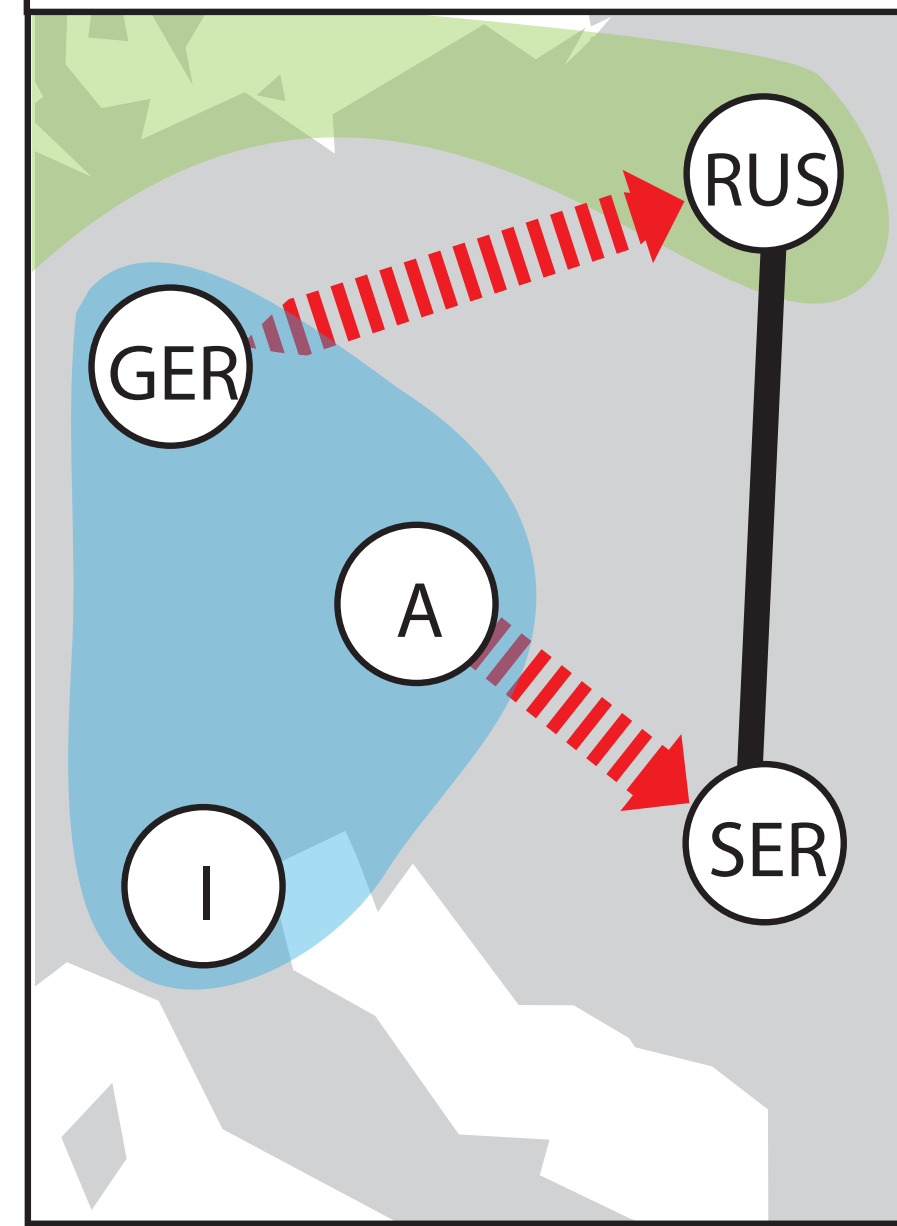
1914 July, 23th
... Austria imposes ultimatum on Serbia.



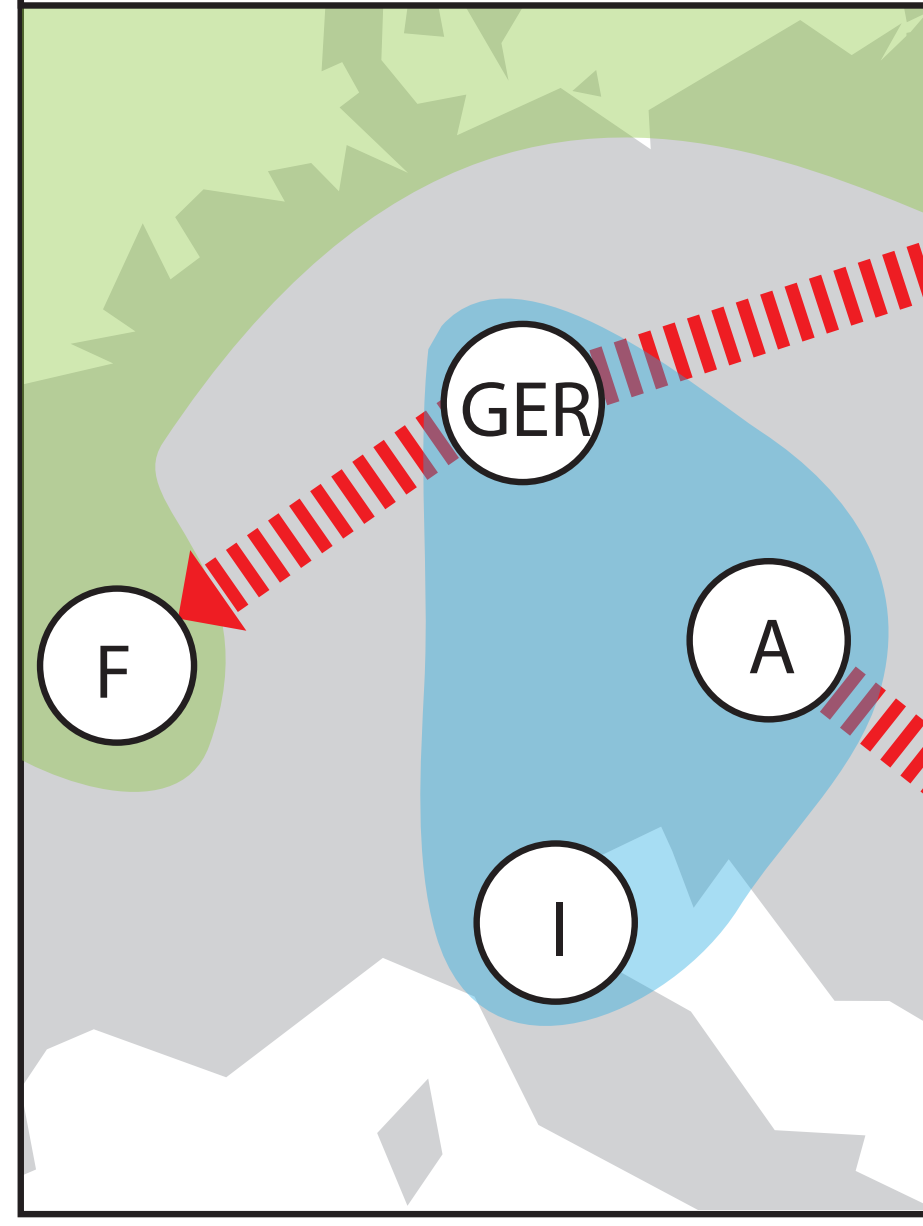
July, 28th
Rejection of the ultimatum leads to first open war.



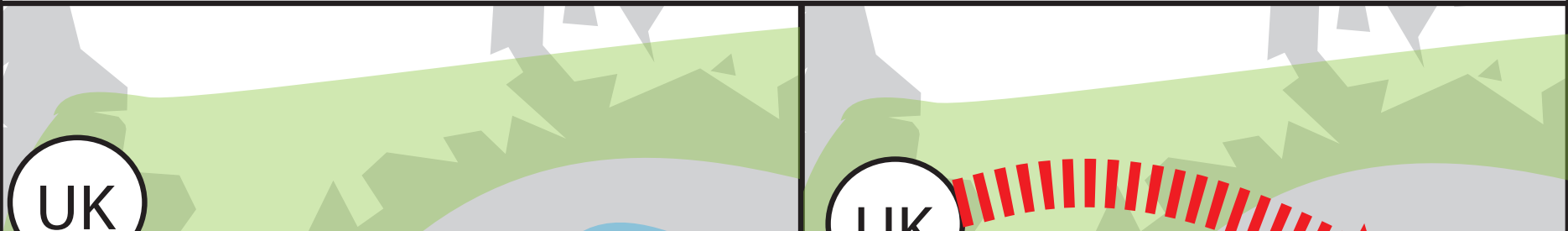
Aug., 1st
German mobilization is very fast...



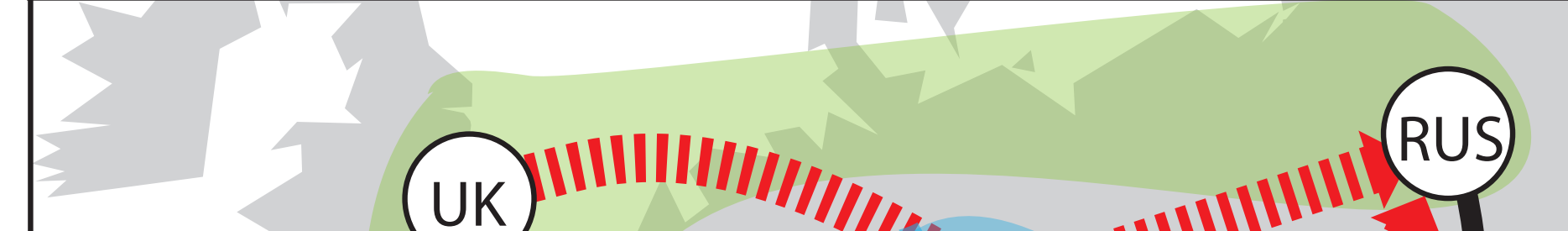
Aug., 3rd
... and wants to attack first.



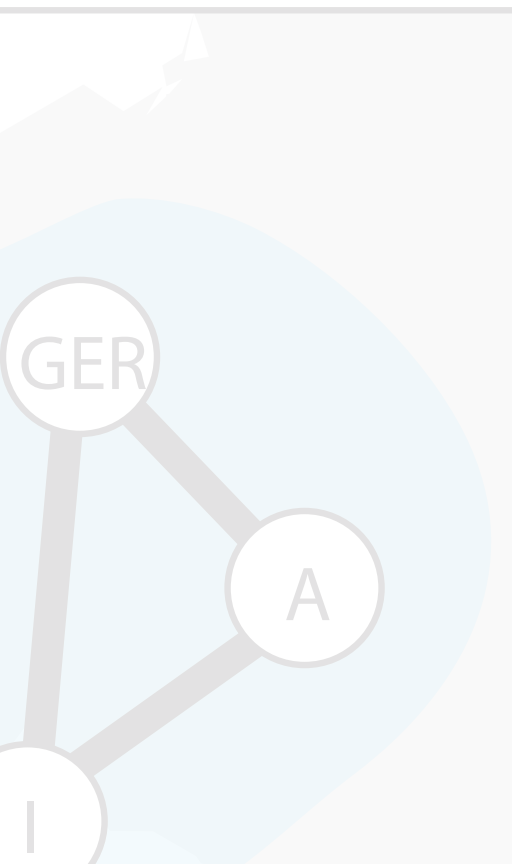
Aug., 4th
When attacking Belgium, Britain declares war on Germany due to its contract with Belgium from 1837



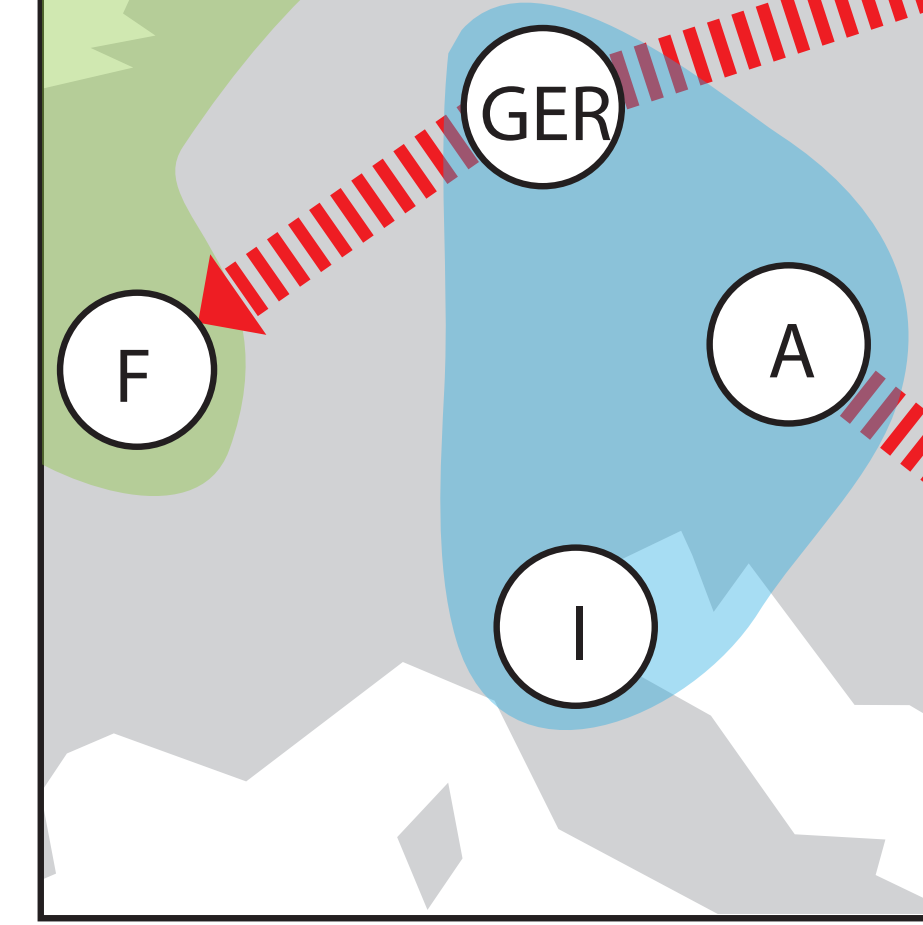
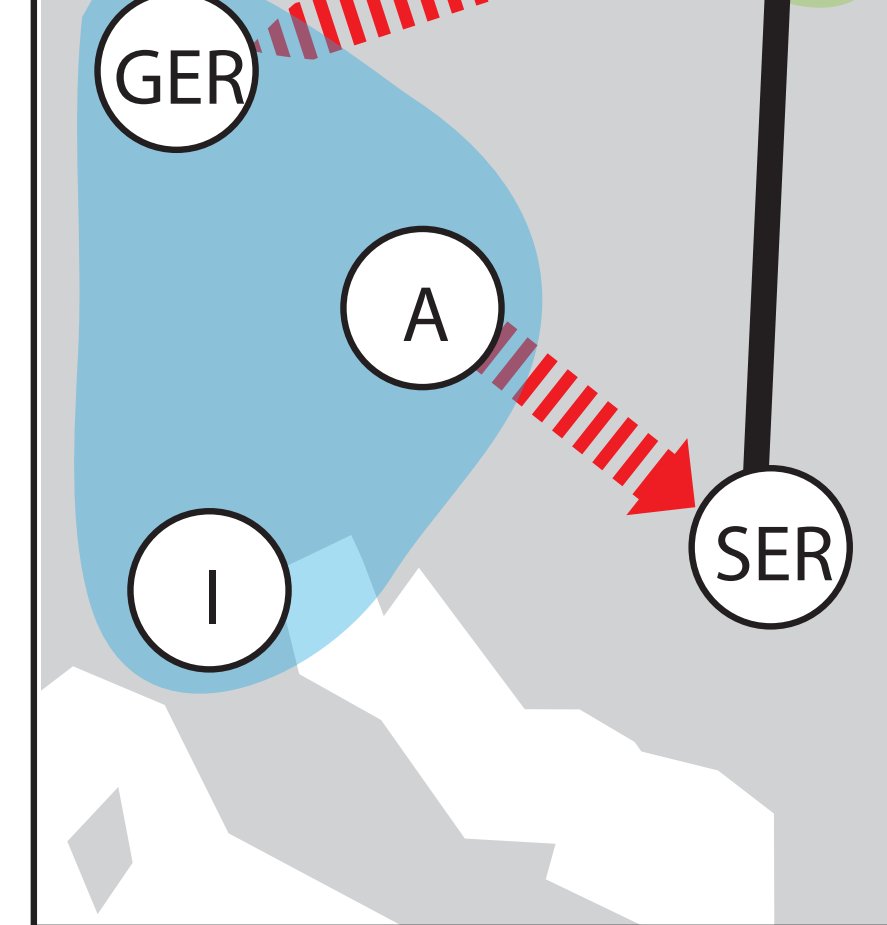
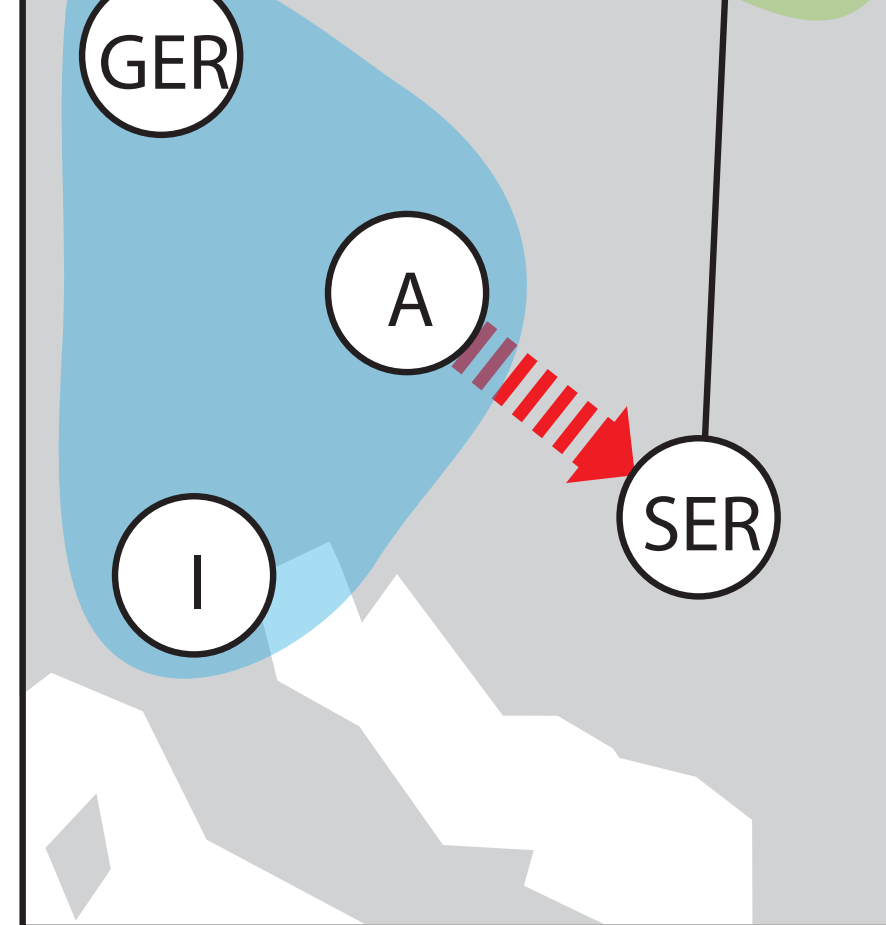
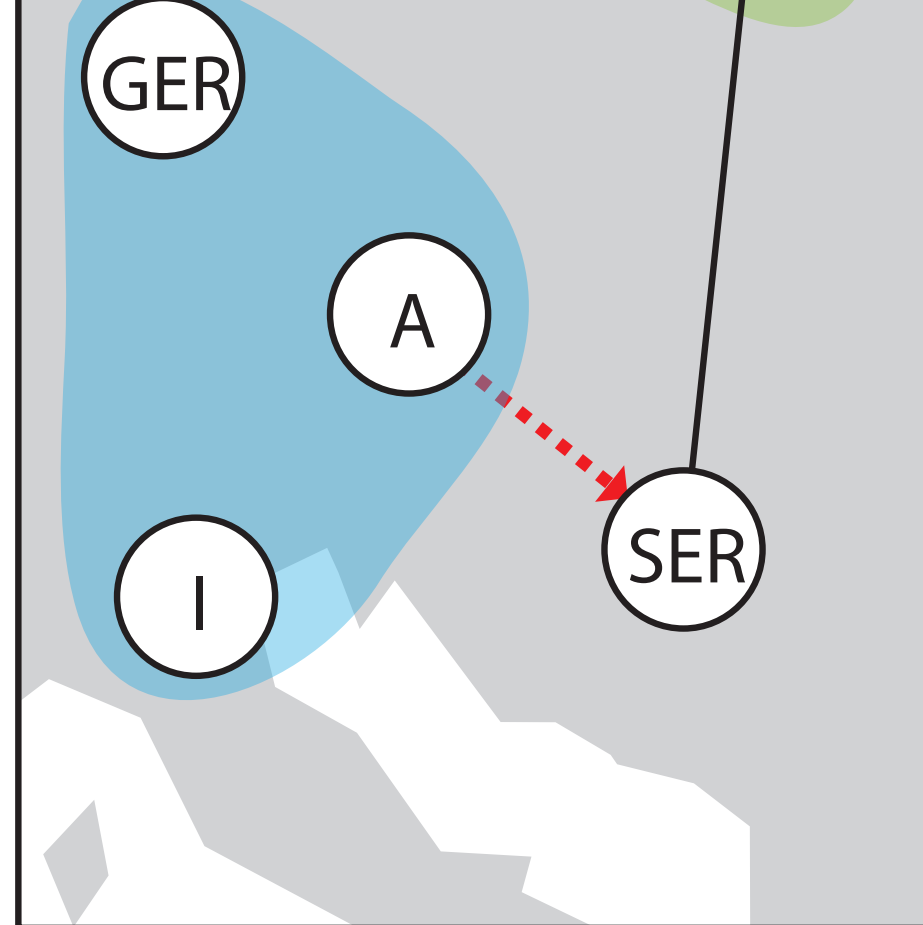
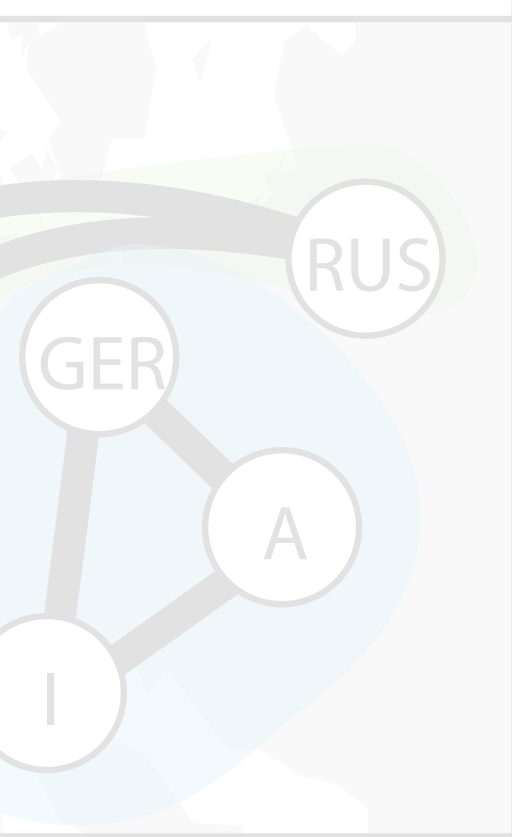
Aug., 6th
1 month after the assassination of the Austrian prince, most european powers are at war. Italy leaves the Triple Alliance.



Alliance

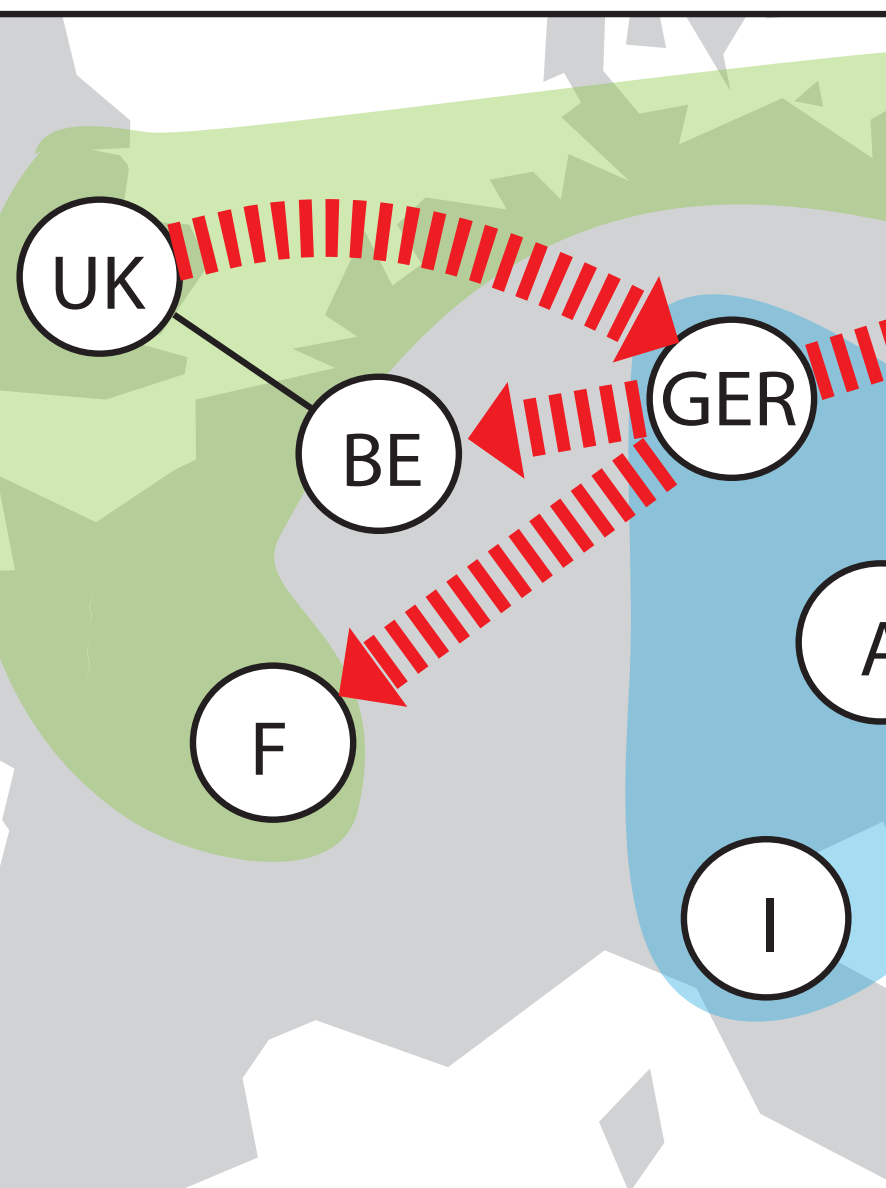
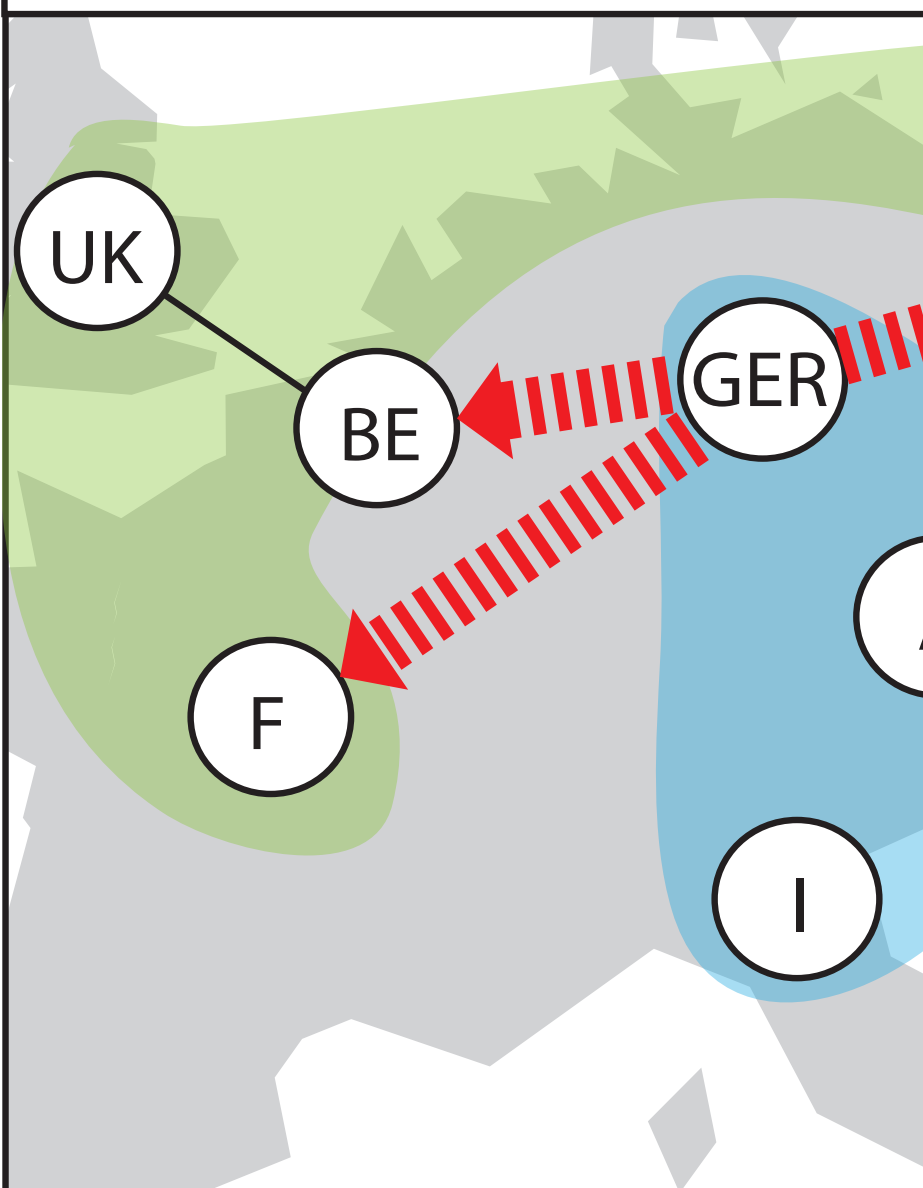


Entente



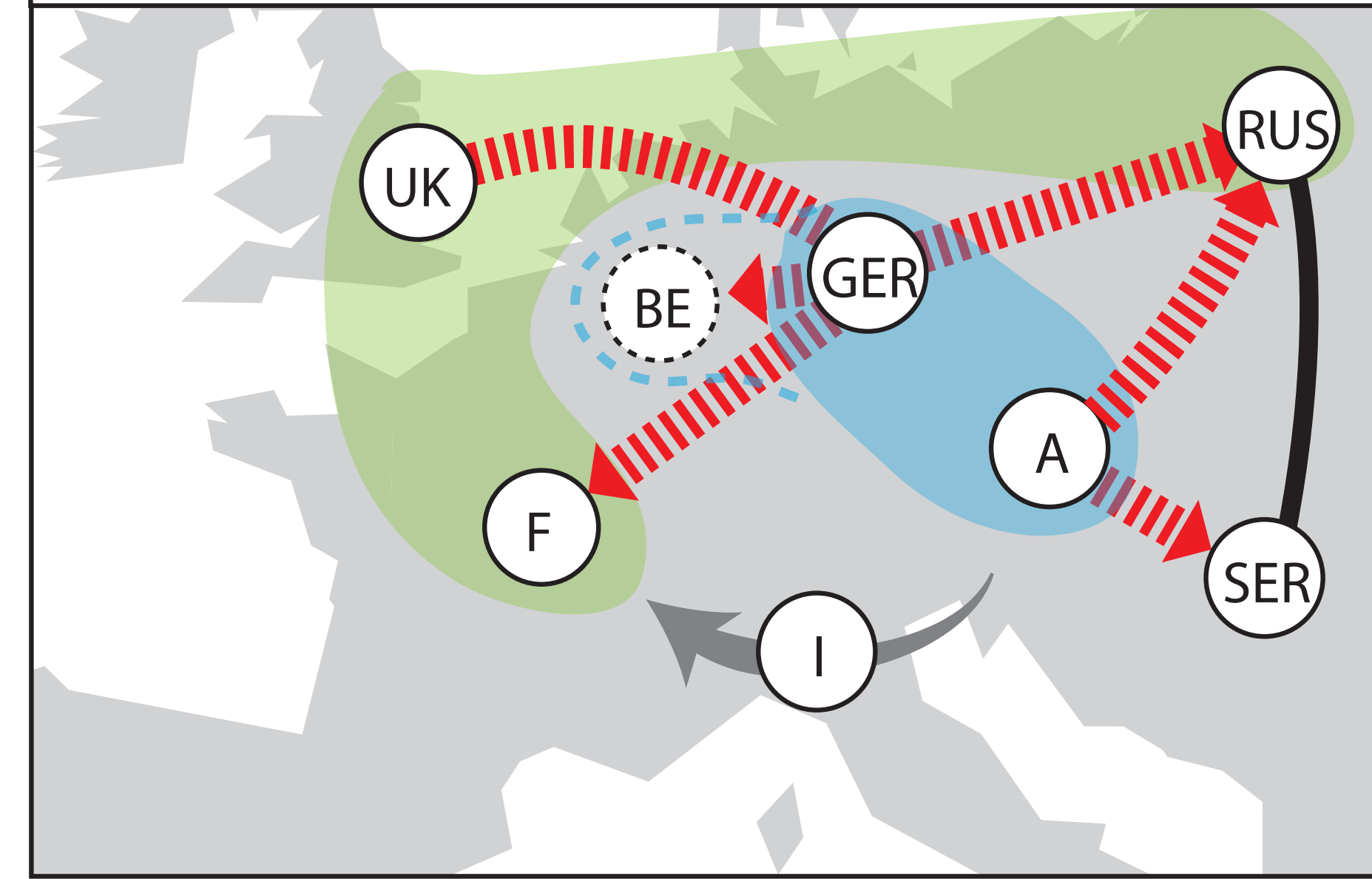
Aug., 4st

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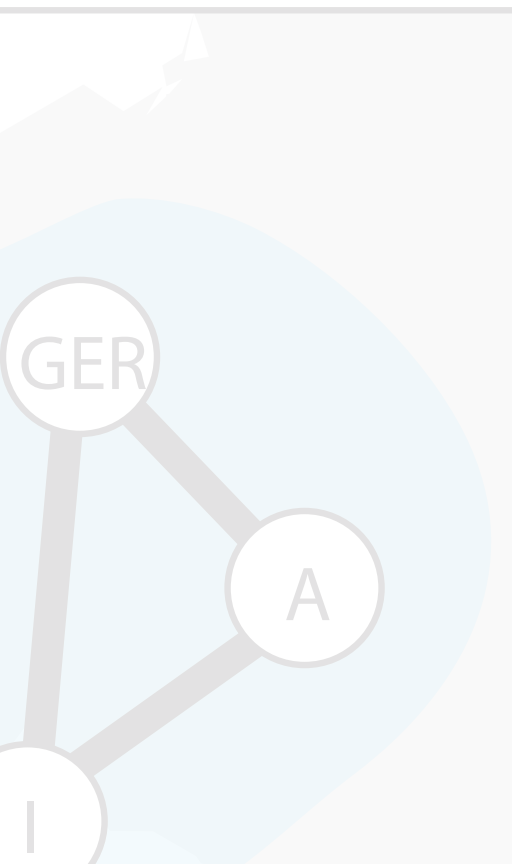


Aug., 6th

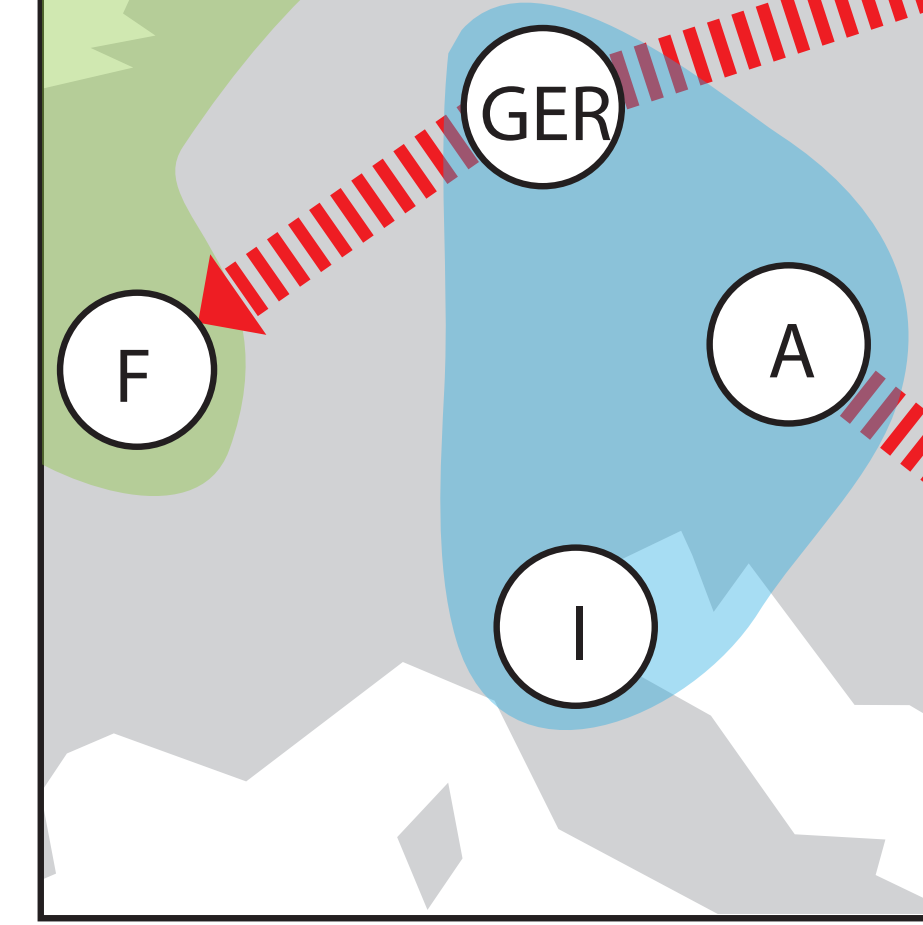
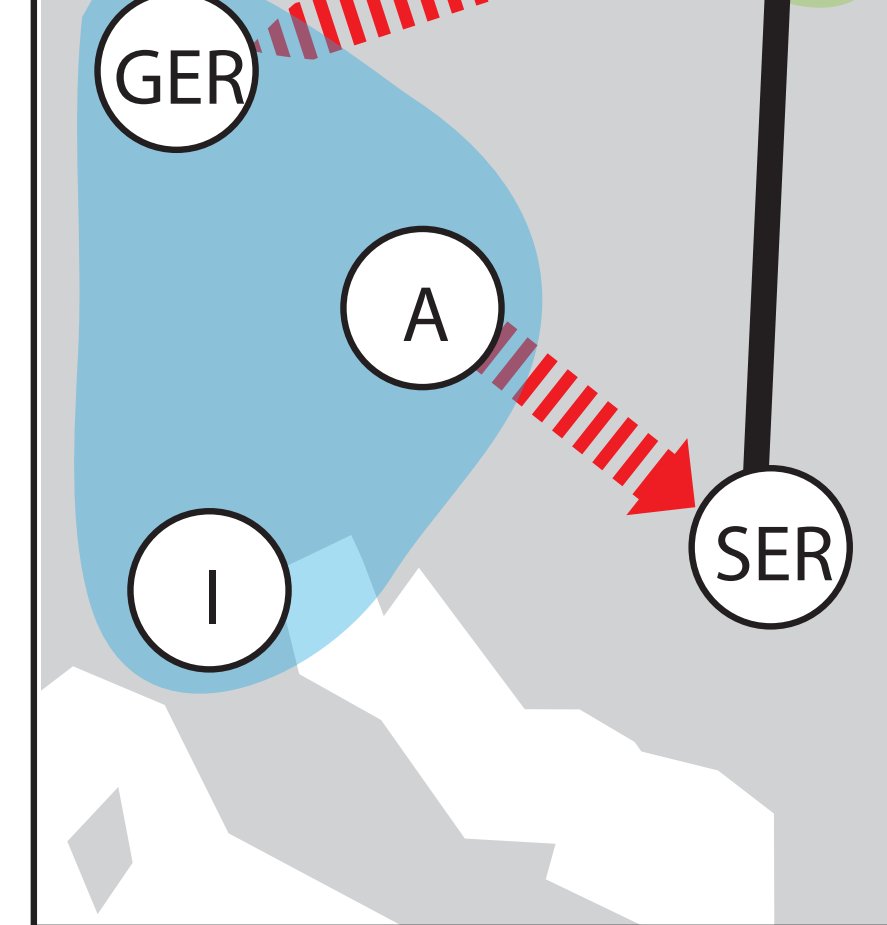
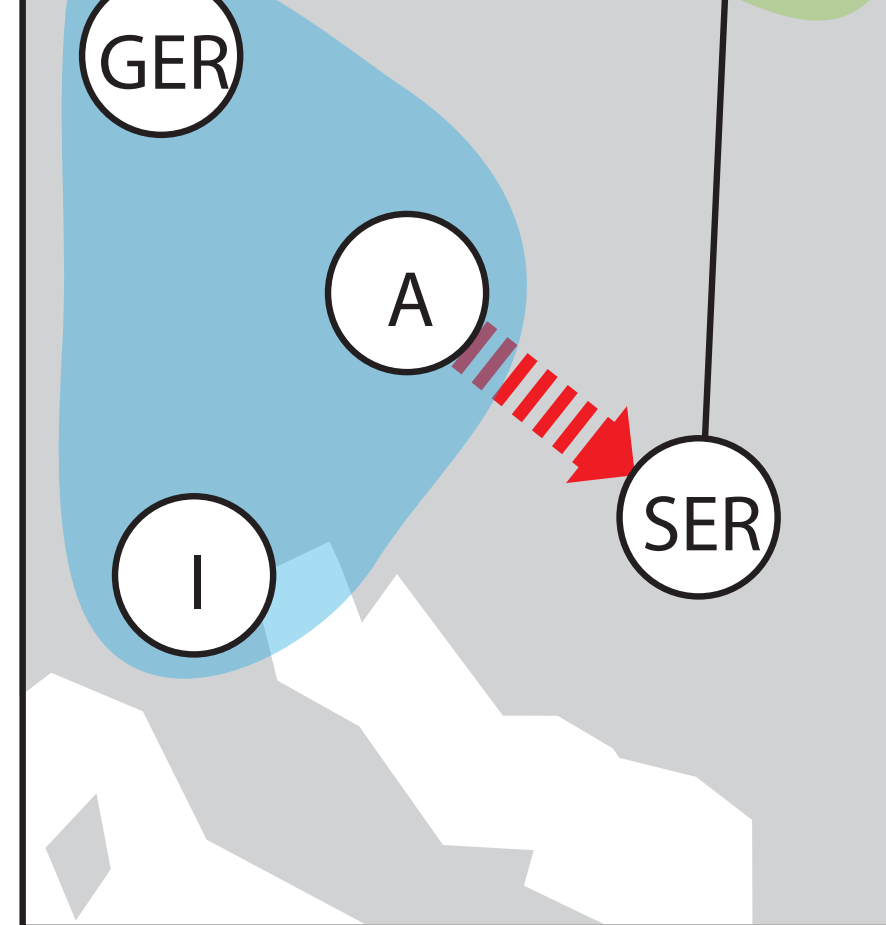
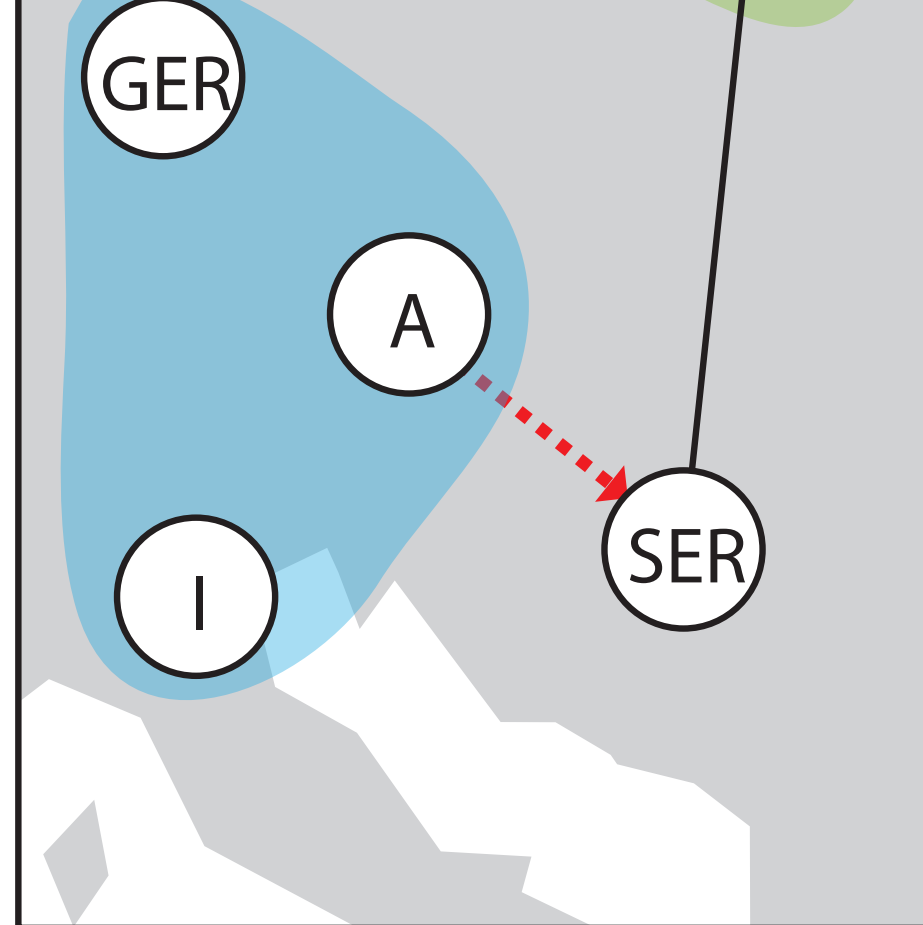
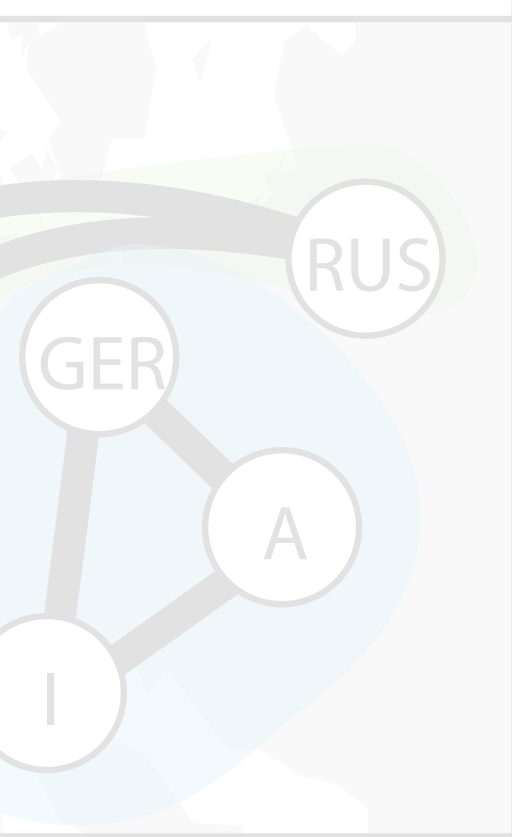
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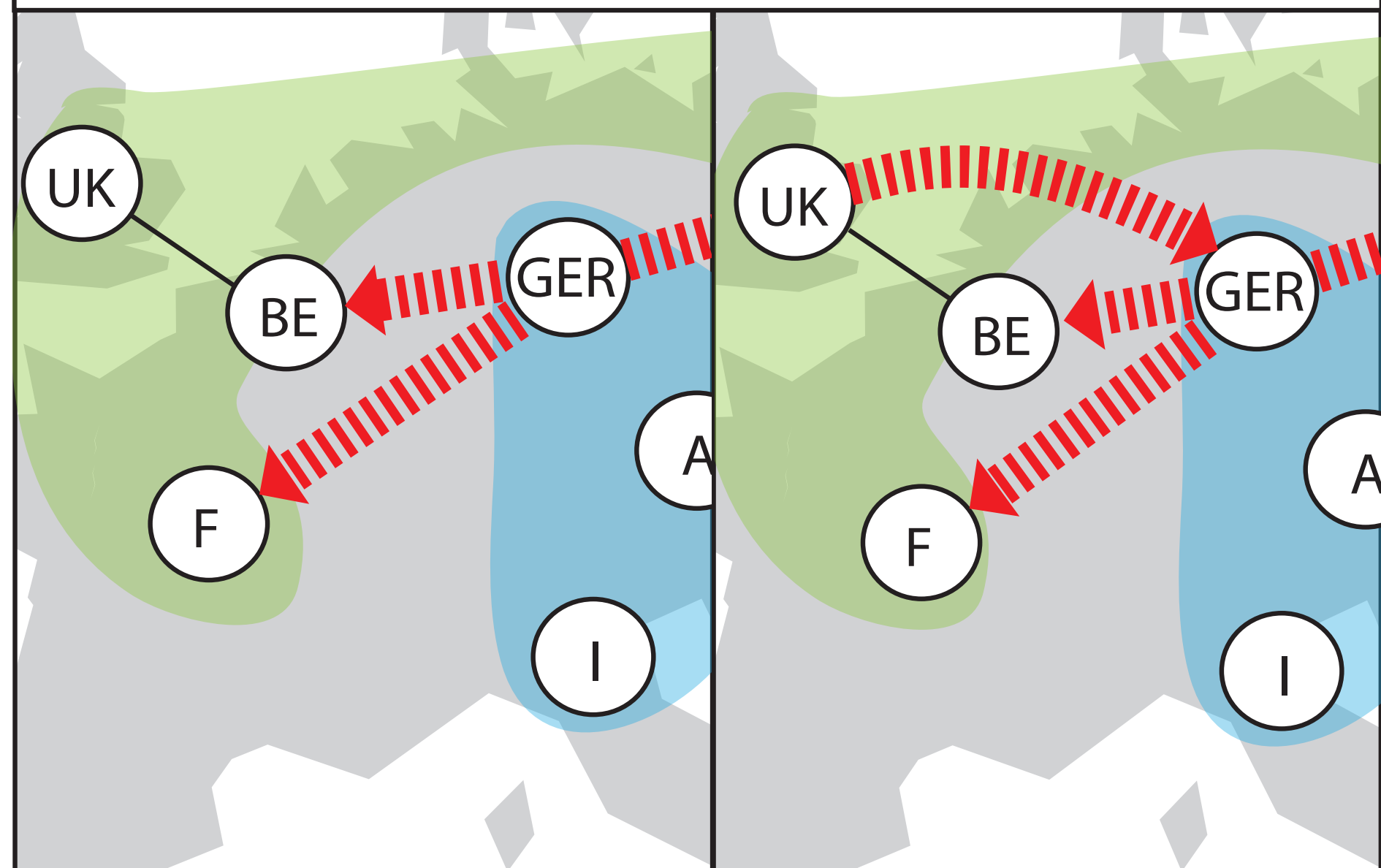


Entente



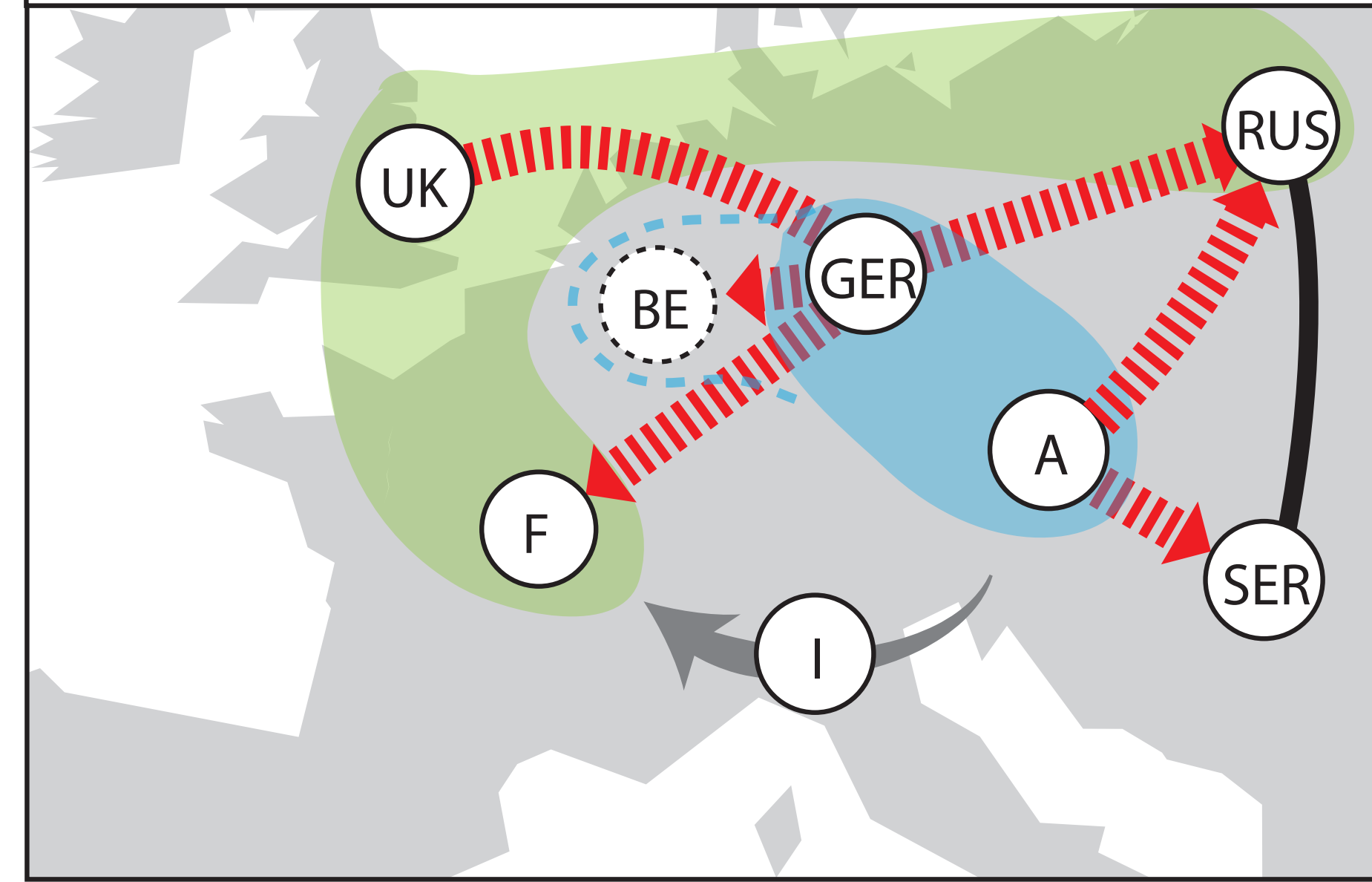
Aug., 4st

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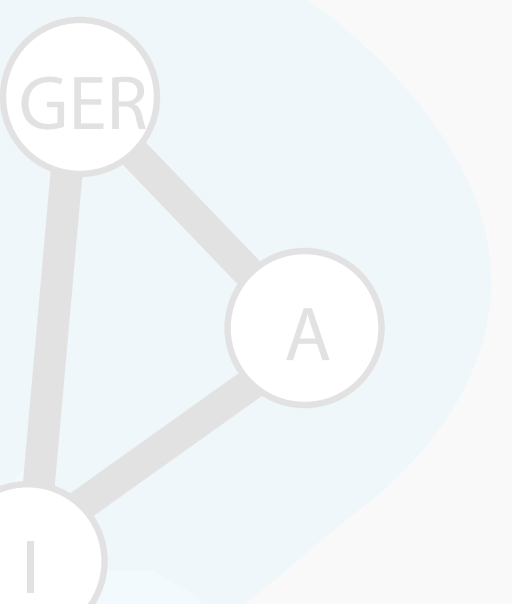


Aug., 6th

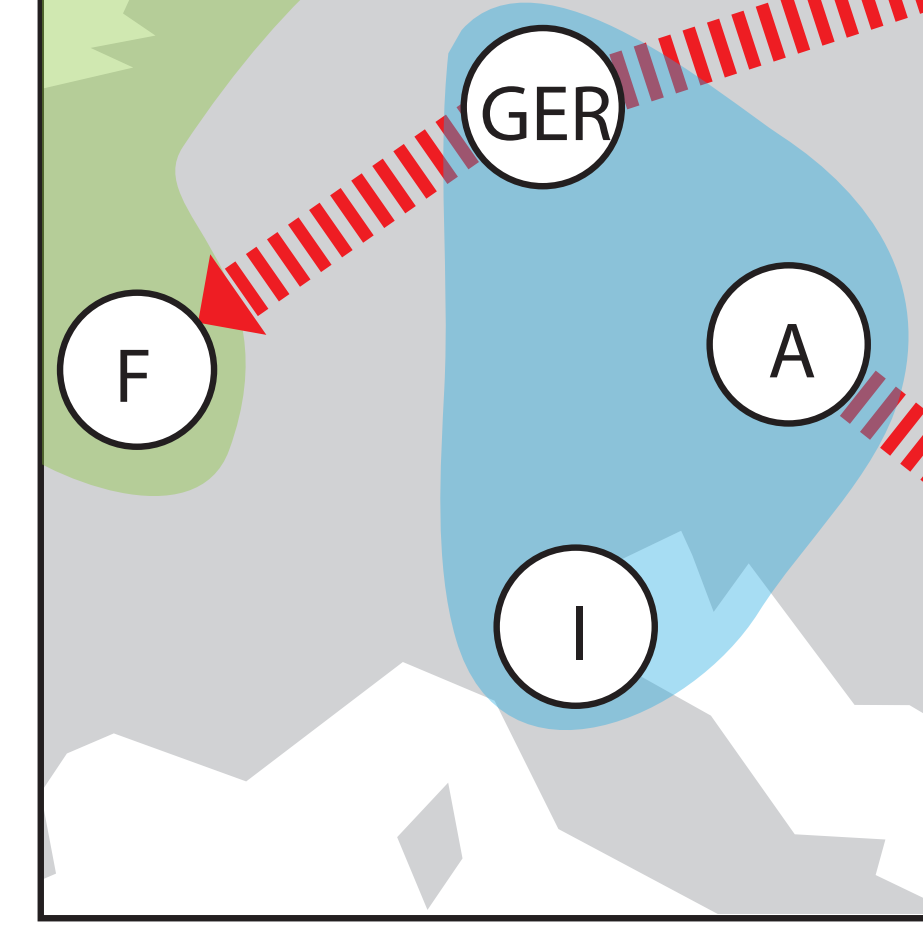
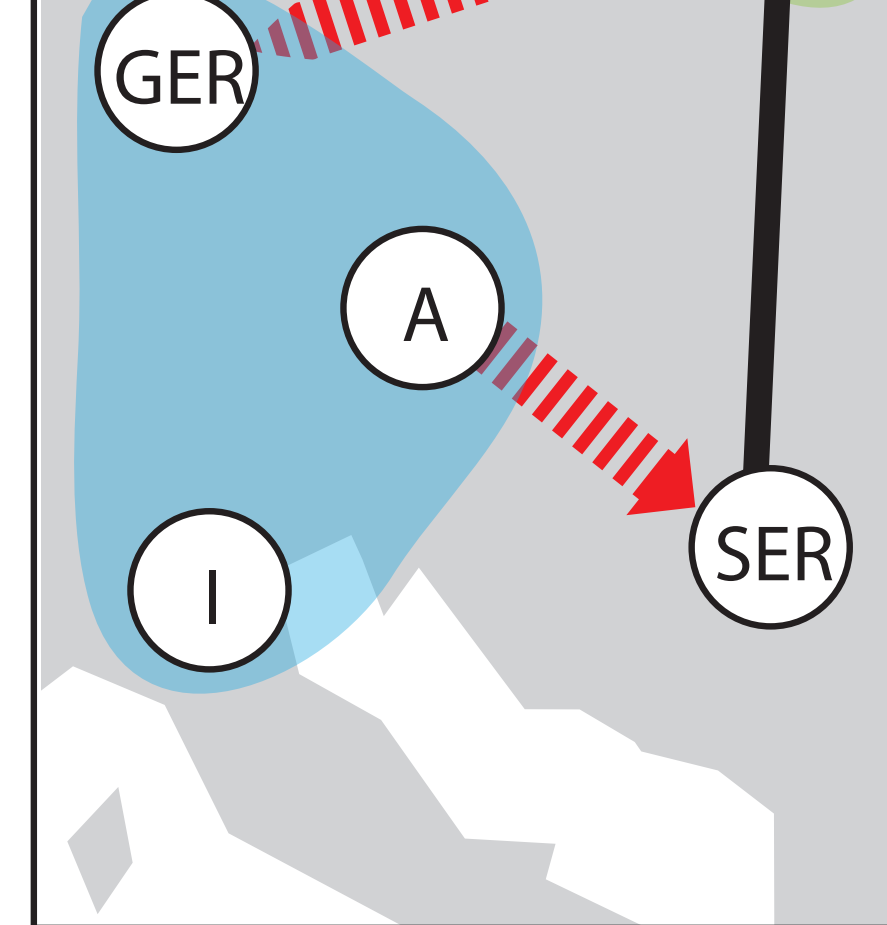
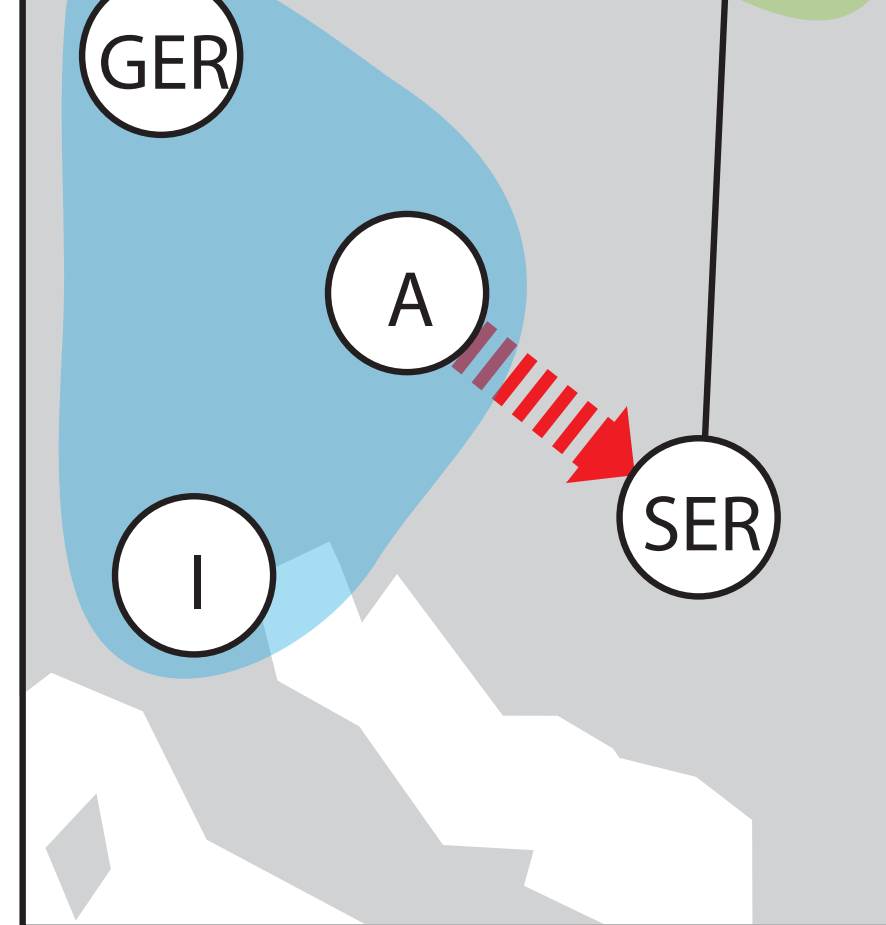
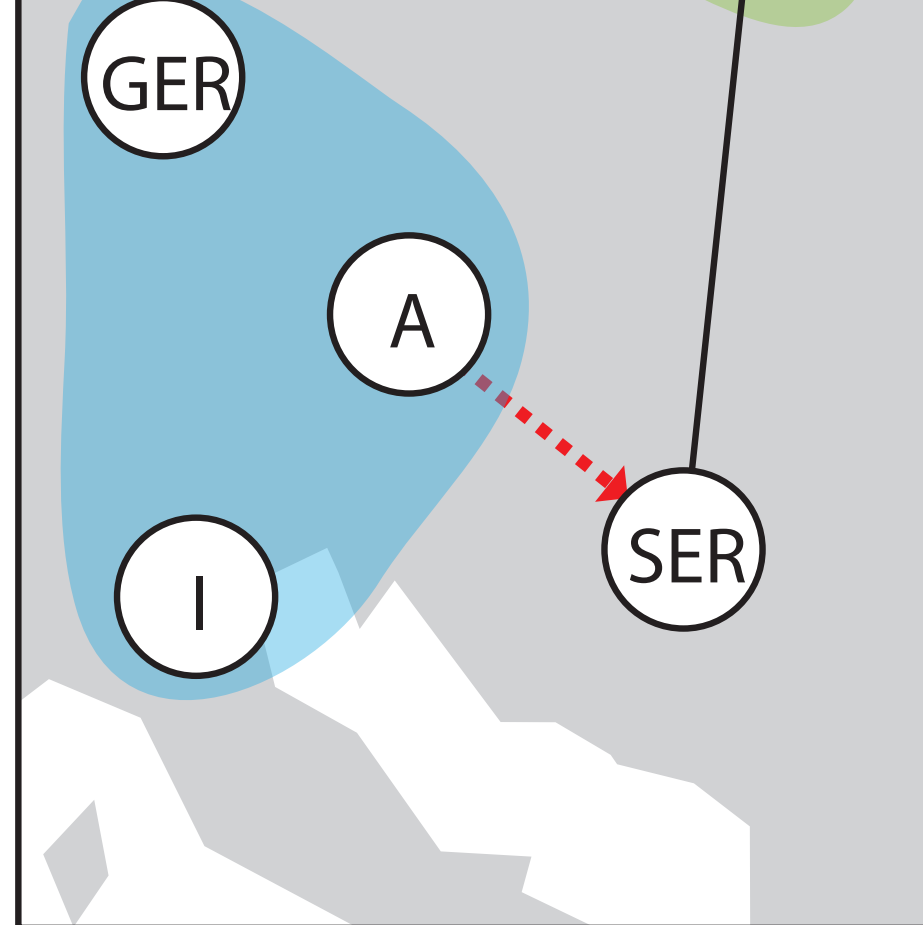
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Alliance

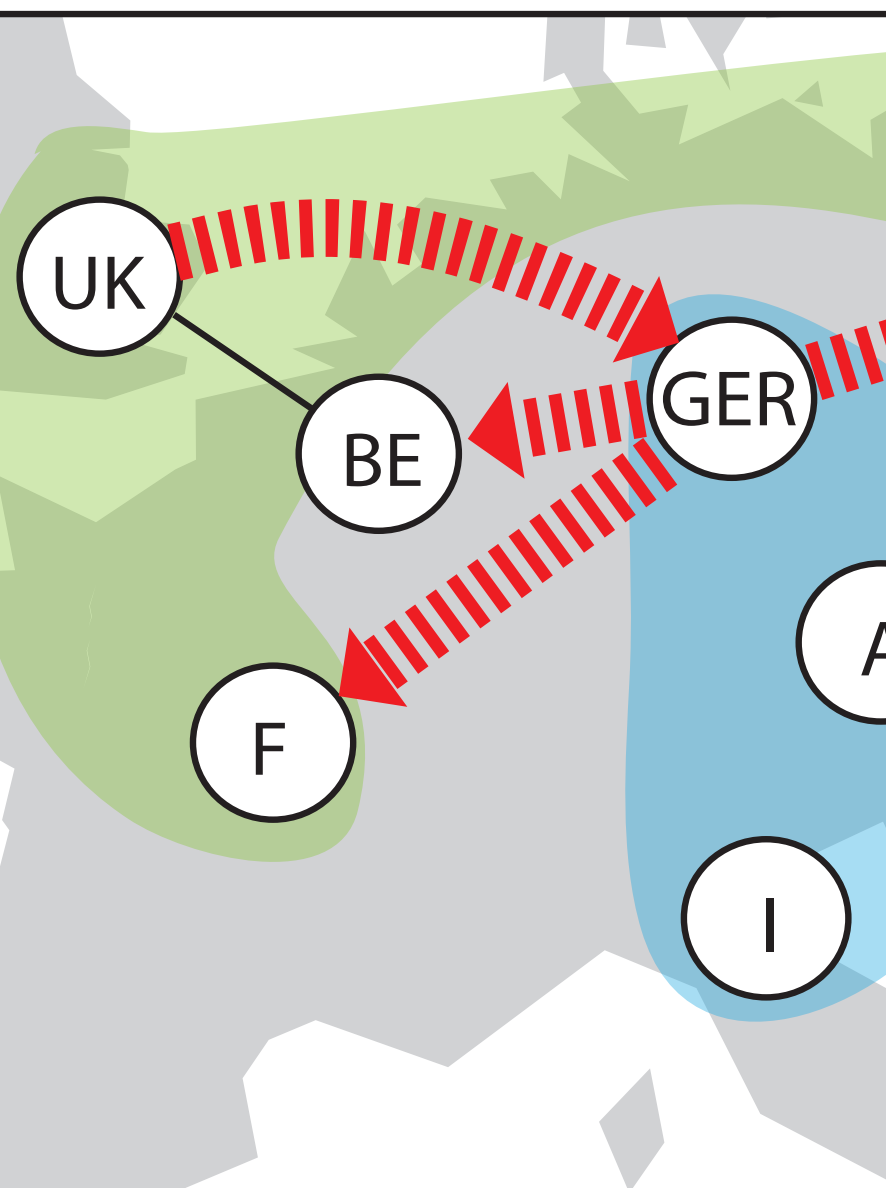
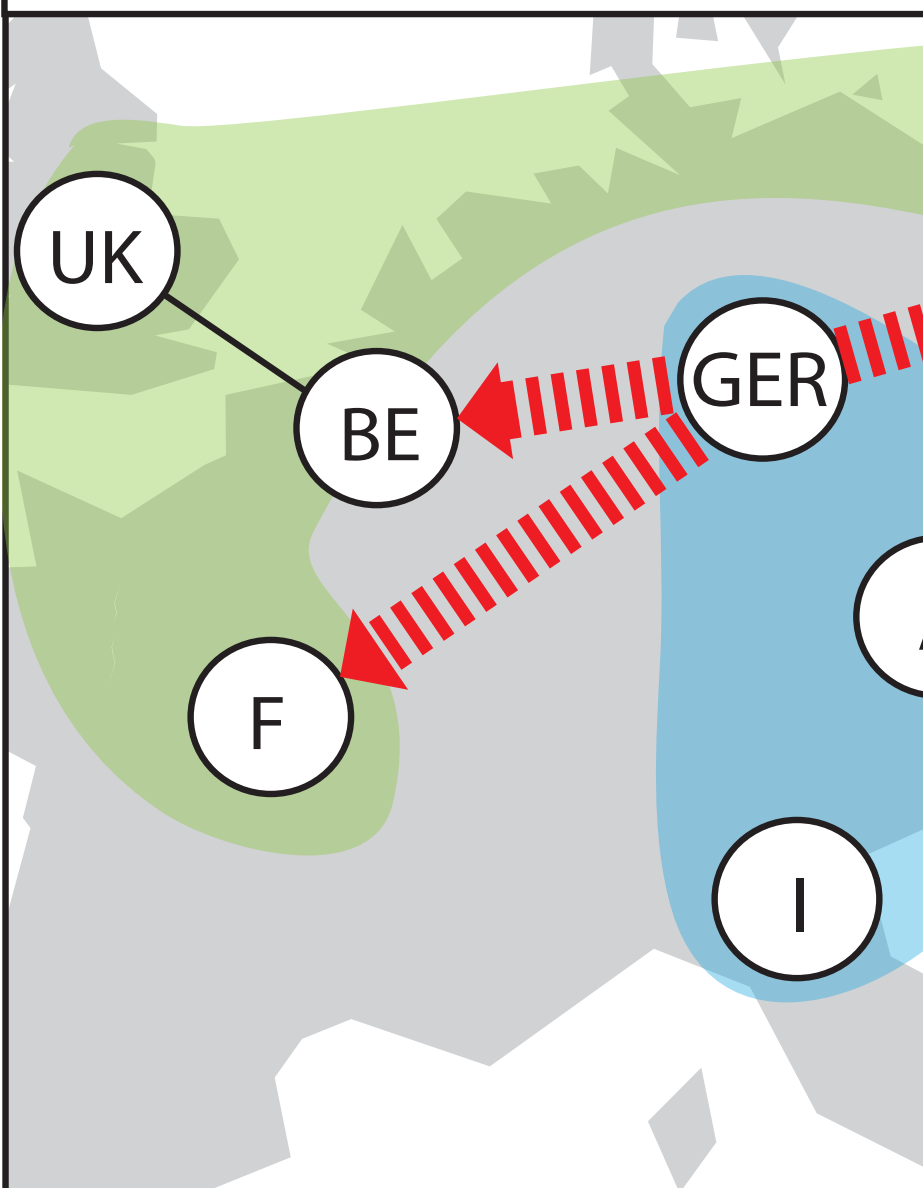


Entente



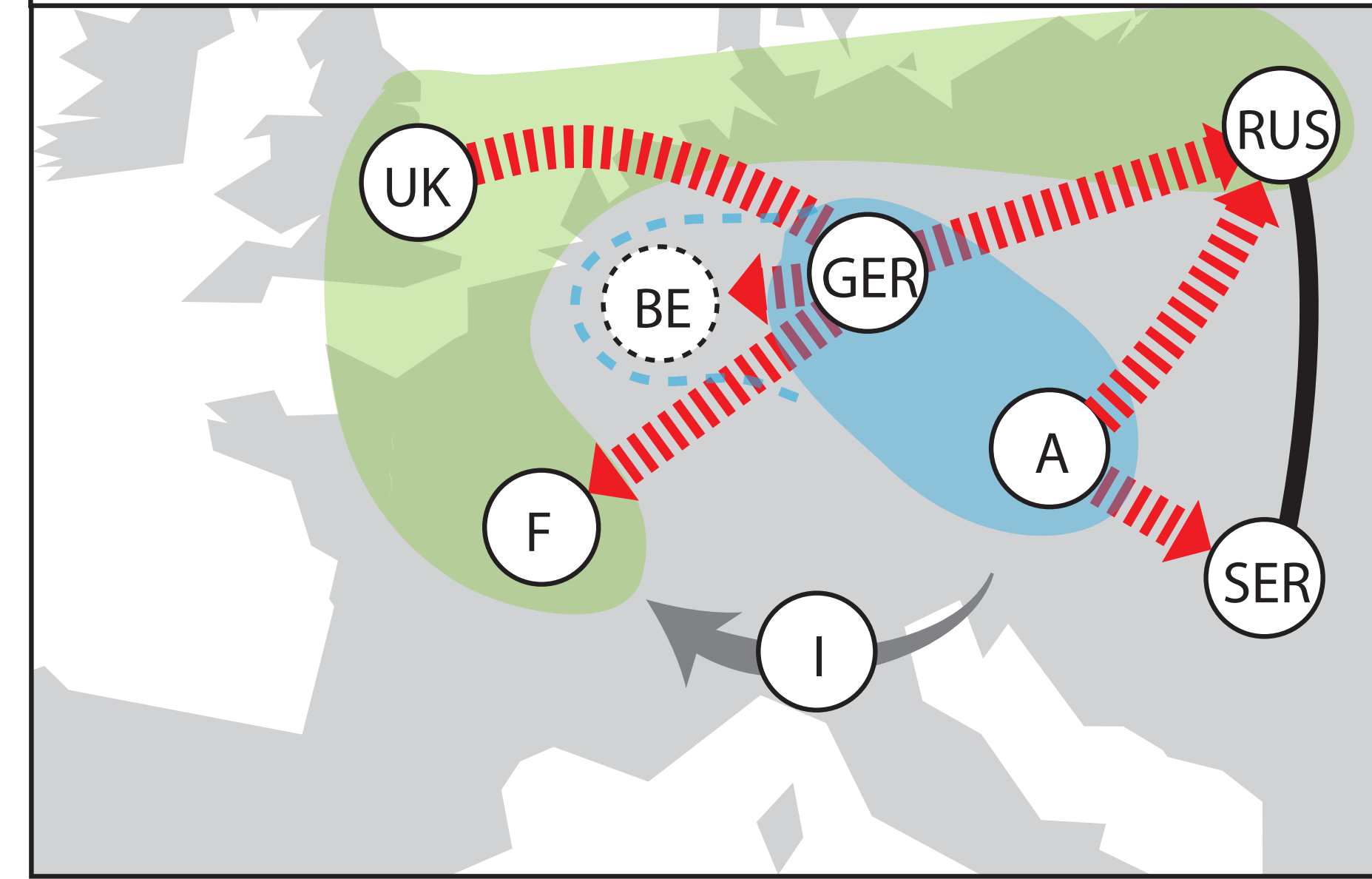
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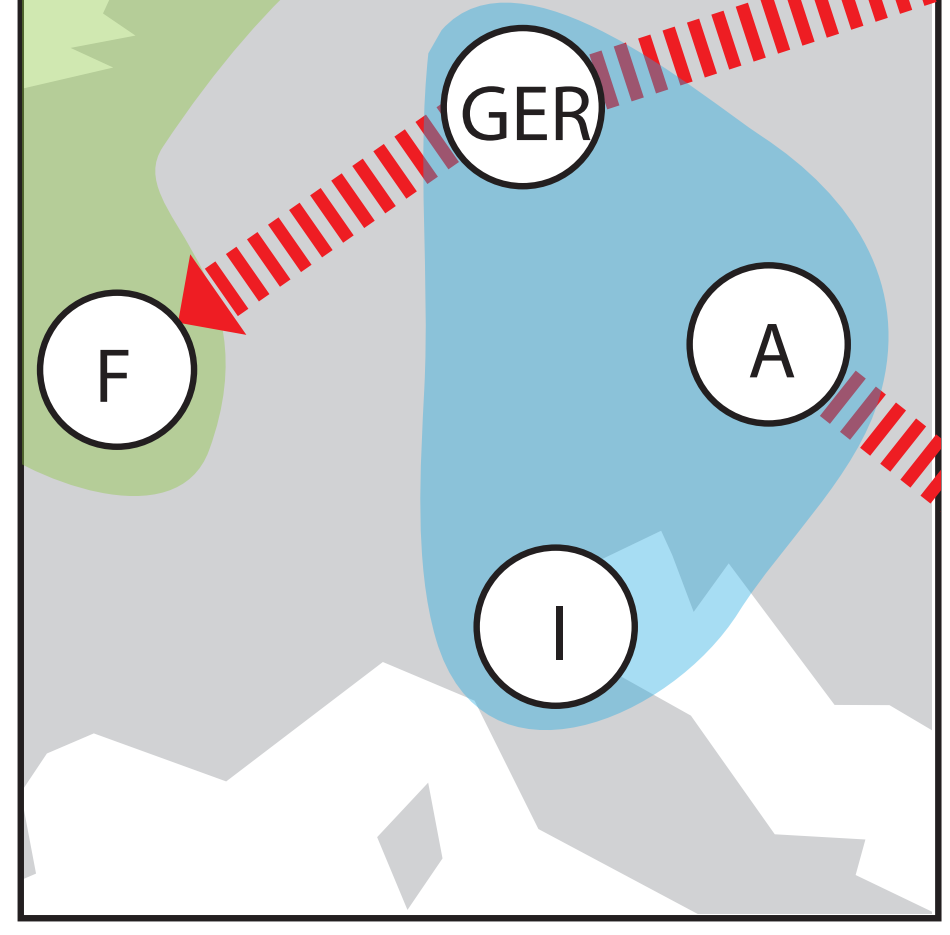
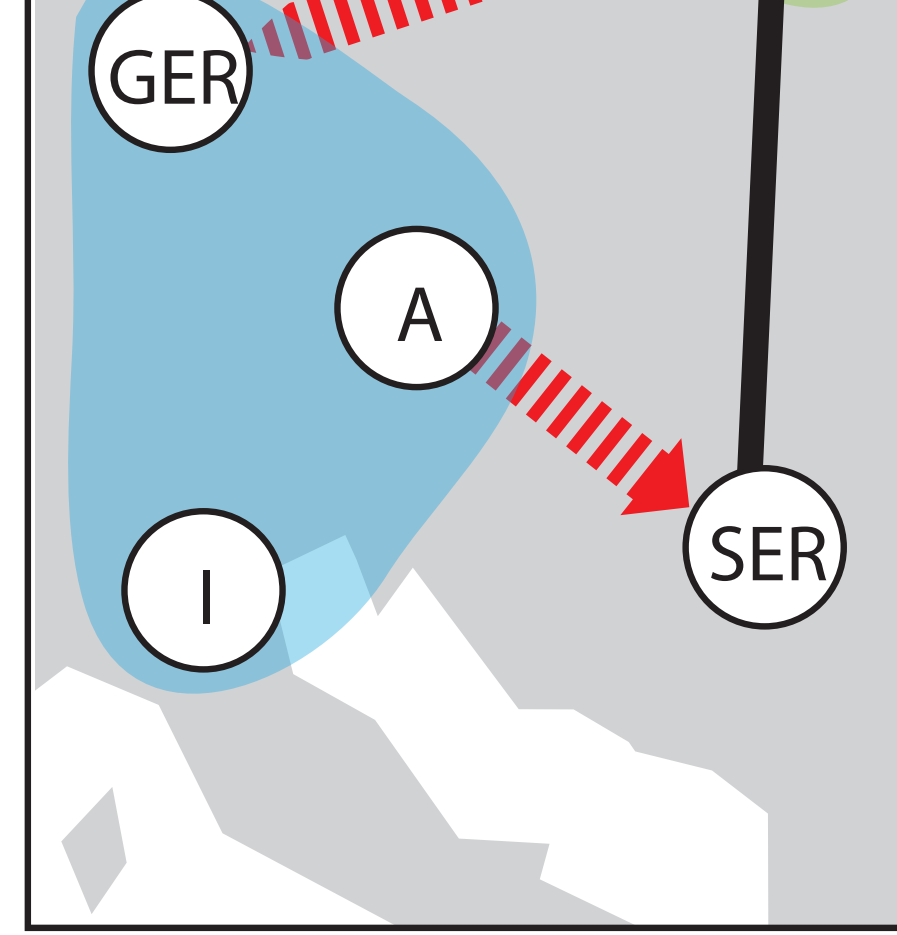
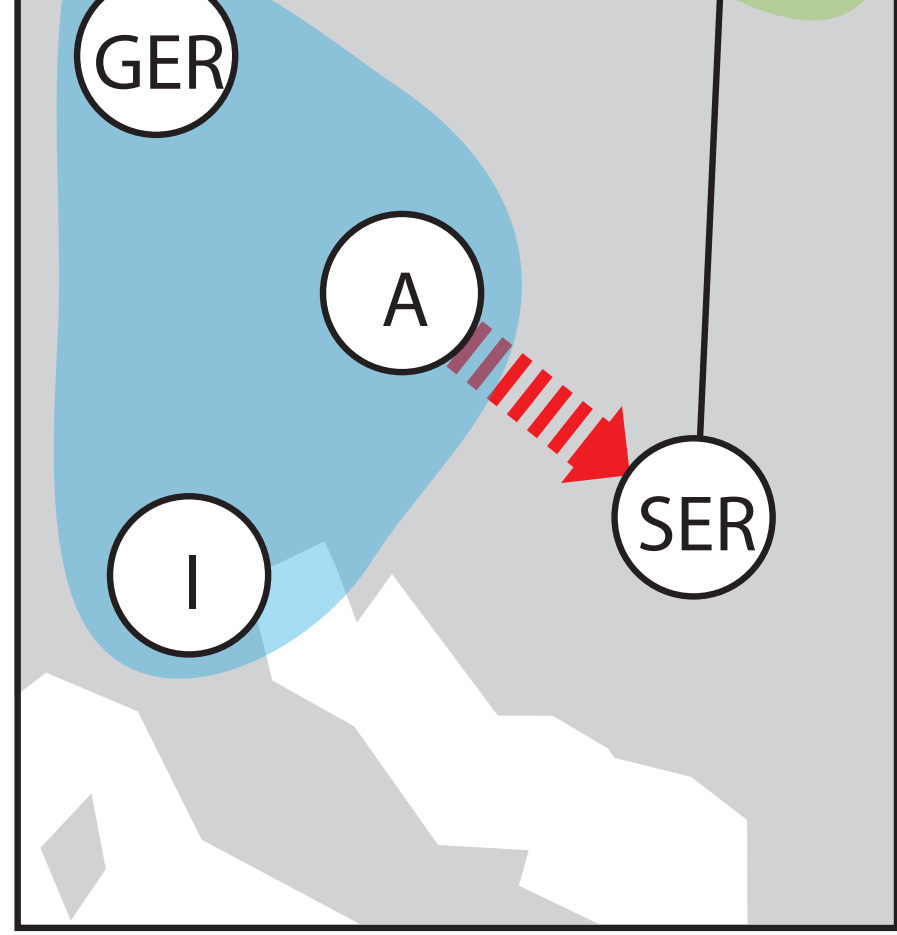
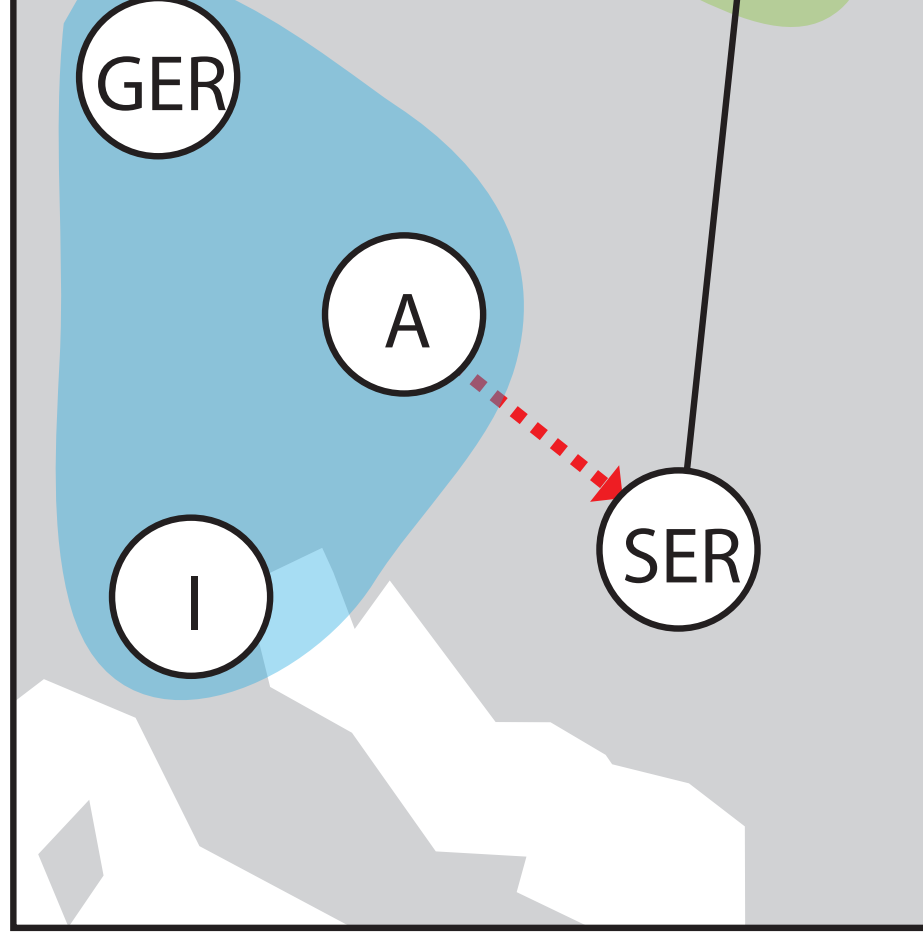


Aug., 6th

1 month after the assassination of the Austrian prince, most european powers are at war. Italy leaves the Triple Alliance.



Alliance



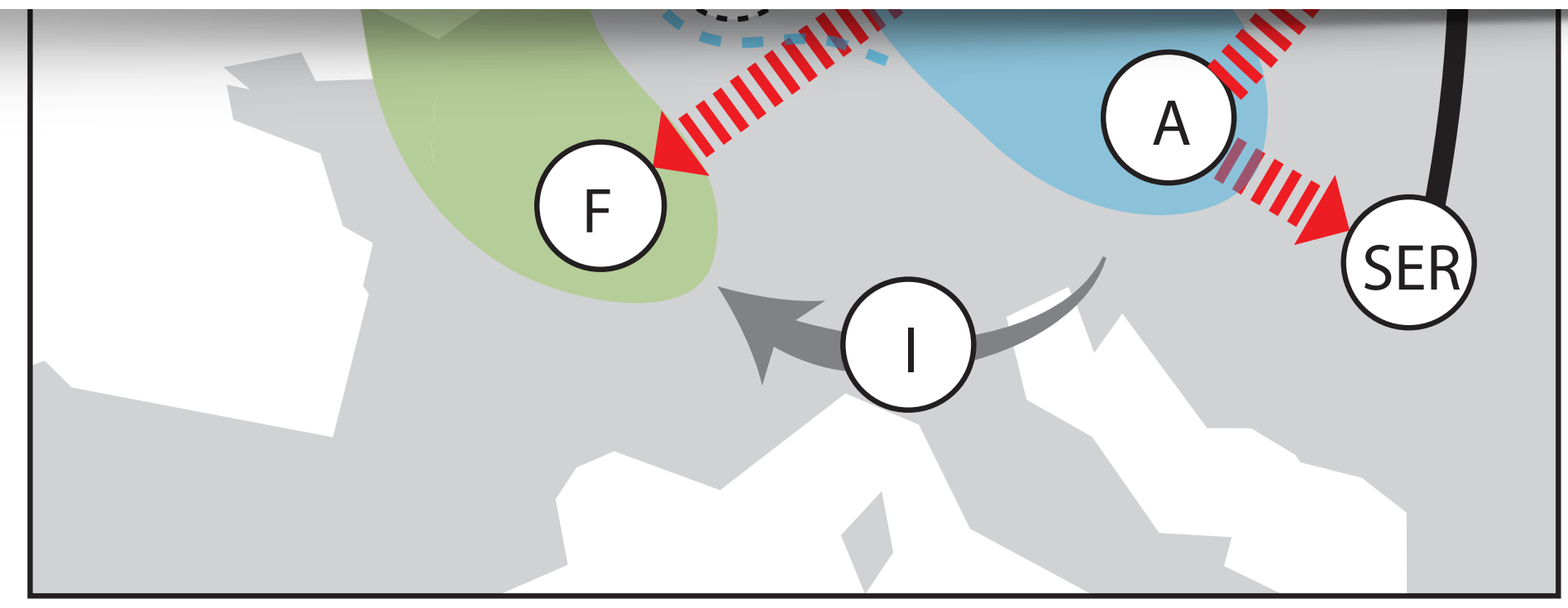
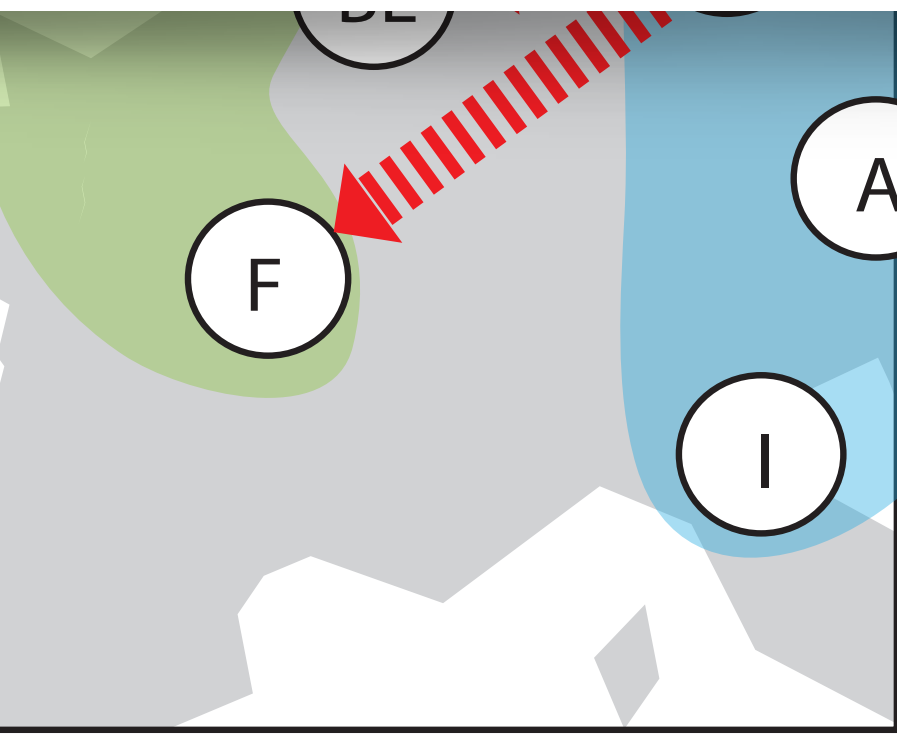
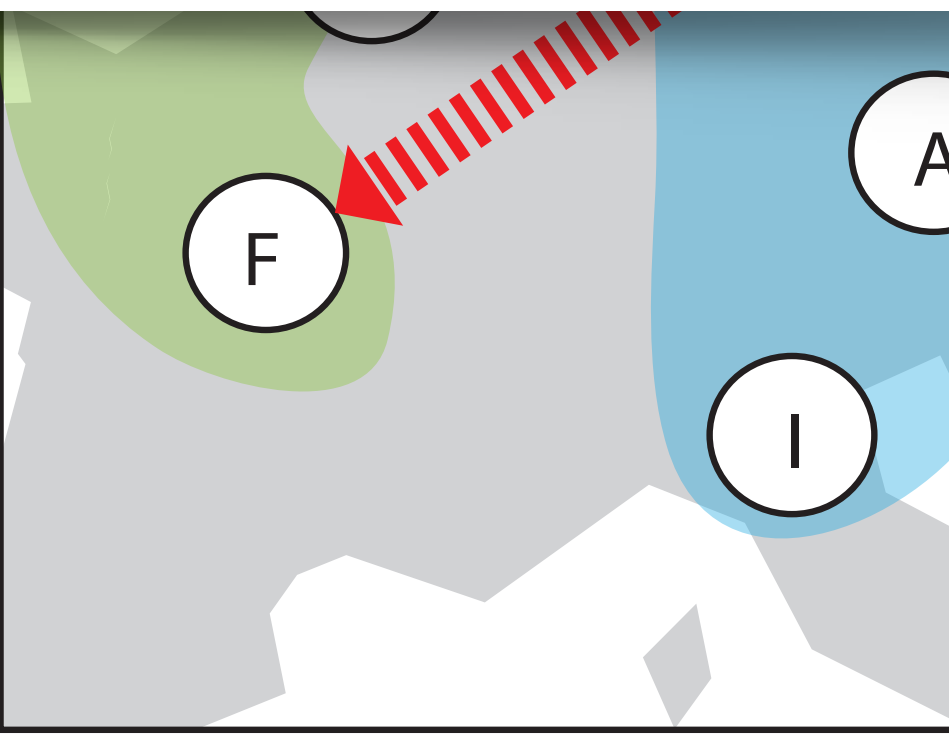
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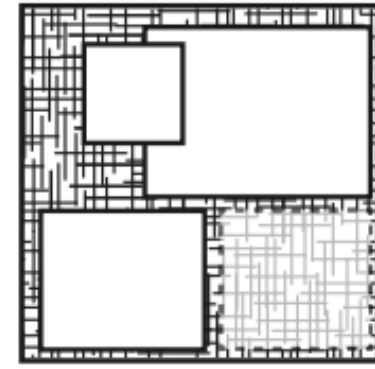
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1 month after the assassination of the Austrian prince, most european powers are at war. Italy leaves the Triple Alliance.

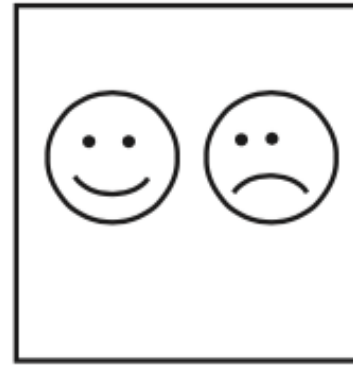
1. Is there a systematic way?



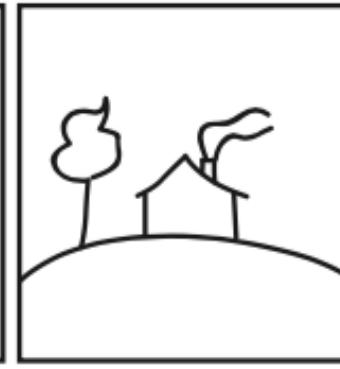
1) Traditional Comics



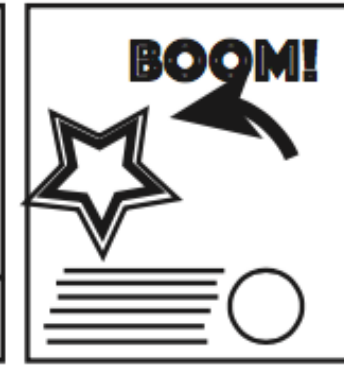
(a) Panels



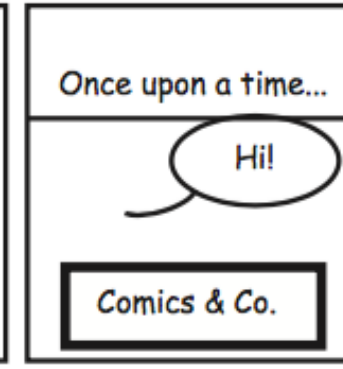
(b) Characters



(c) World

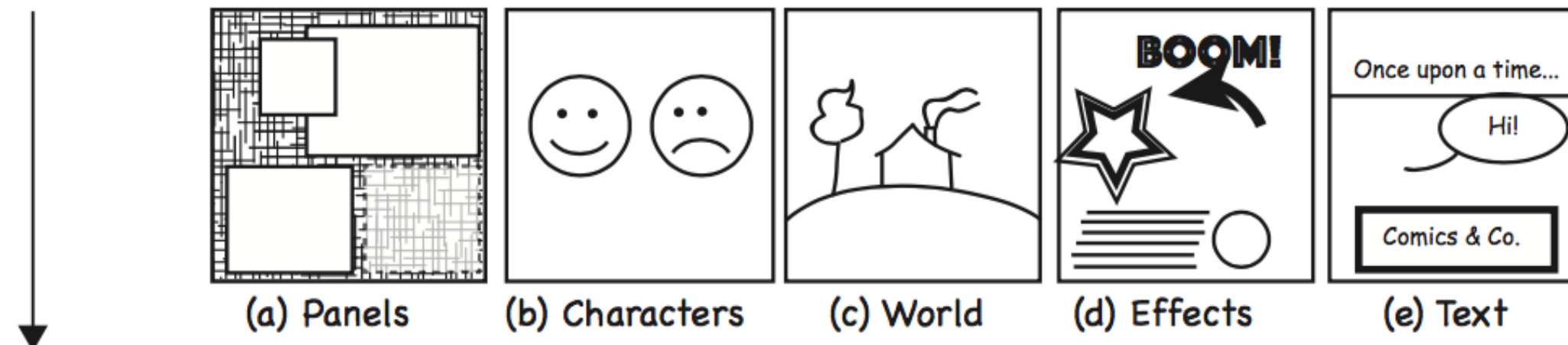


(d) Effects



(e) Text

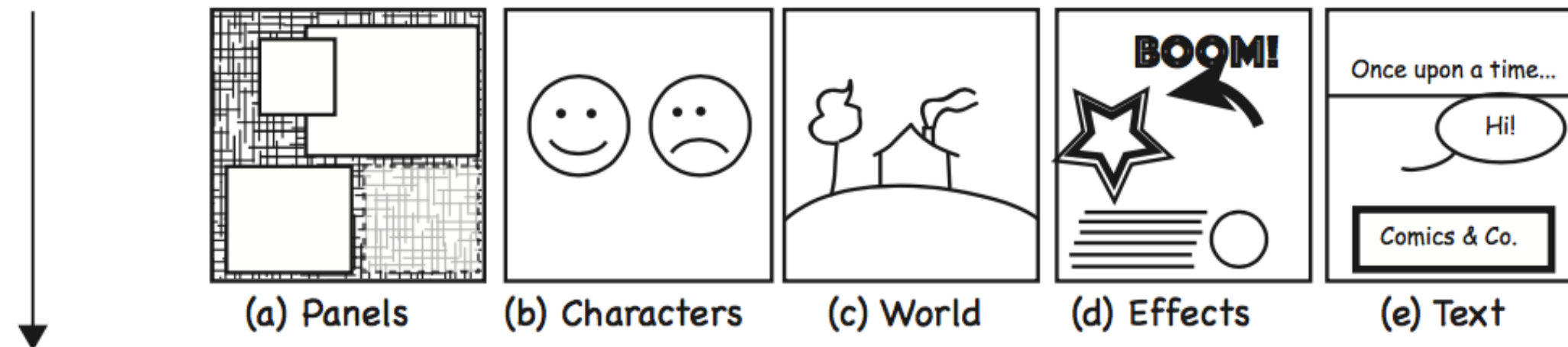
1) Traditional Comics



2) Designing for Graph Changes



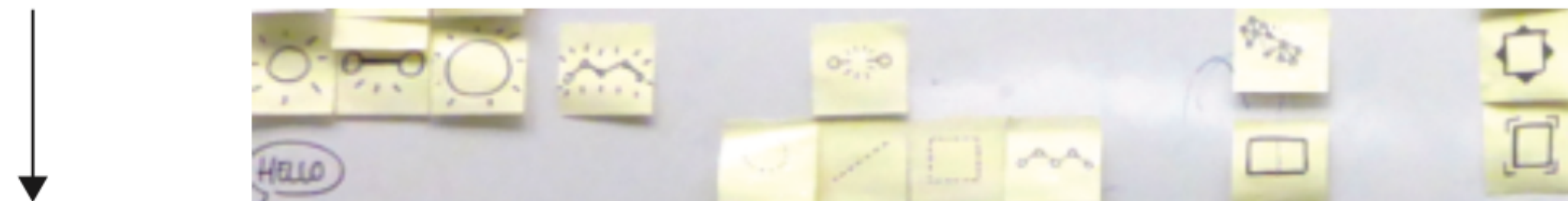
1) Traditional Comics



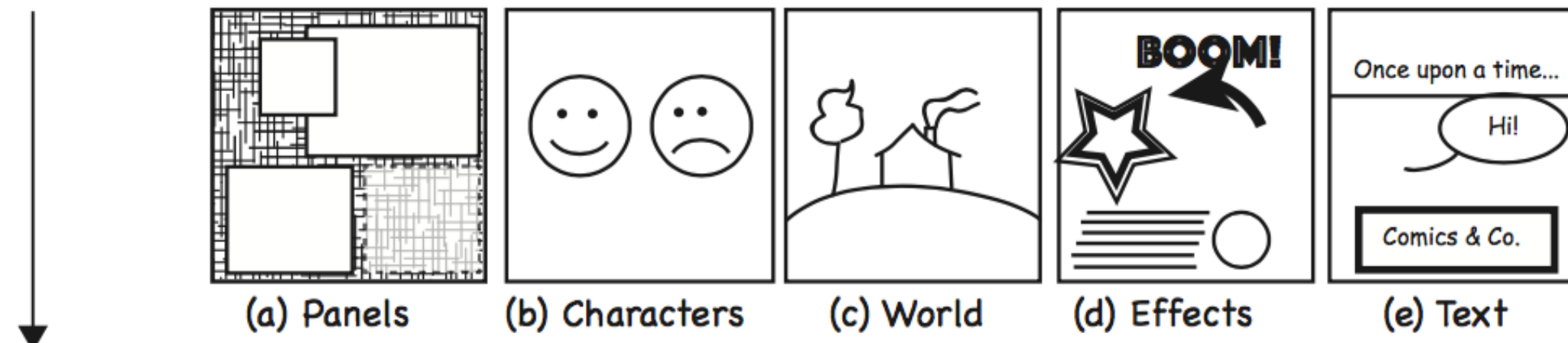
2) Designing for Graph Changes



3) Design Principles



1) Traditional Comics



2) Designing for Graph Changes



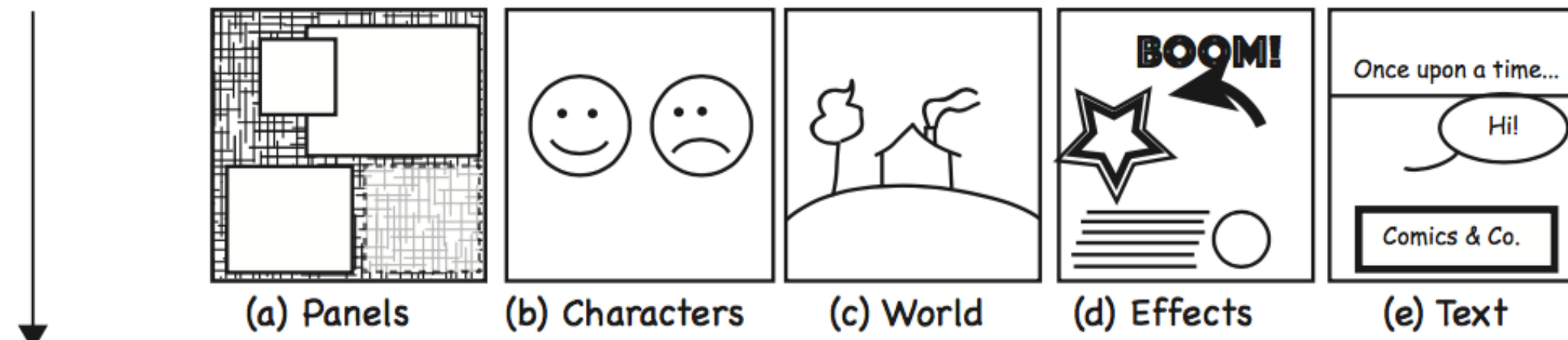
3) Design Principles



4) Creating Comics



1) Traditional Comics



2) Designing for Graph Changes



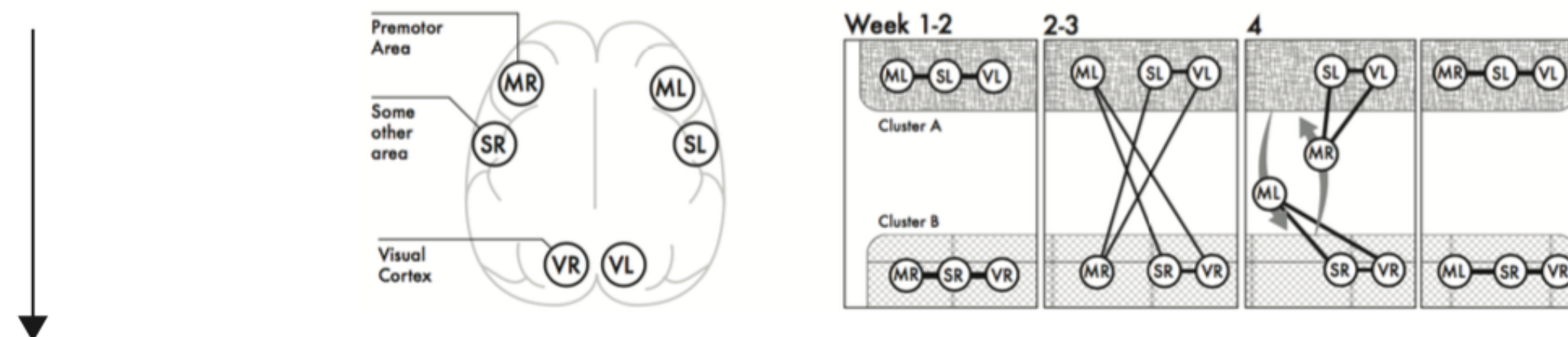
3) Design Principles



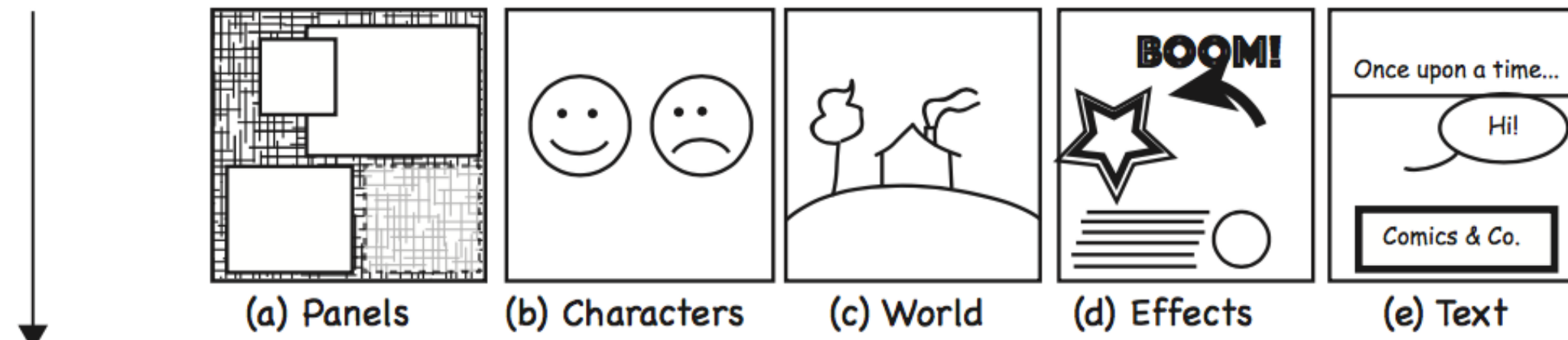
4) Creating Comics



5) Discussion with Domain Experts



1) Traditional Comics



2) Designing for Graph Changes



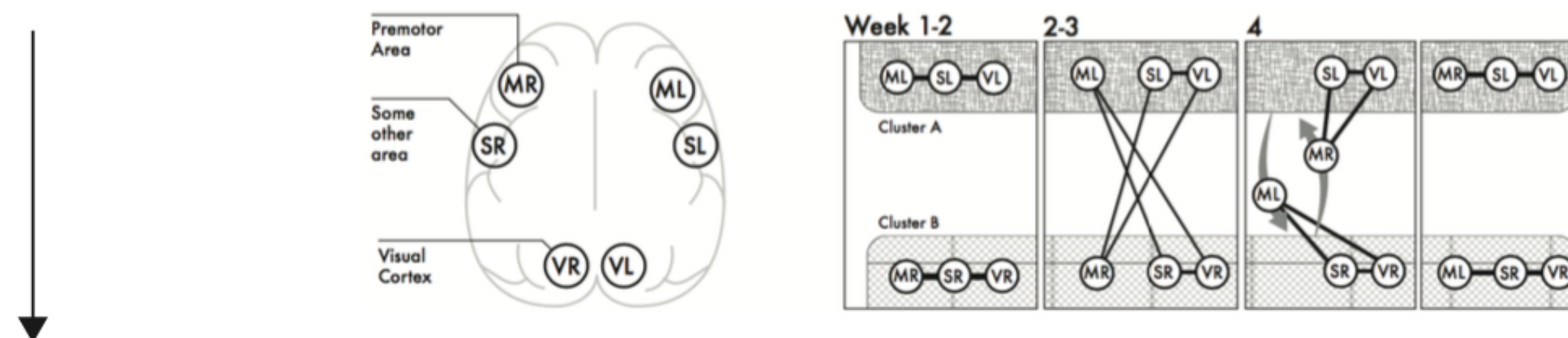
3) Design Principles



4) Creating Comics



5) Discussion with Domain Experts

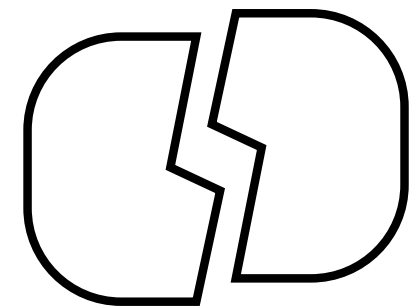


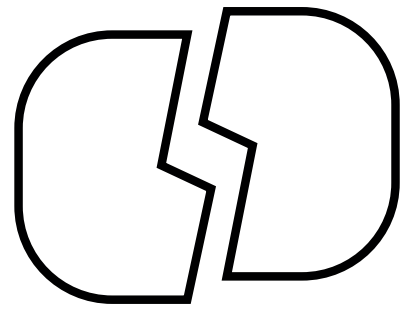
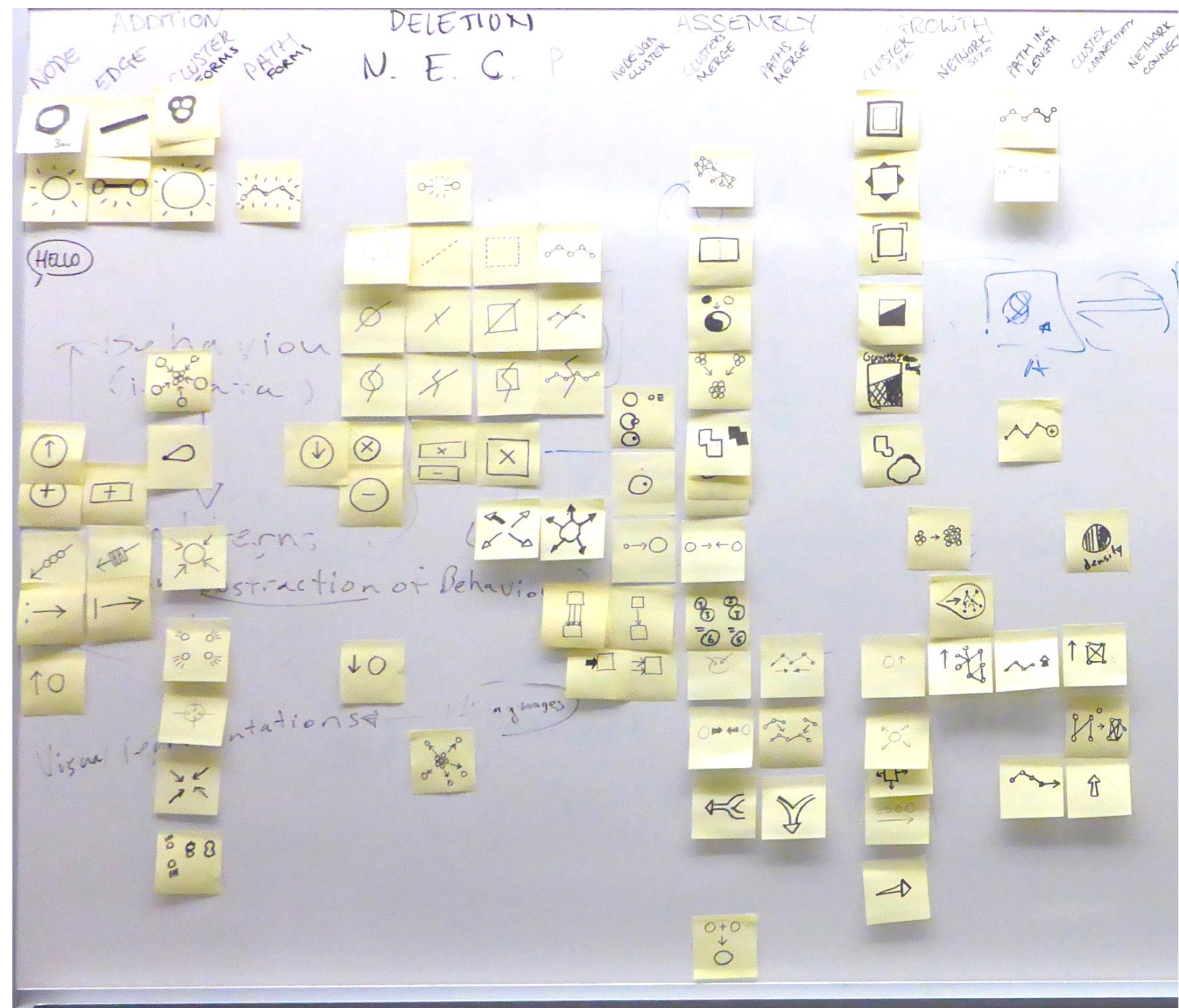
6) Readability Study (see Section "Readability Study")

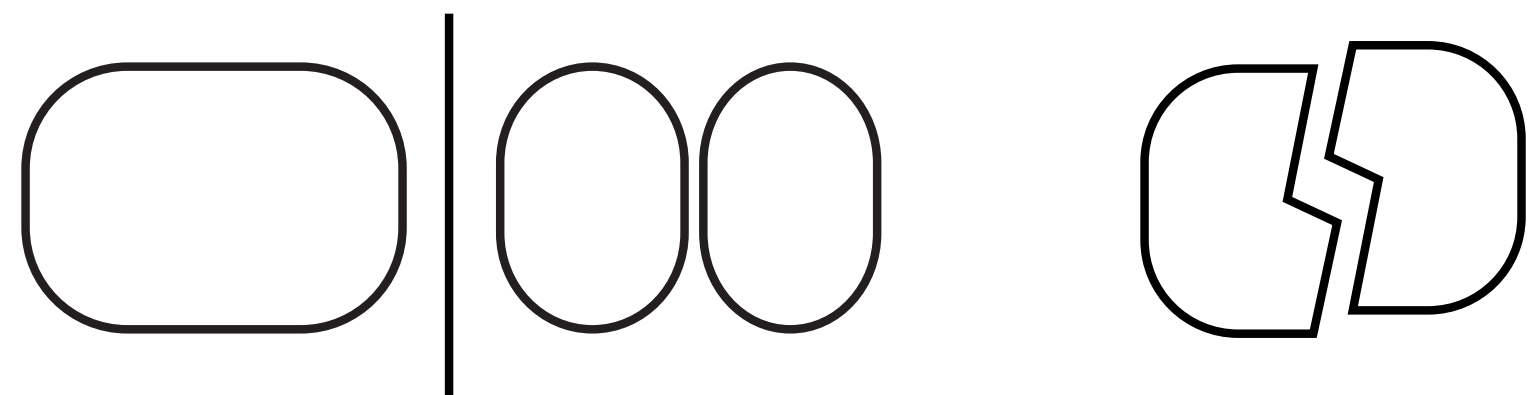
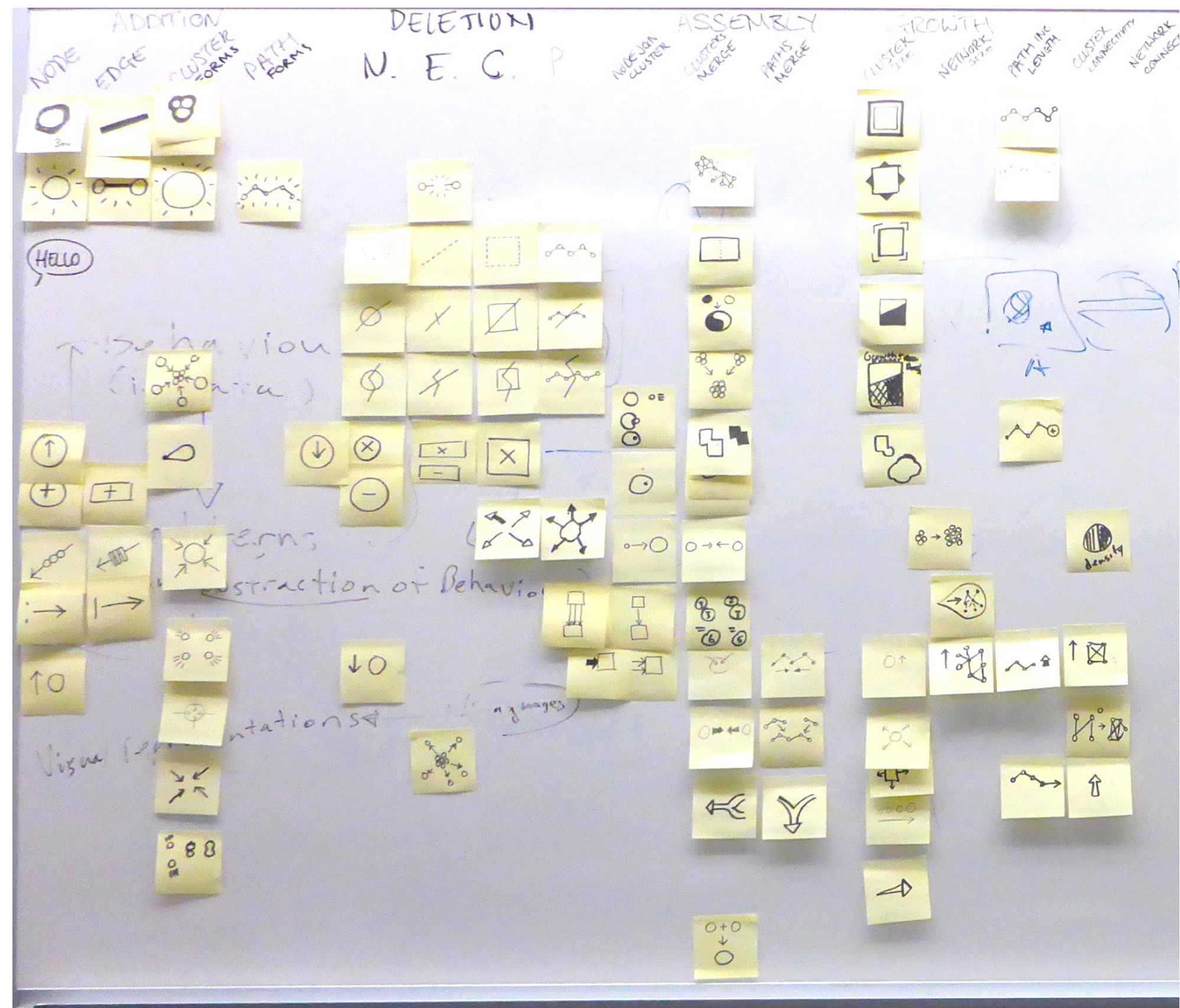
[Sitar et al 2007]
[Lee et al, 2006]
[Shannon et al., 2009]
[Soo et al. 2010]
[Ahn et al, 2014]
[Kerracher et al., 2015]

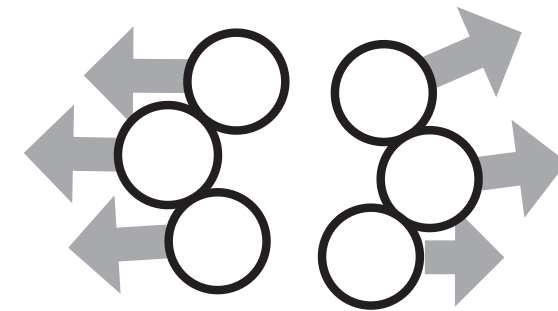
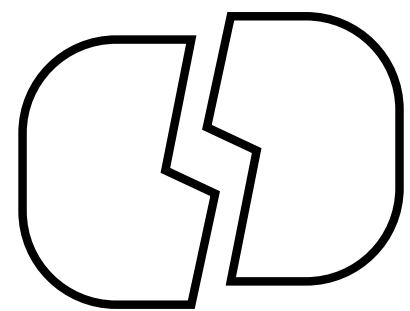
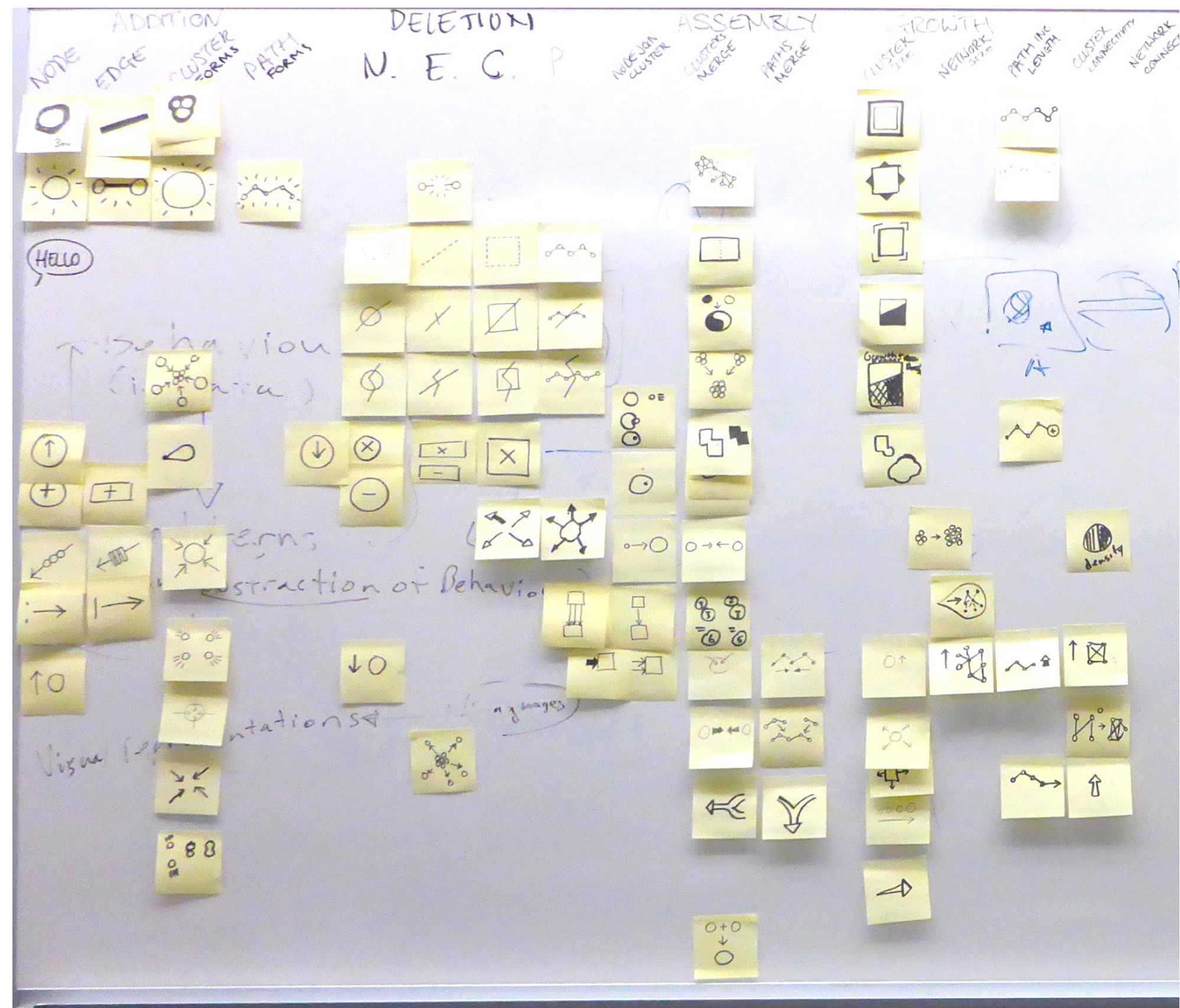


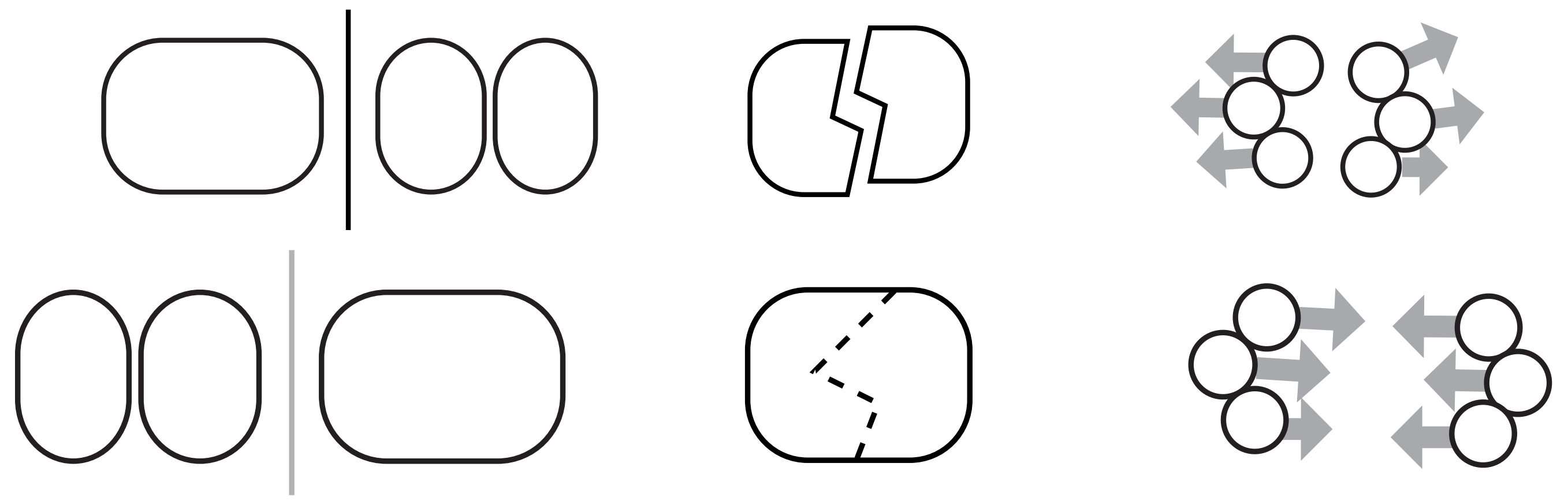
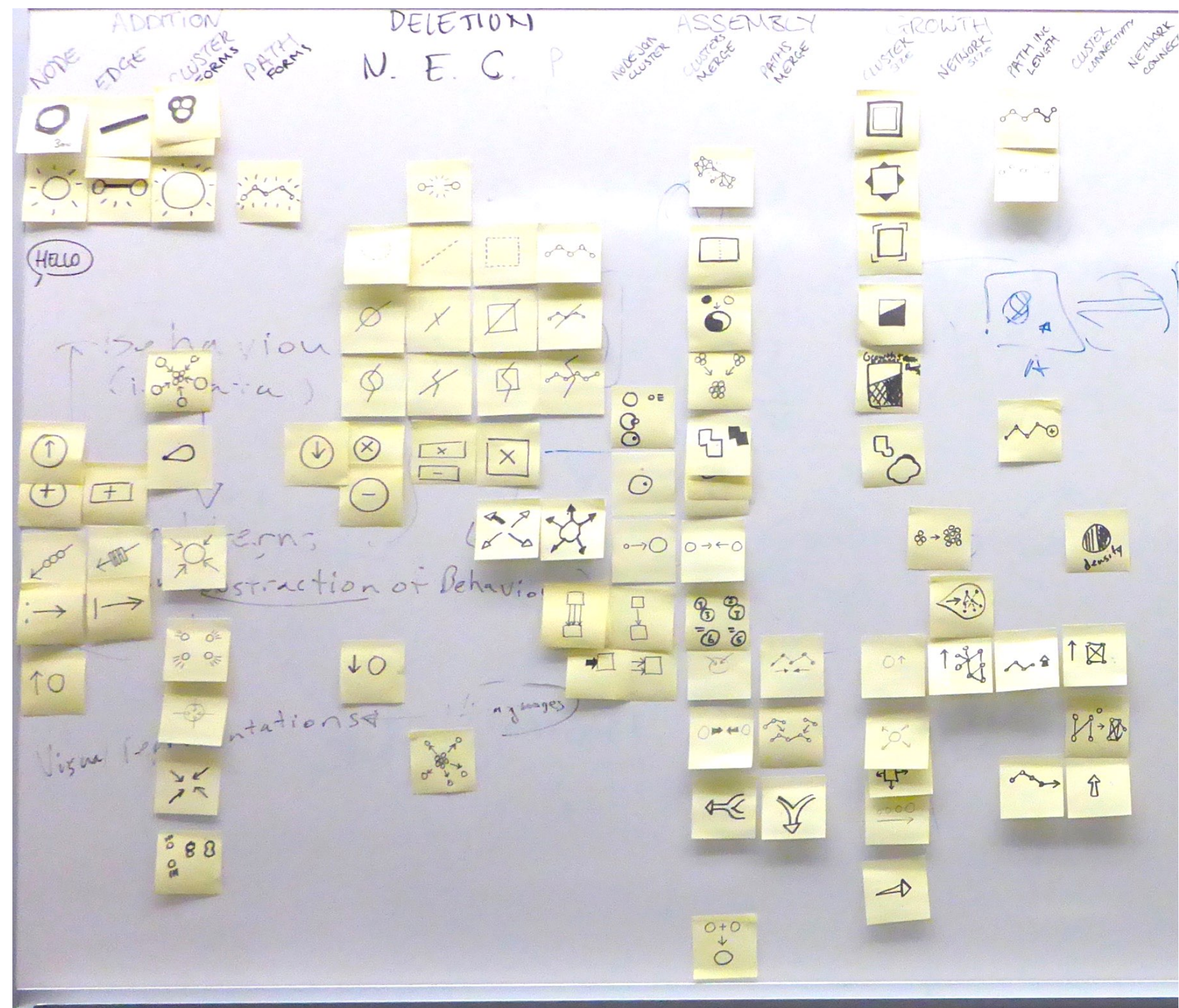
[Sitar et al 2007]
[Lee et al, 2006]
[Shannon et al., 2009]
[Soo et al. 2010]
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[Kerracher et al., 2015]



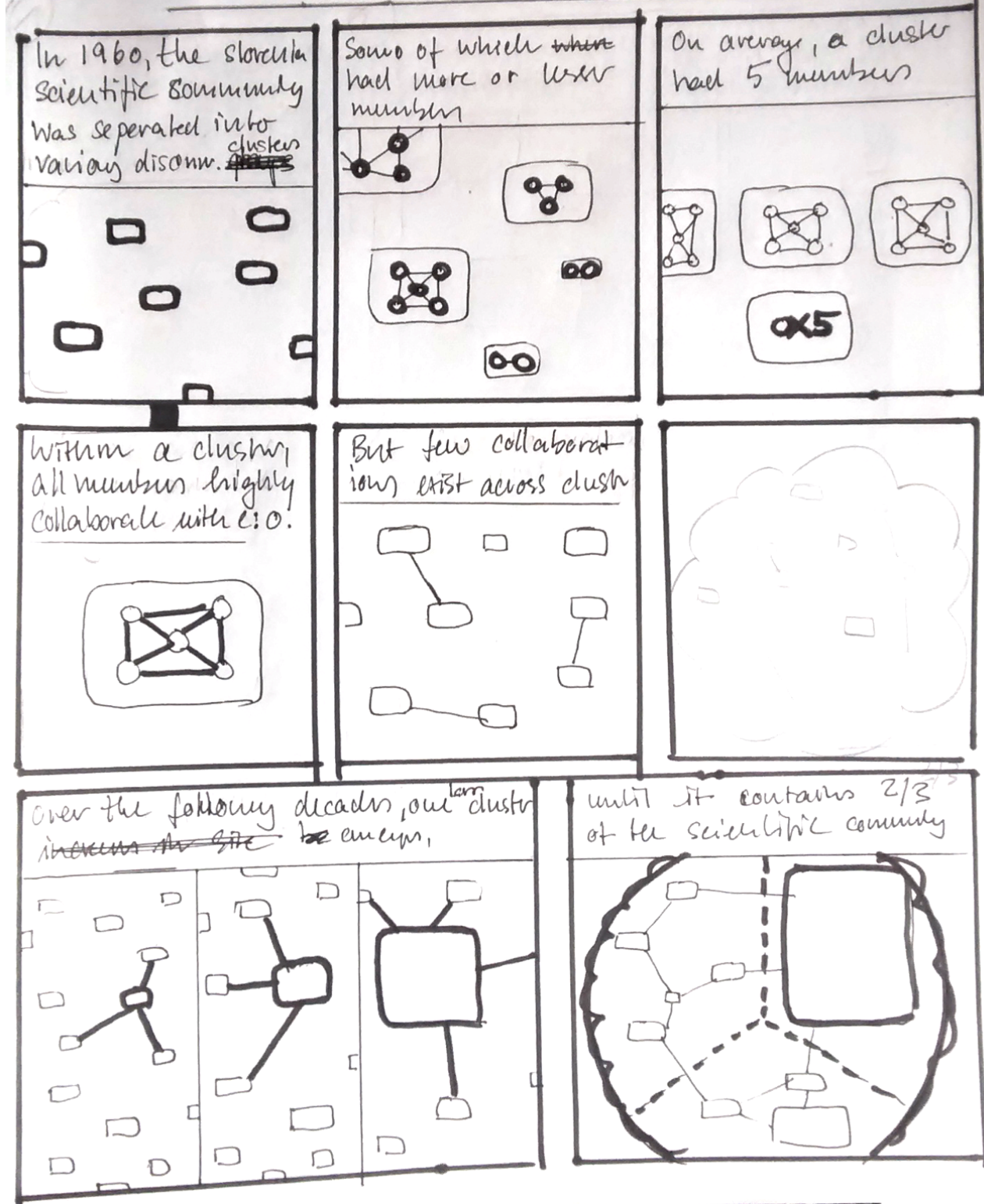




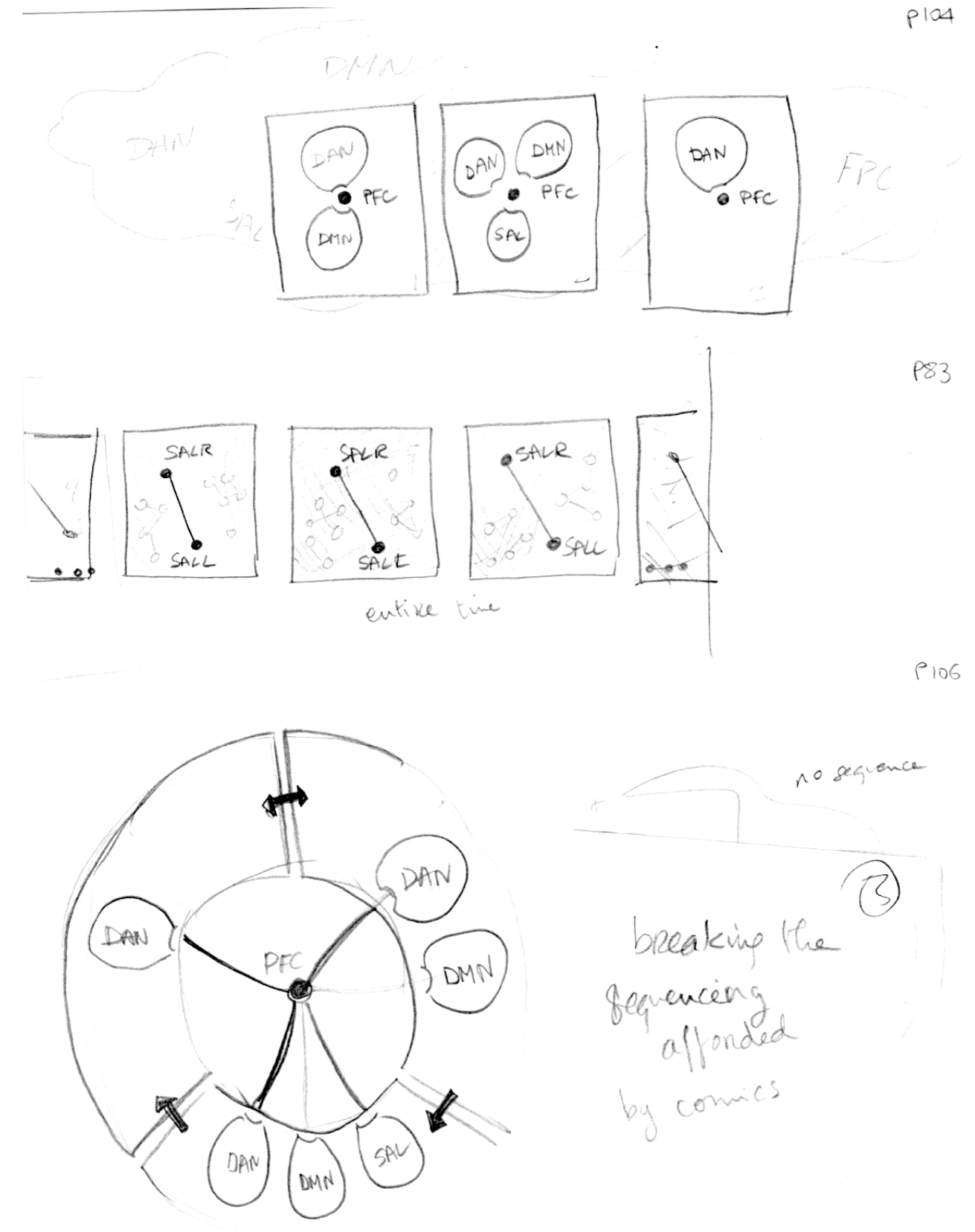
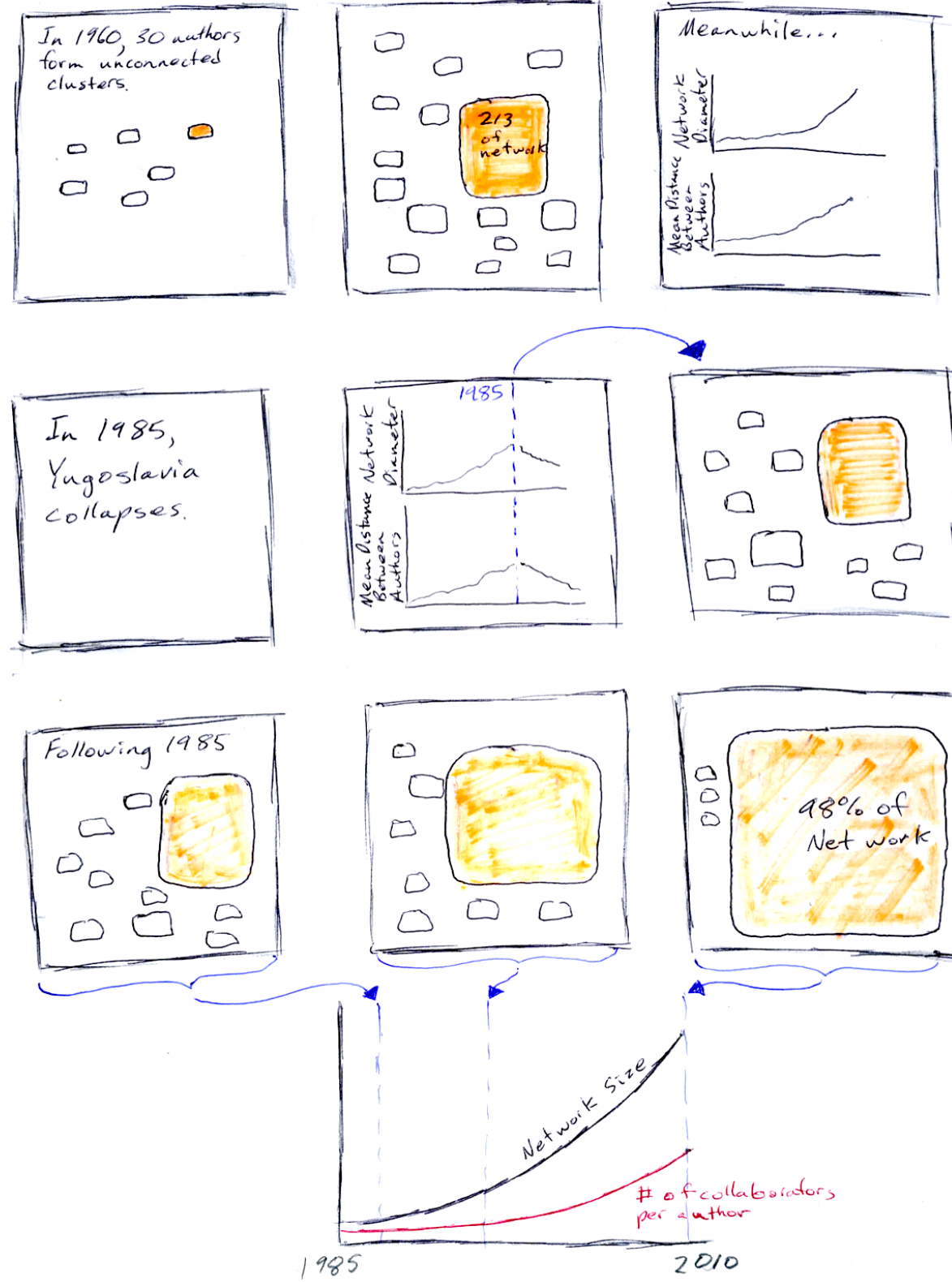




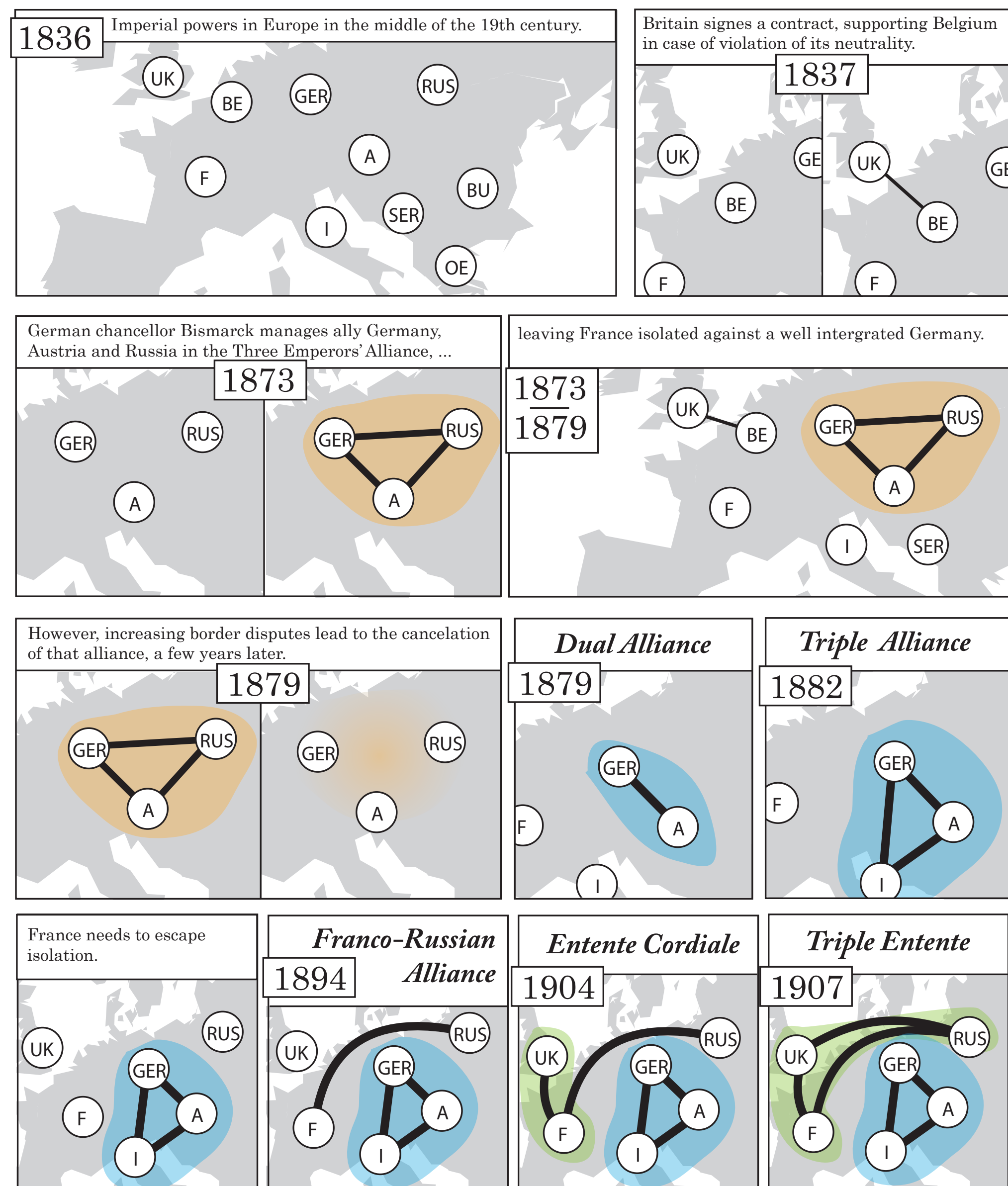
SLOVENE SCIENTIFIC COLLABOR. NETWORK



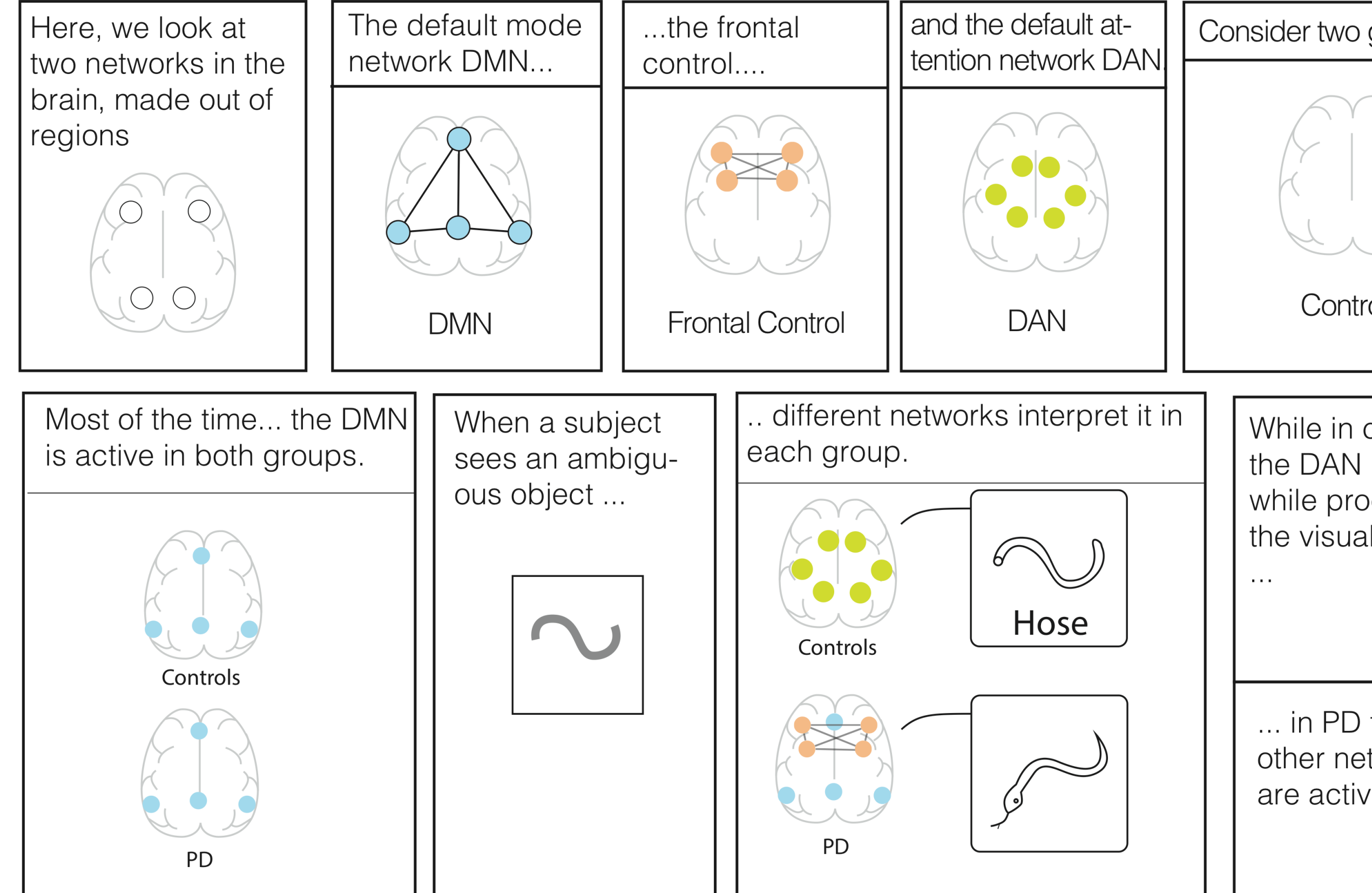
Slovene Co-authorship.



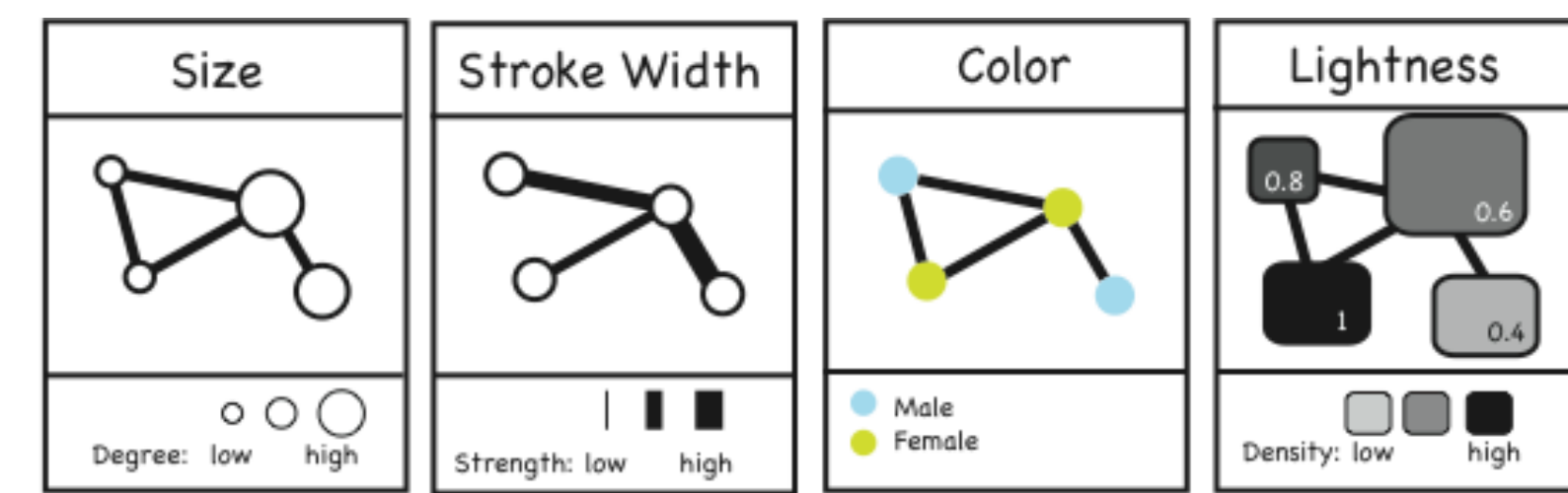
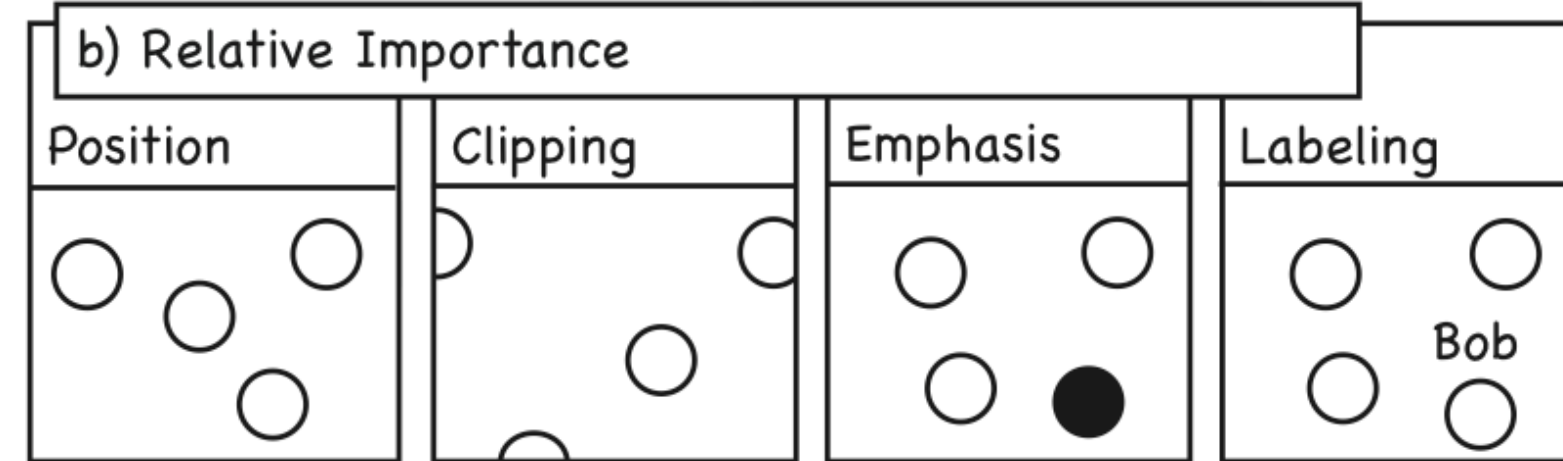
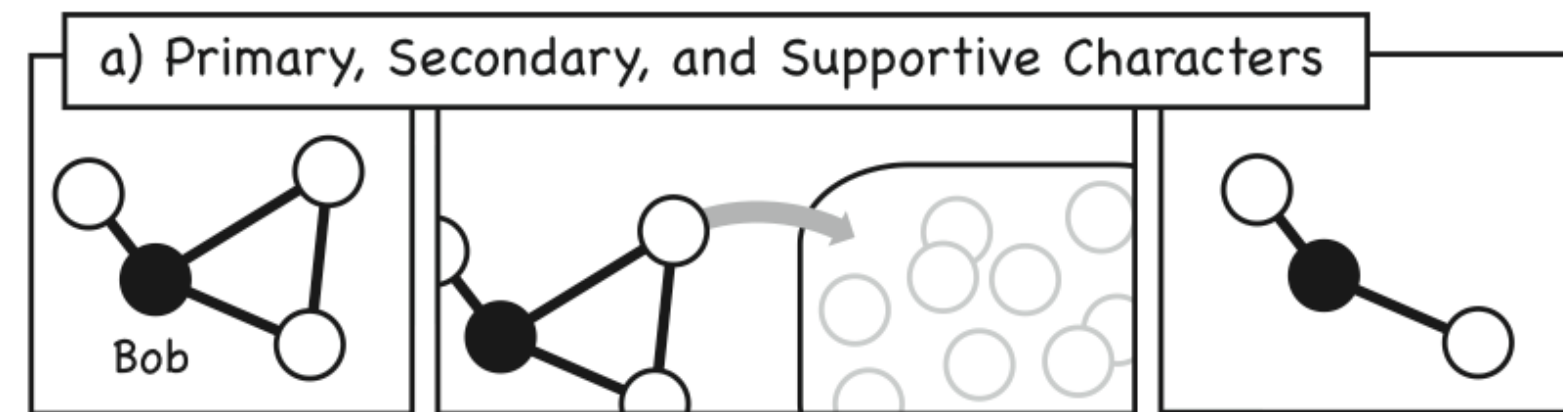
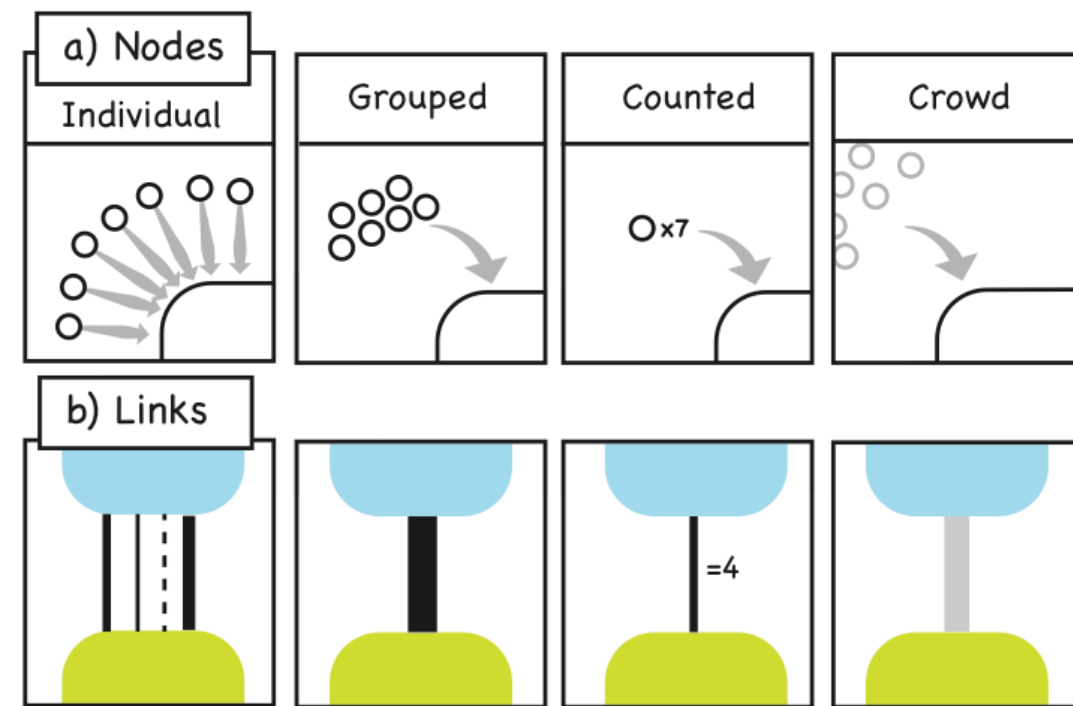
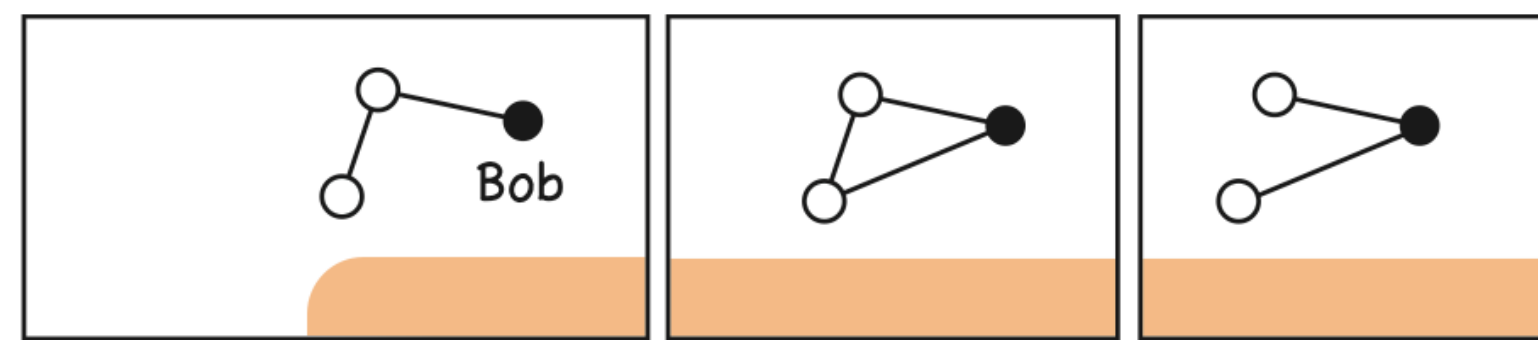
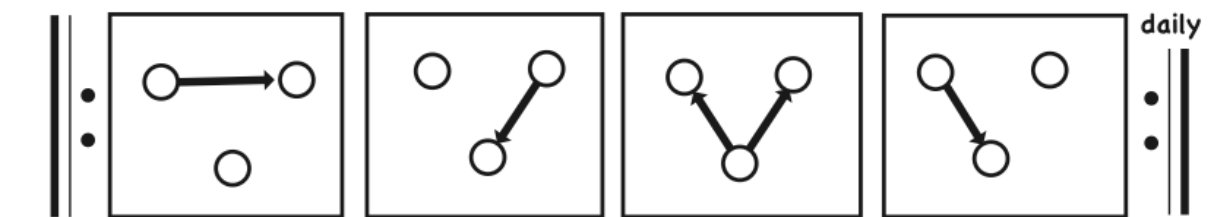
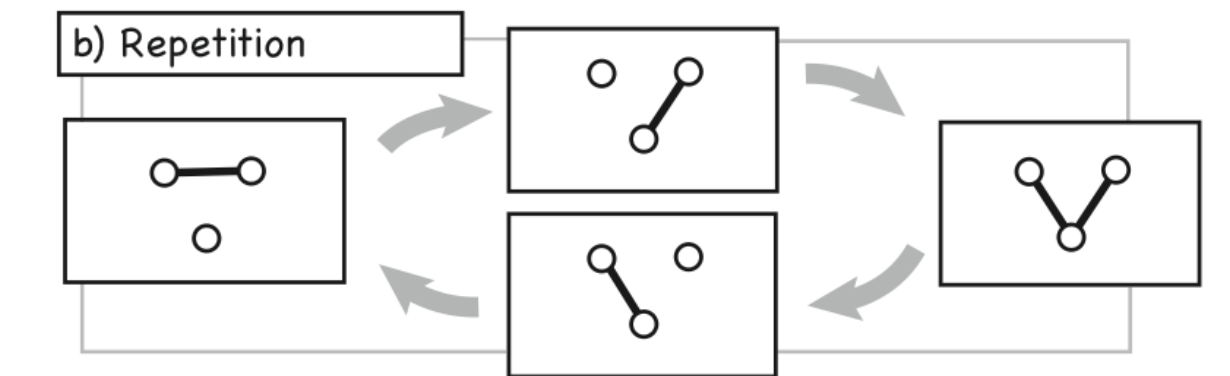
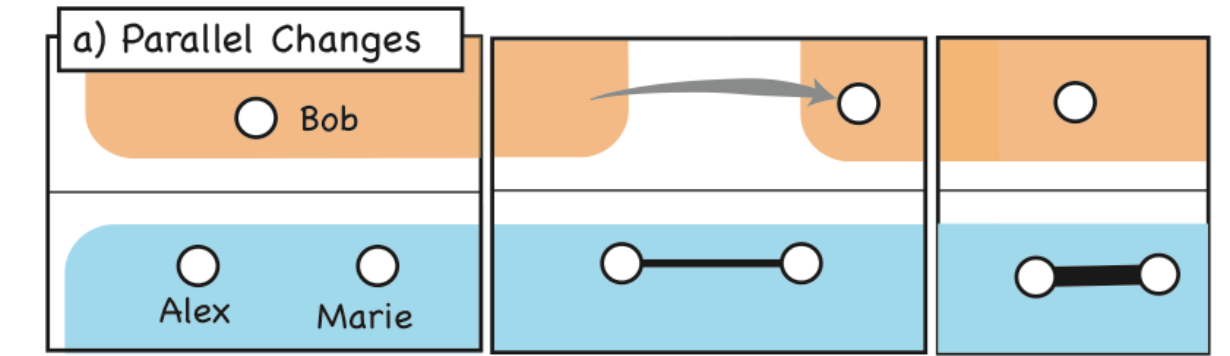
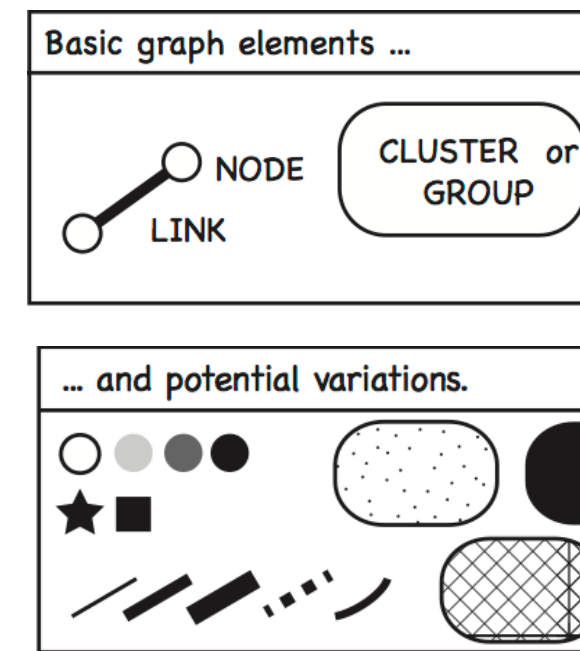
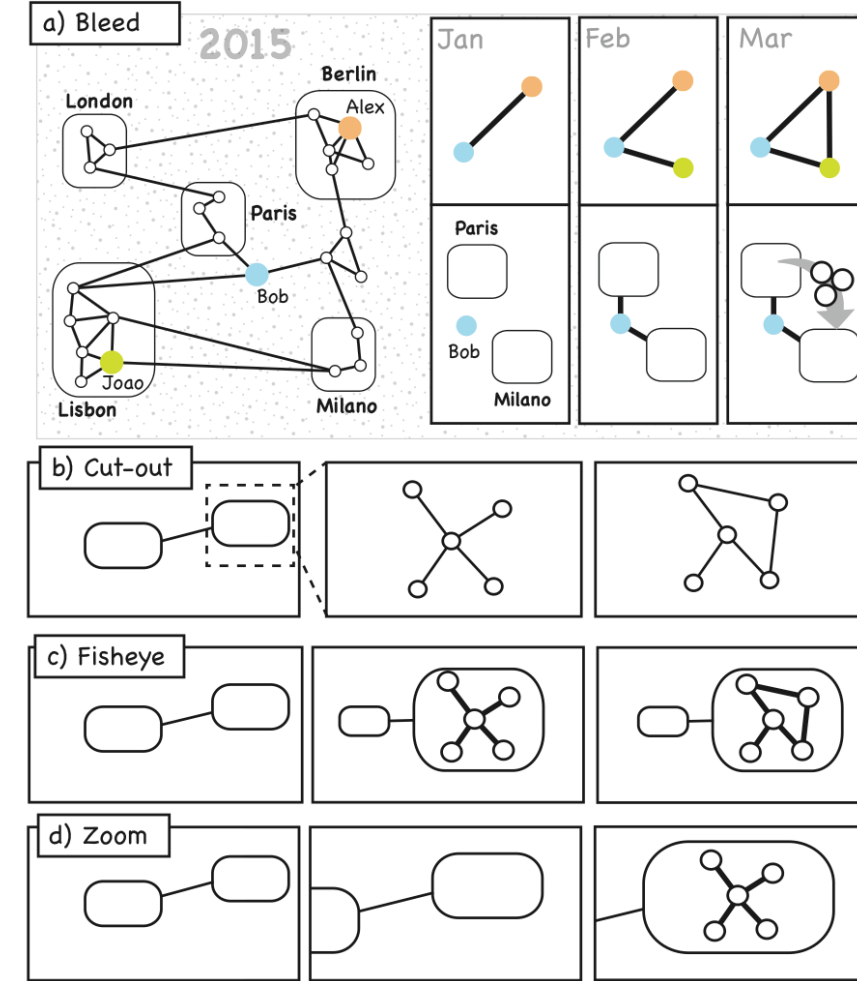
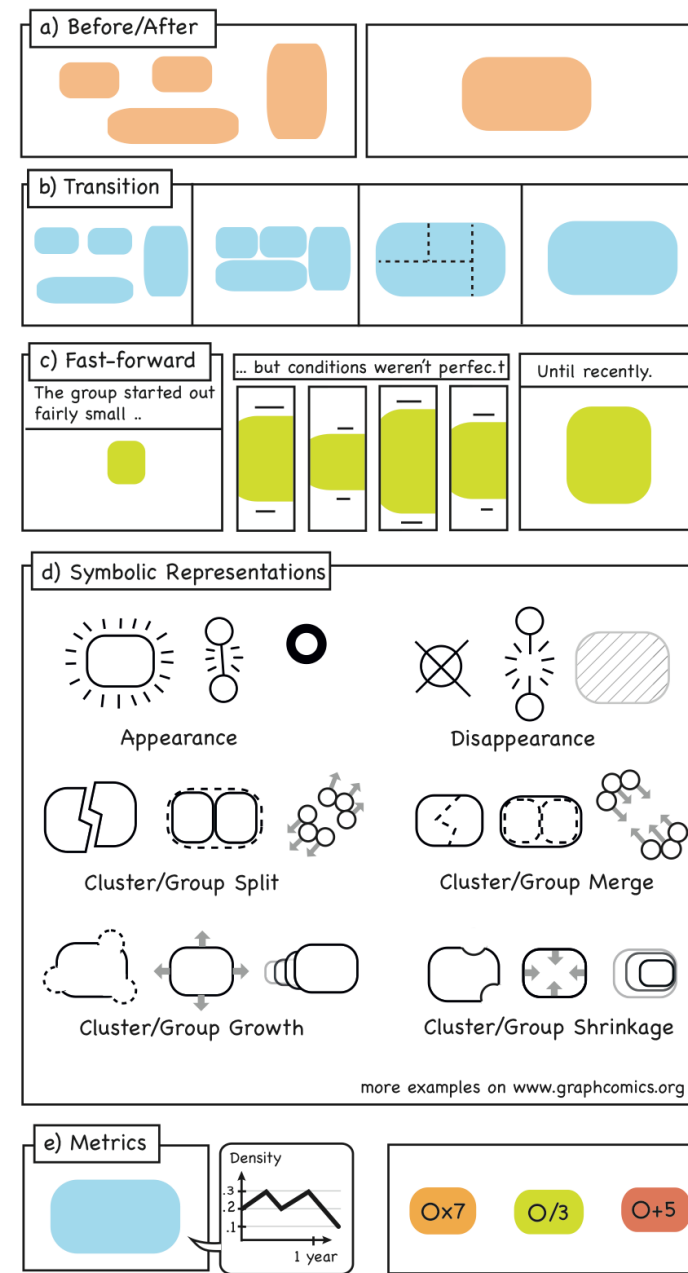
European Alliances before World War I (1836-1914)



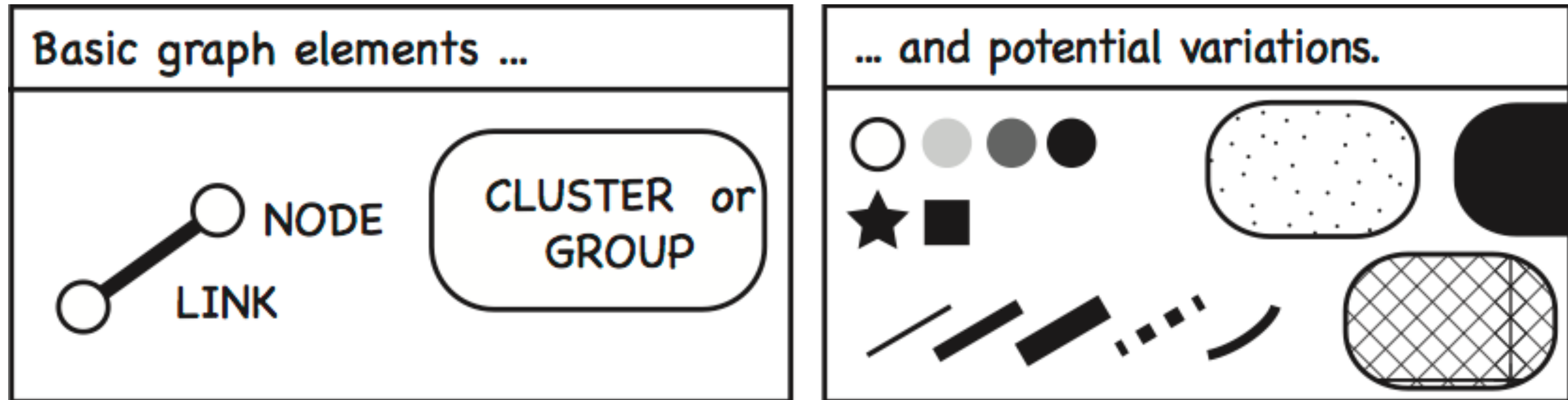
Hallucinations in PD patients



Design Factors



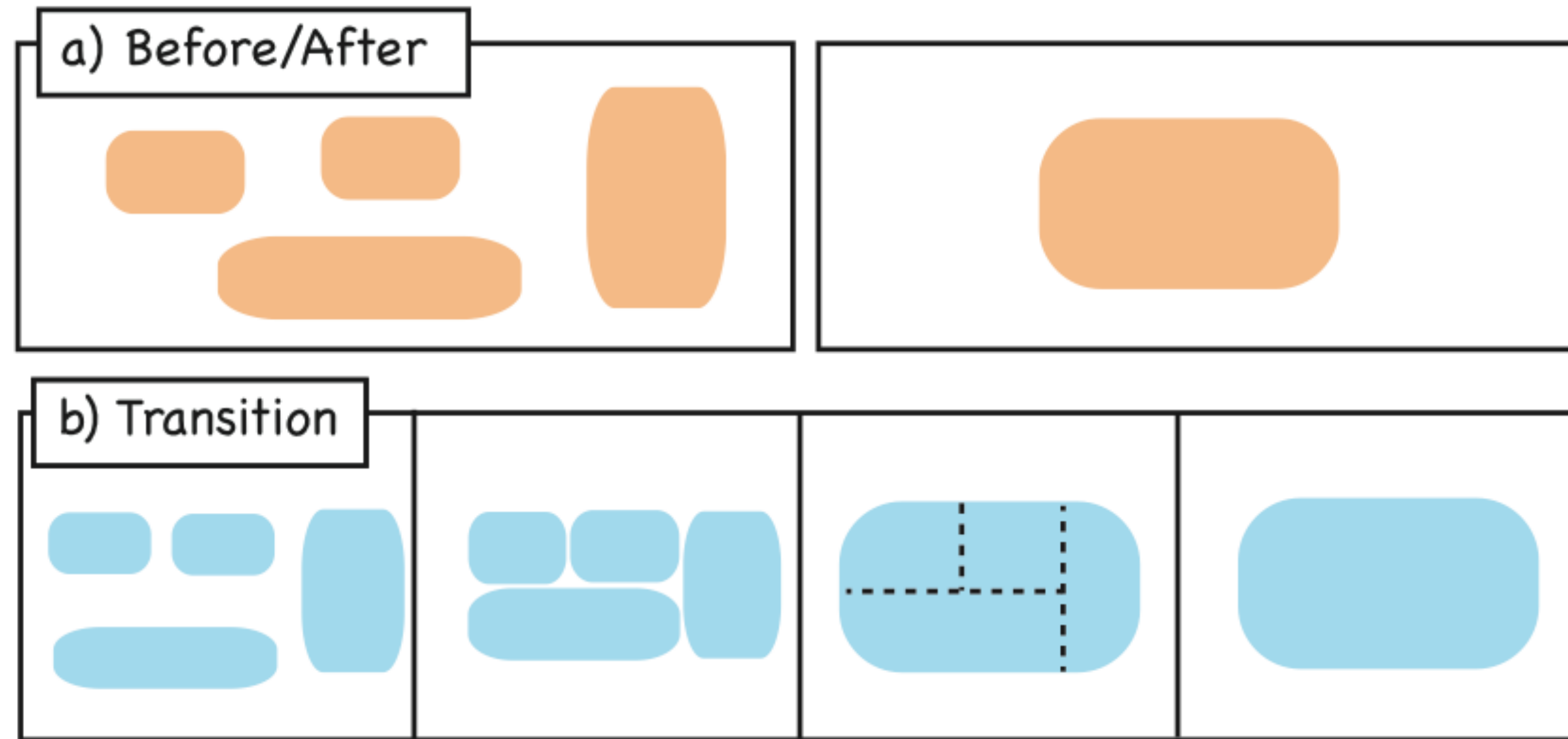
1. Visual Representation of Graph Elements



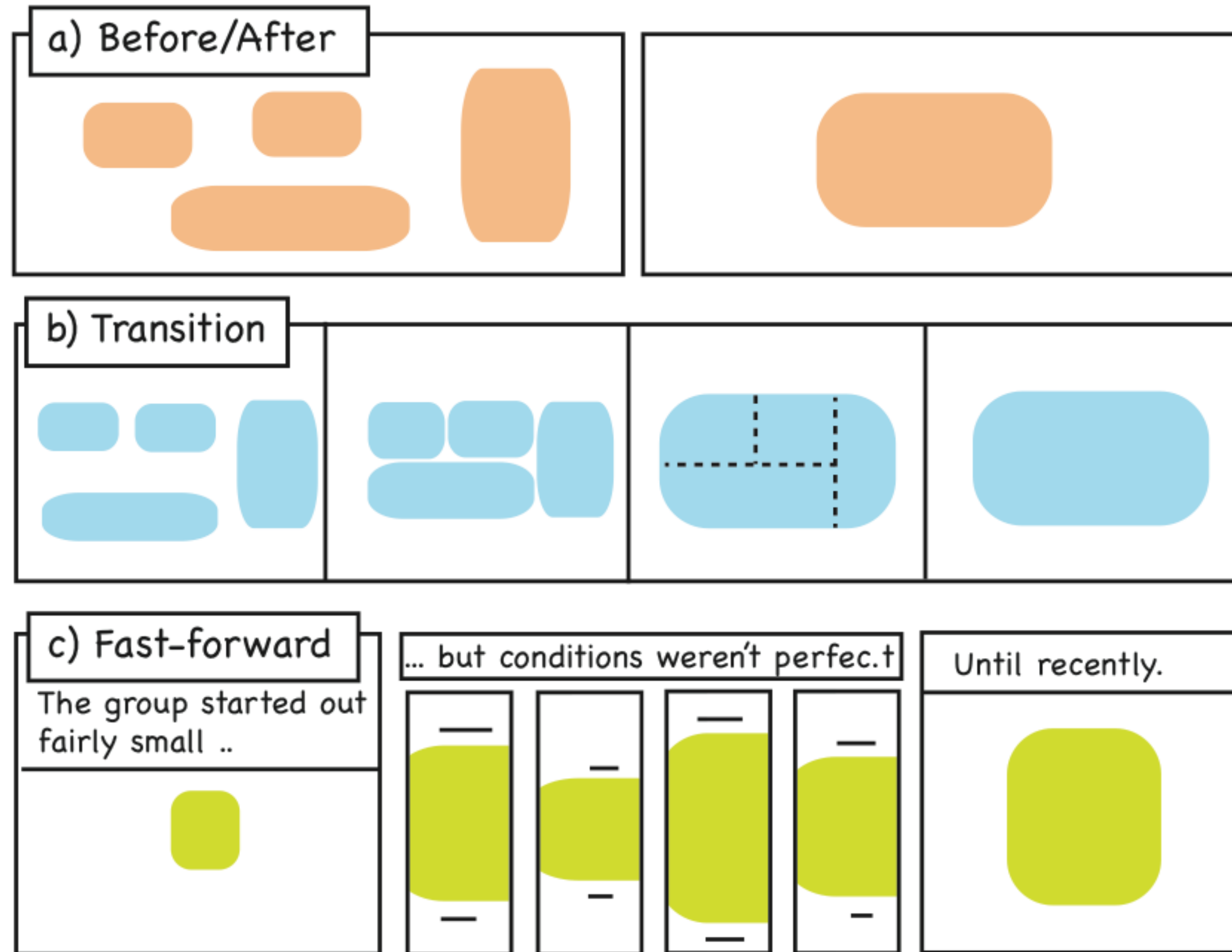
2. Visual Representation of Change



2. Visual Representation of Change

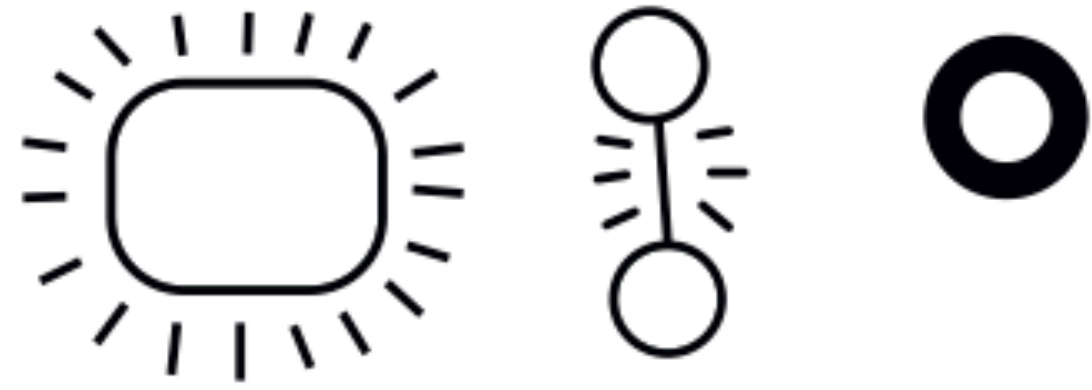


2. Visual Representation of Change

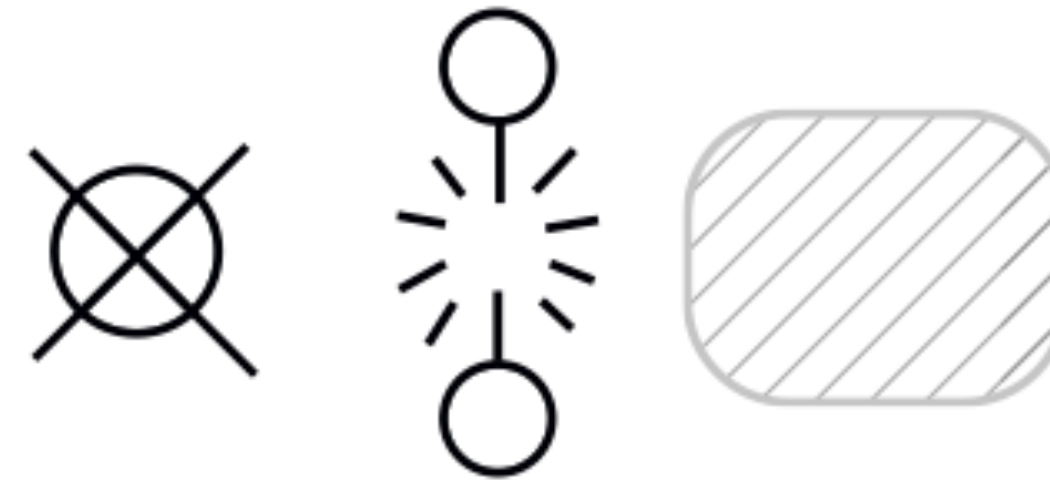


2. Visual Representation of Change

d) Symbolic Representations



Appearance



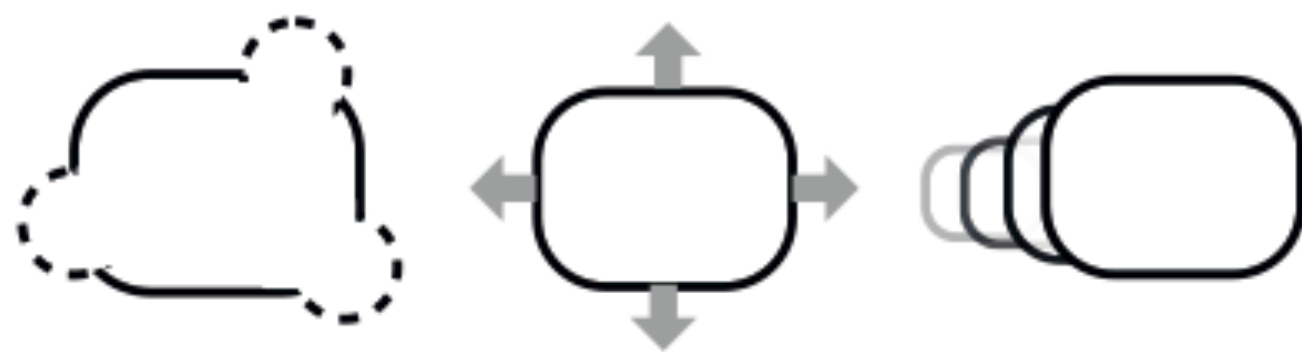
Disappearance



Cluster/Group Split



Cluster/Group Merge



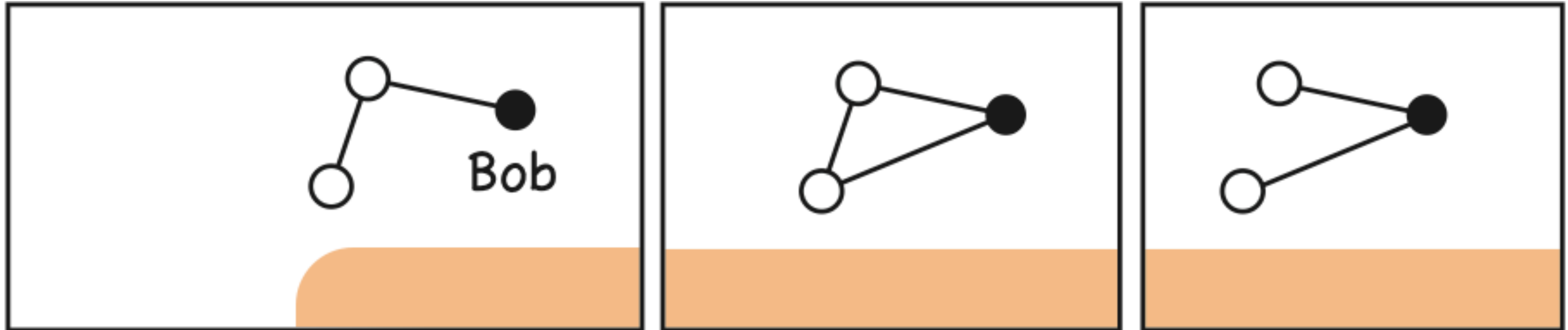
Cluster/Group Growth



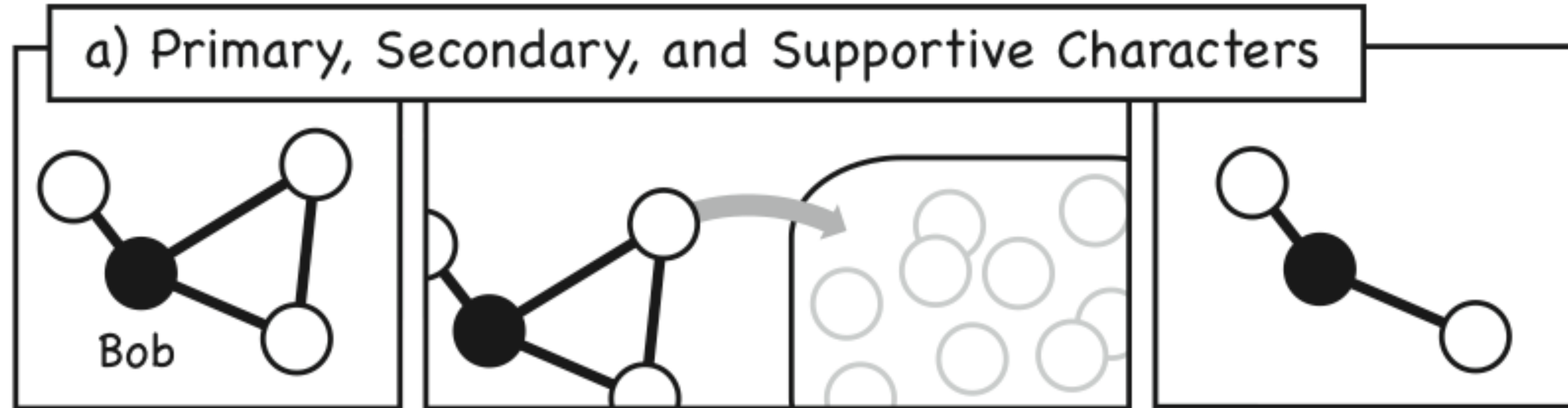
Cluster/Group Shrinkage

more examples on www.graphcomics.org

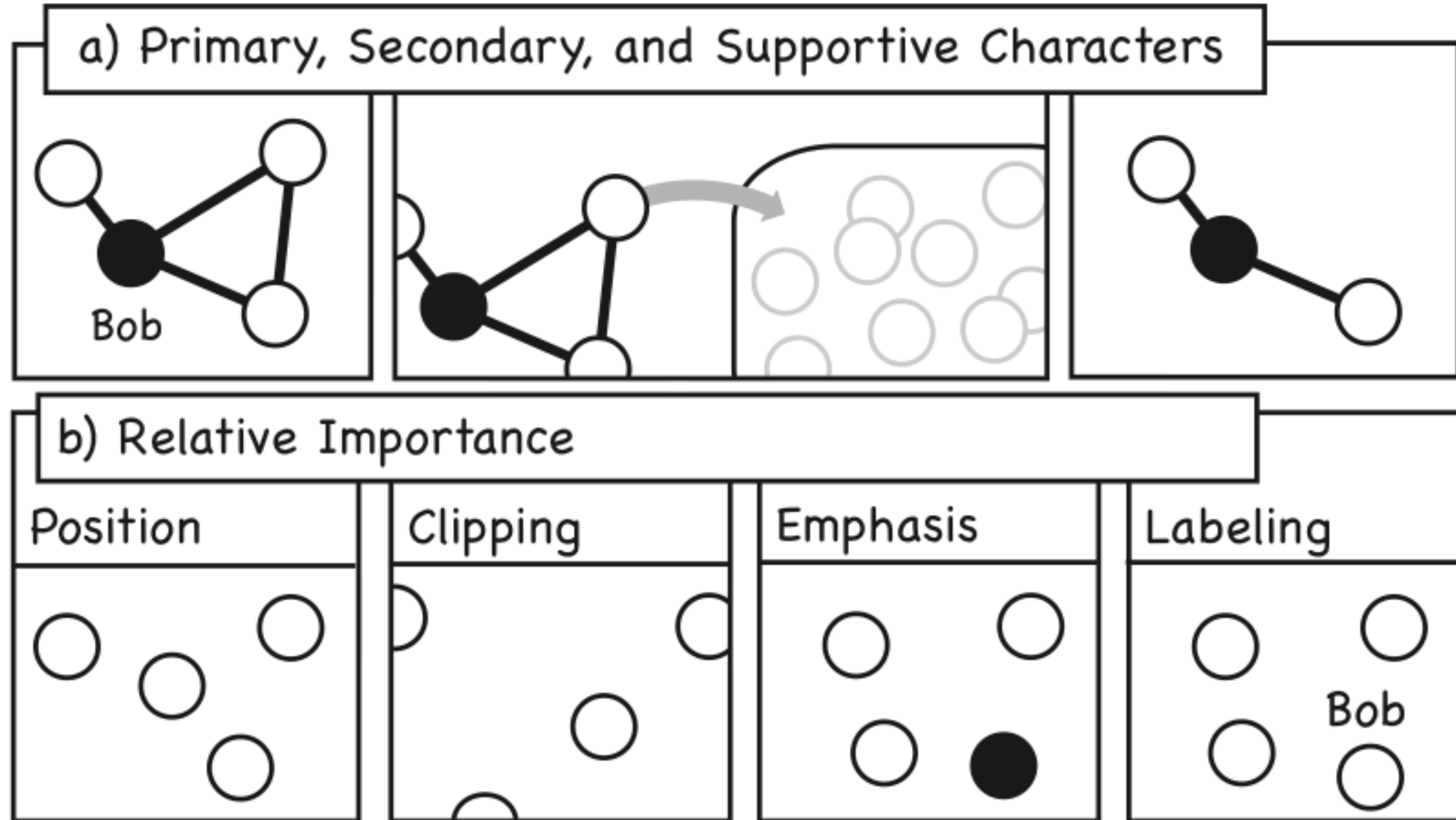
4. Element Identity

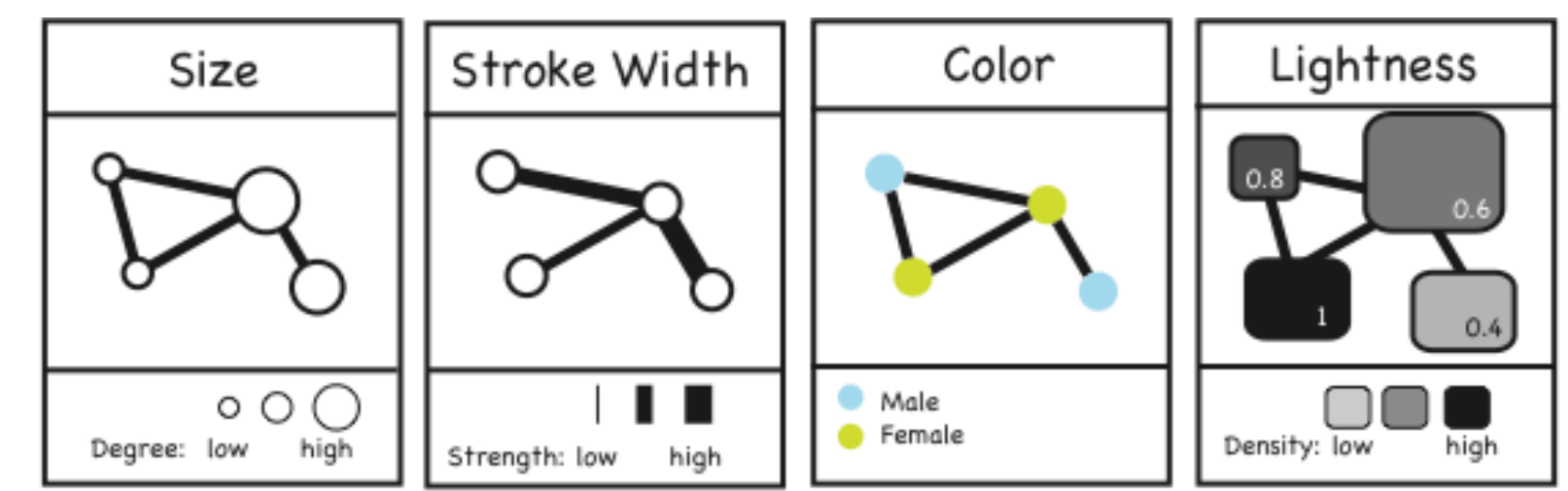
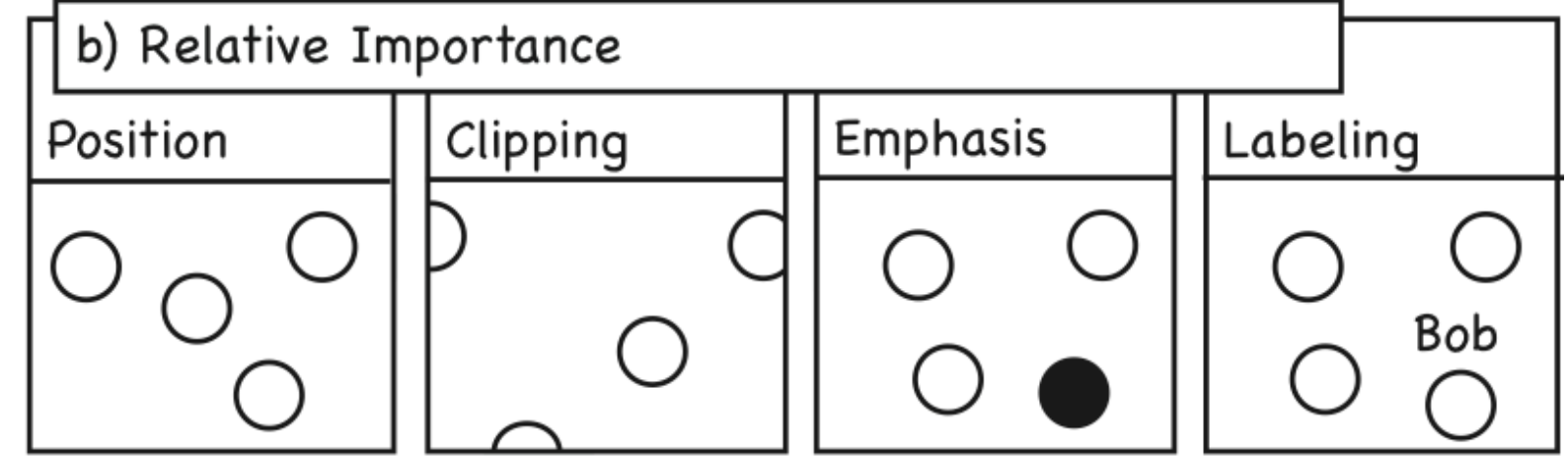
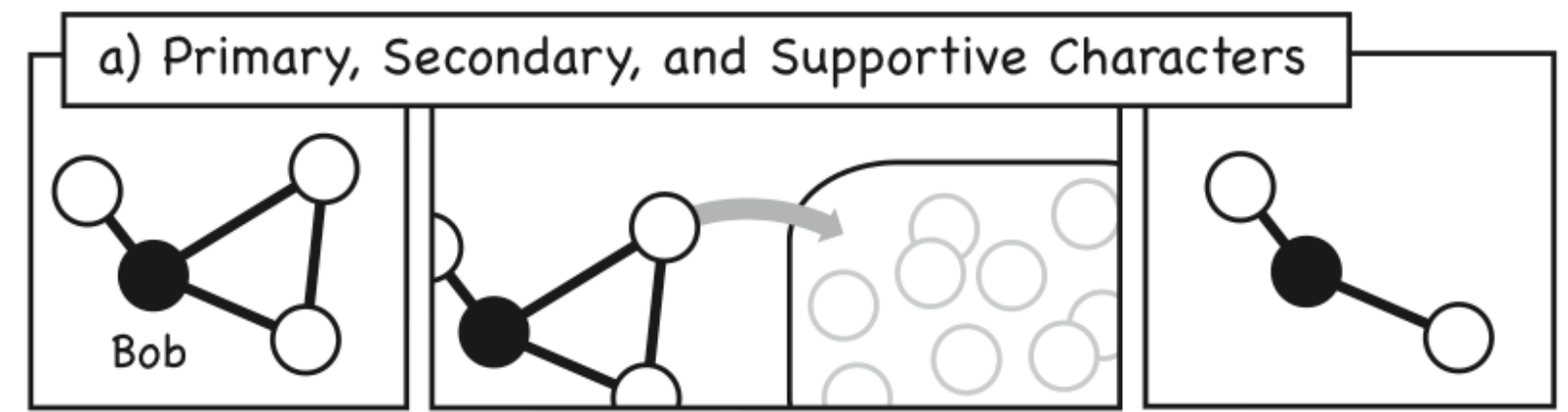
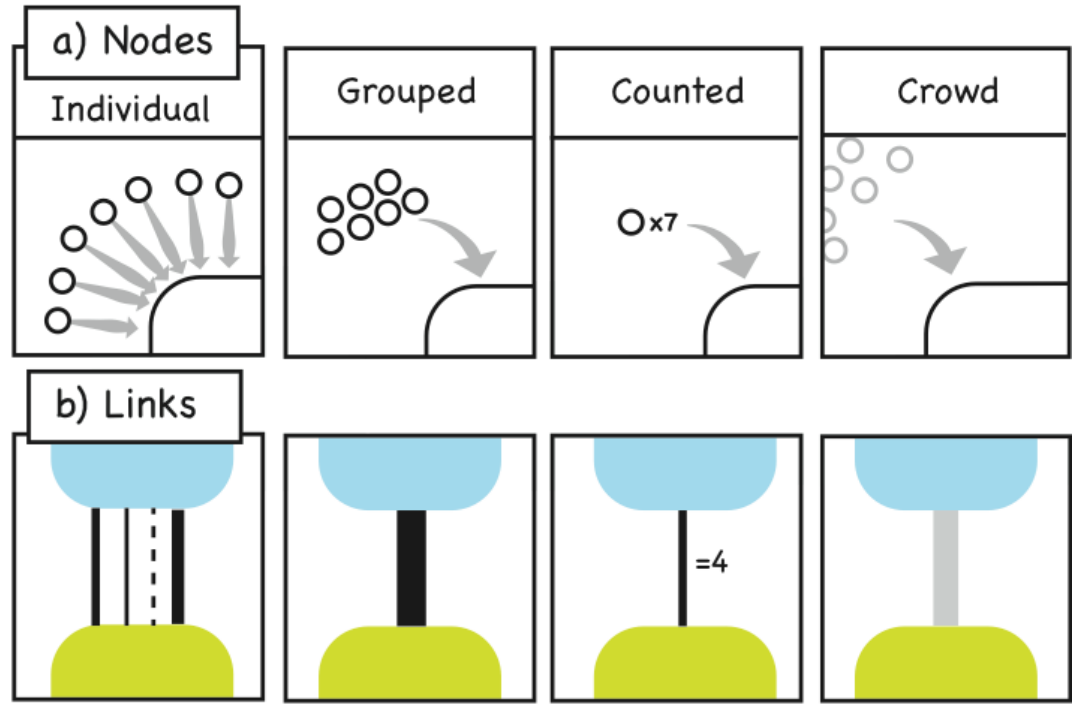
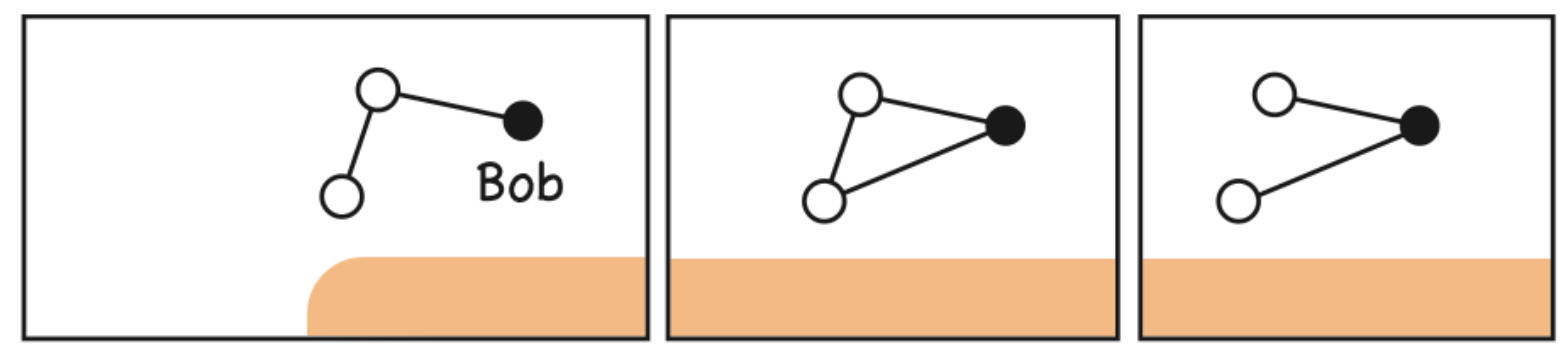
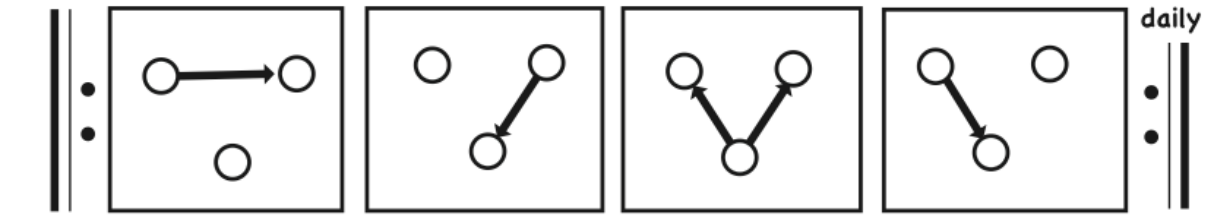
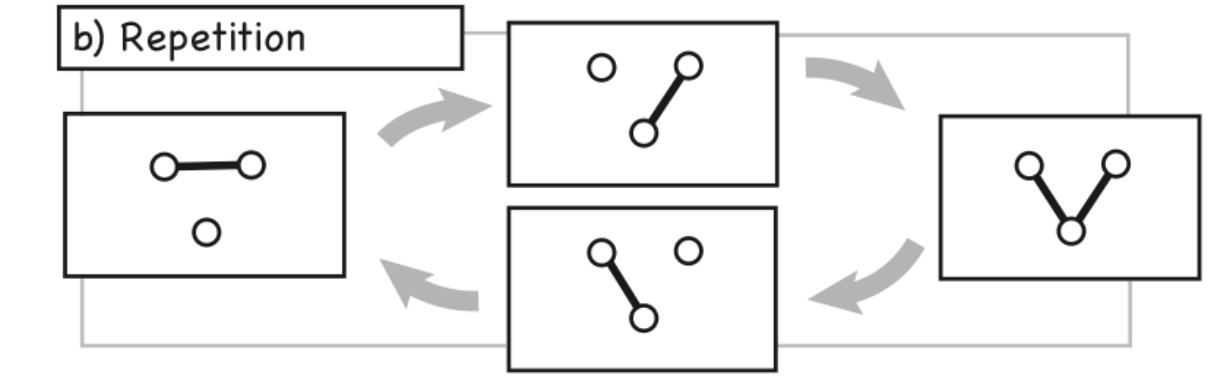
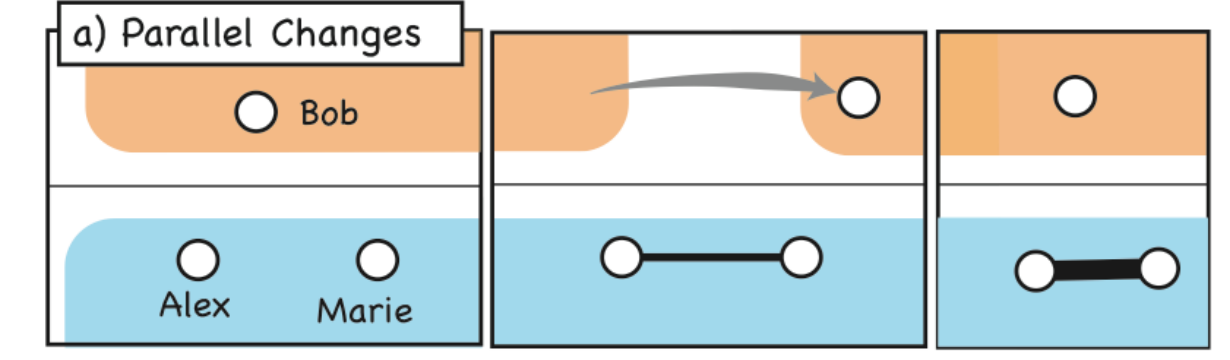
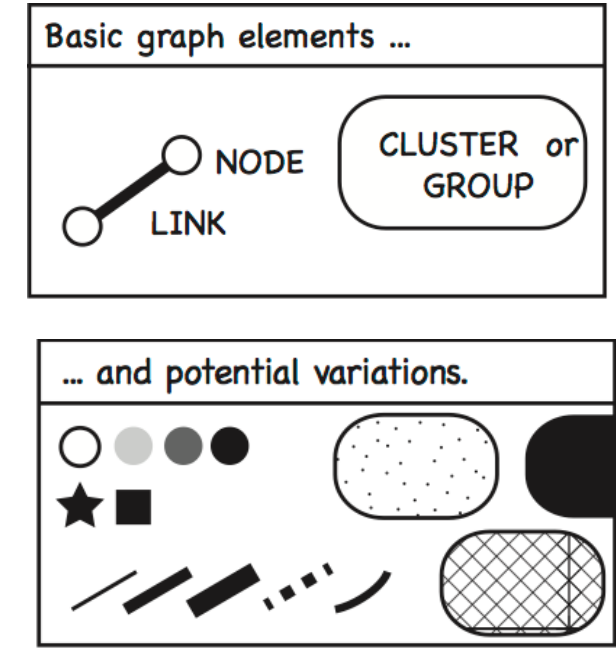
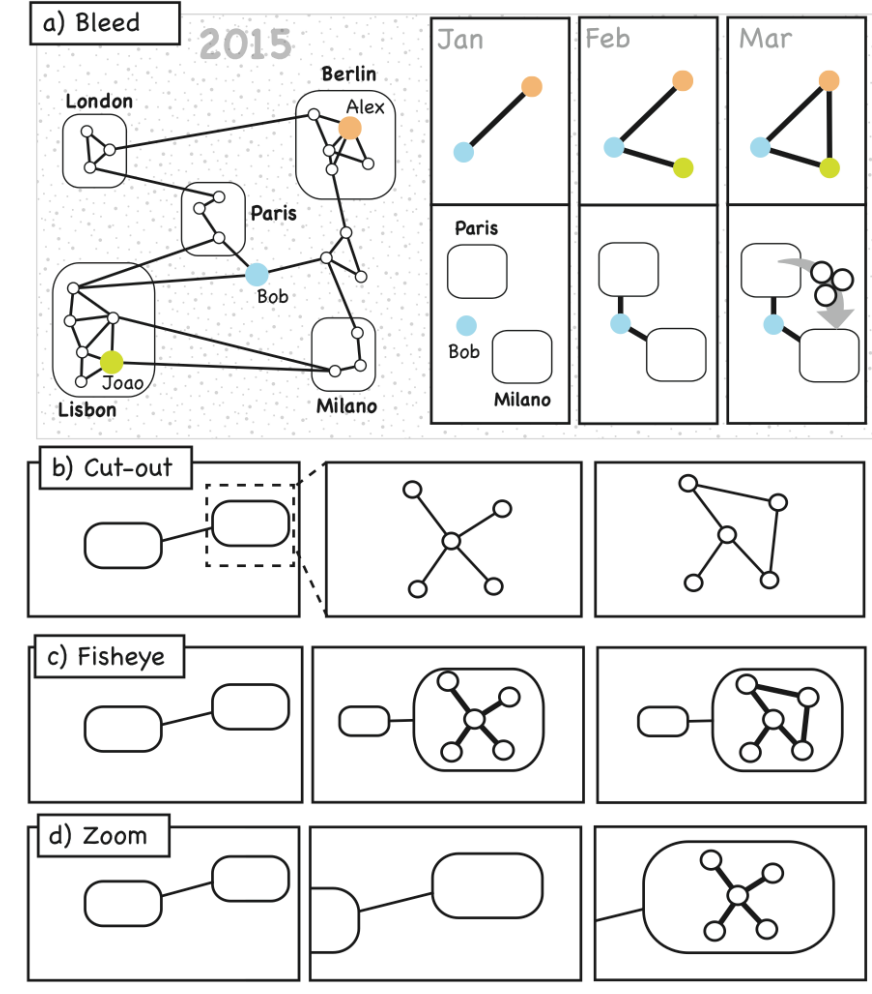
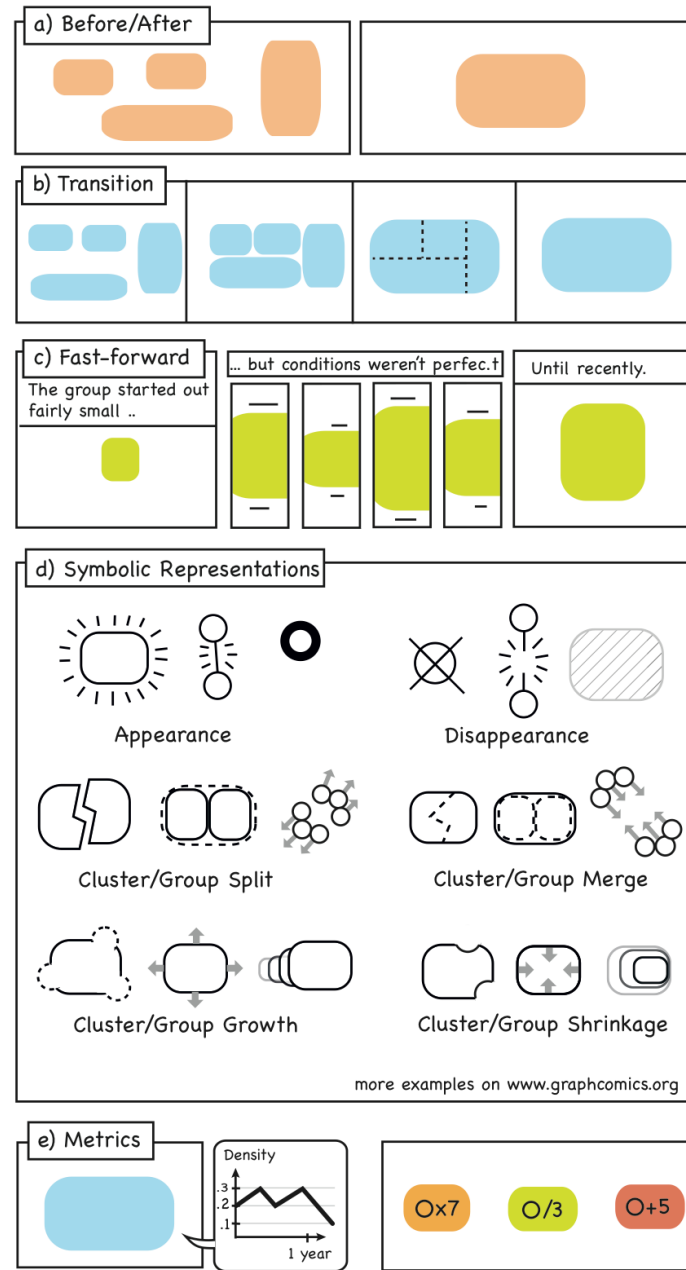


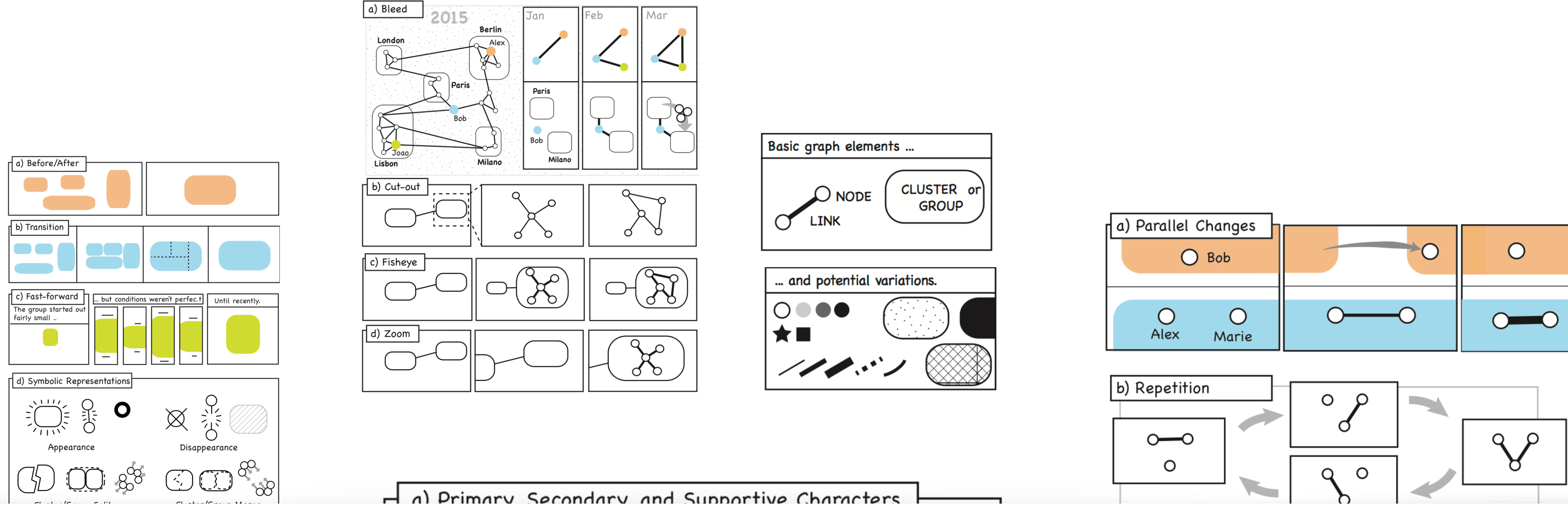
5. Cast of Character



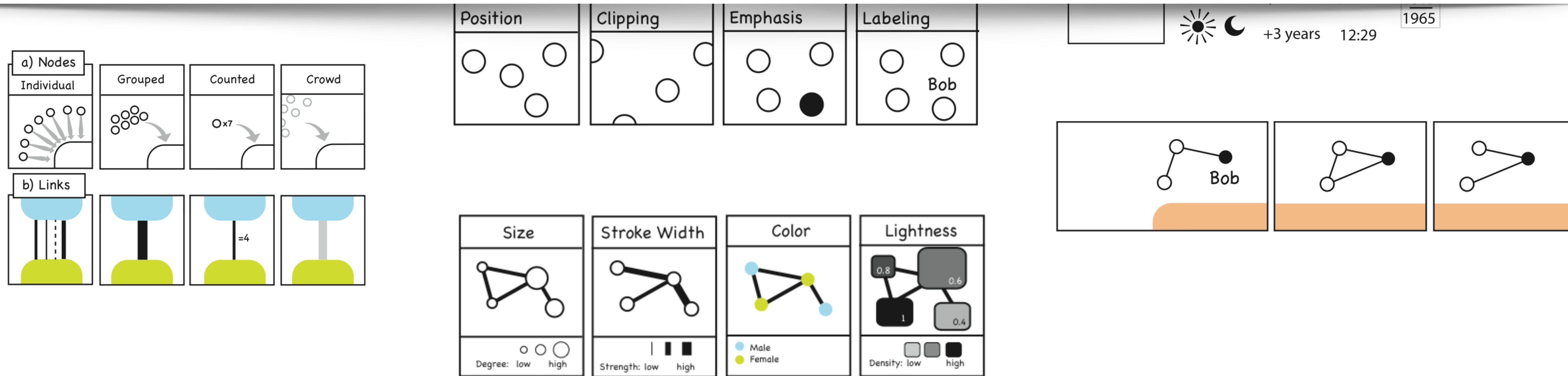
5. Cast of Character

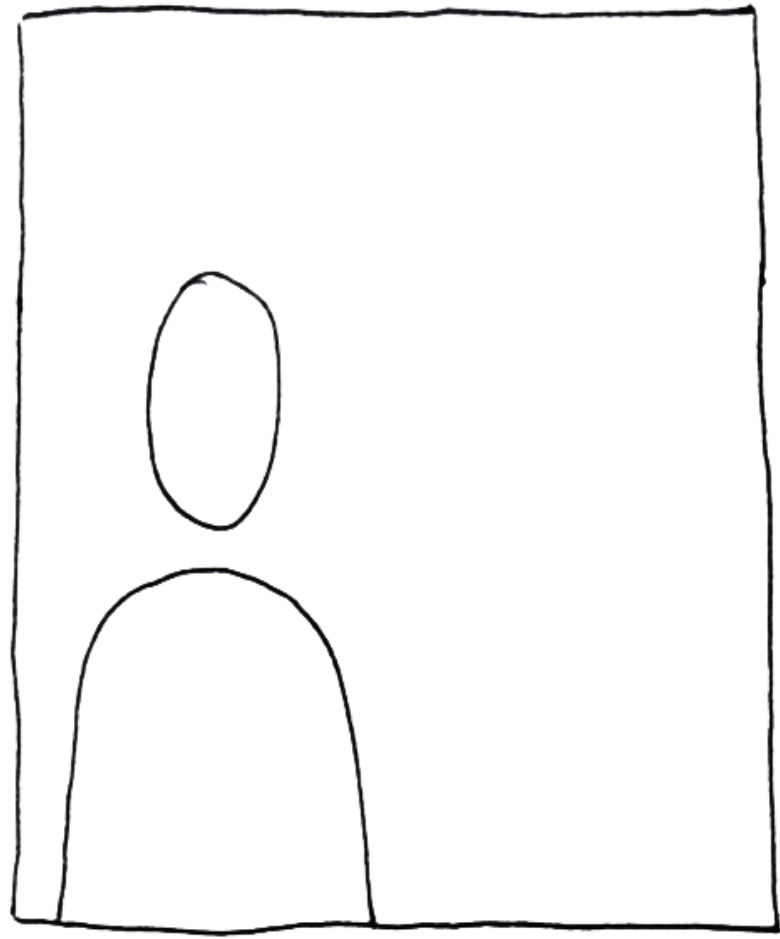


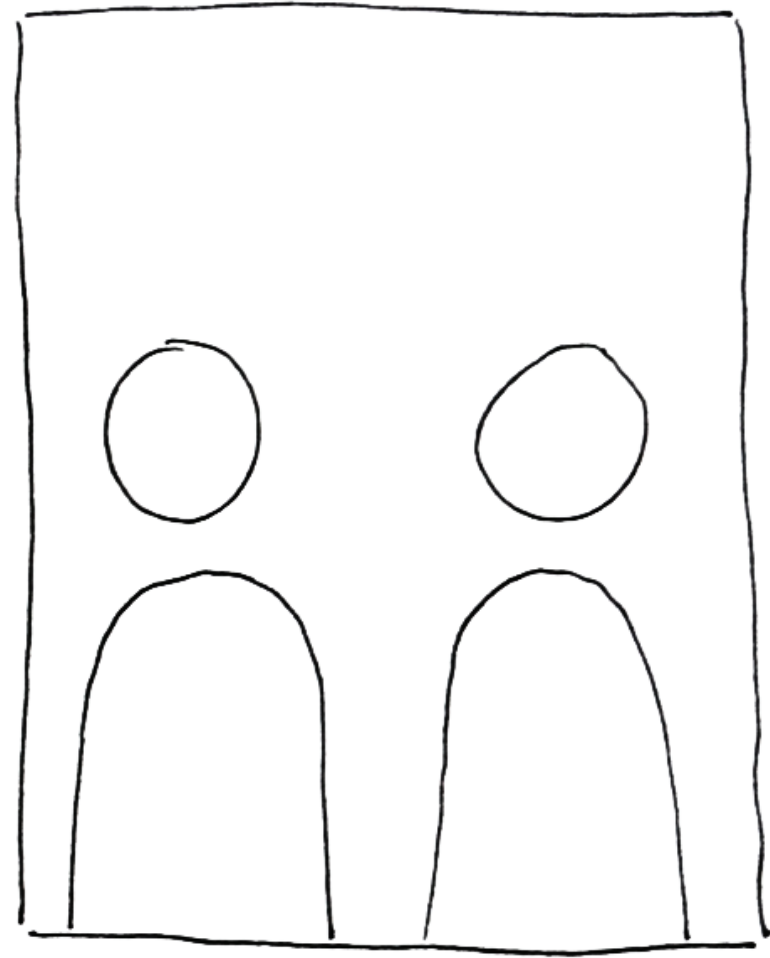
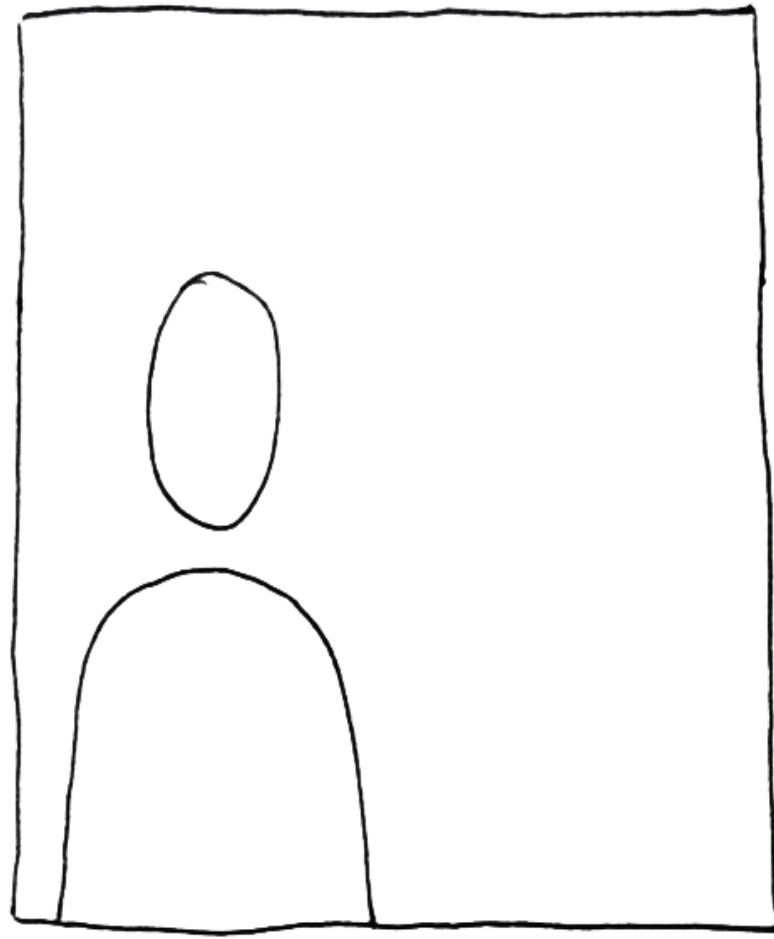


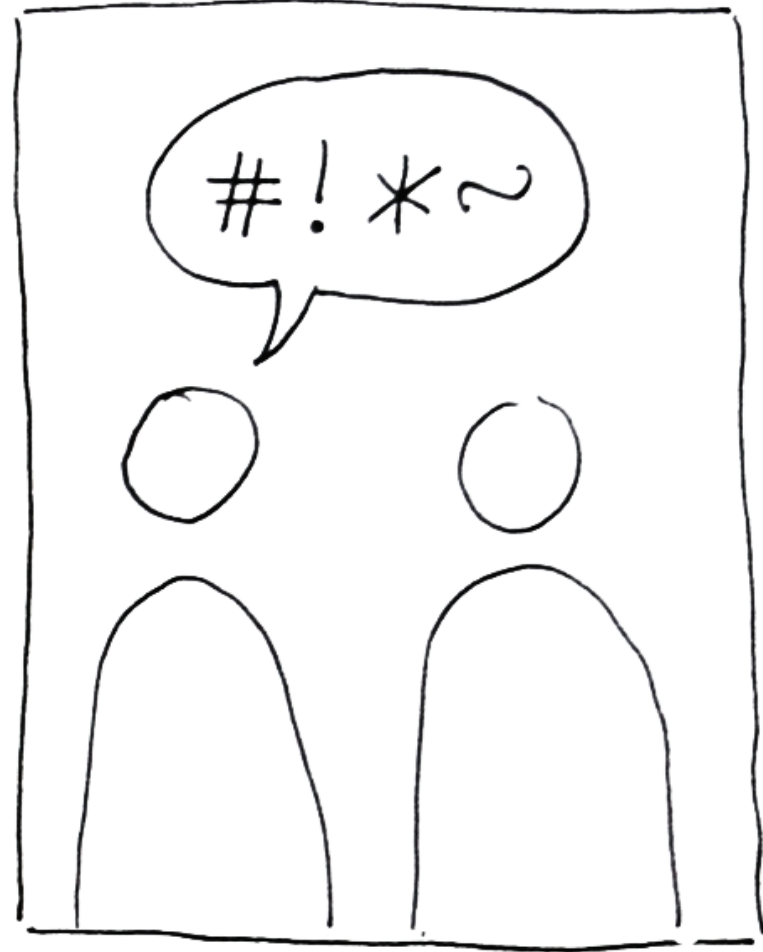
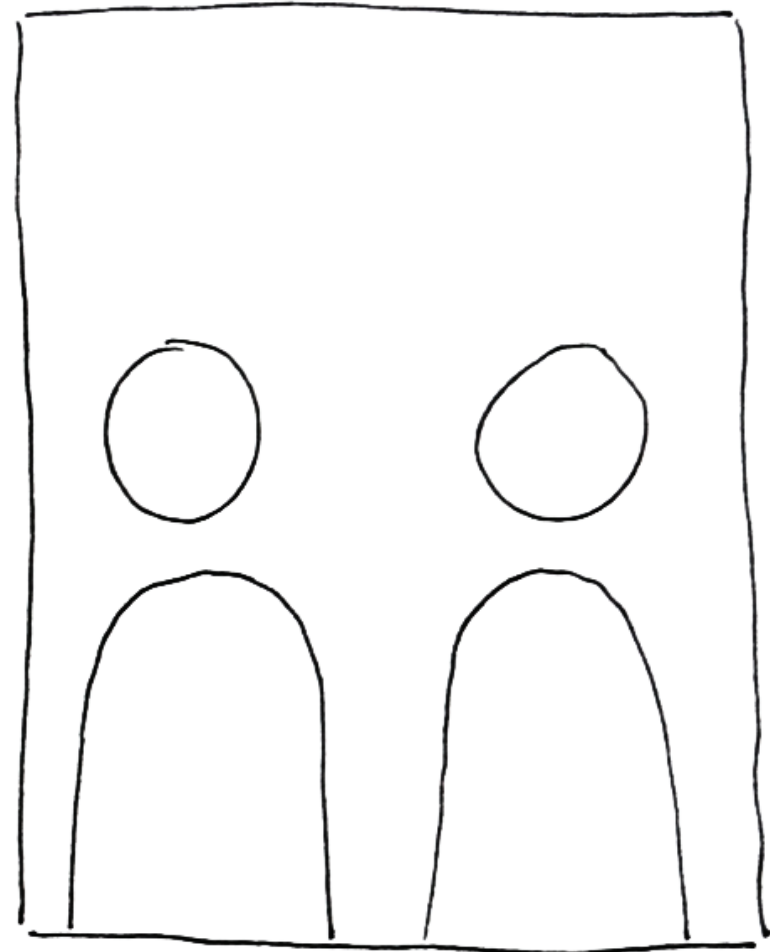
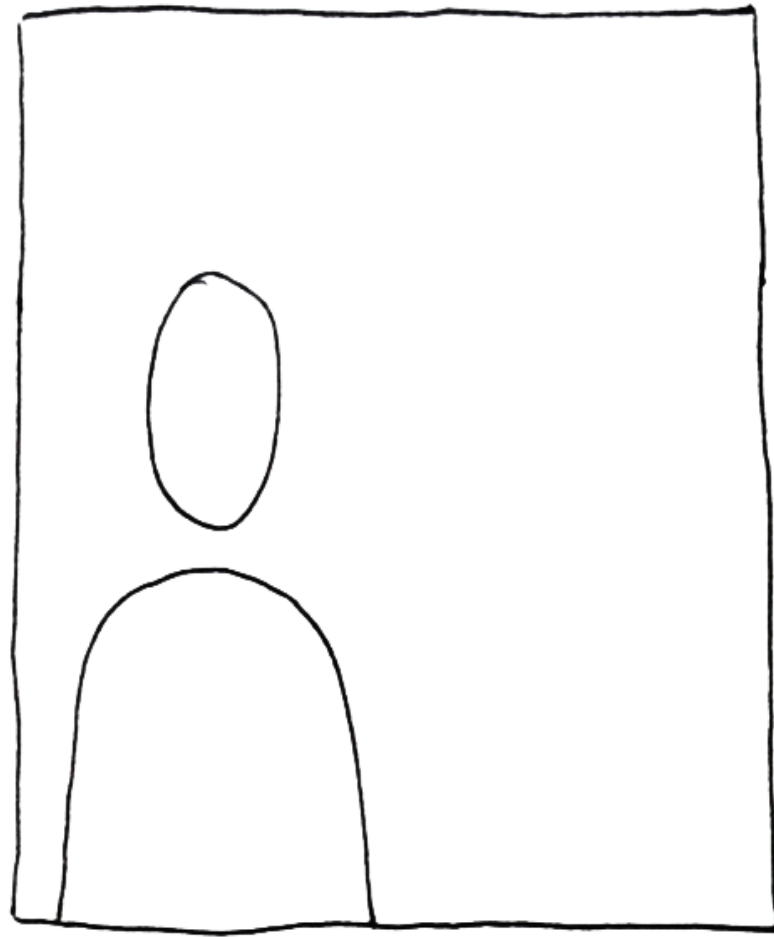


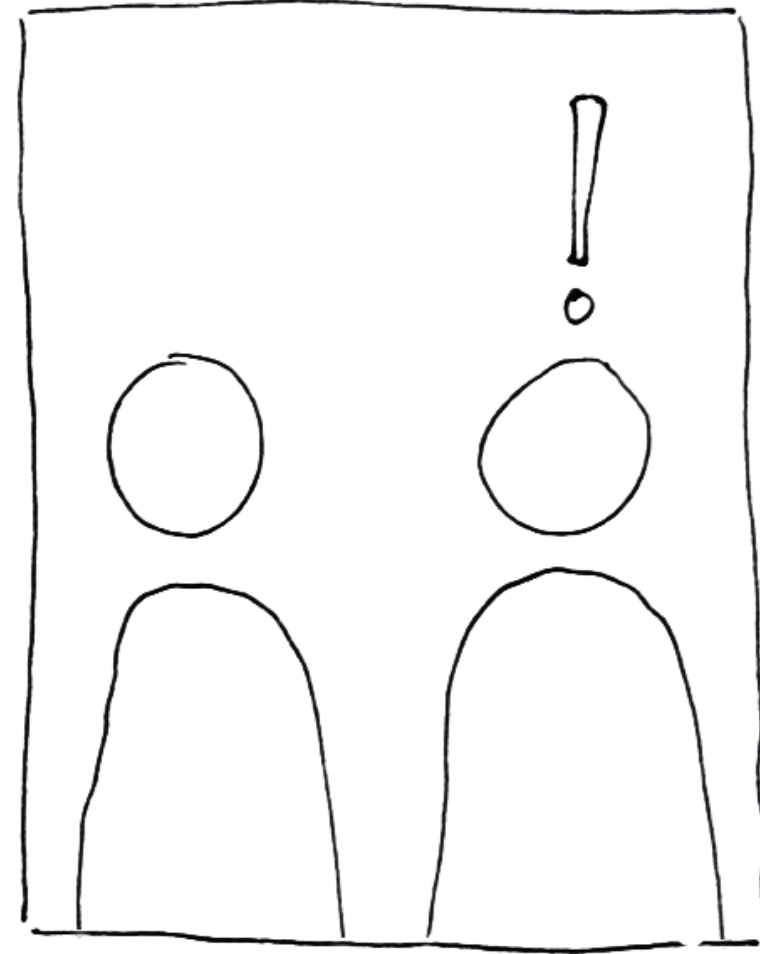
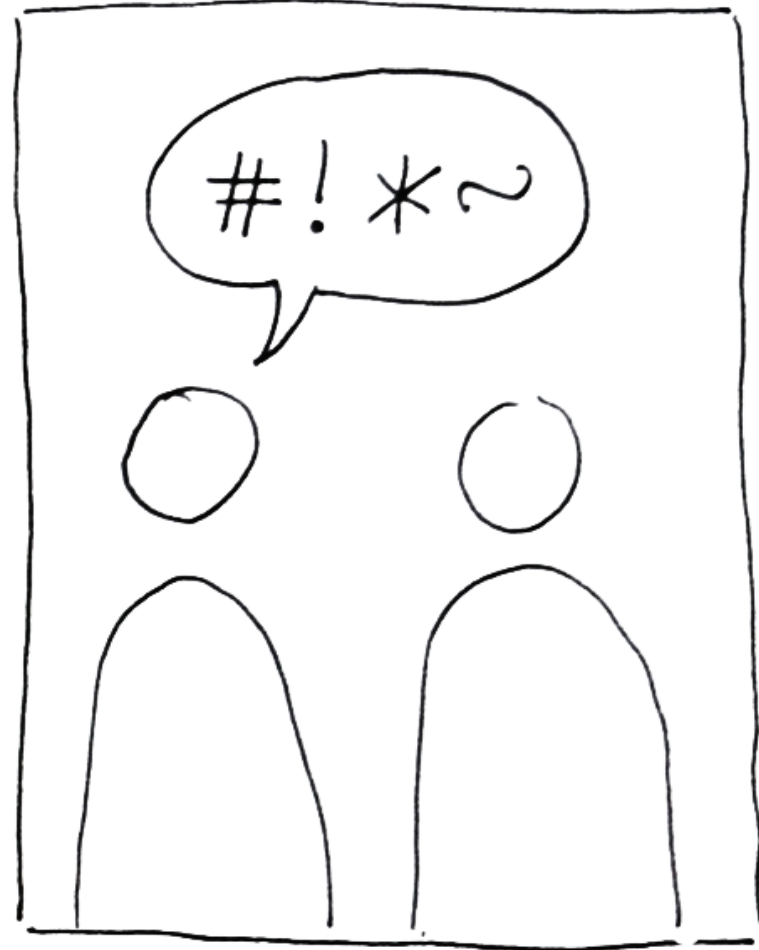
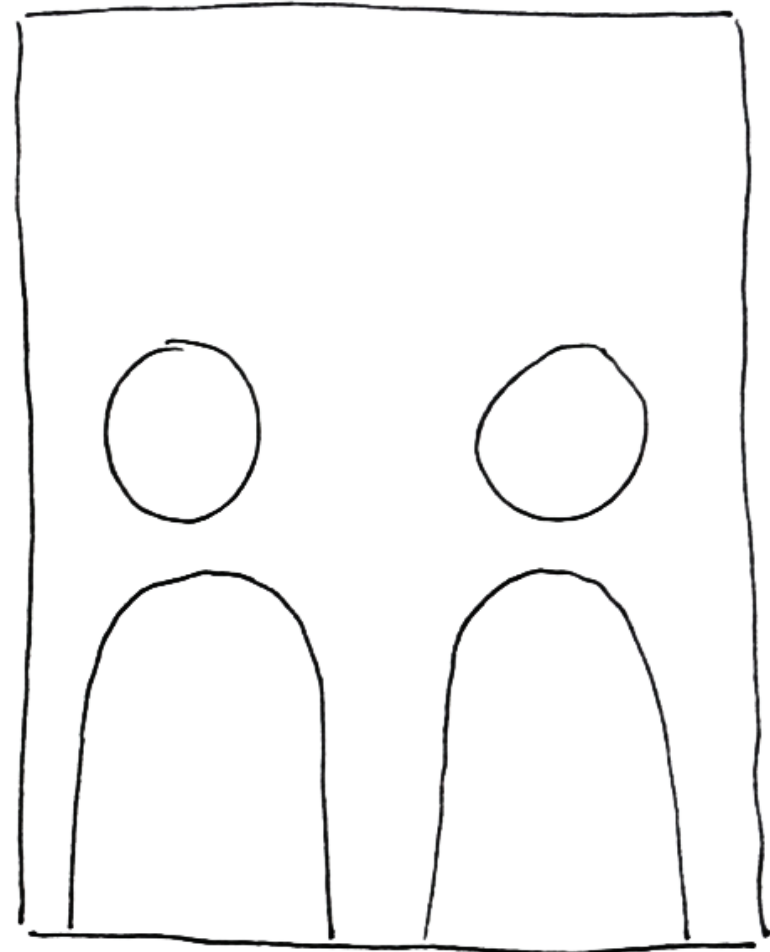
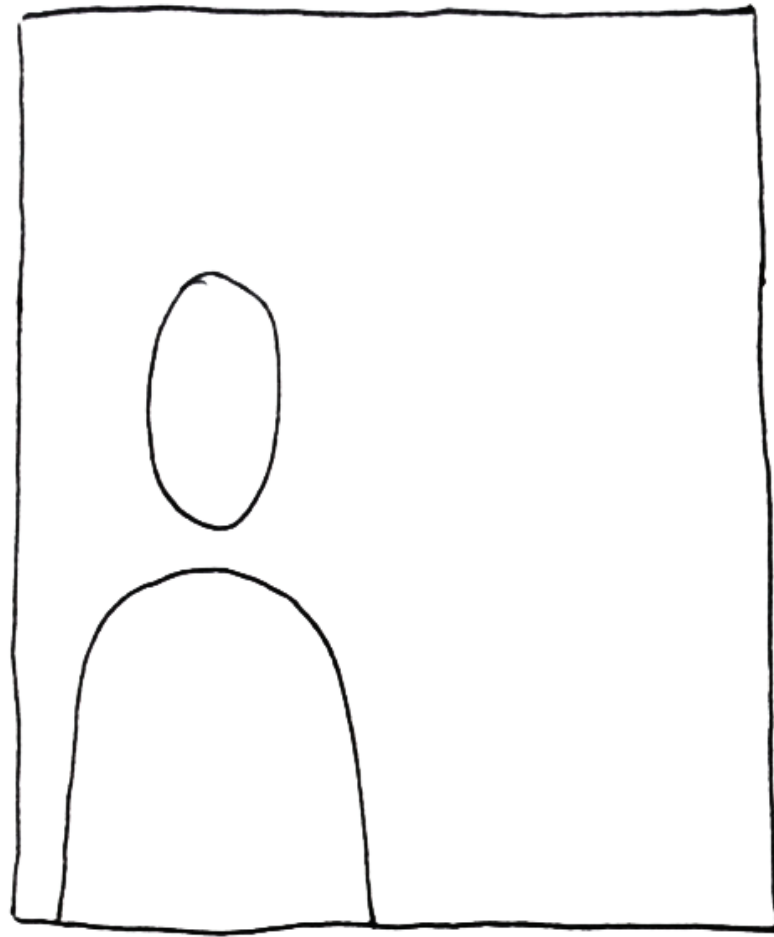
2. Are graph comics understandable?

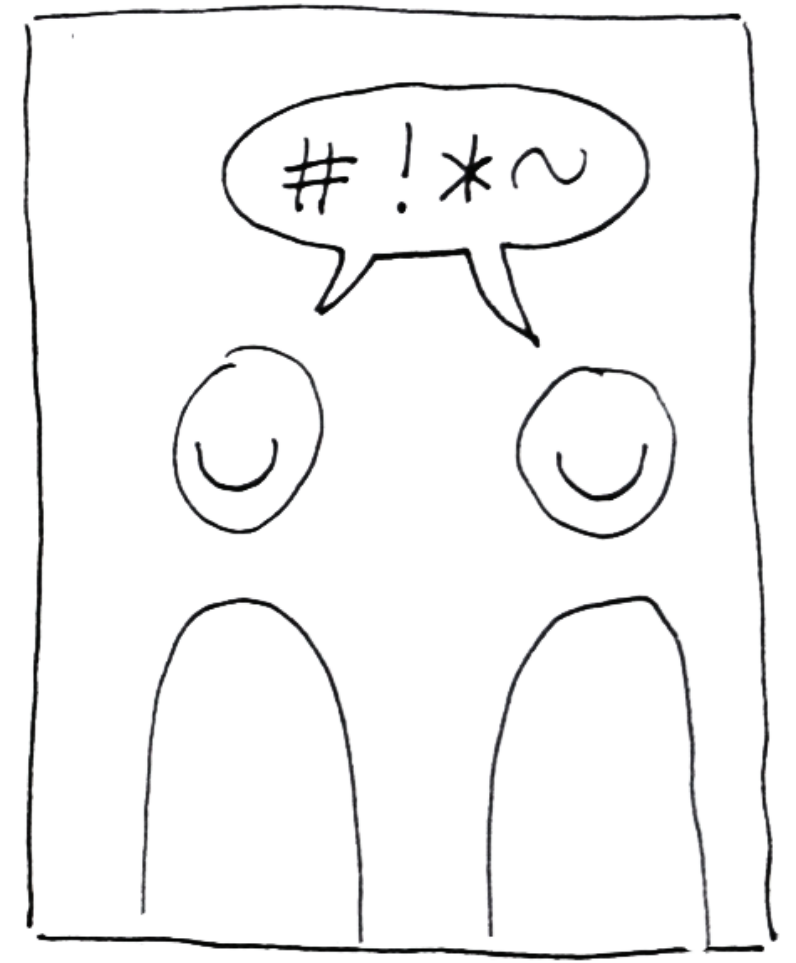
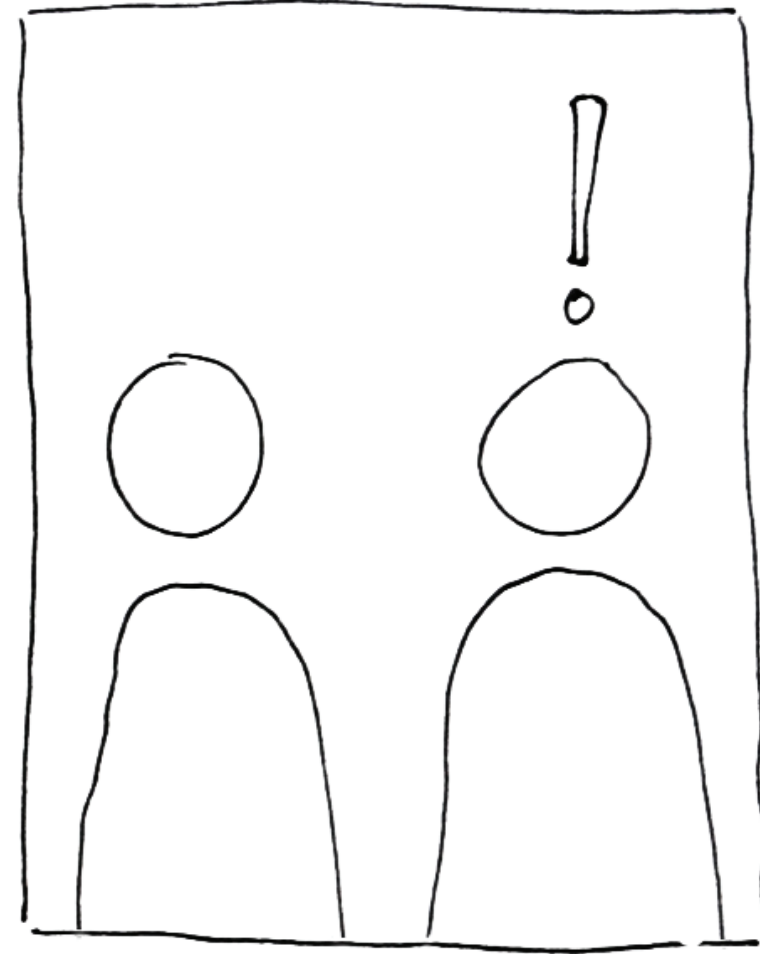
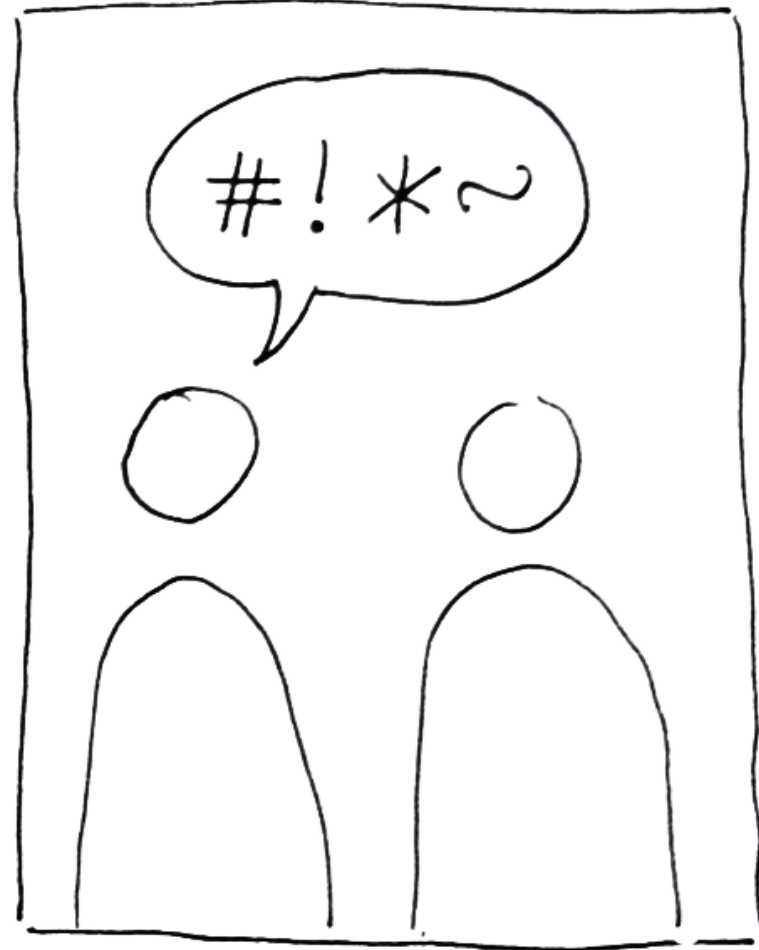
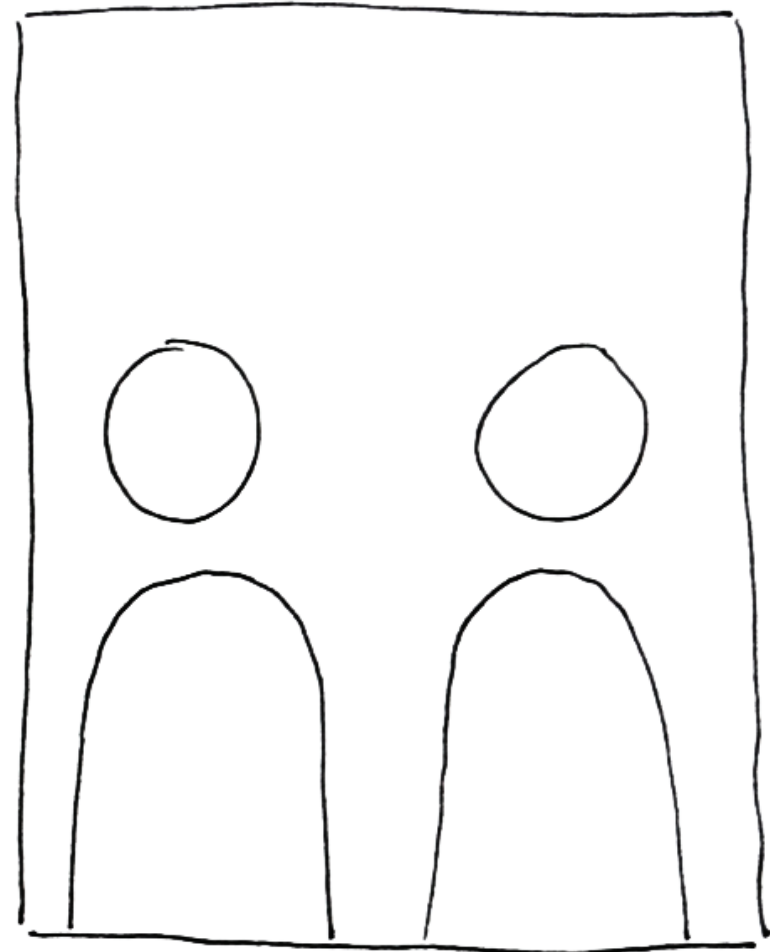
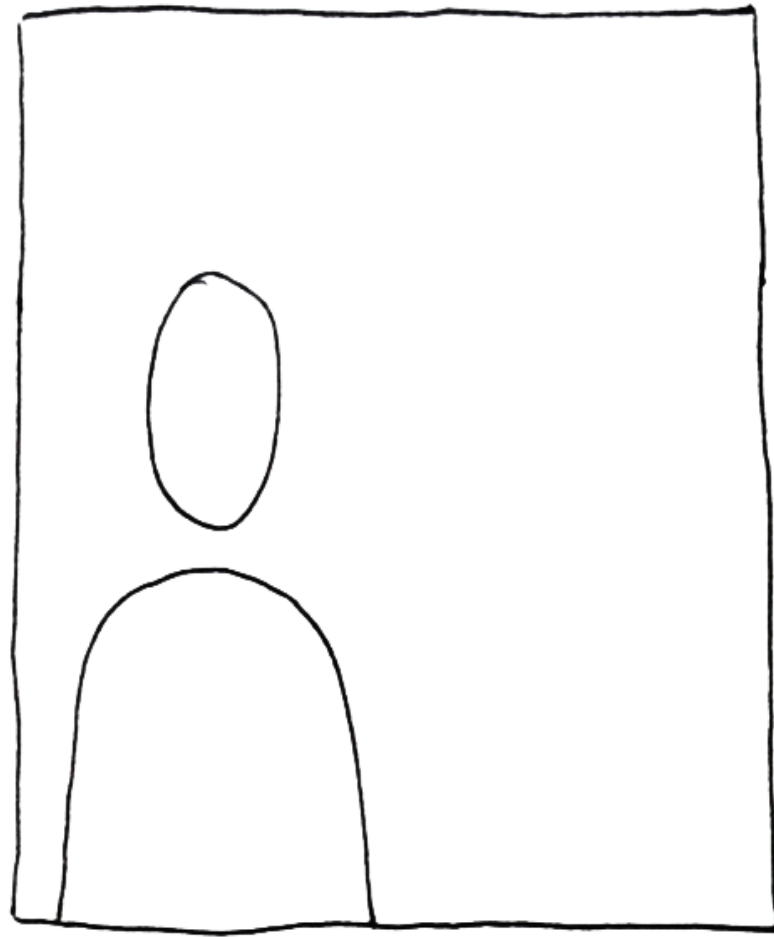




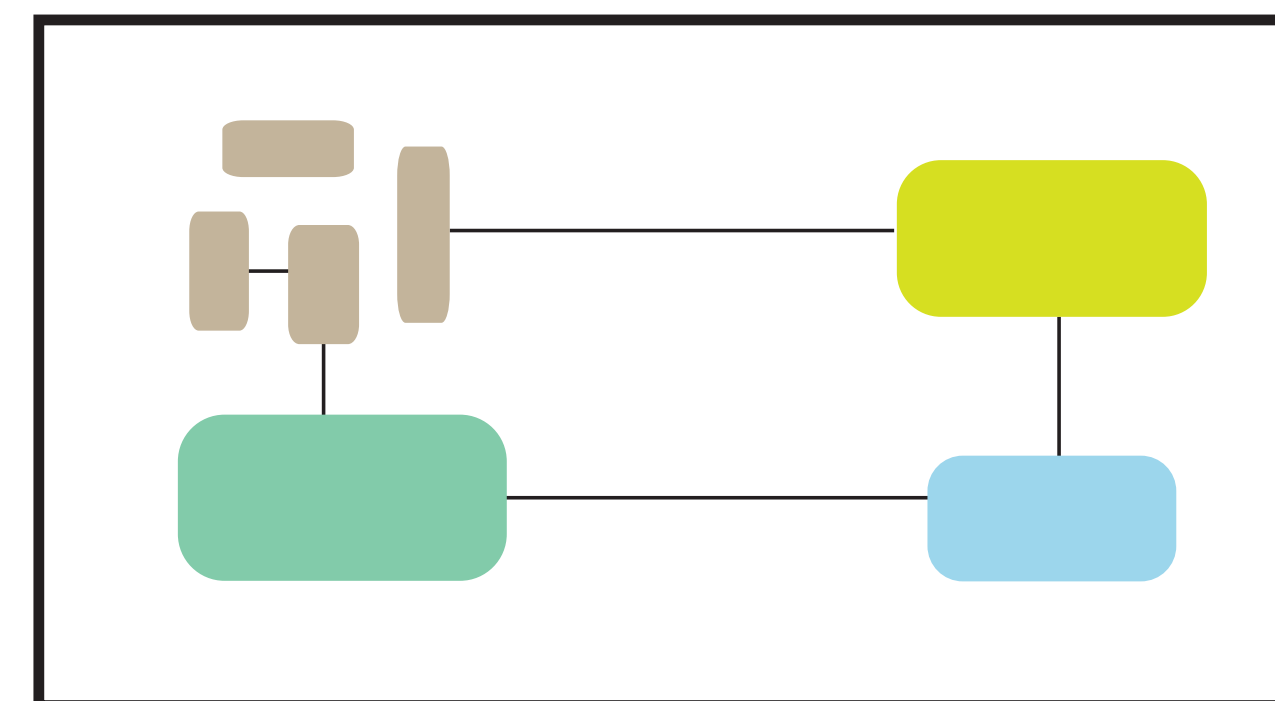
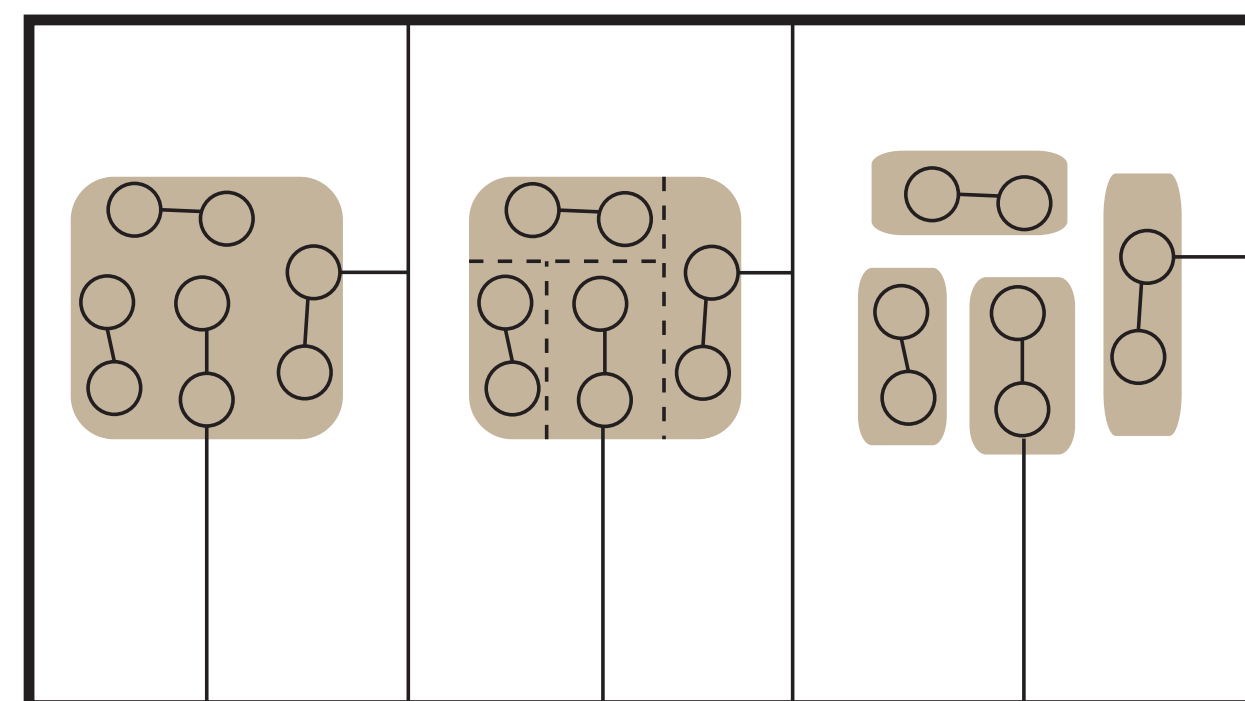
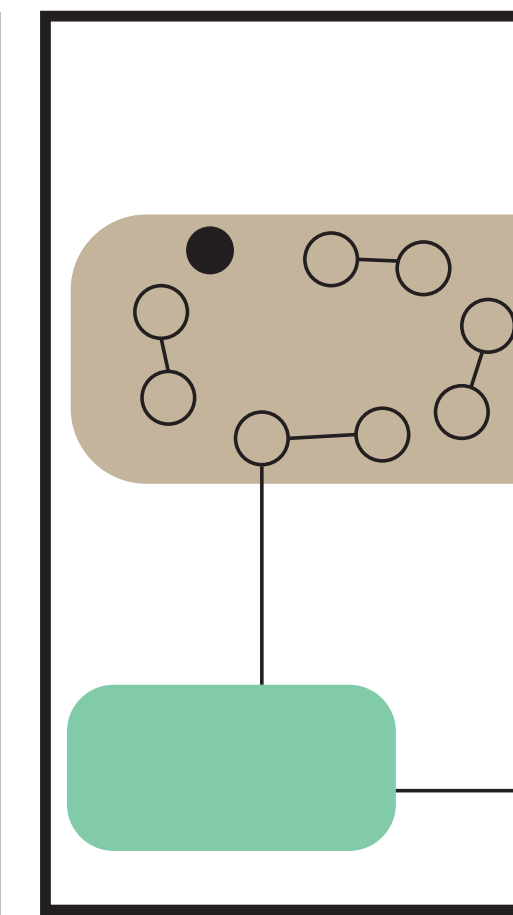
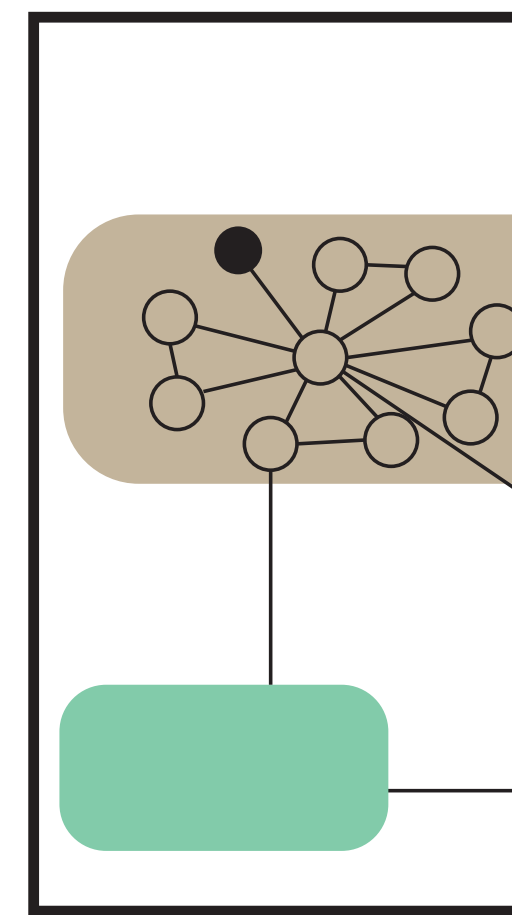
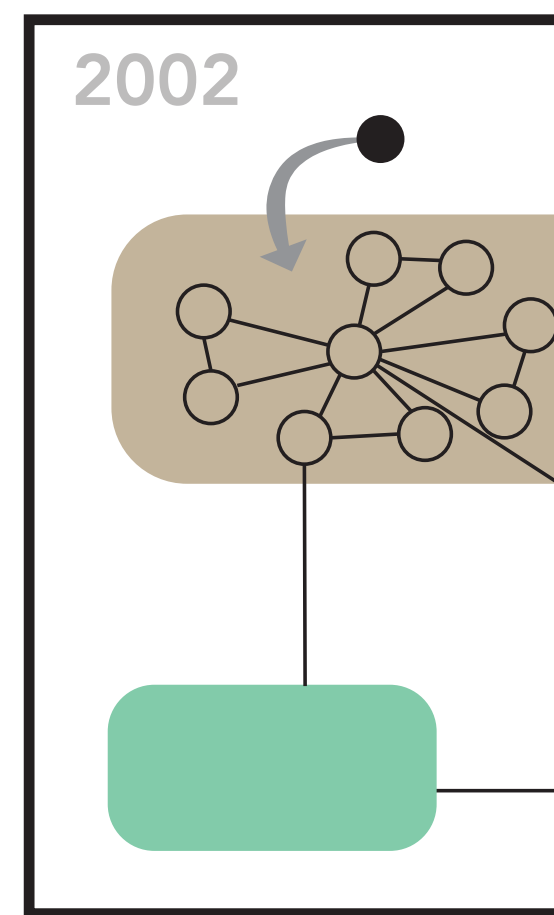
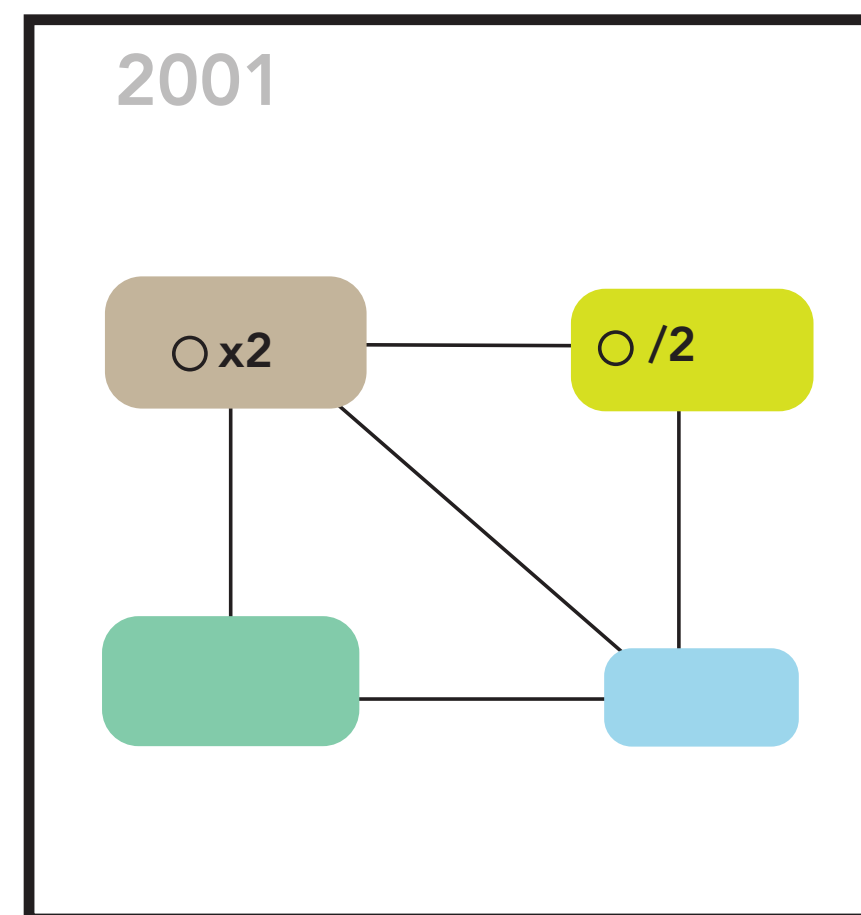
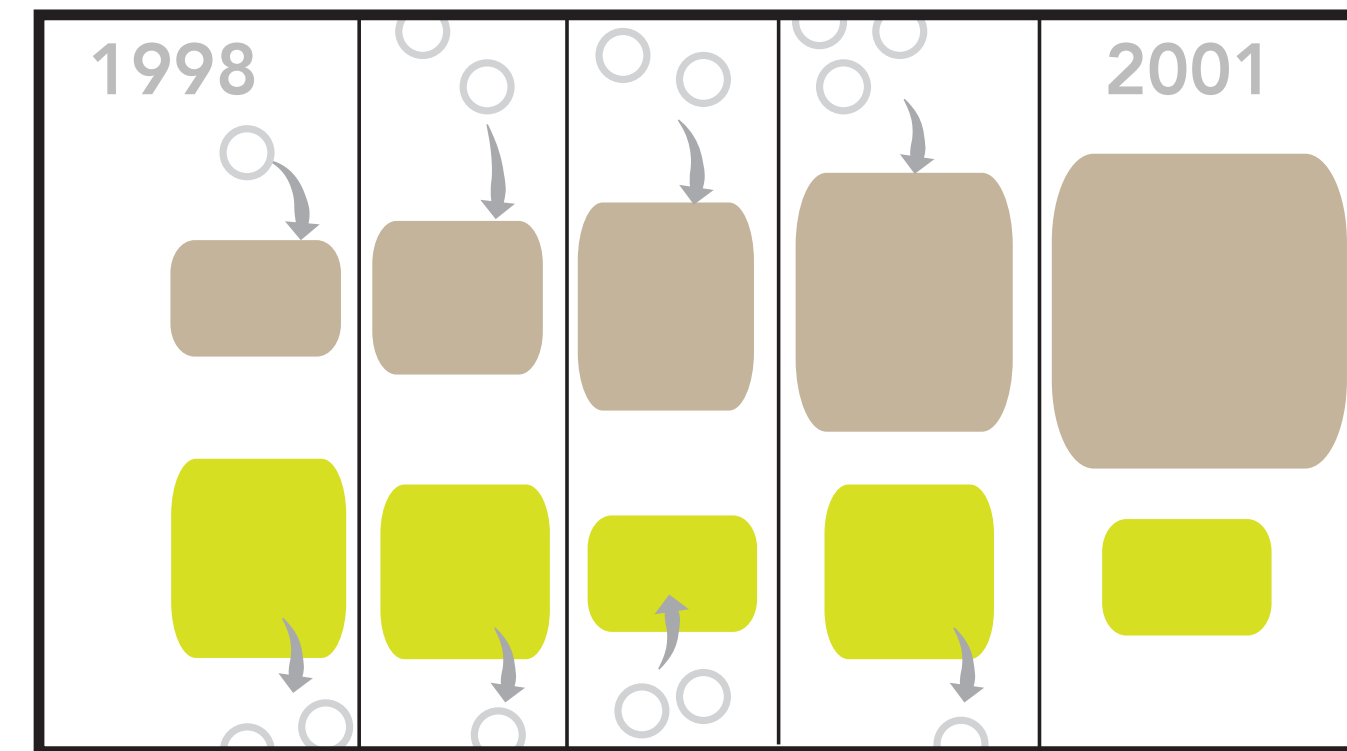
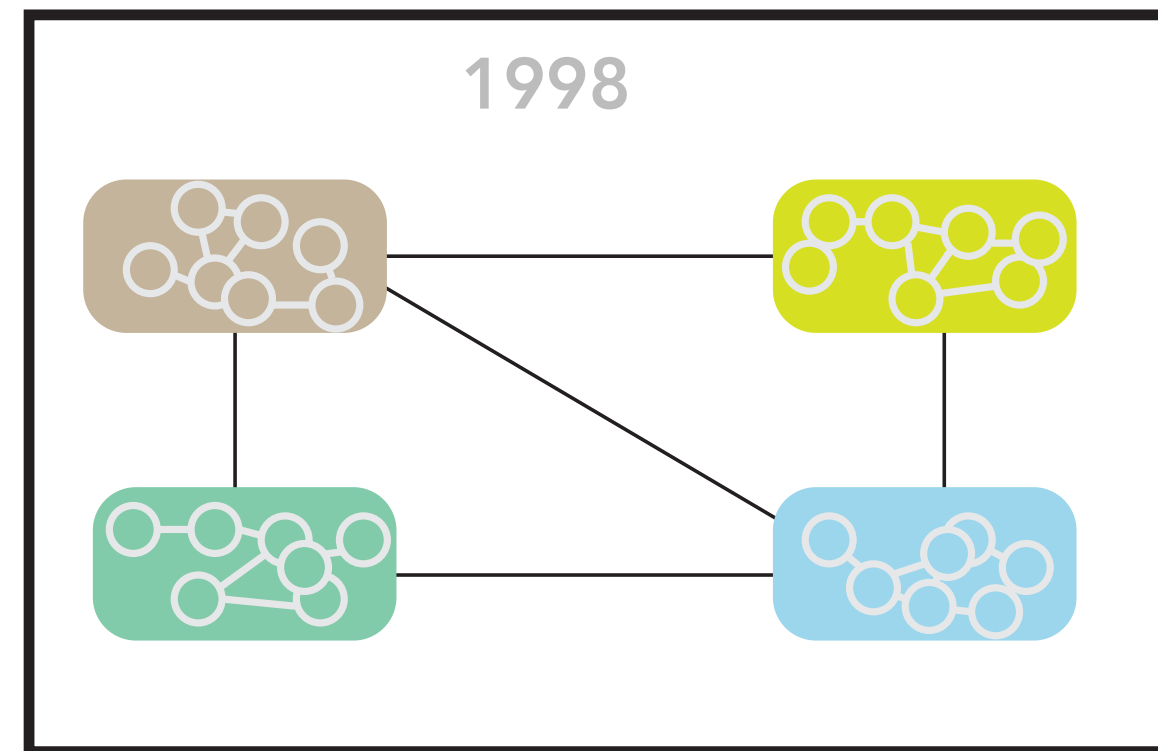




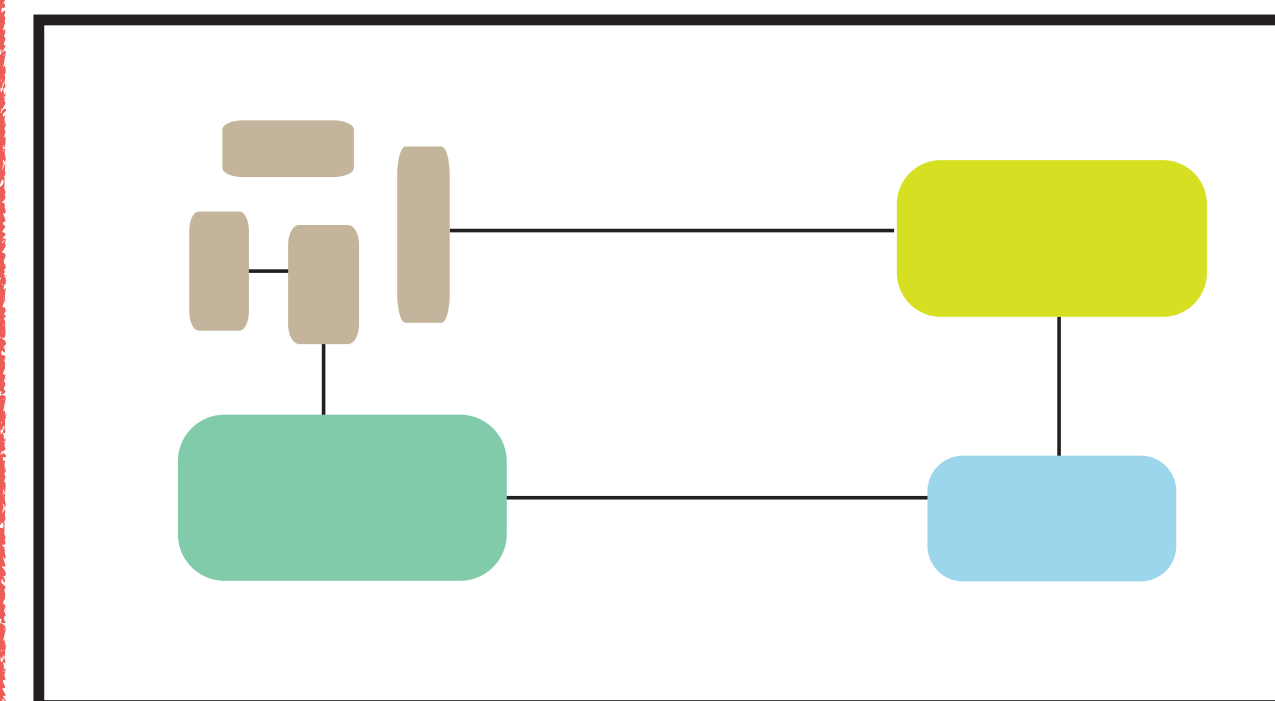
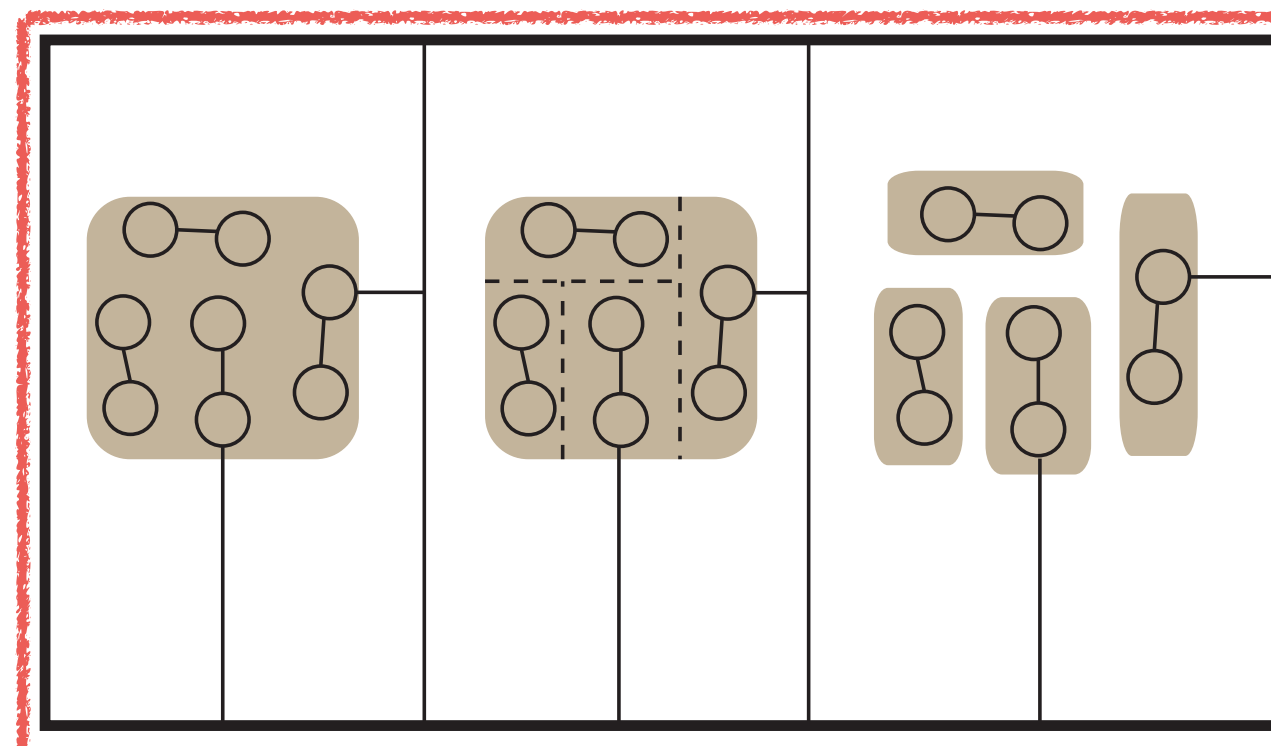
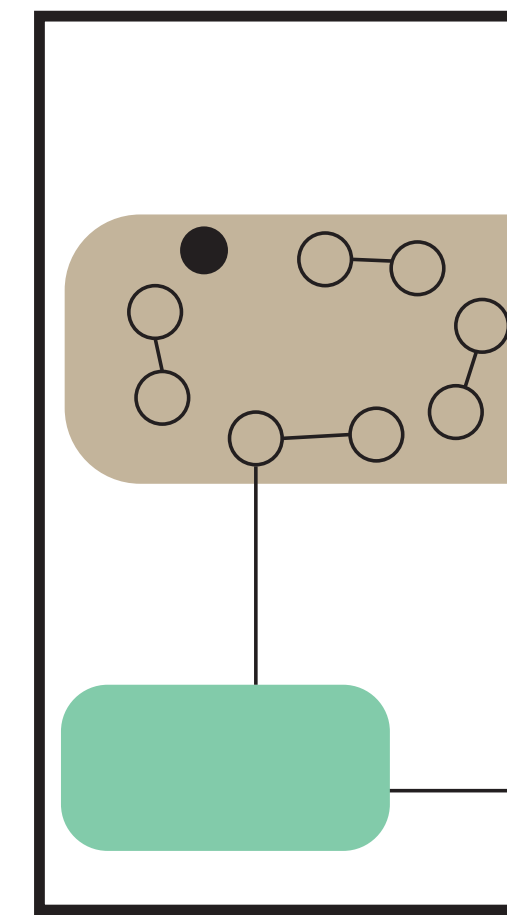
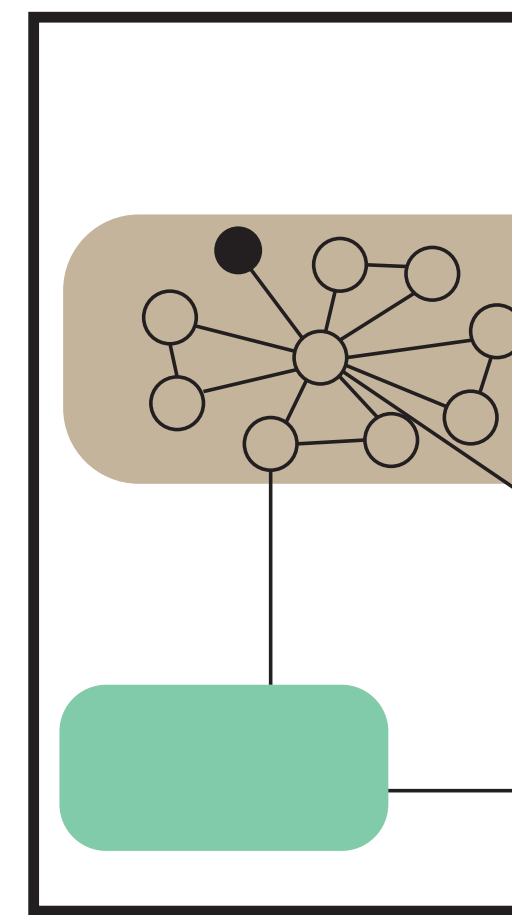
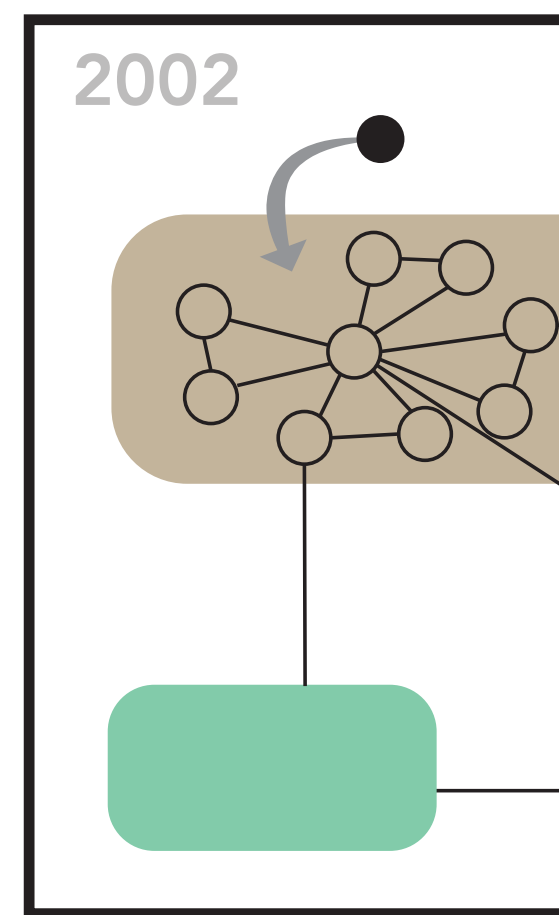
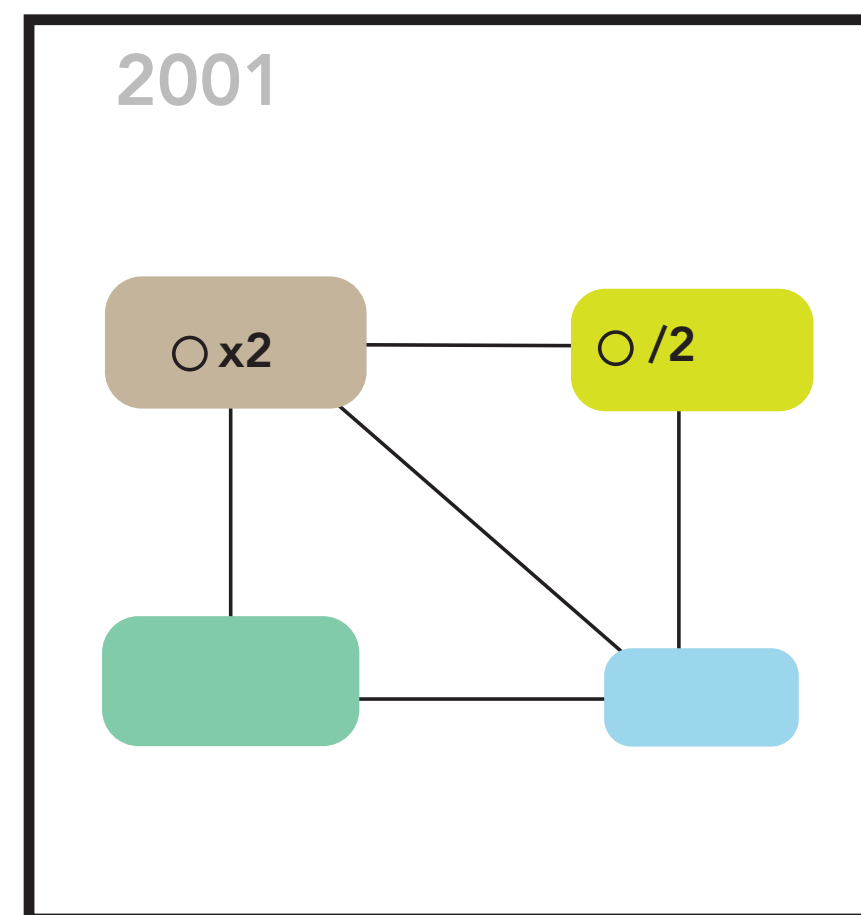
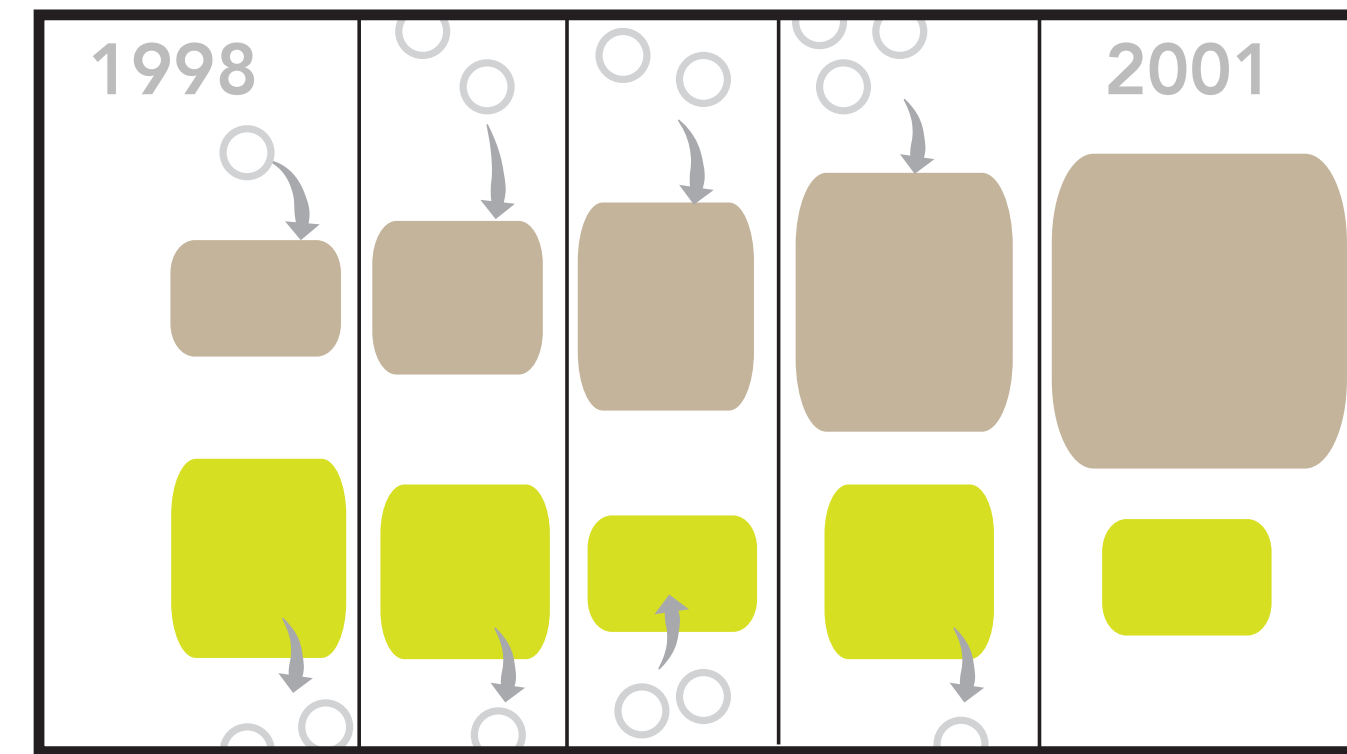
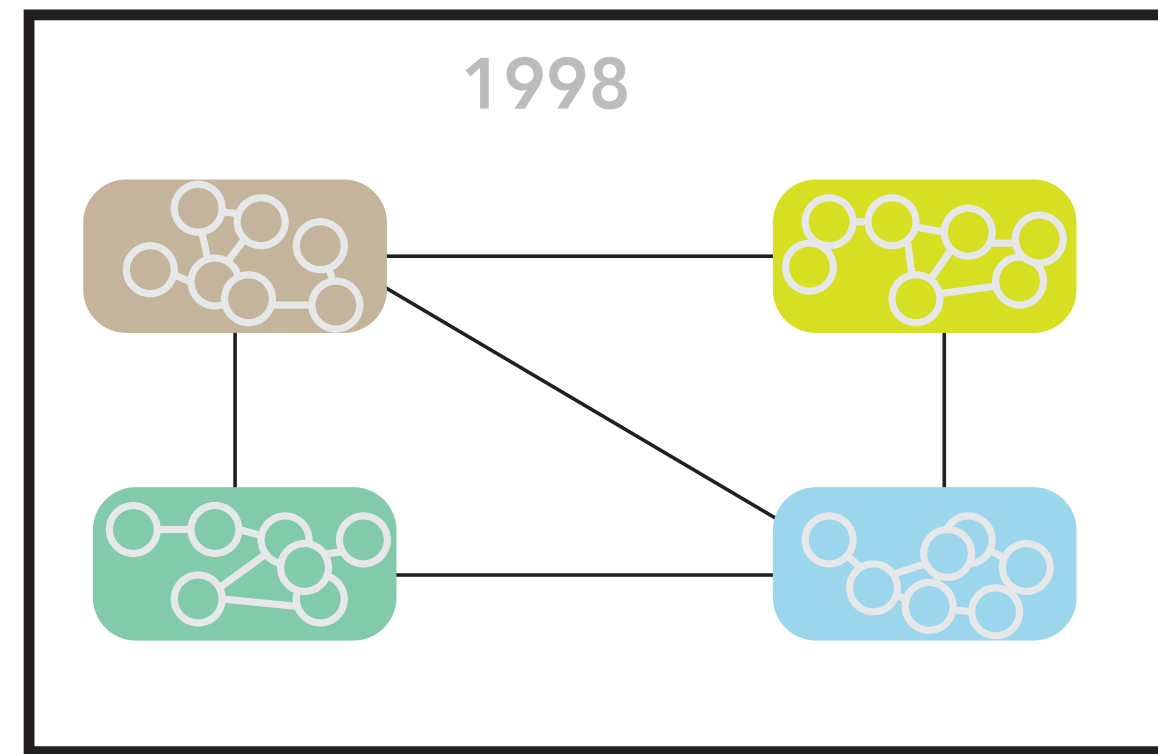




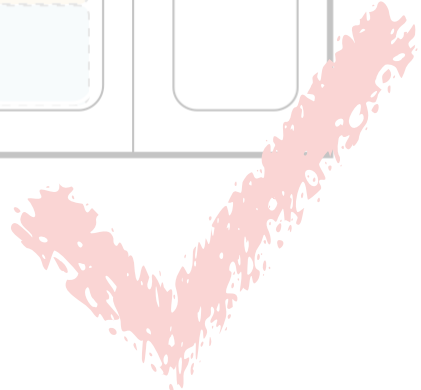
Criminal Network



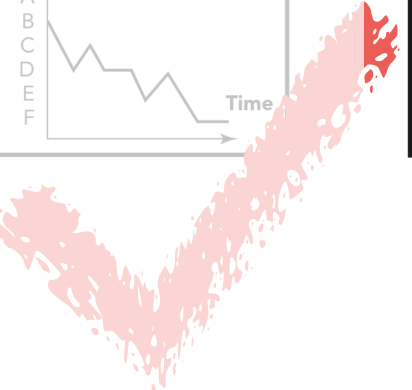
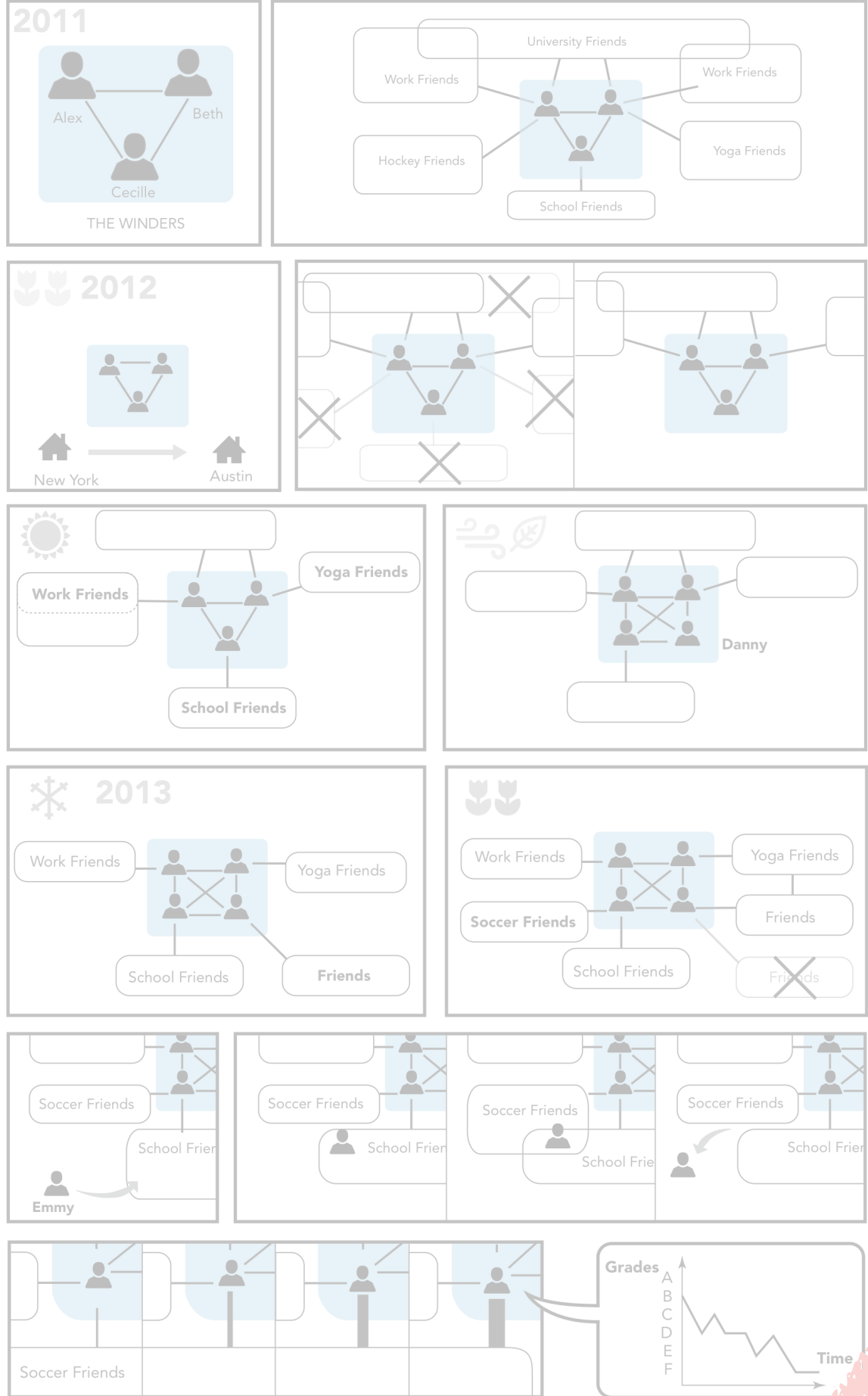
Criminal Network



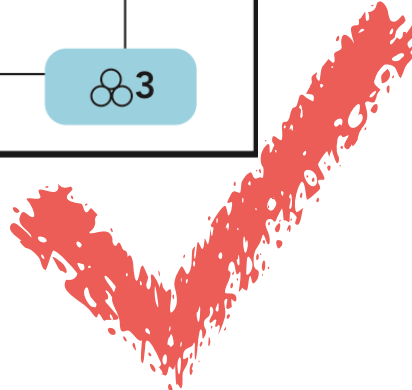
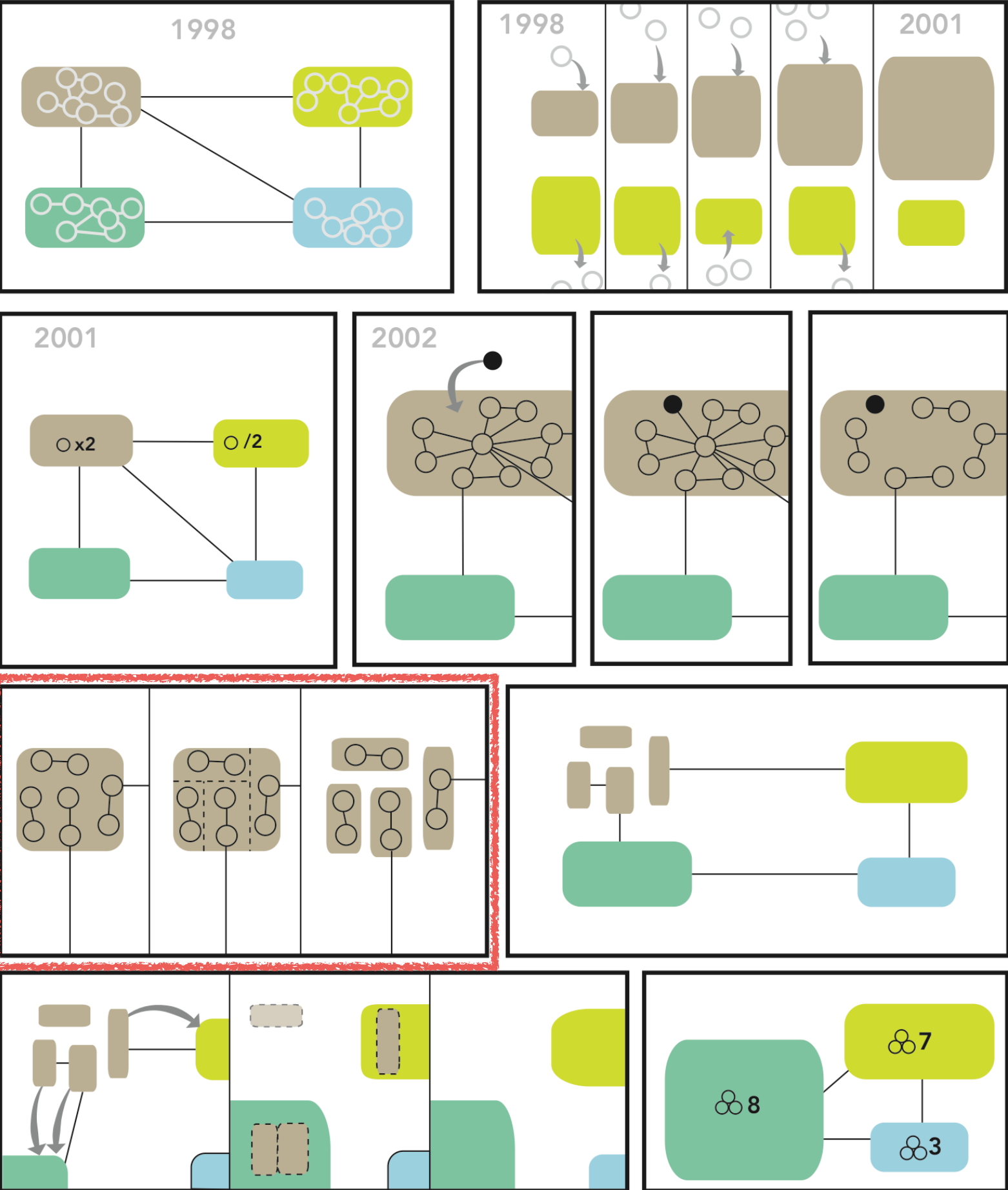
Start Up

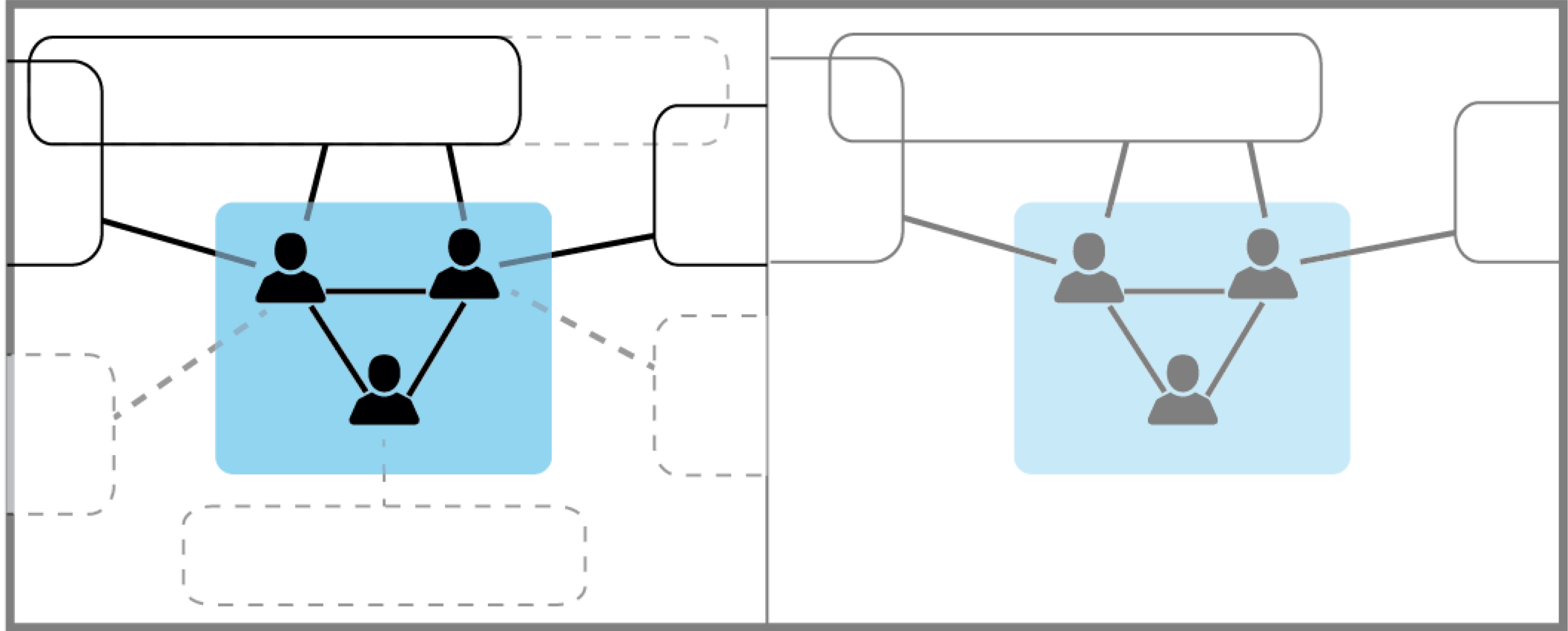


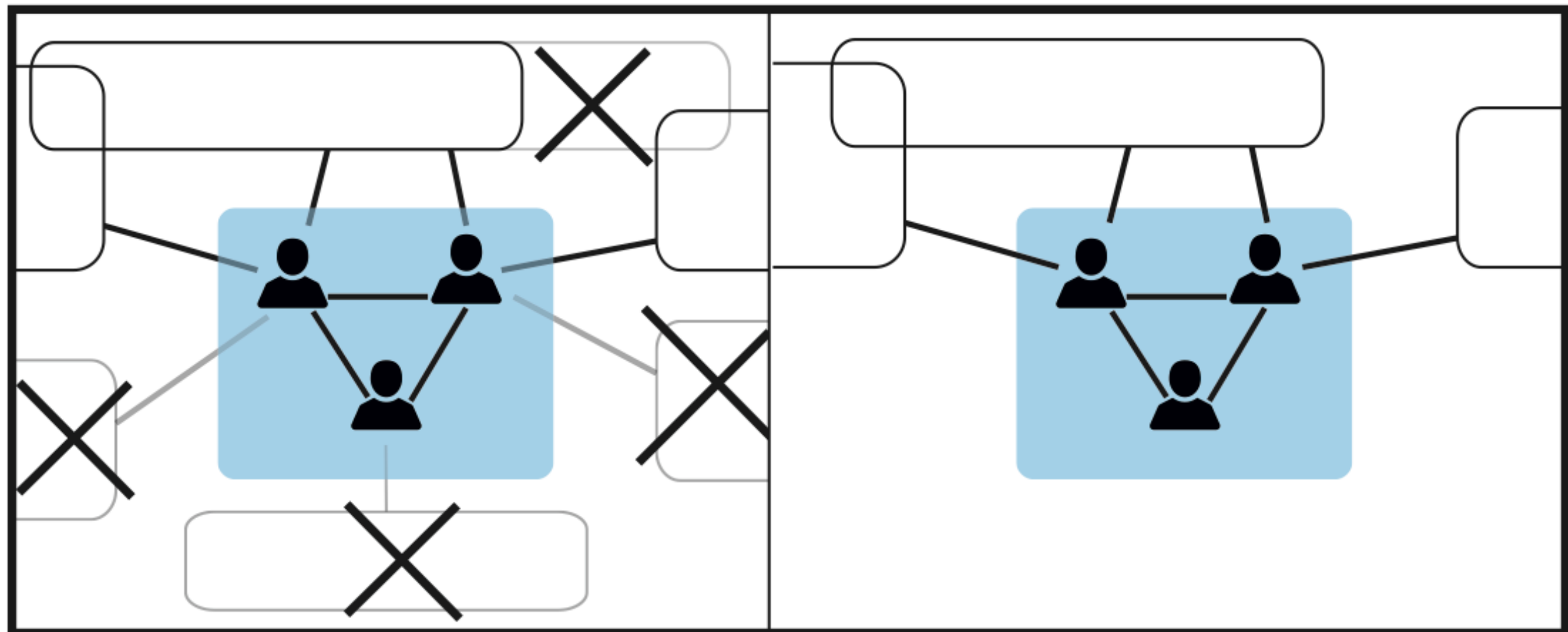
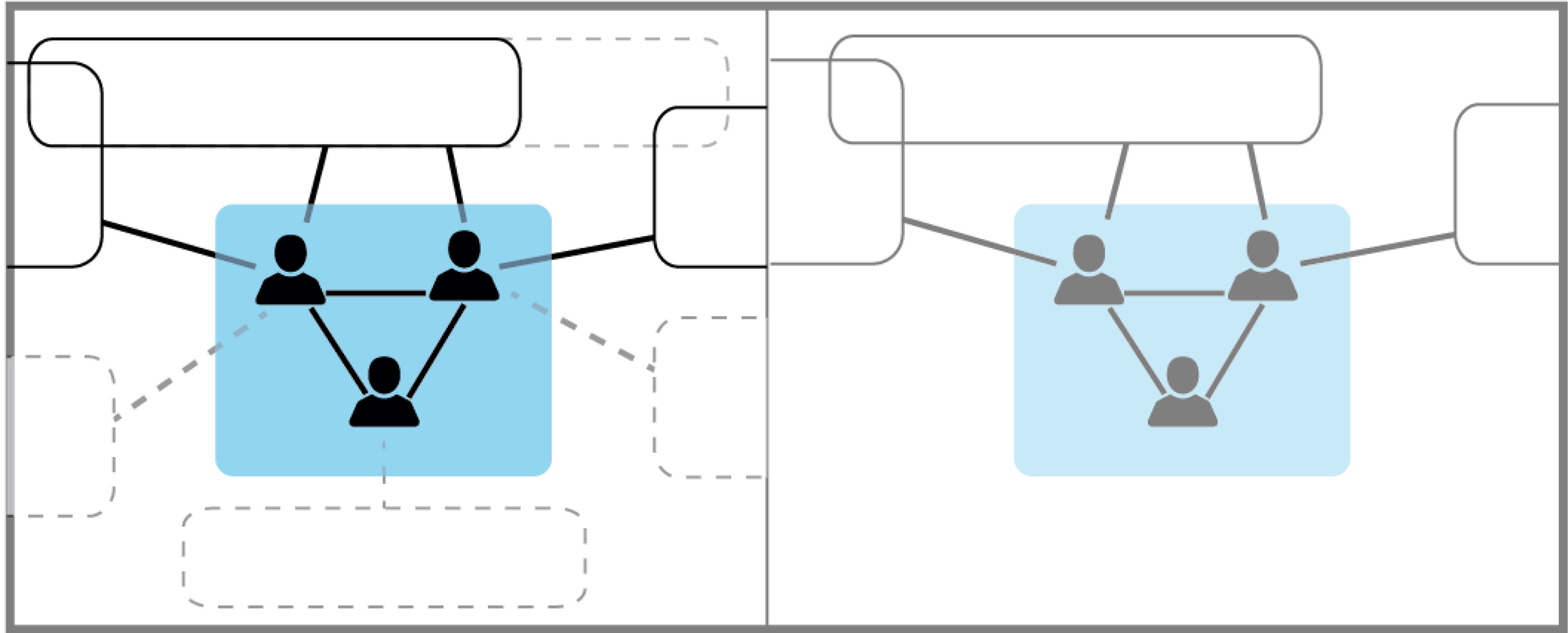
Family

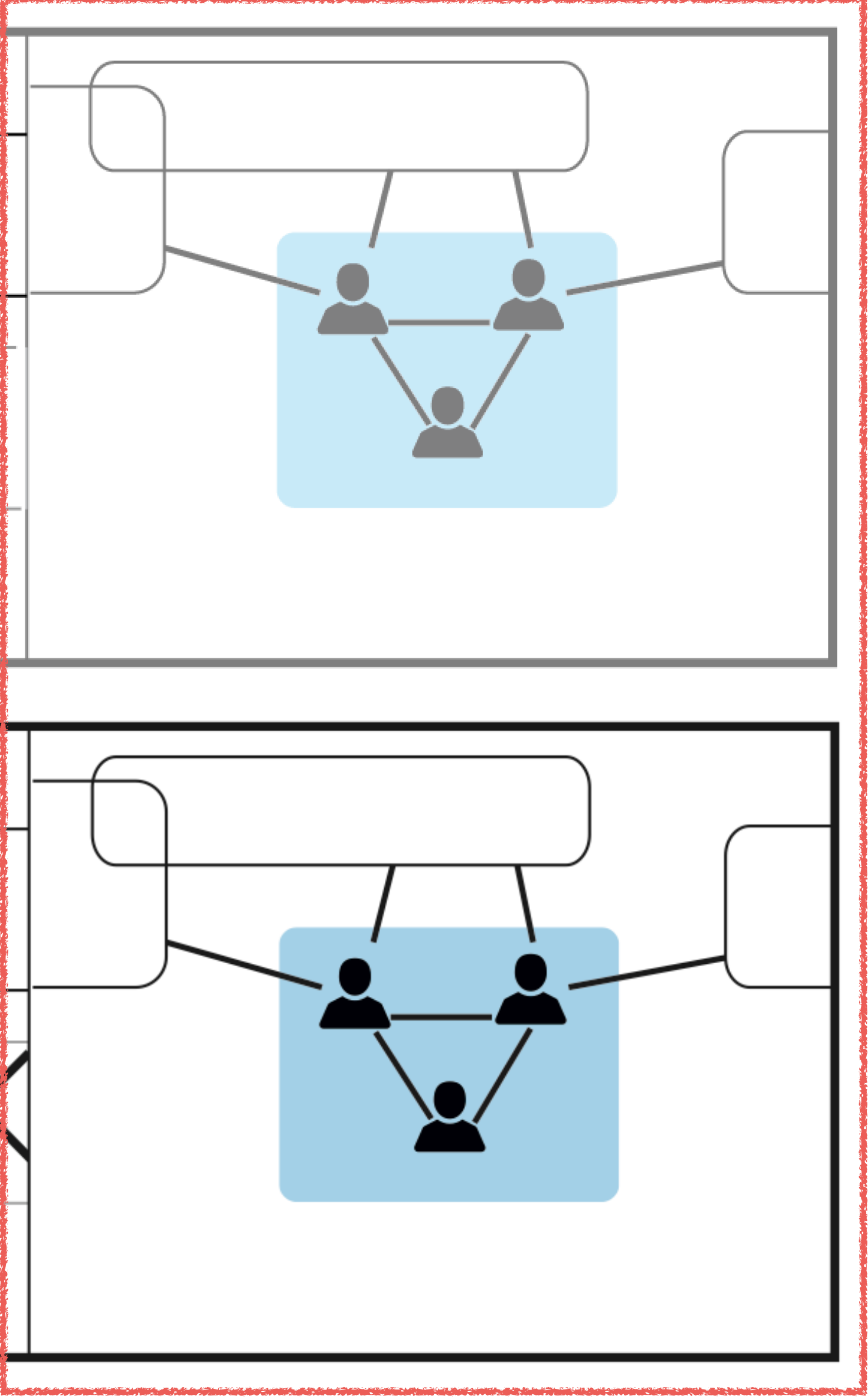
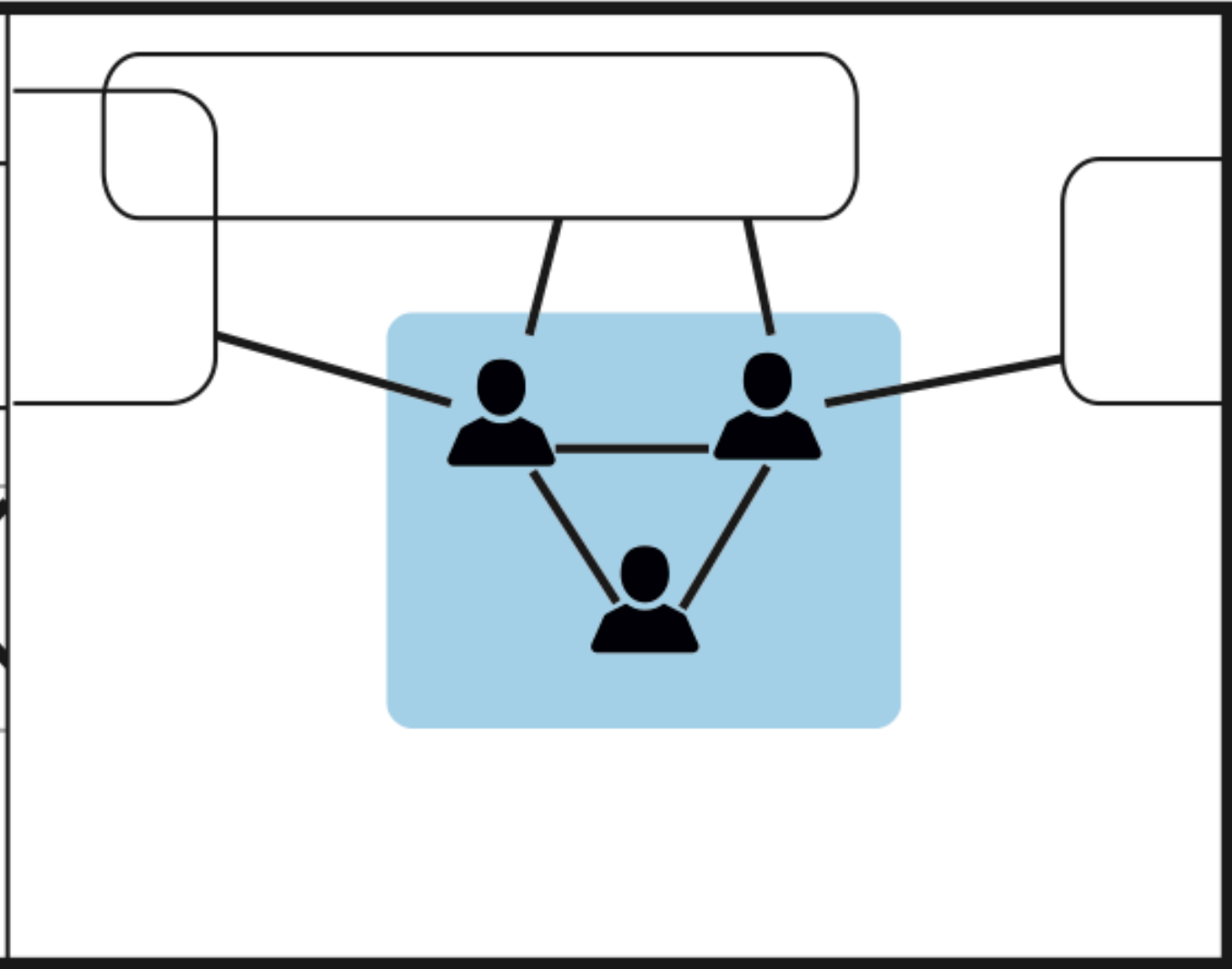
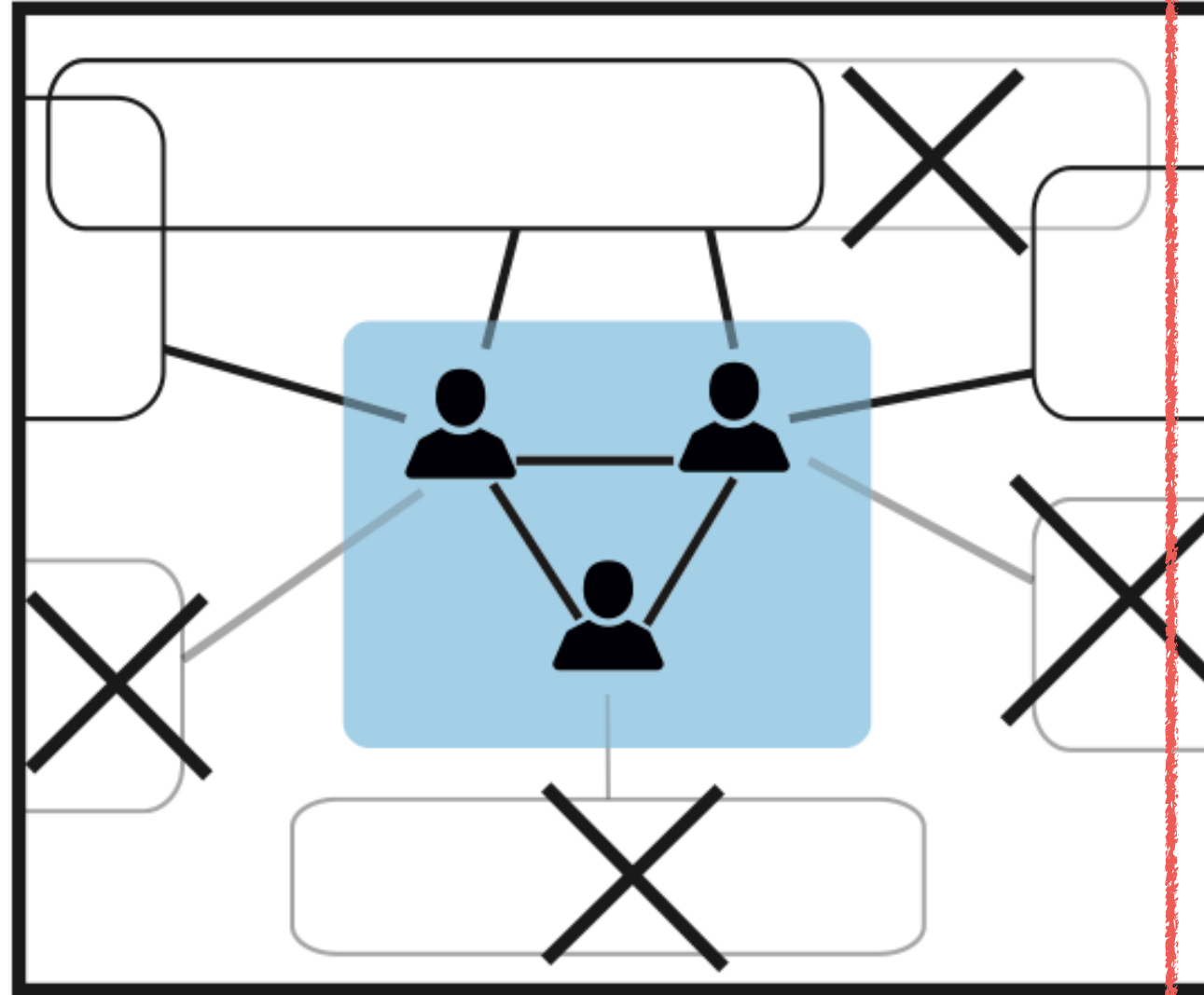
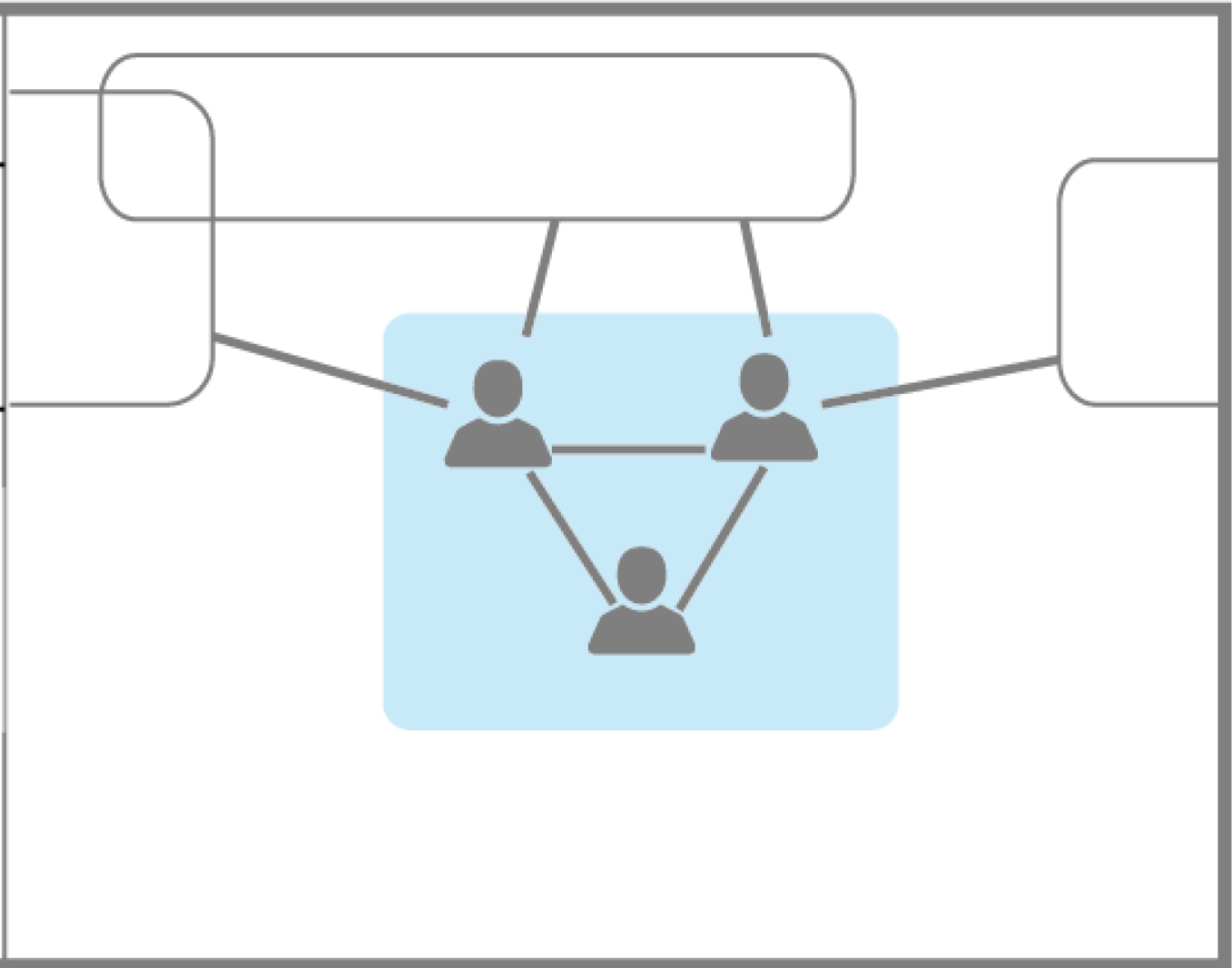
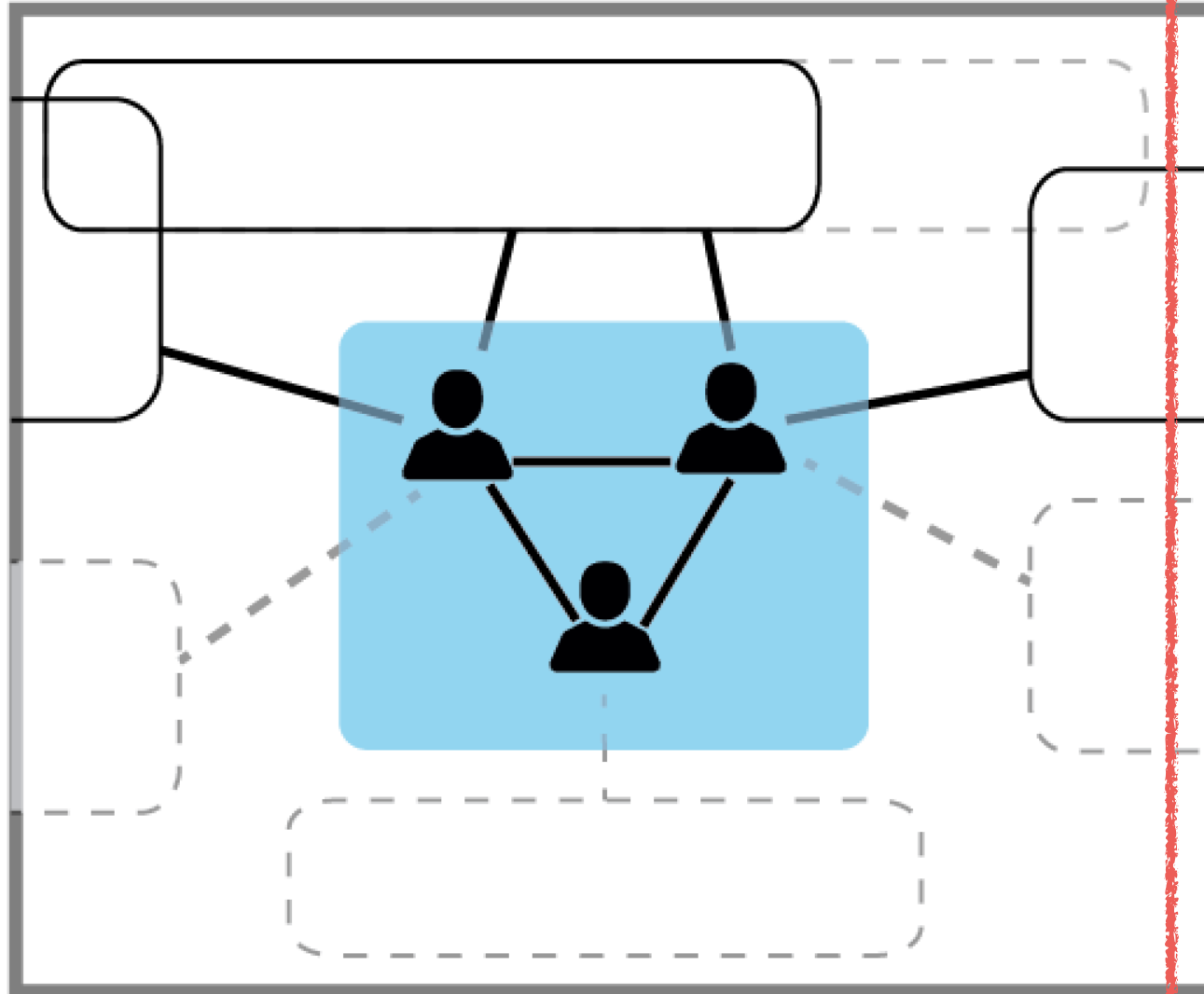


Criminal Network

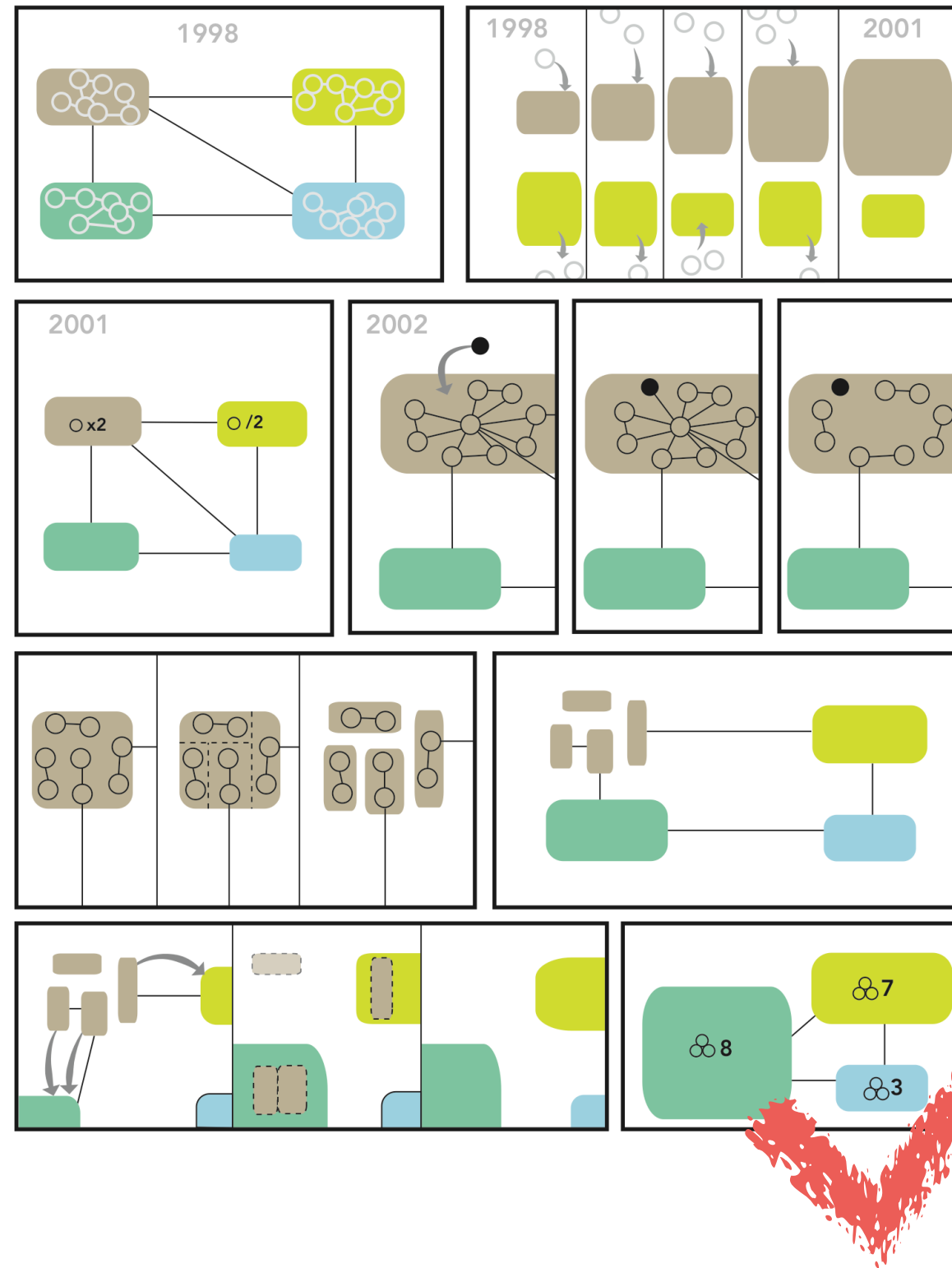






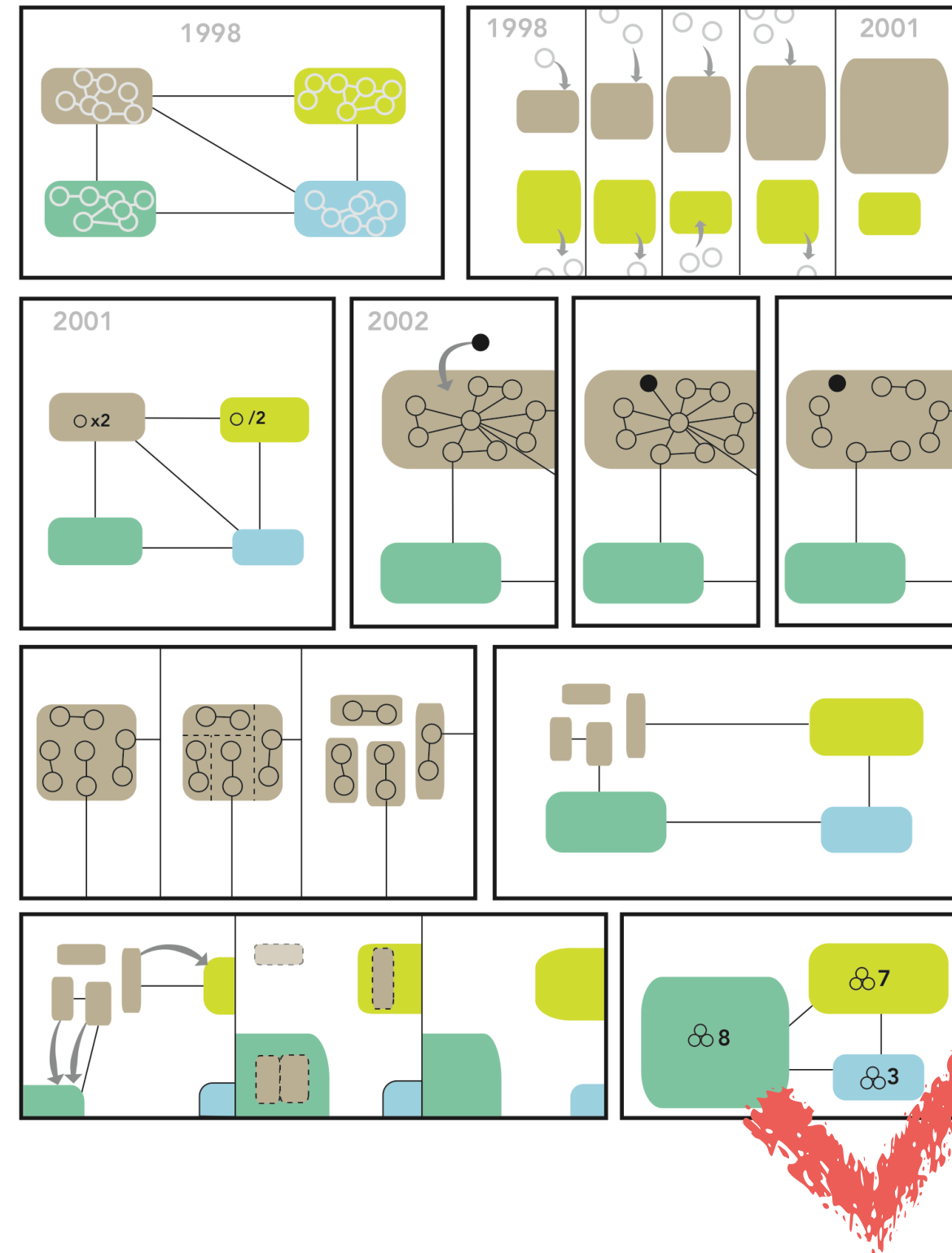


Criminal Network

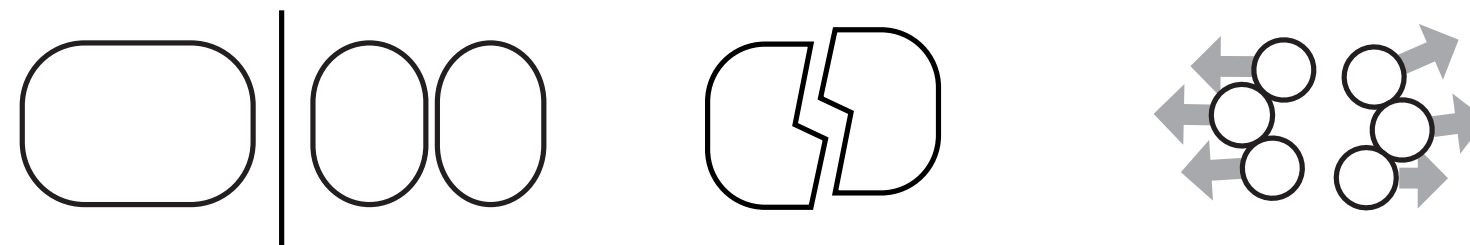
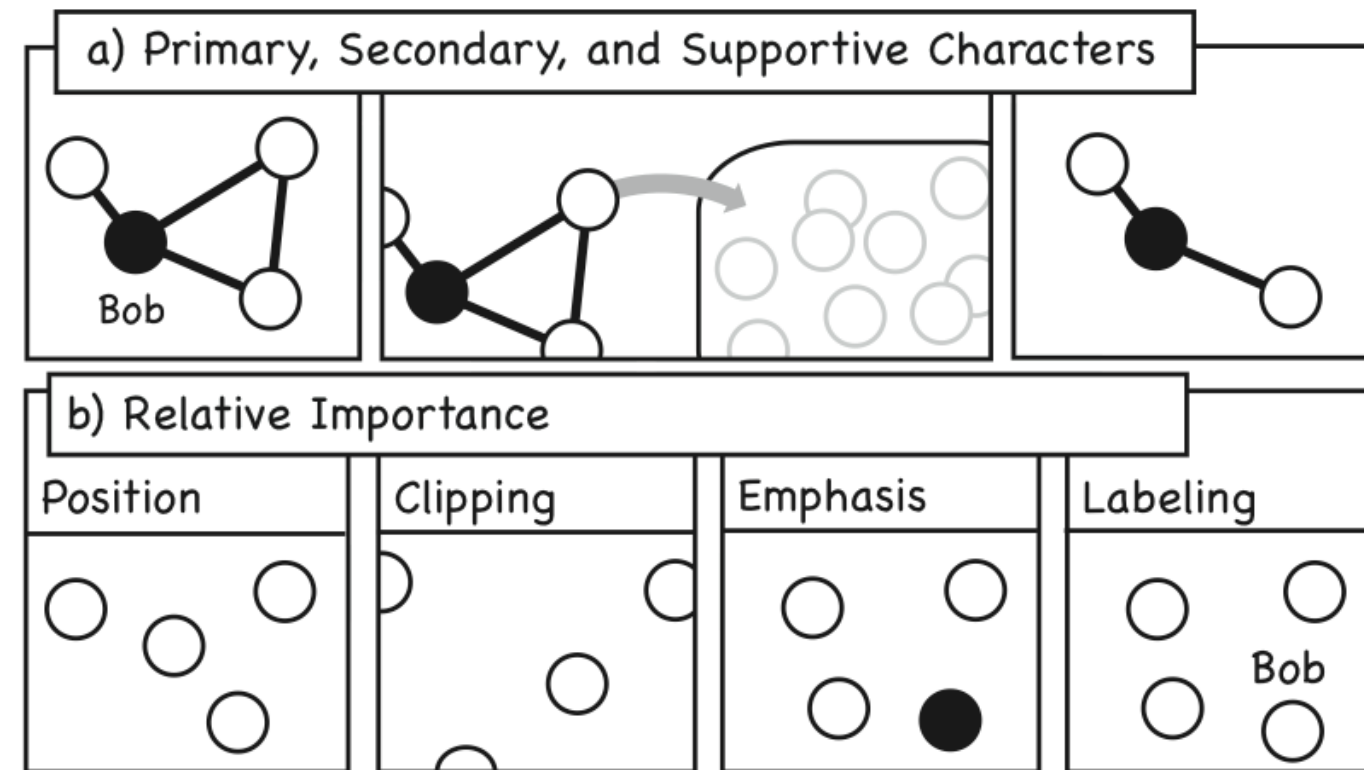


Readability

Criminal Network

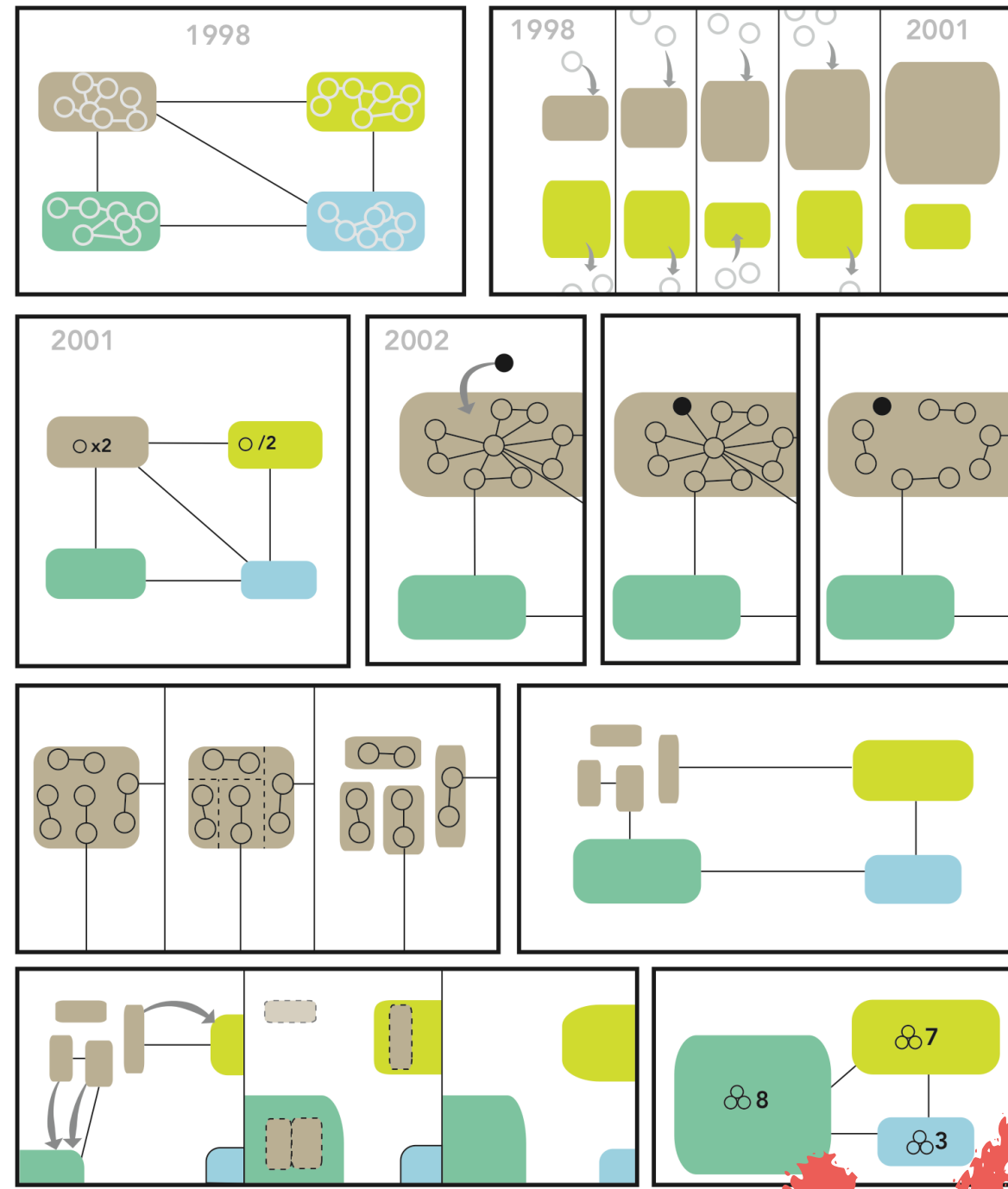


Readability

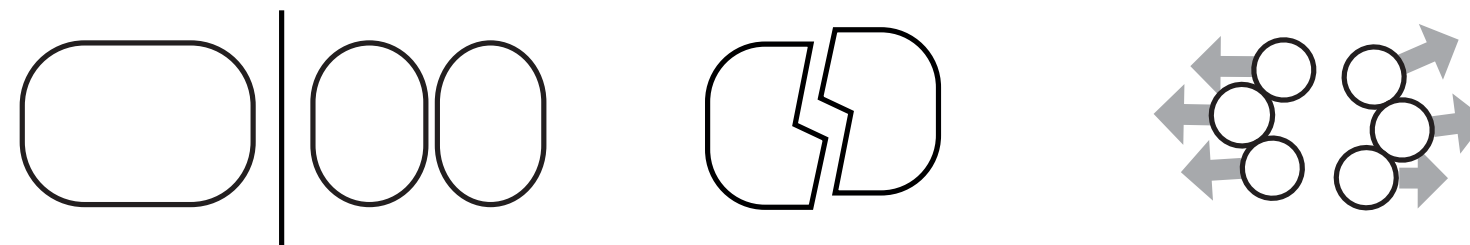
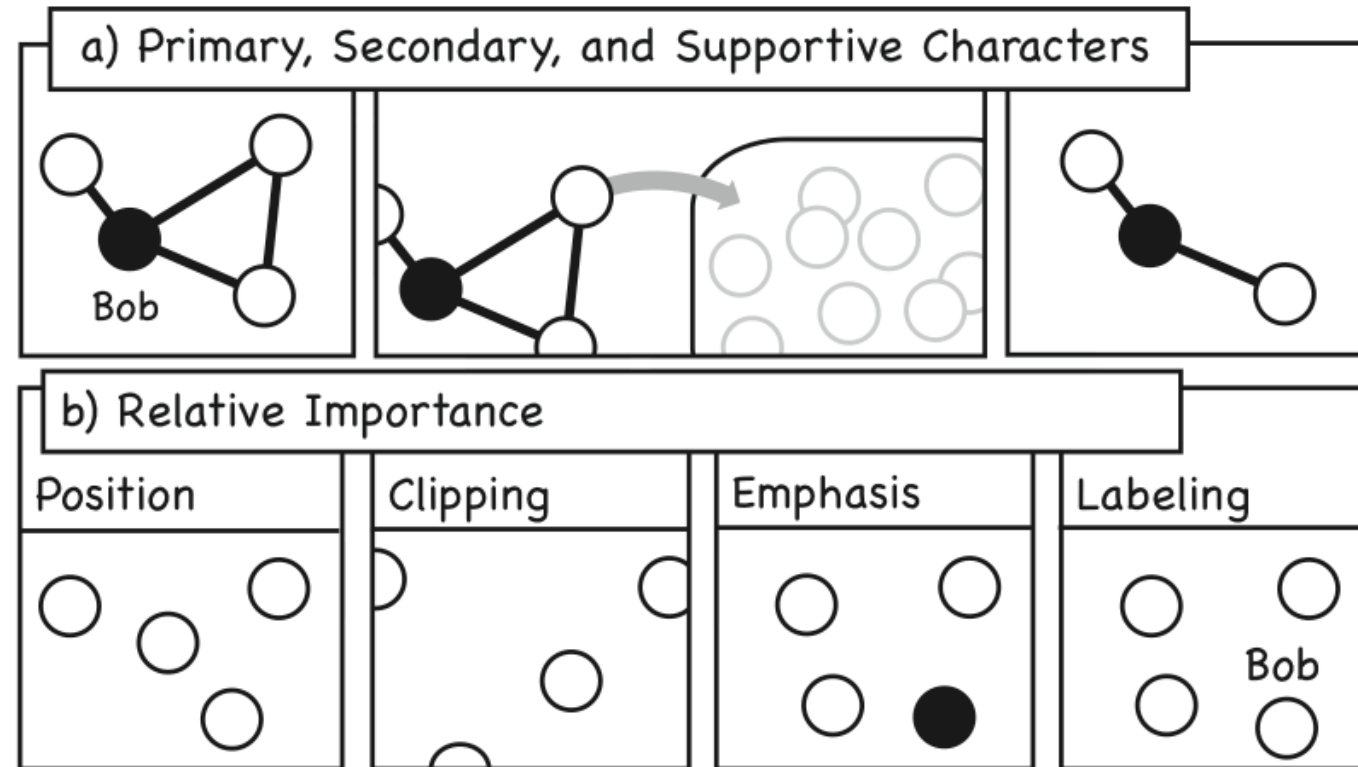


Design Factors
+ Solutions

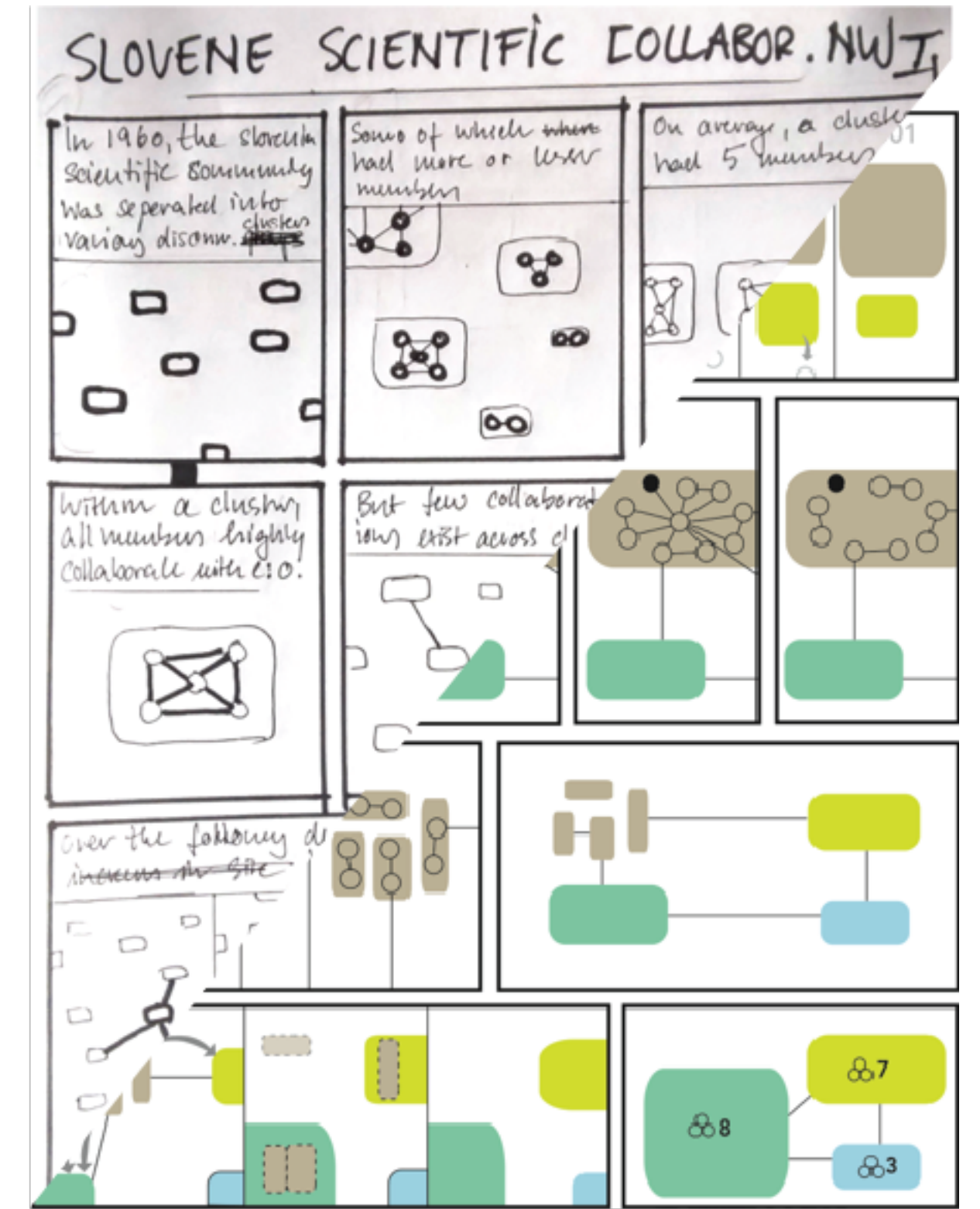
Criminal Network



Readability



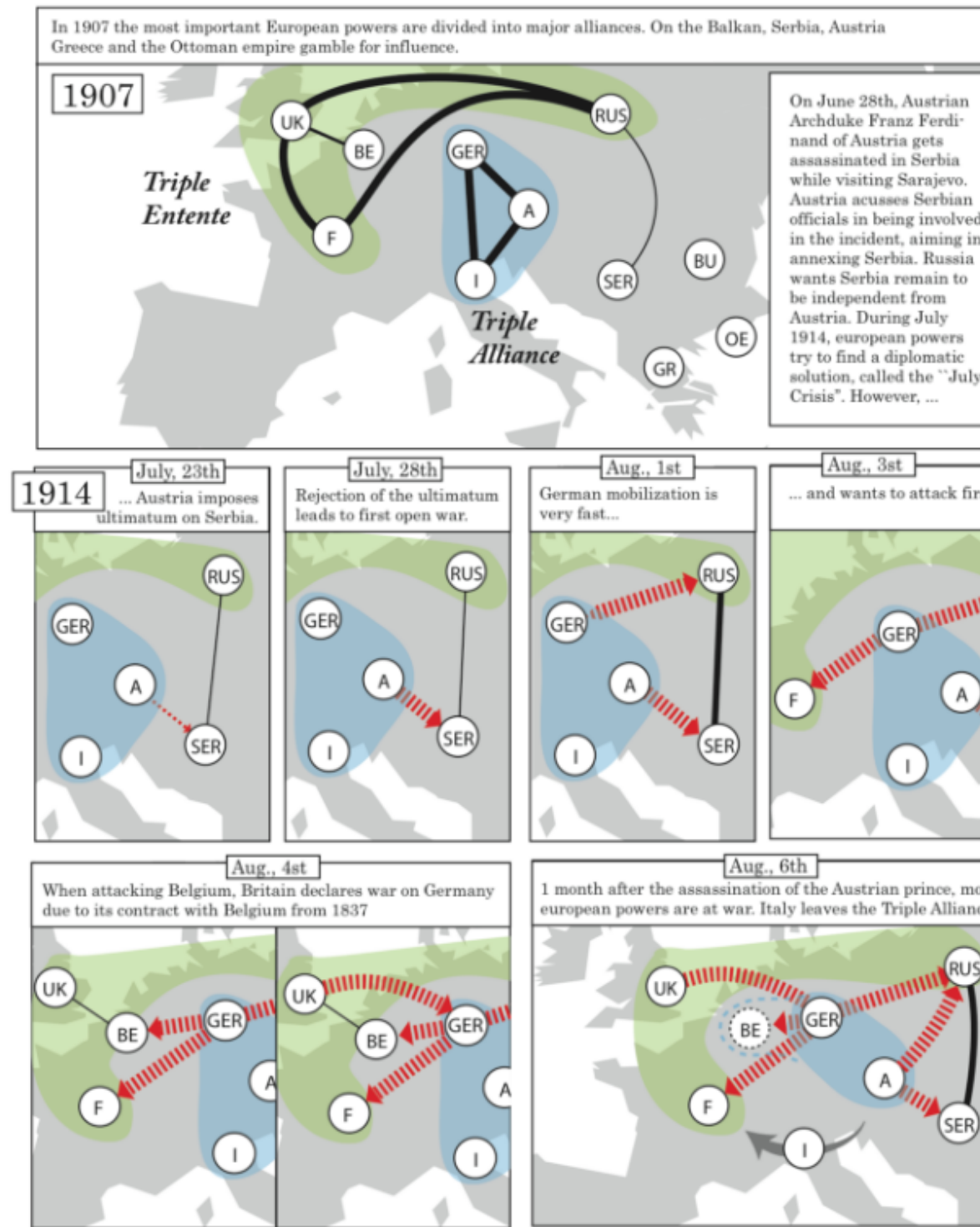
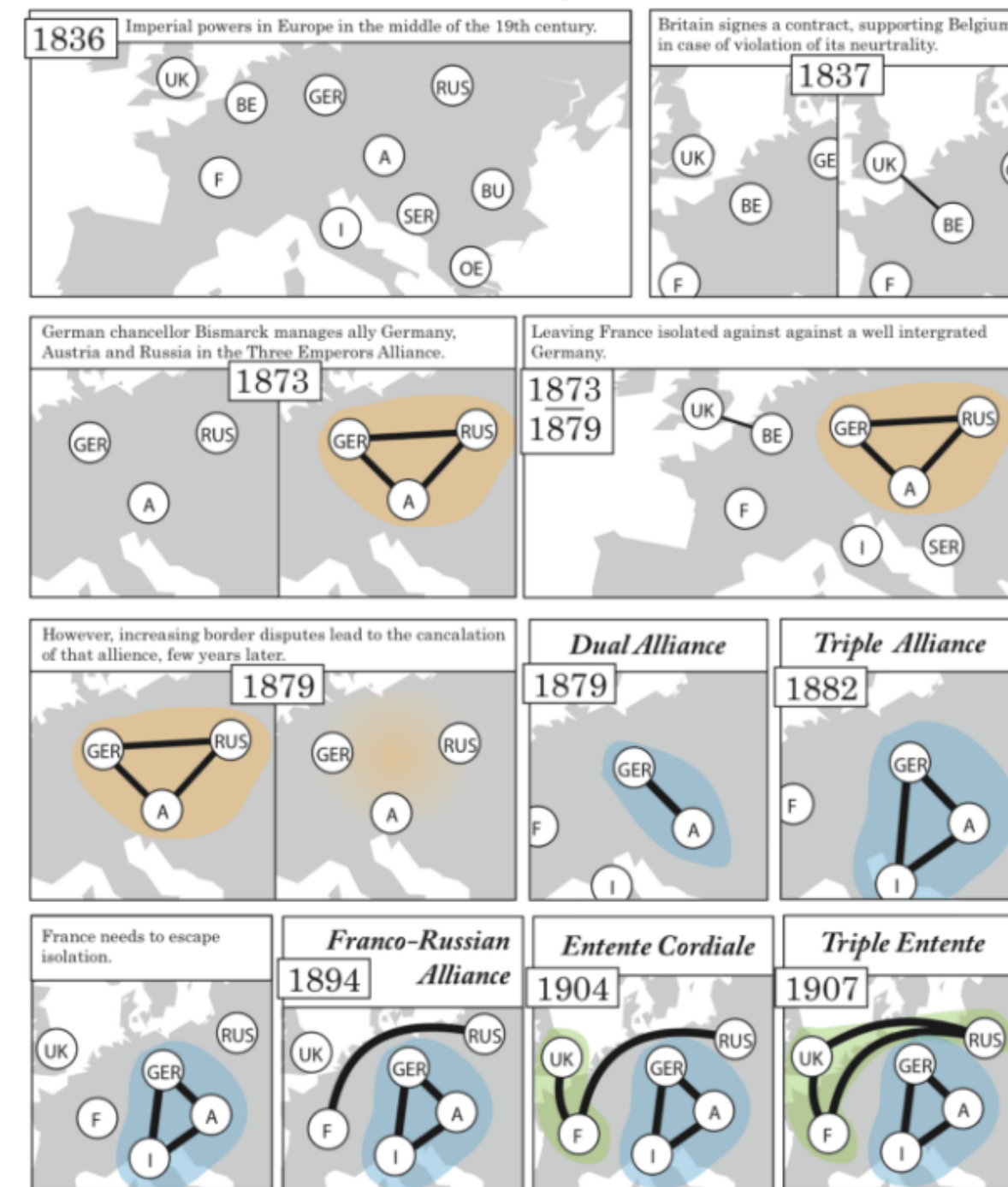
Design Factors + Solutions



Automation?

Graph Comics

European Alliances before World War I (1836-1914)



[Benjamin Bach](#), [Natalie Kerracher](#), [Kyle Hall](#), [Sheelagh Carpendale](#), [Jessie Kennedy](#), and [Nathalie Henry Riche](#)



[Paper](#)



[Video](#)



[Examples](#)



[Design Considerations](#)



[Symbolic Representations of Change](#)



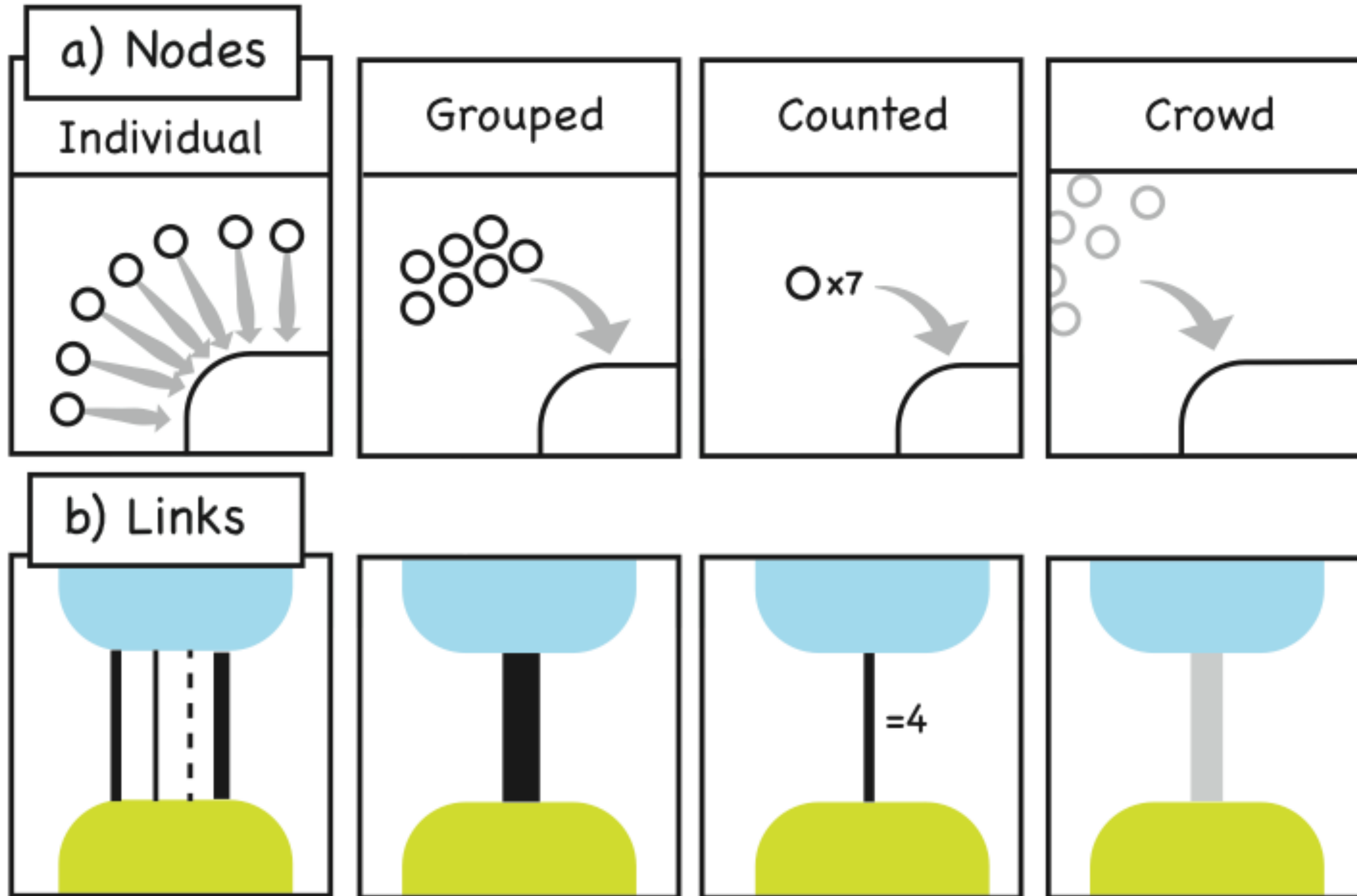
[Design Space Exploration](#)



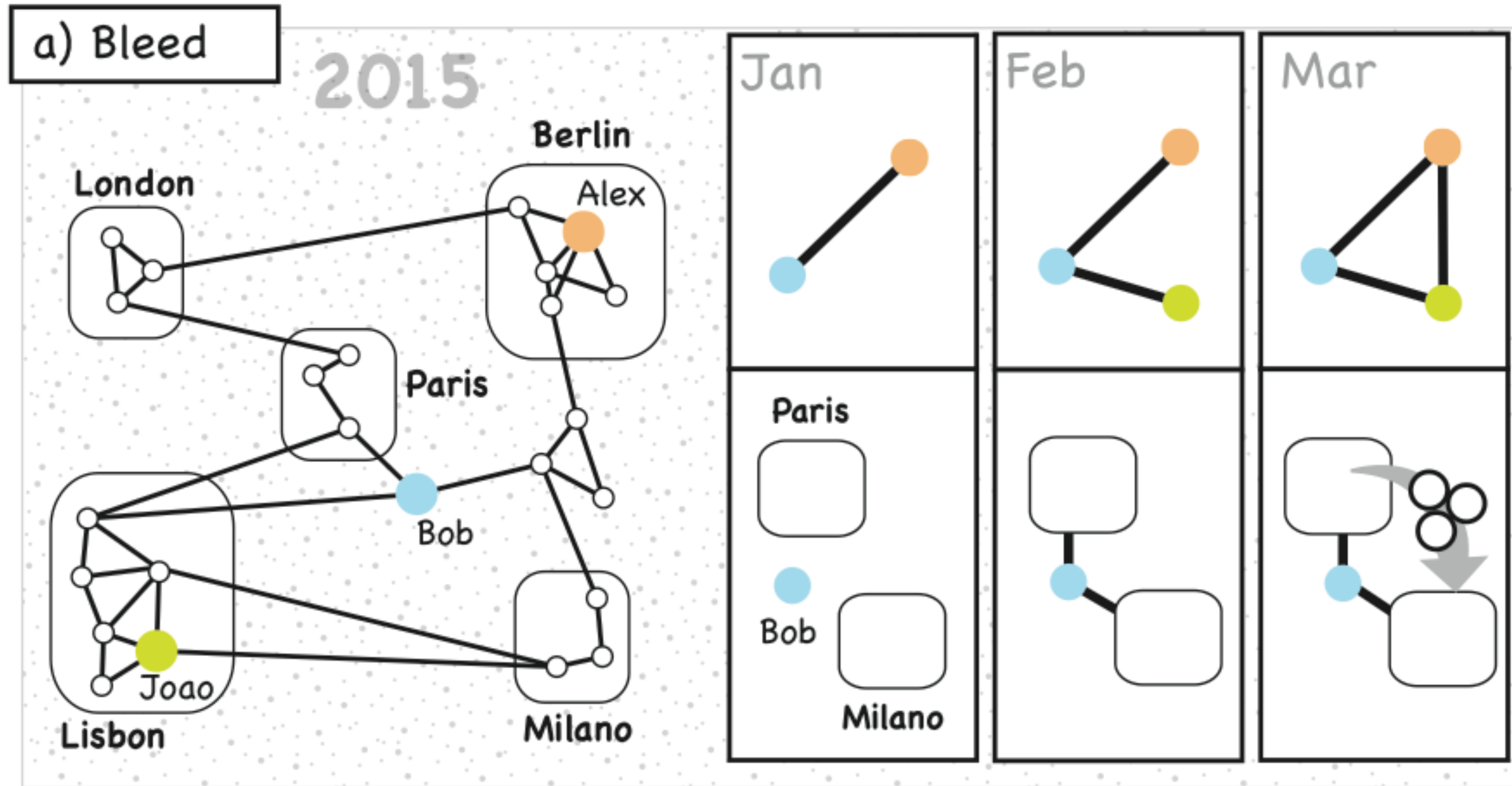
[Reading Study](#)

aviz.fr/~bbach/graphcomics

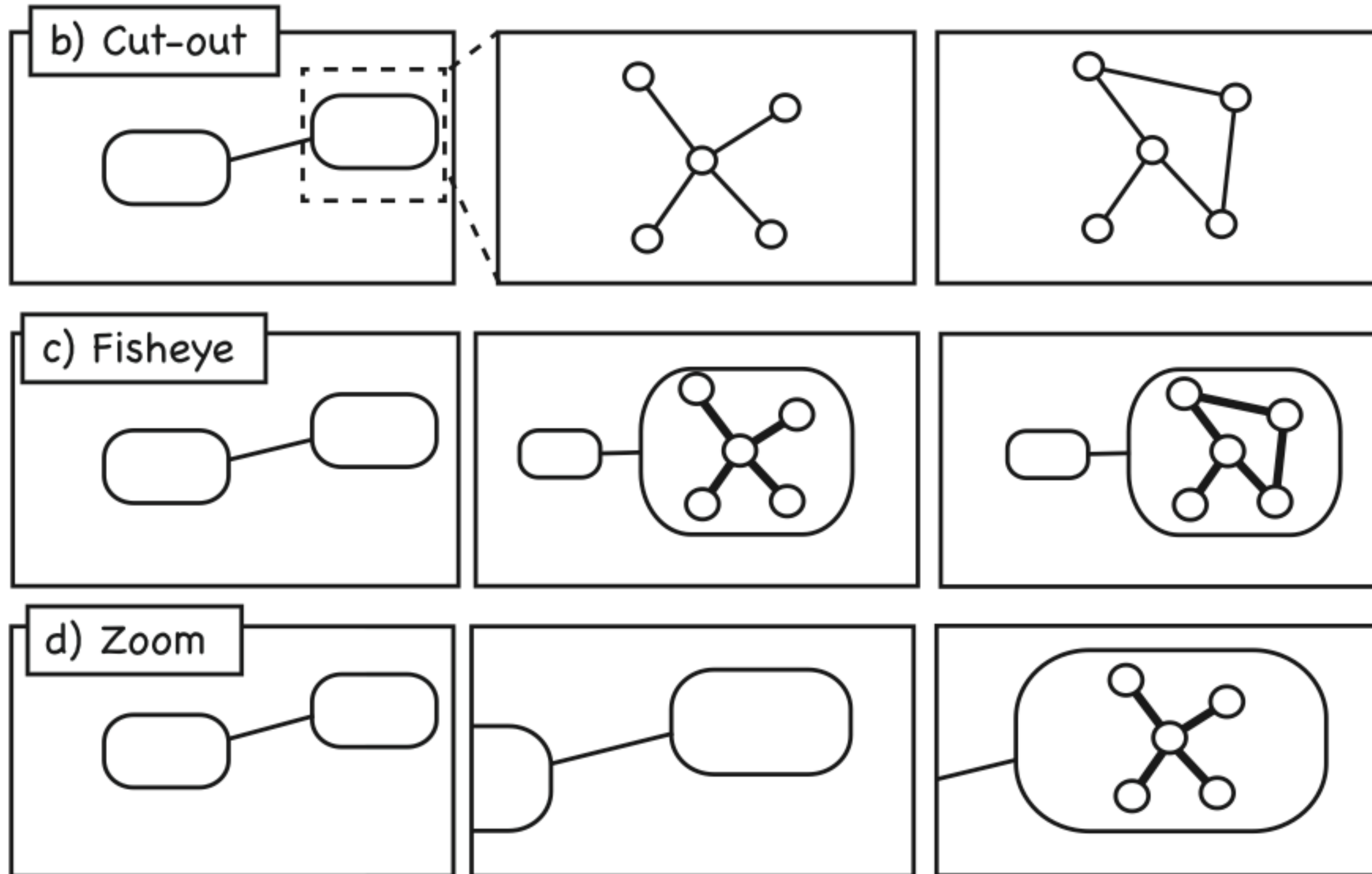
6 . Level of Detail



7. Overview and Detail



7. Overview and Detail



C1: Element Identity?

C1: Element Identity?

C2: Depicting change?

C1: Element Identity?

C2: Depicting change?

C3: Order of events?

C1: Element Identity?

C2: Depicting change?

C3: Order of events?

C4: Spatial context?

C1: Element Identity?

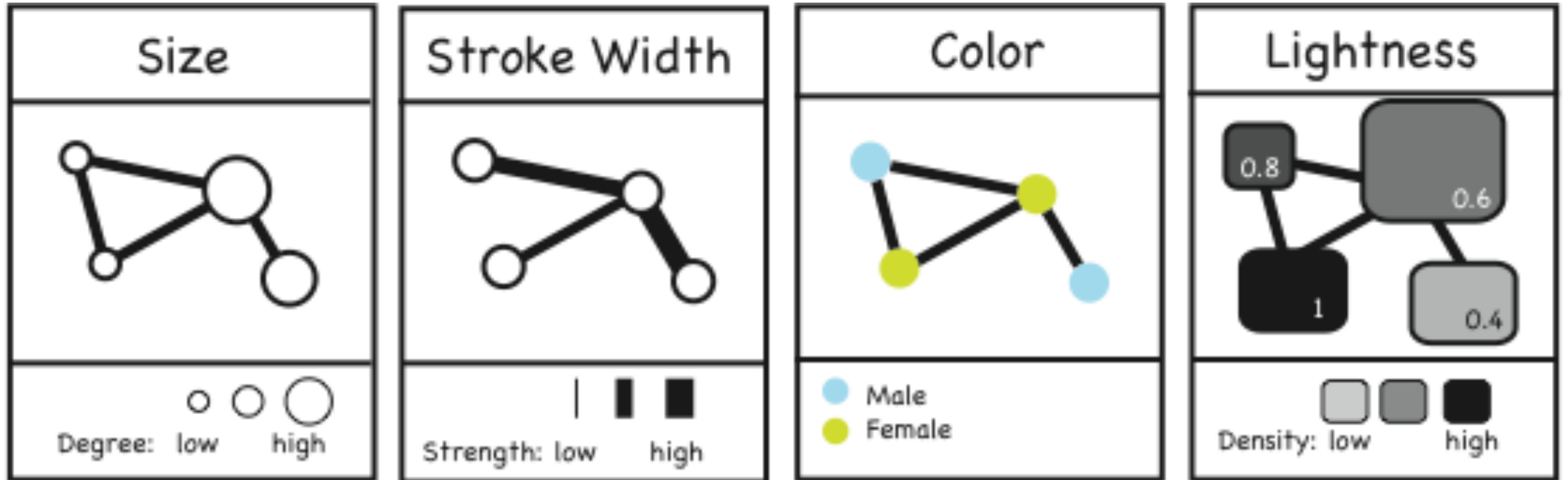
C2: Depicting change?

C3: Order of events?

C4: Spatial context?

C5: Number of Events?

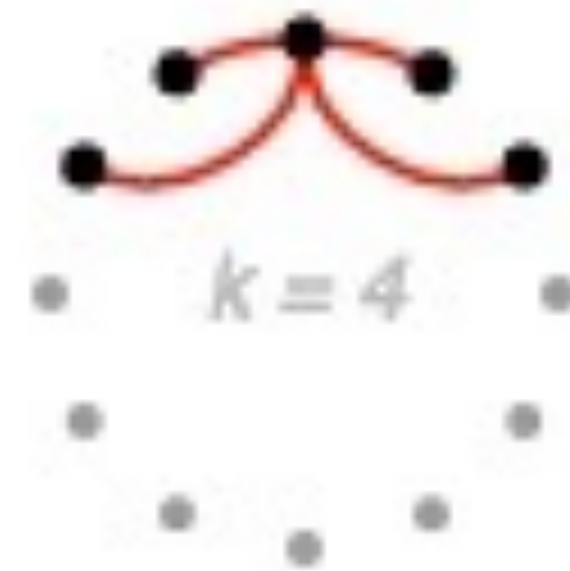
8. Multivariate Networks



We start with a ring of n vertices



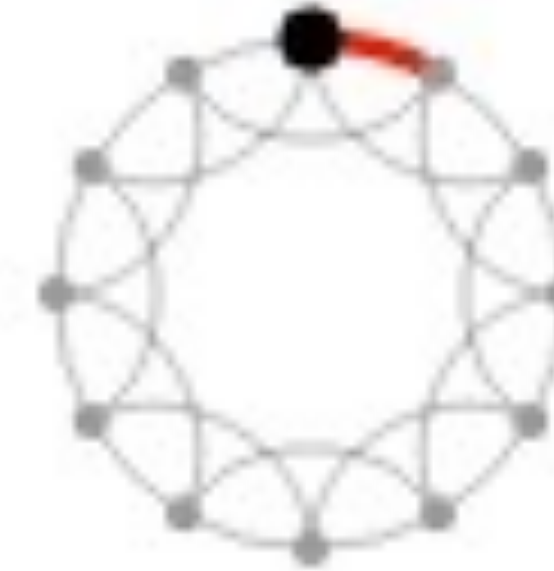
where each vertex is connected to its k nearest neighbors



like so.



We choose a vertex, and the edge to its nearest clockwise neighbour.



SLOVENE SCIENTIFIC COLLABOR. NETWORK I

In 1960, the Slovenian Scientific Community was separated into various disconn. clusters

Some of which were had more or less members

On average, a cluster had 5 members

Within a cluster, all members highly collaborate with each other.

But few collaborations exist across clusters

Over the following decades, one cluster increases in size until it contains 2/3 of the scientific community

SLOVENE COLL. II

As this happens, the network grows by attracting new members joining the scientific community...

... and the diameter drops consistently

This trend continues, until, on the collapse of Y in 1990, there is a loss of many members

And its diameter grows again

The largest cluster falls into smaller clusters...

... which remain only loosely connected

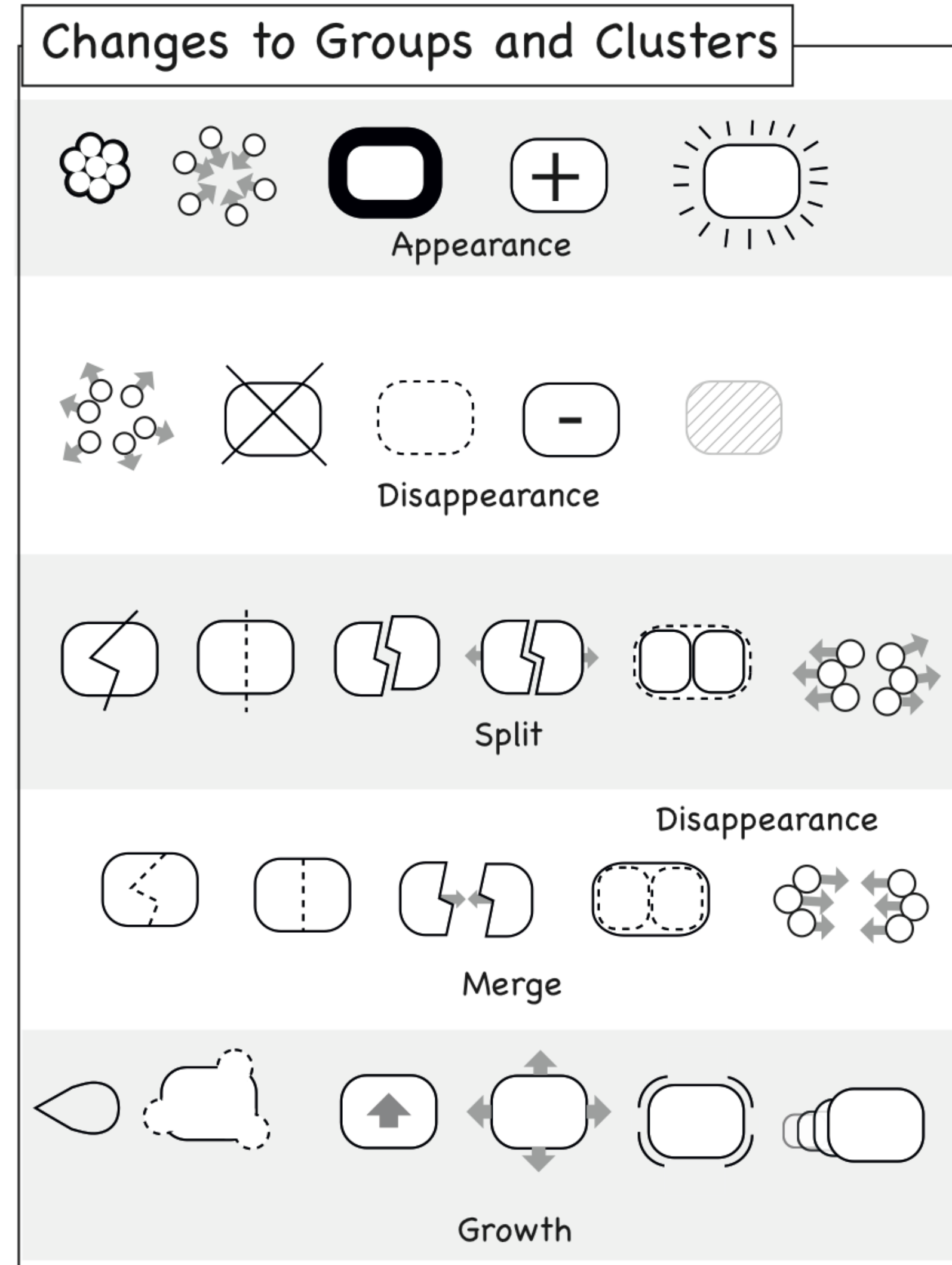
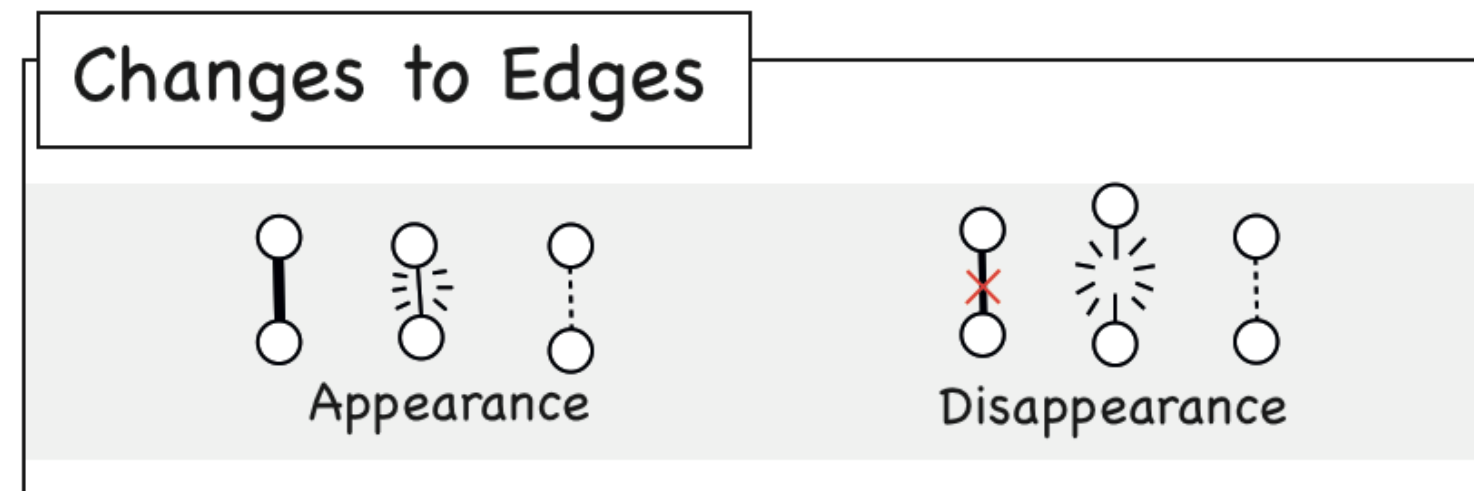
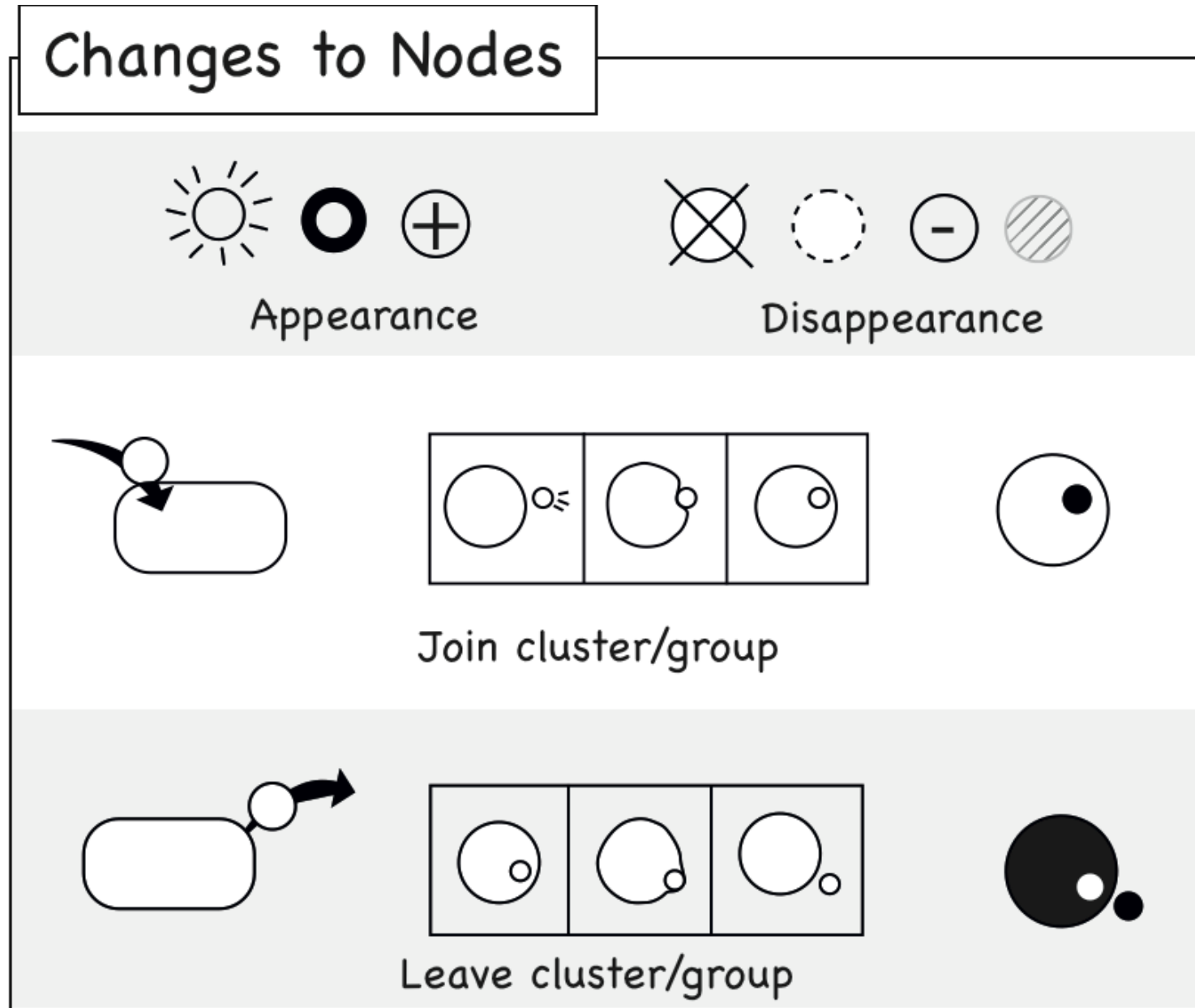
SLOVENE COLL. III

The network in 1990... .. is similar to 1960

Yet, in the 90s, the network grows again, and one large cluster emerges... .. that includes 98% of the scientific network in 2010

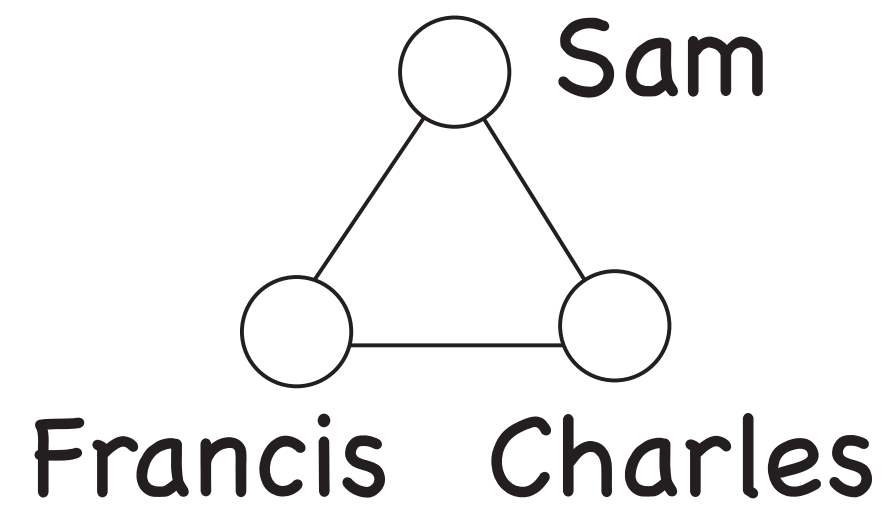
The density of the collabor. in 2010 is twice as high, as in 1989, before the collapse

3. Visual Representation of Change

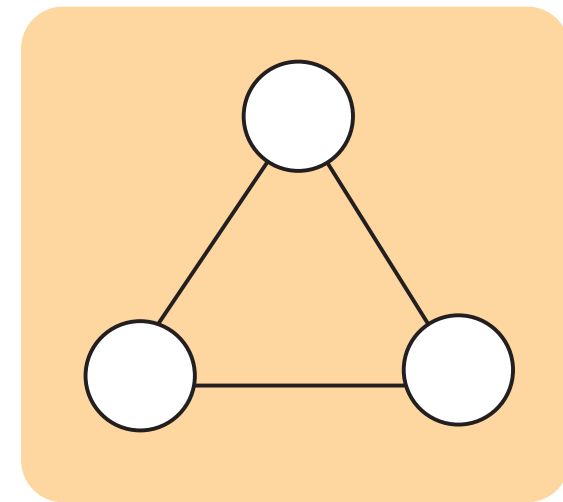


A Start-Up Story

Sam, Charles and Francis are three friends...

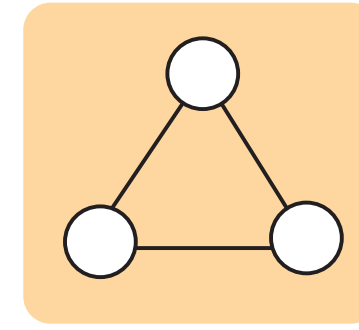


... founding their own start-up ...



Creative & Co.

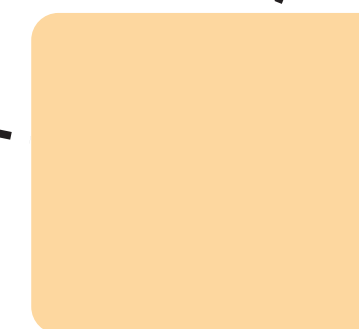
... and looking for collaborators.



They found a company working on a similar idea...

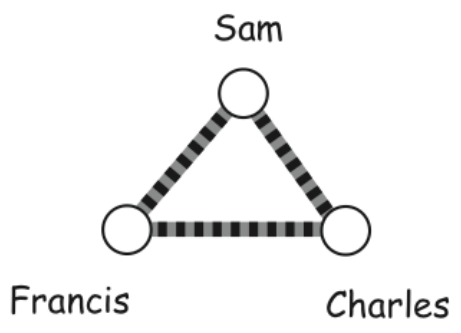


... with which they kept increasing collaboration.



Start-up

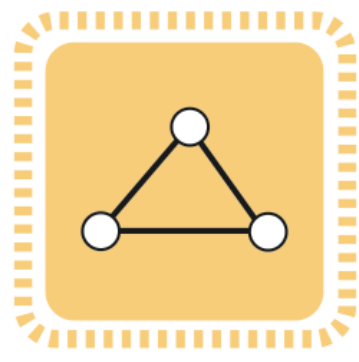
Sam, Charles and Francis are 3 students that become friends at the university.



Sam
Francis Charles

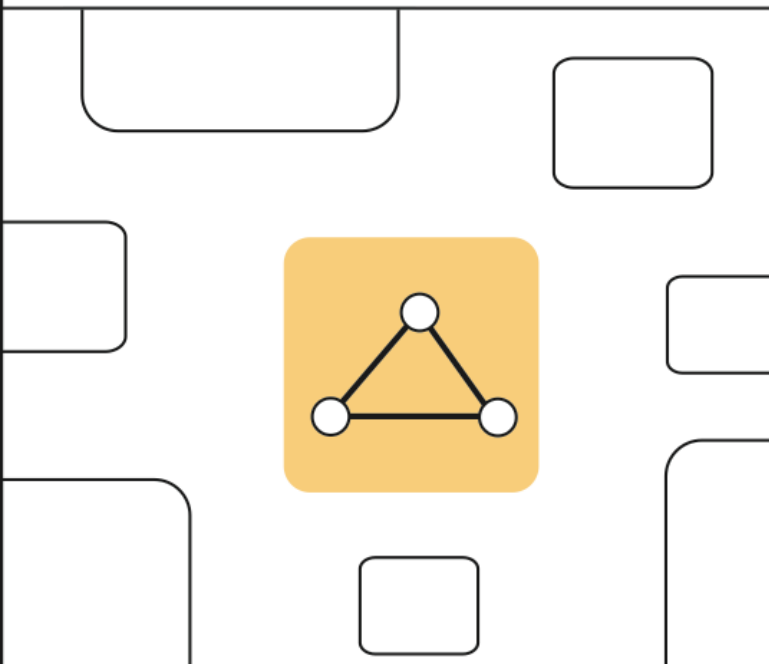
After graduation, they founded a start-up...

1998



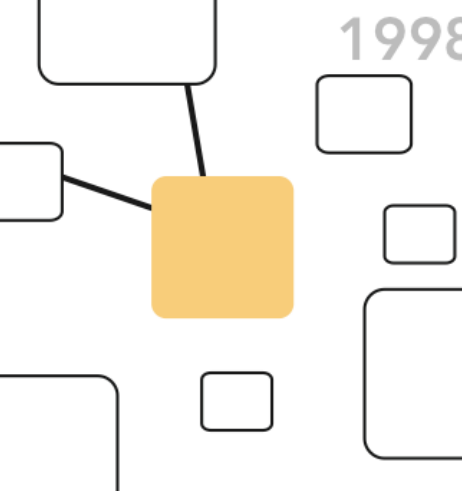
START UP

... where looking for customers.

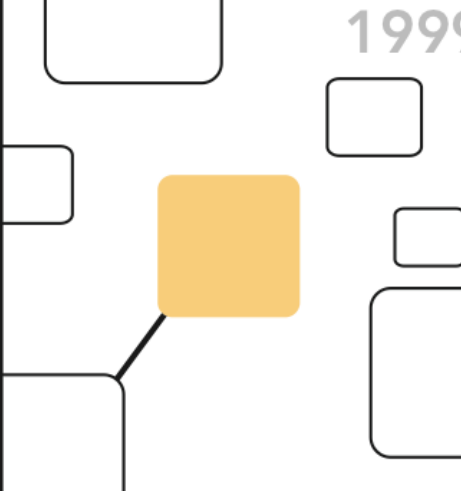


For two years, they have had few and different customers.

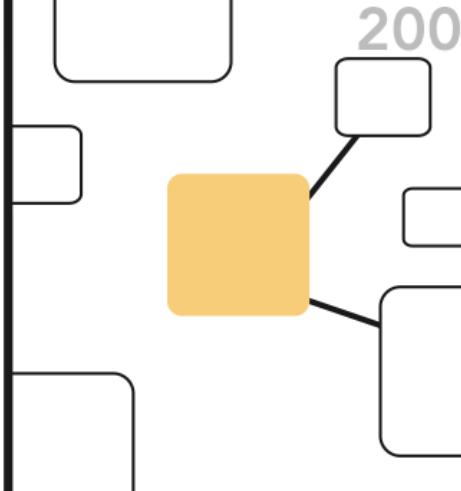
1998



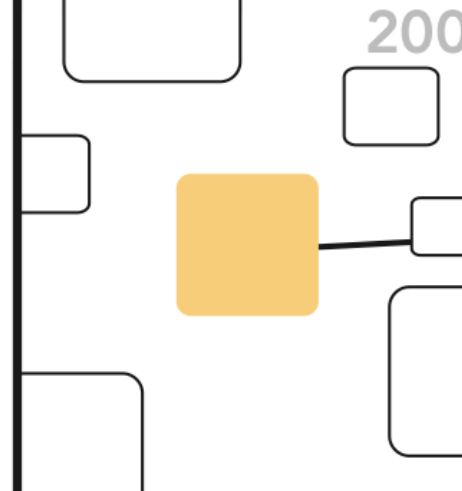
1999



2000

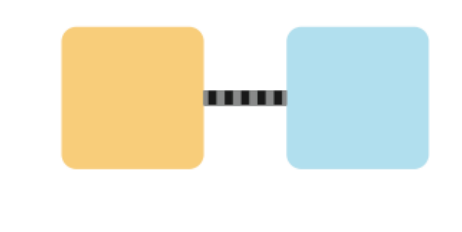


2001



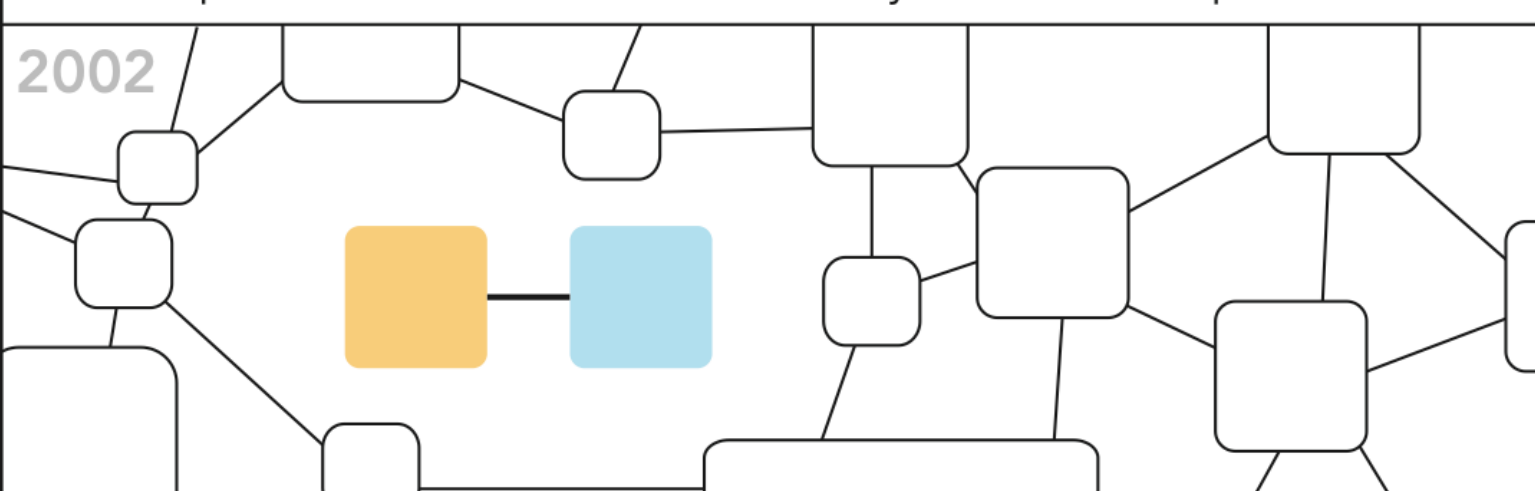
In 2002, they new another star-up, working on similar stuff.

2002

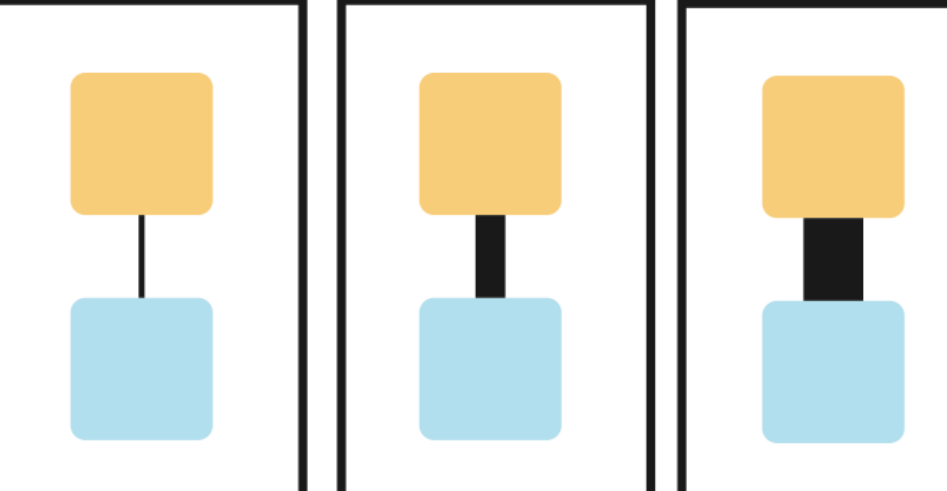


Both companies where isolated from other very connected companies.

2002

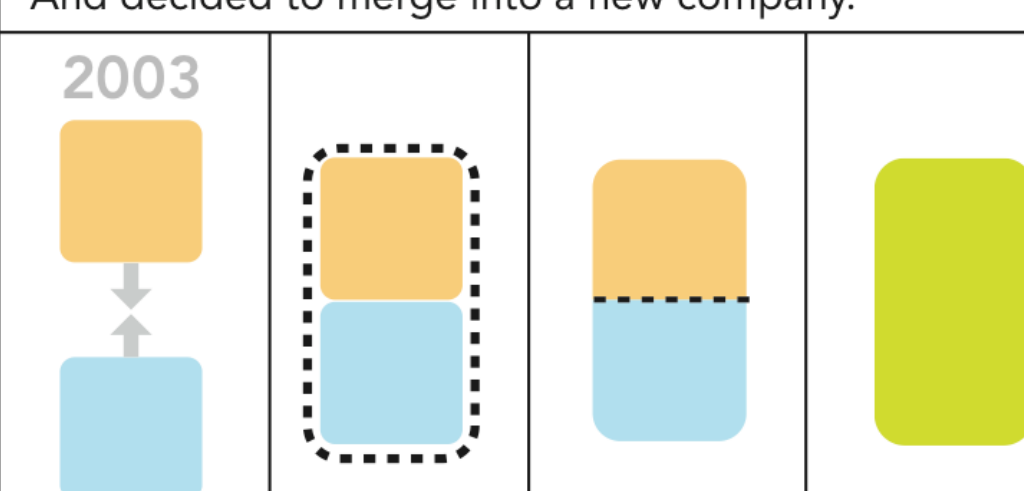


Both companies strengthened their collaboration.

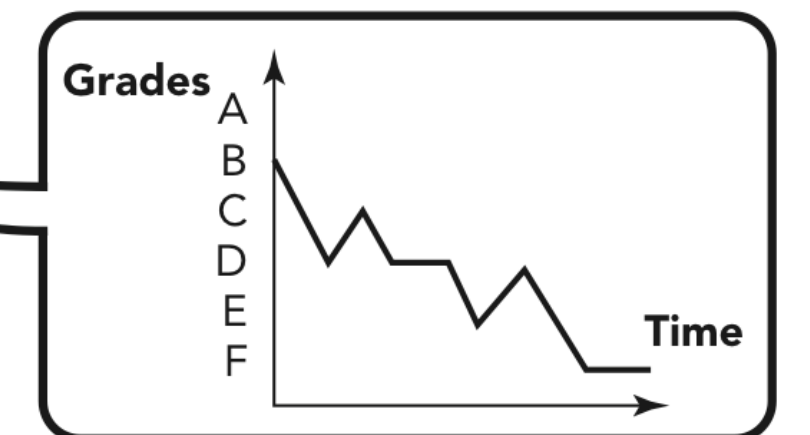
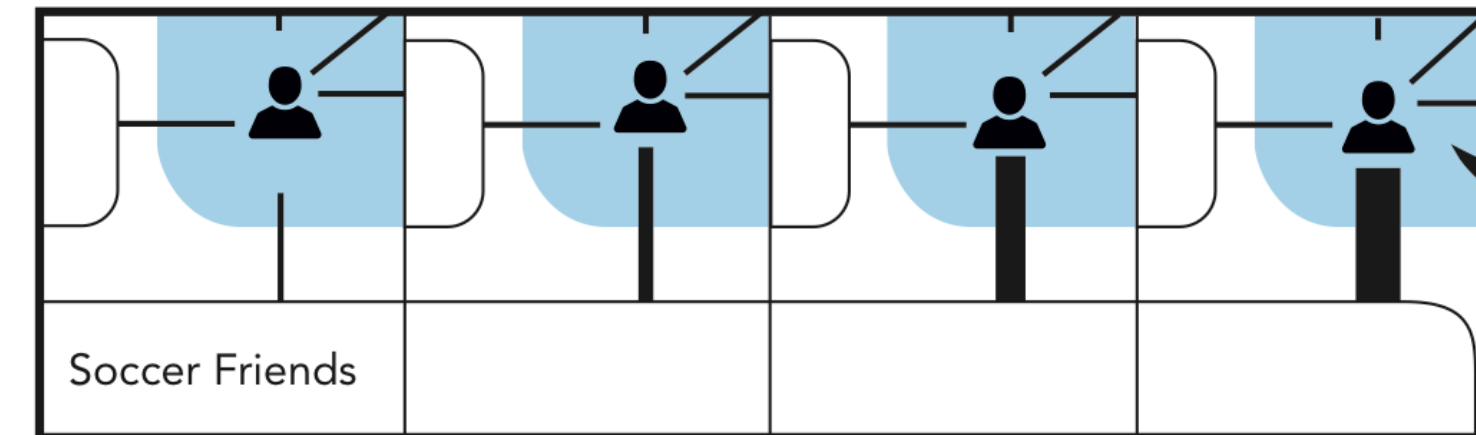
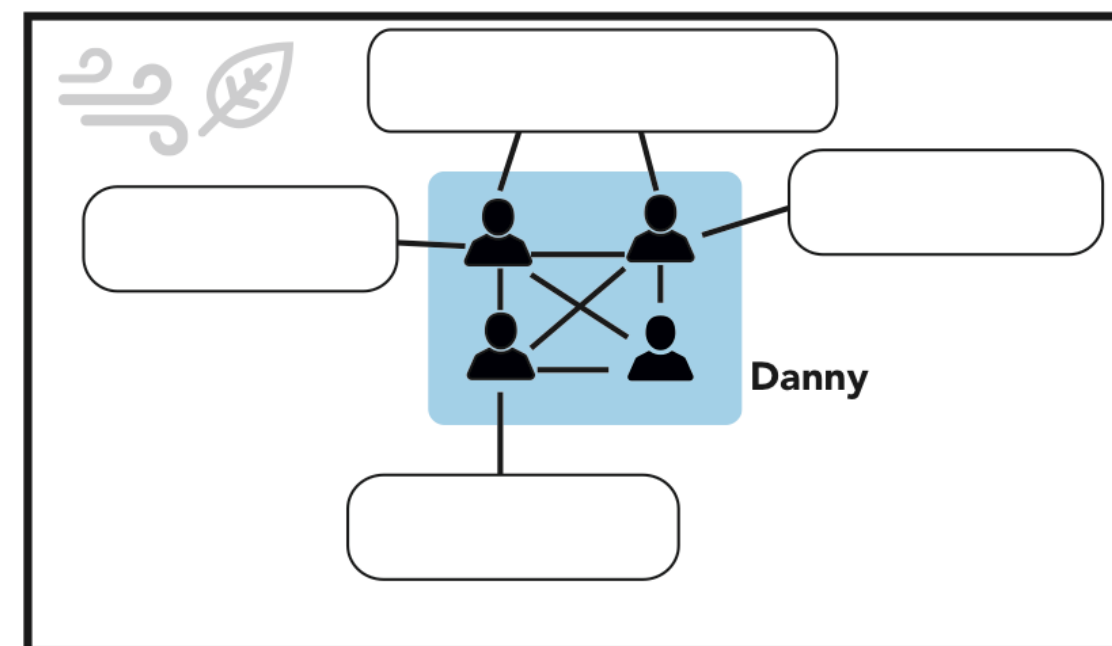
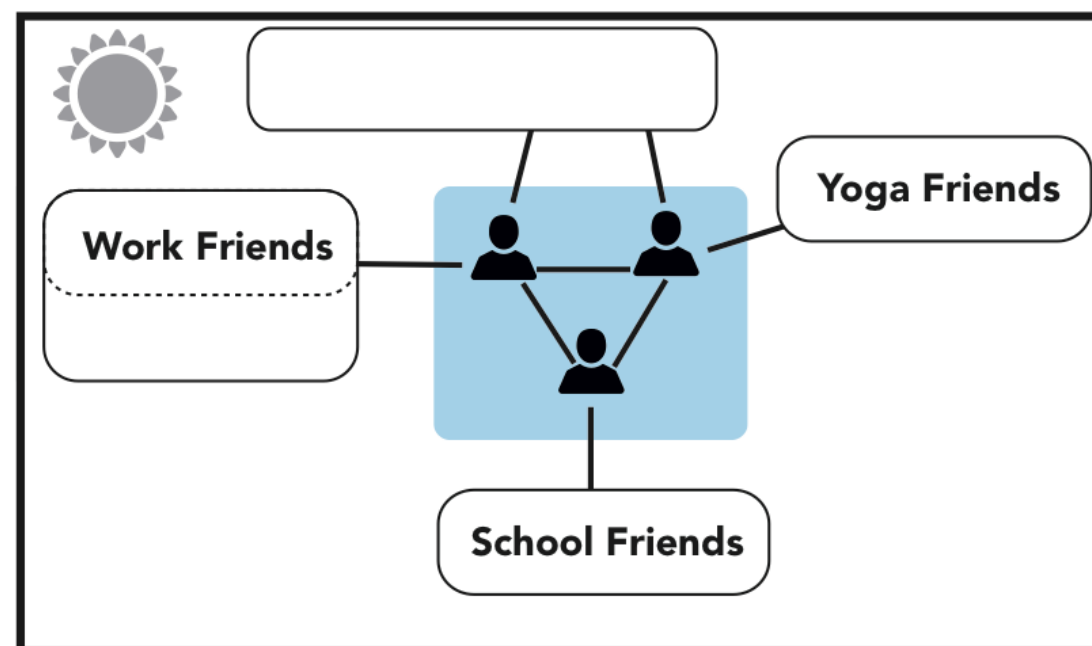
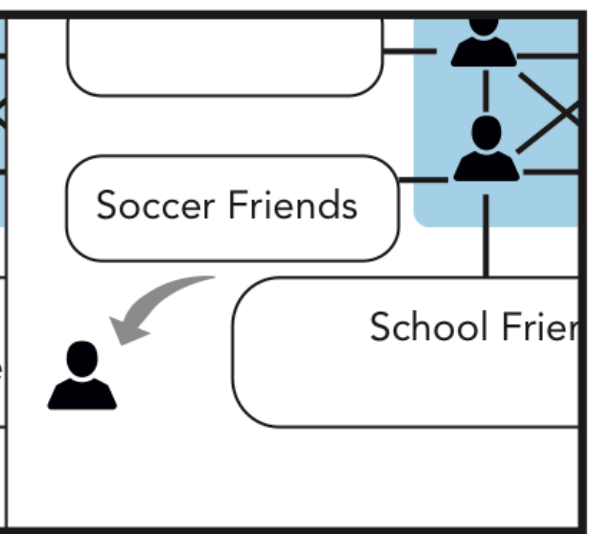
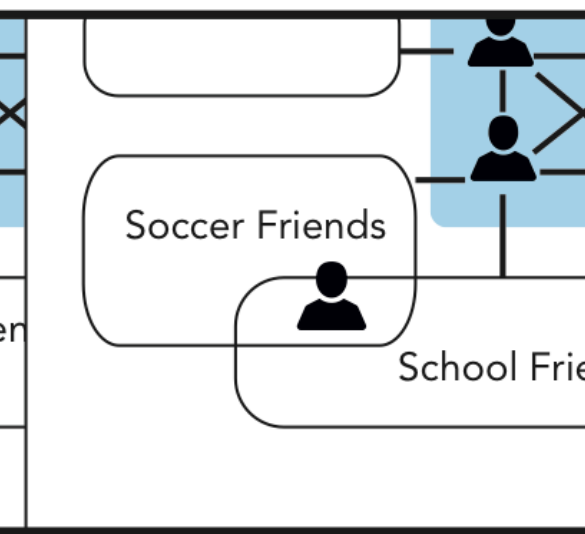
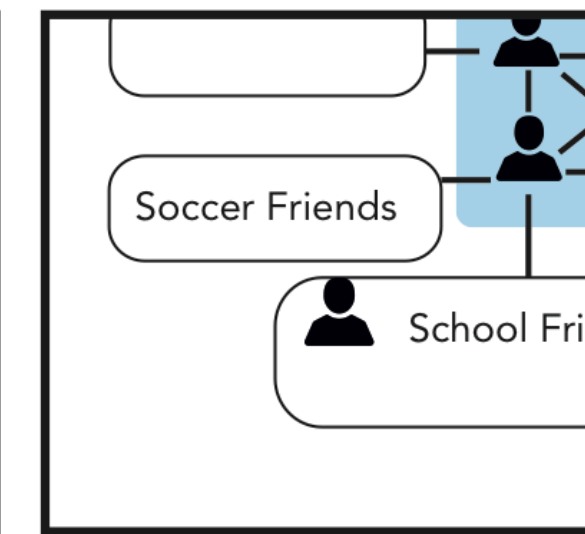
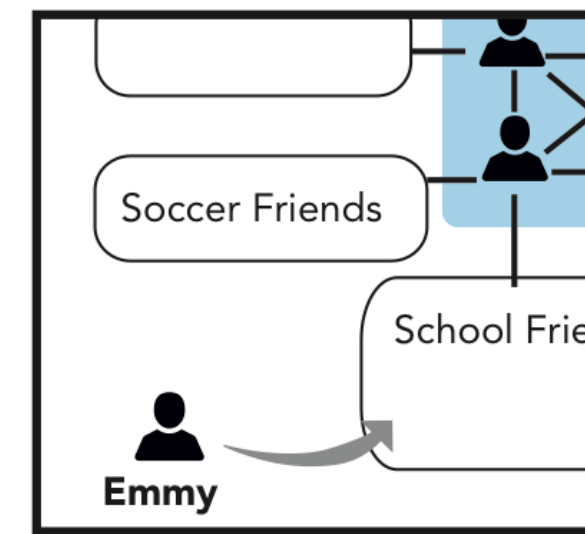
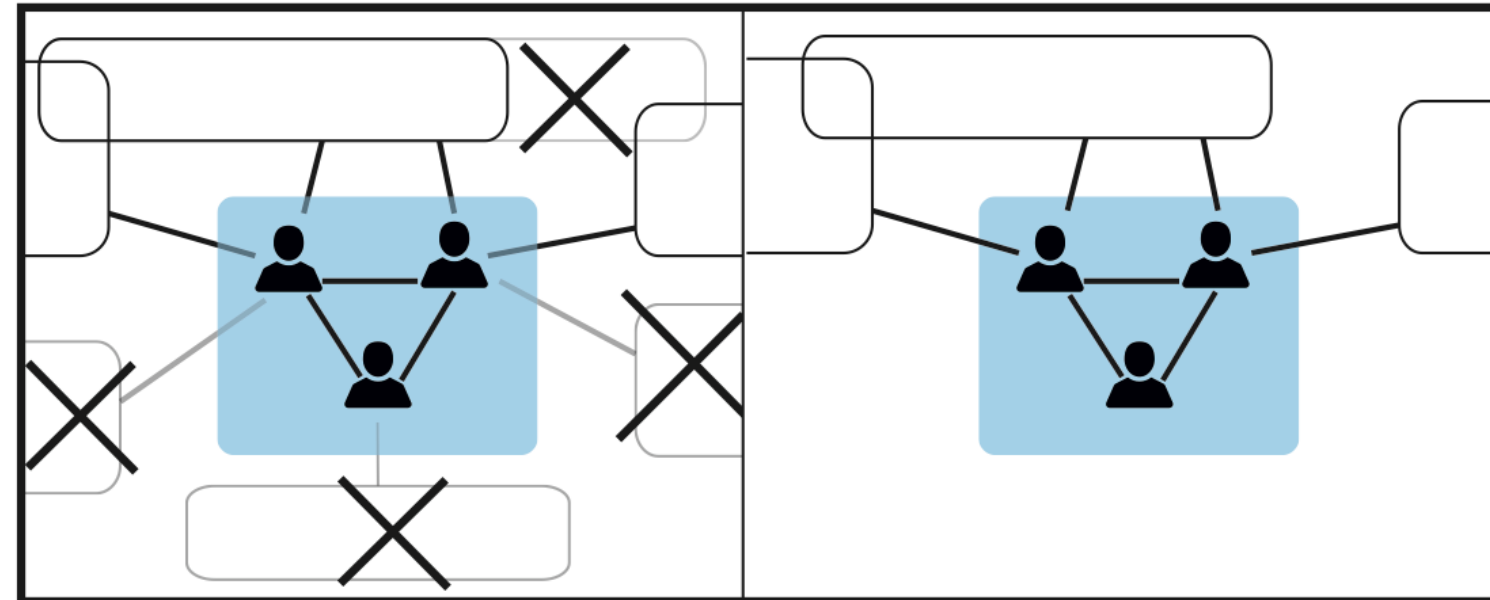
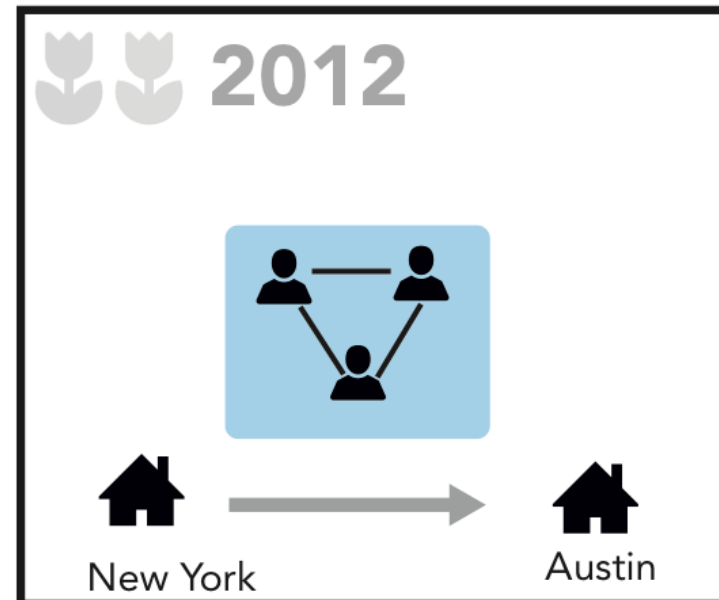
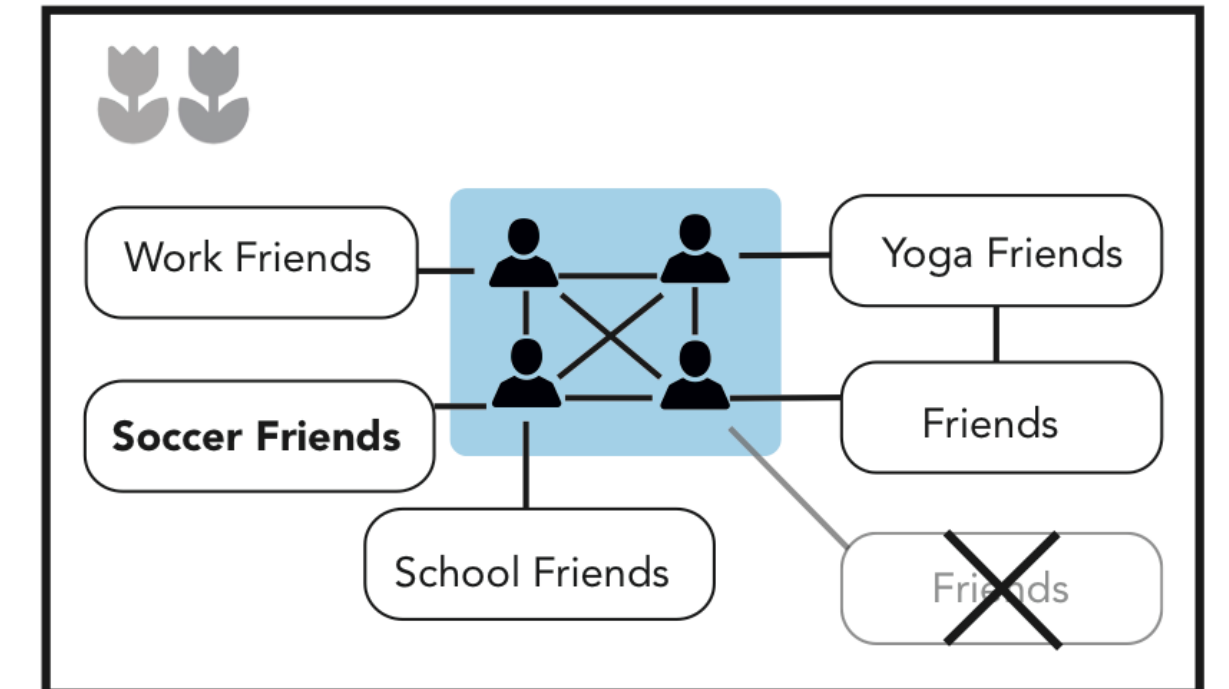
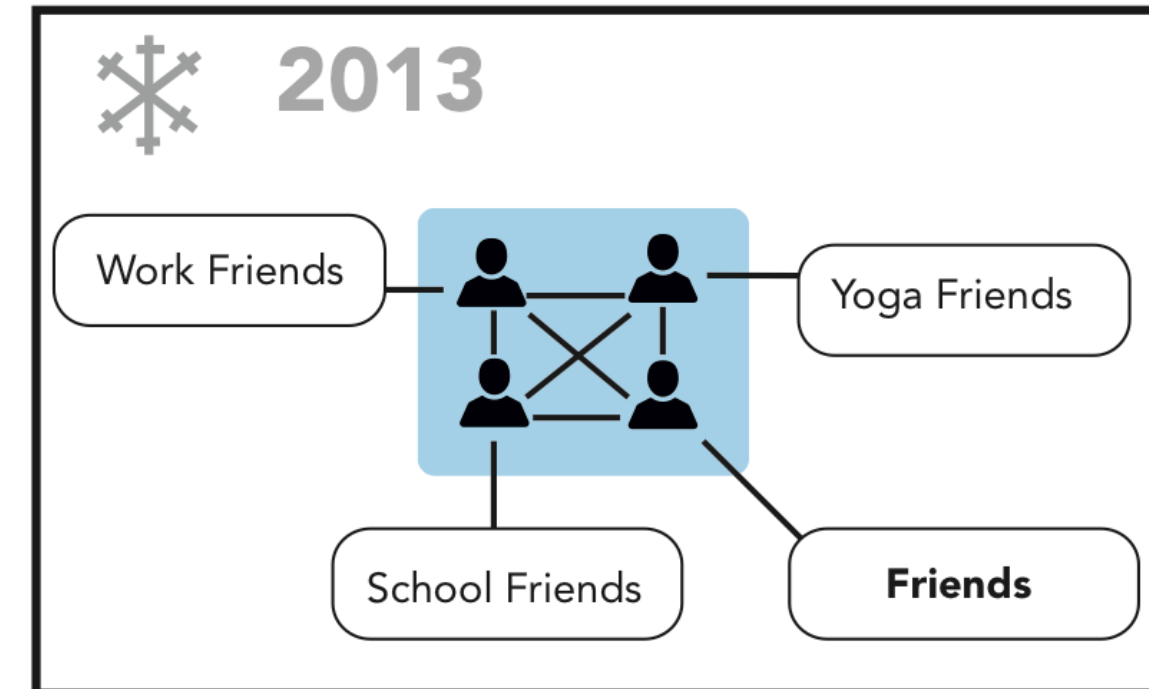
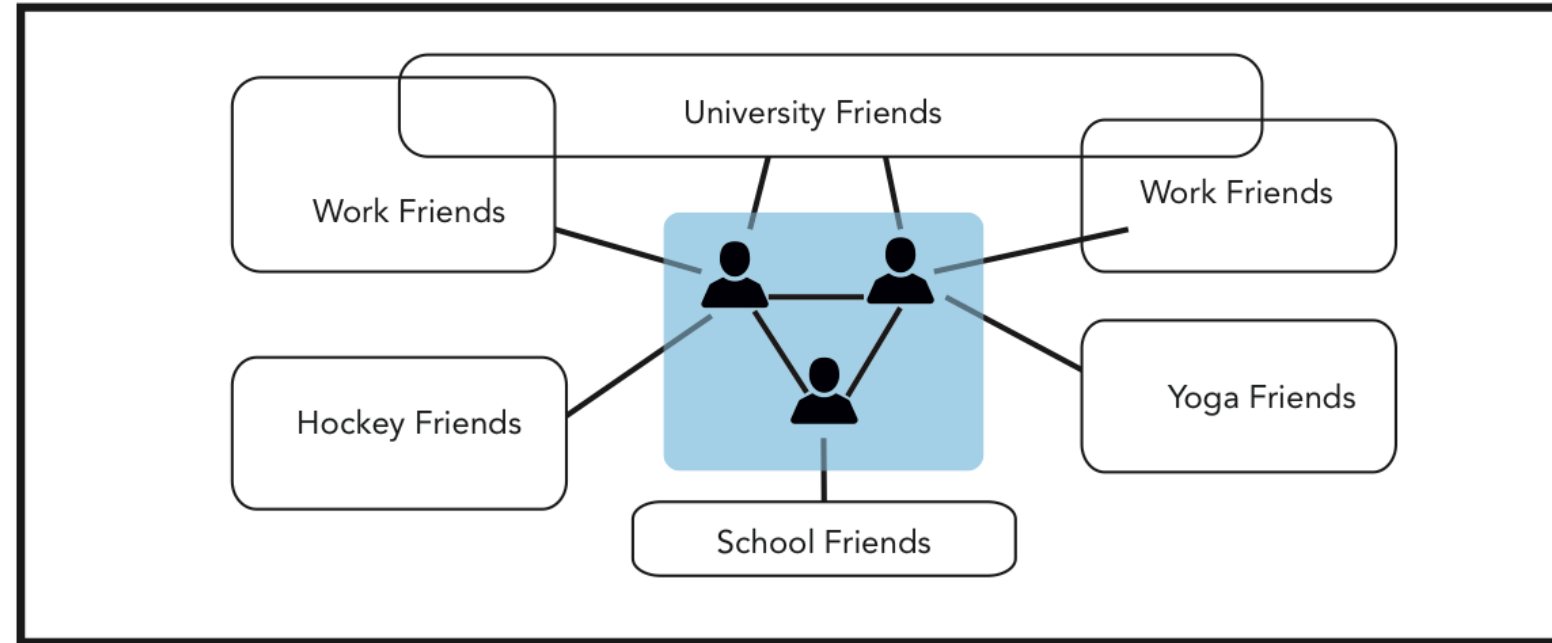
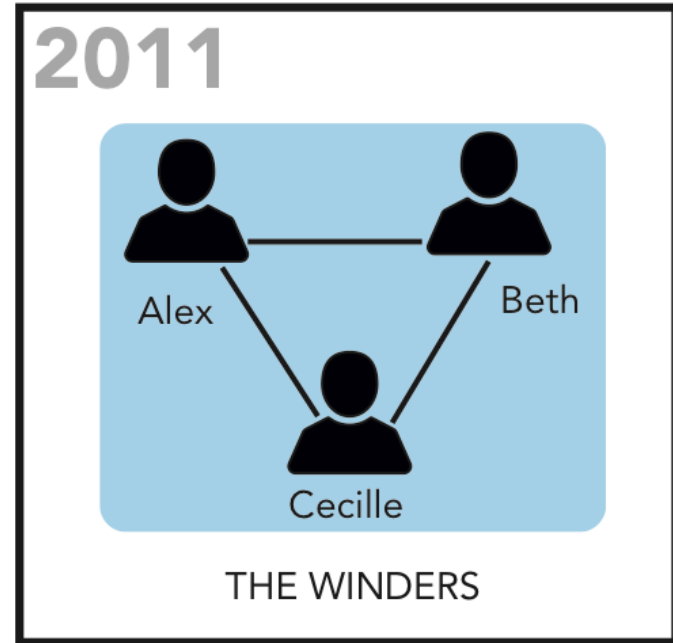


And decided to merge into a new company.

2003

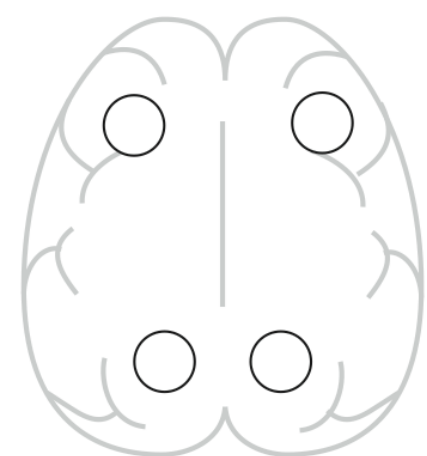


Family

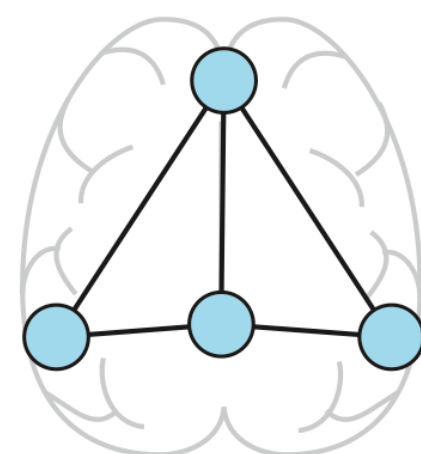


Hallucinations in PD patients

Here, we look at two networks in the brain, made out of regions

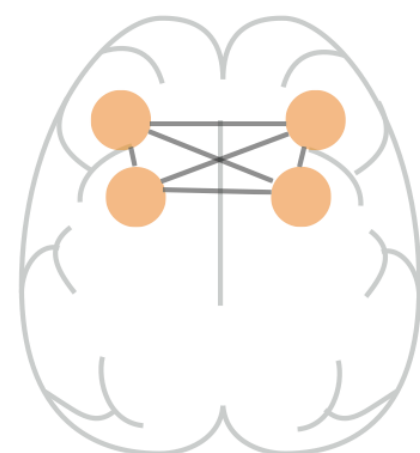


The default mode network DMN...



DMN

...the frontal control....



Frontal Control

and the default attention network DAN



DAN

Consider two groups of people:



Controls

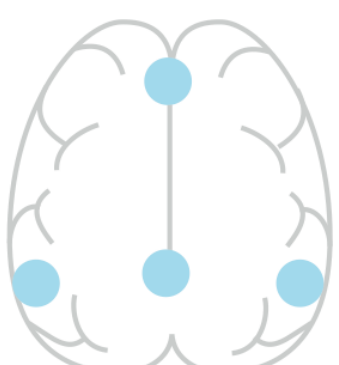


Parkinson Disease (PD)

Most of the time... the DMN is active in both groups.

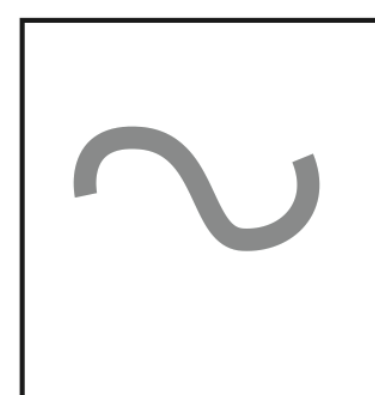


Controls

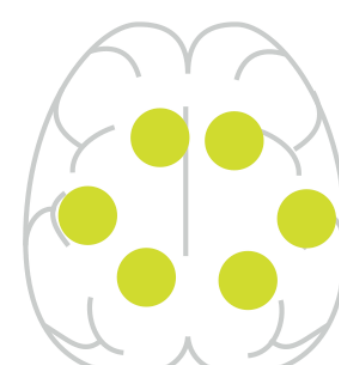


PD

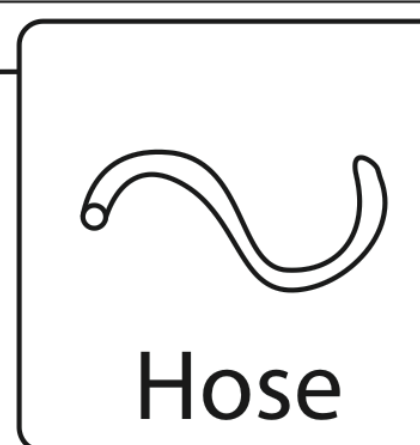
When a subject sees an ambiguous object ...



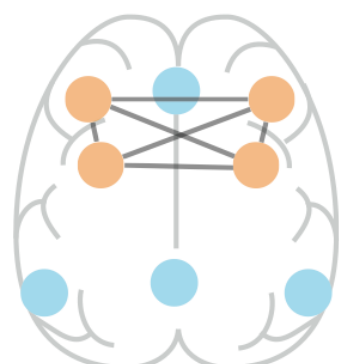
.. different networks interpret it in each group.



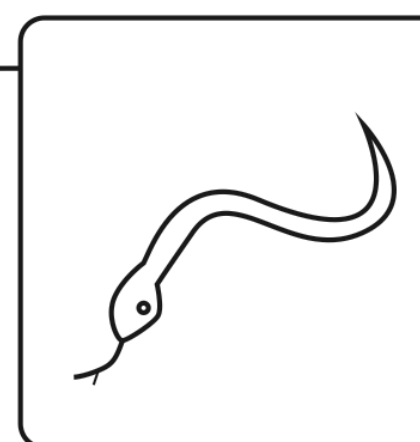
Controls



Hose



PD



While in controls, the DAN is active while processing the visual stimulus, ...



Controls

... in PD the other networks are active.



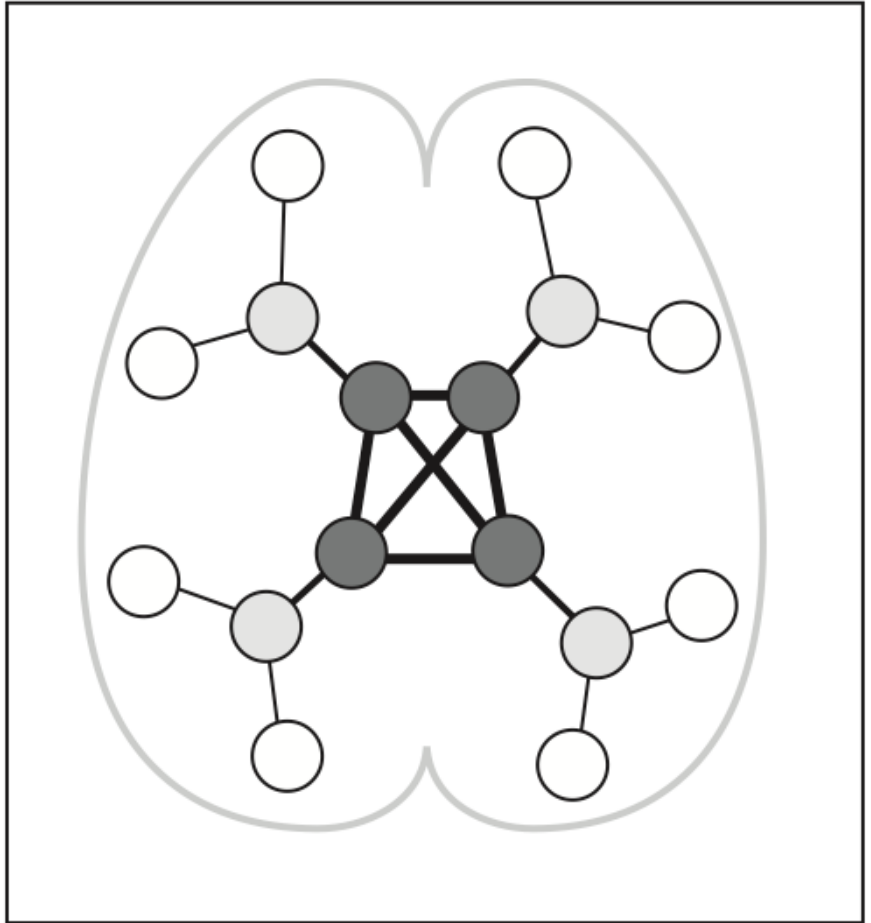
PD

Brain Network Organization at Birth

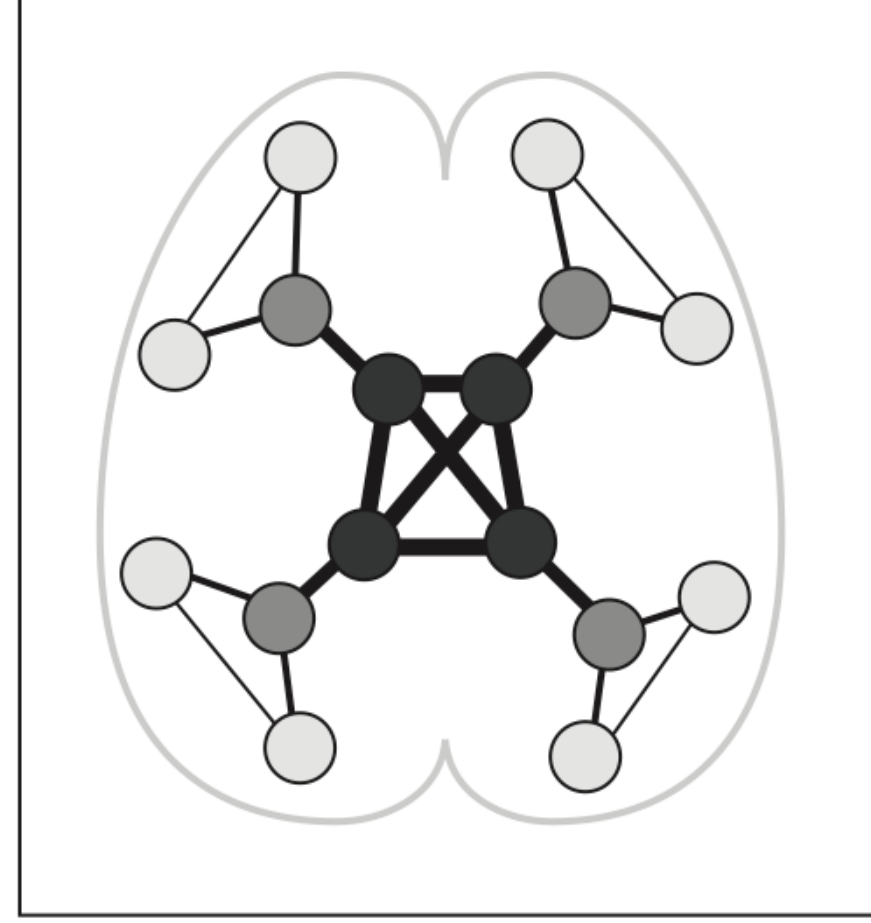
Conditions observed:

- Legend
- High degree (Rich Club)
 - Low degree (Feeder)

Pre-term

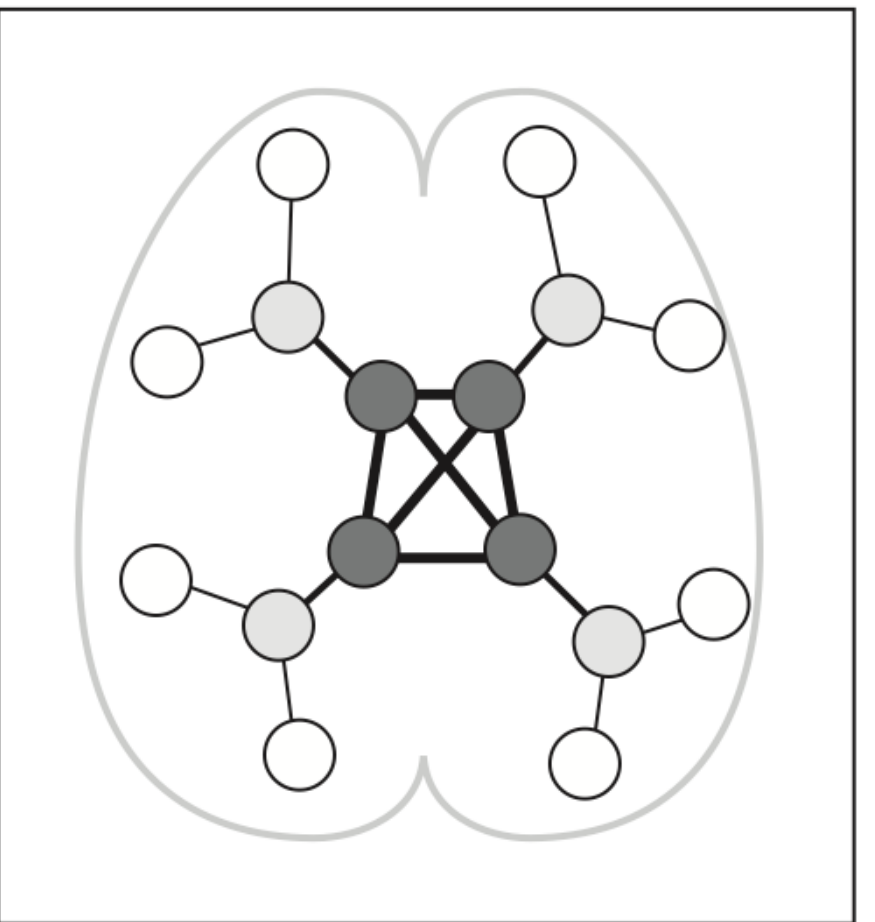


Term

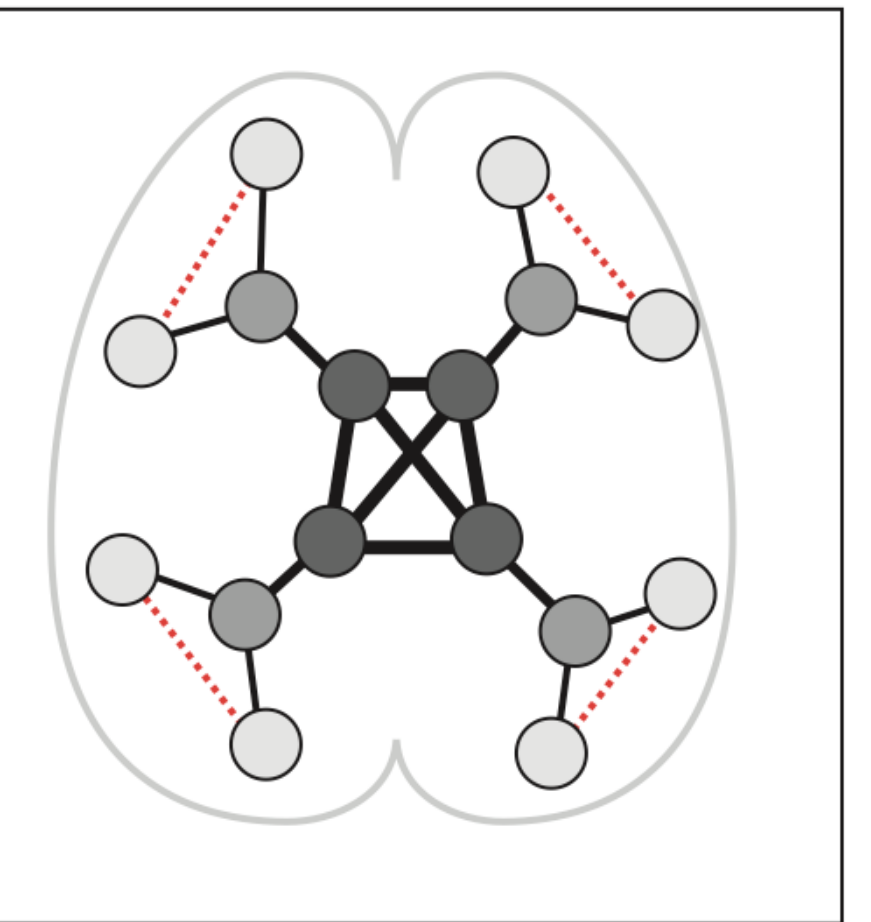


Hypothesis for Evolution:

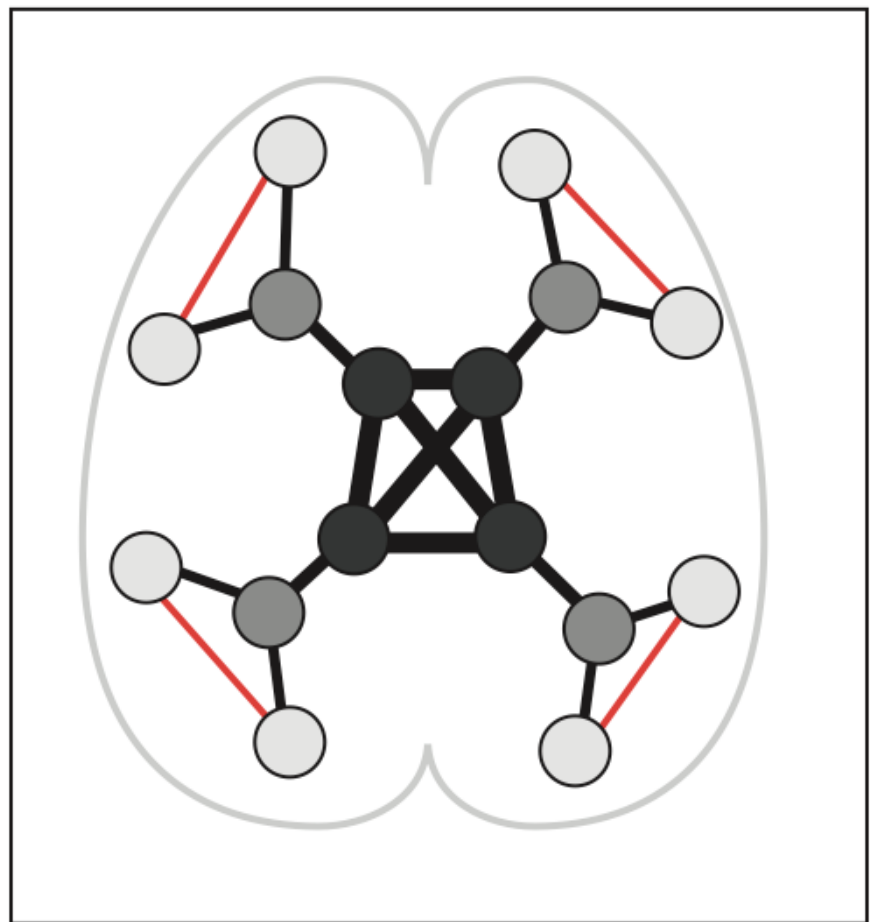
30 week



35 week



40 week



European Alliances before World War I (1836-1914)

| | | | |
|--|--|---|---|
| <p>1836 Imperial powers in Europe in the middle of the 19th century.</p> | <p>Britain signs a contract, supporting Belgium in case of violation of its neutrality.</p> <p>1837</p> | | |
| <p>German chancellor Bismarck manages ally Germany, Austria and Russia in the Three Emperors' Alliance, ...</p> <p>1873</p> | <p>... leaving France isolated against a well integrated Germany.</p> <p>1873 1879</p> | | |
| <p>However, increasing border disputes lead to the cancellation of that alliance, a few years later.</p> <p>1879</p> | <p>Dual Alliance</p> <p>1879</p> | <p>Triple Alliance</p> <p>1882</p> | |
| <p>France needs to escape isolation.</p> <p>1894</p> | <p>Franco-Russian Alliance</p> <p>1904</p> | <p>Entente Cordiale</p> <p>1904</p> | <p>Triple Entente</p> <p>1907</p> |

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1907

Triple Entente

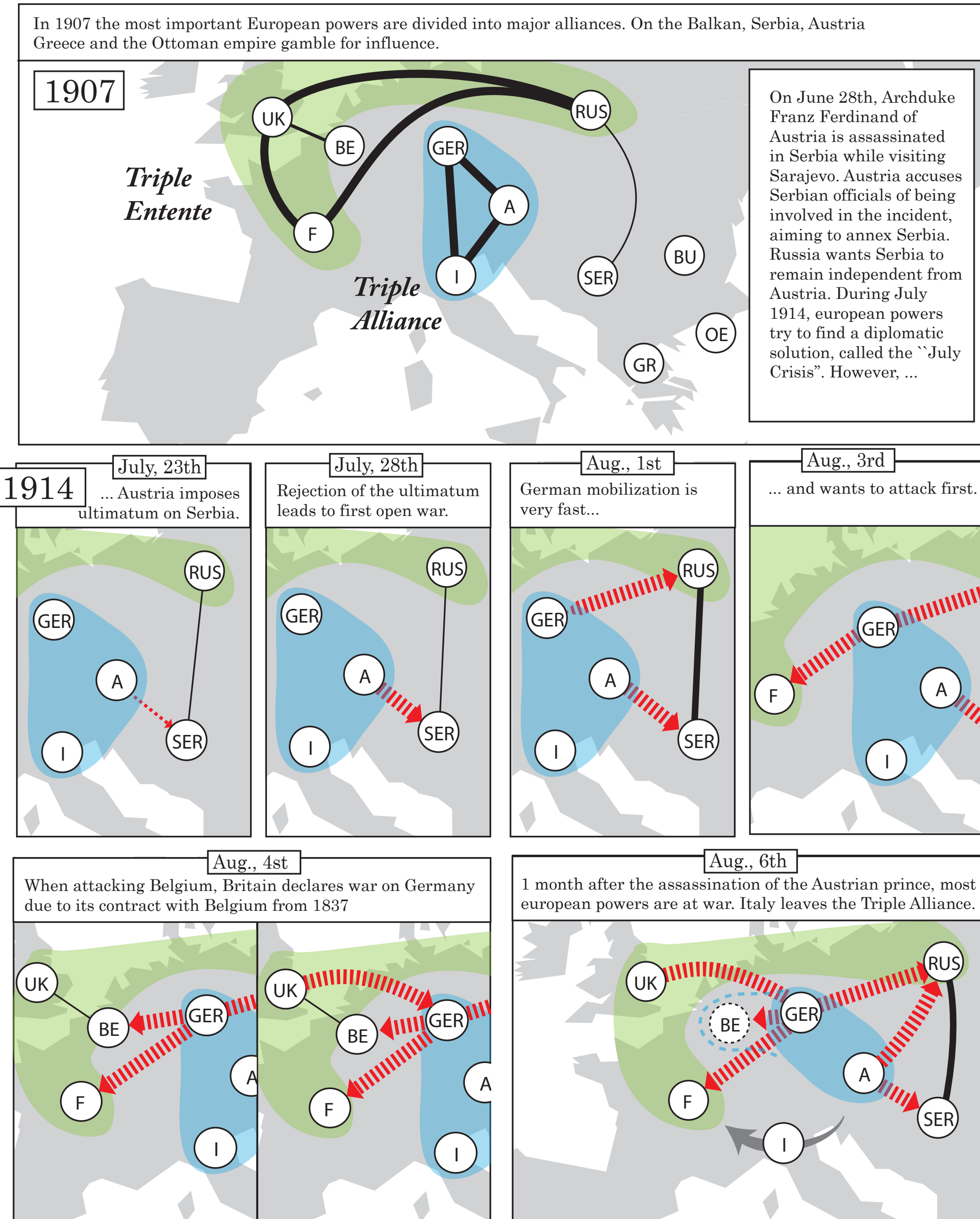
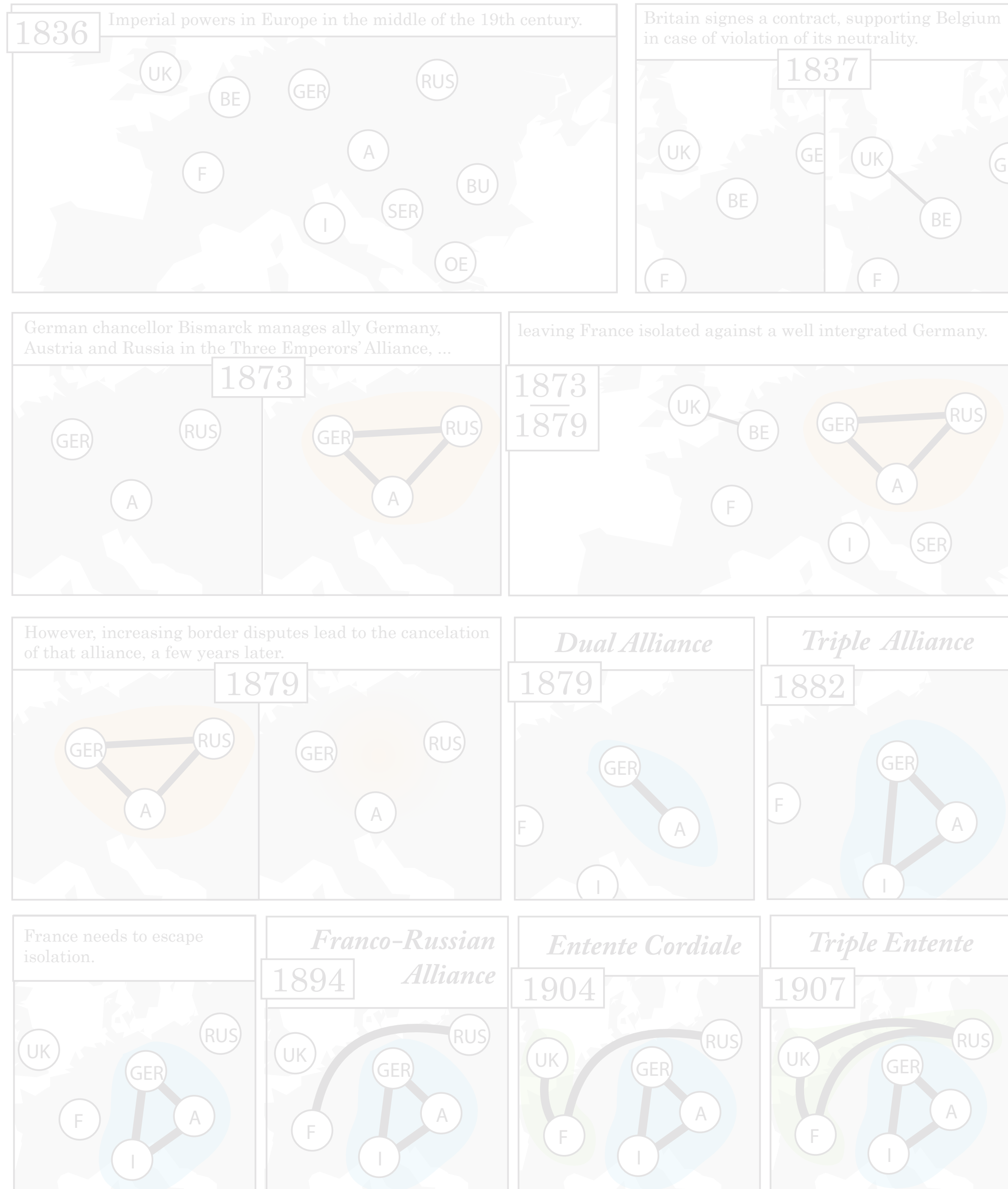
Triple Alliance

On June 28th, Archduke Franz Ferdinand of Austria is assassinated in Serbia while visiting Sarajevo. Austria accuses Serbian officials of being involved in the incident, aiming to annex Serbia. Russia wants Serbia to remain independent from Austria. During July 1914, European powers try to find a diplomatic solution, called the "July Crisis". However, ...

1914

| | | | |
|---|---|--|---|
| <p>July, 23th</p> <p>... Austria imposes ultimatum on Serbia.</p> | <p>July, 28th</p> <p>Rejection of the ultimatum leads to first open war.</p> | <p>Aug., 1st</p> <p>German mobilization is very fast...</p> | <p>Aug., 3rd</p> <p>... and wants to attack first.</p> |
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European Alliances before World War I (1836-1914)



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1836 Imperial powers in Europe in the middle of the 19th century.

1837 Britain signs a contract, supporting Belgium in case of violation of its neutrality.

German chancellor Bismarck manages ally Germany, Austria and Russia in the Three Emperors' Alliance, ... leaving France isolated against a well intergrated Germany.

1873

1879

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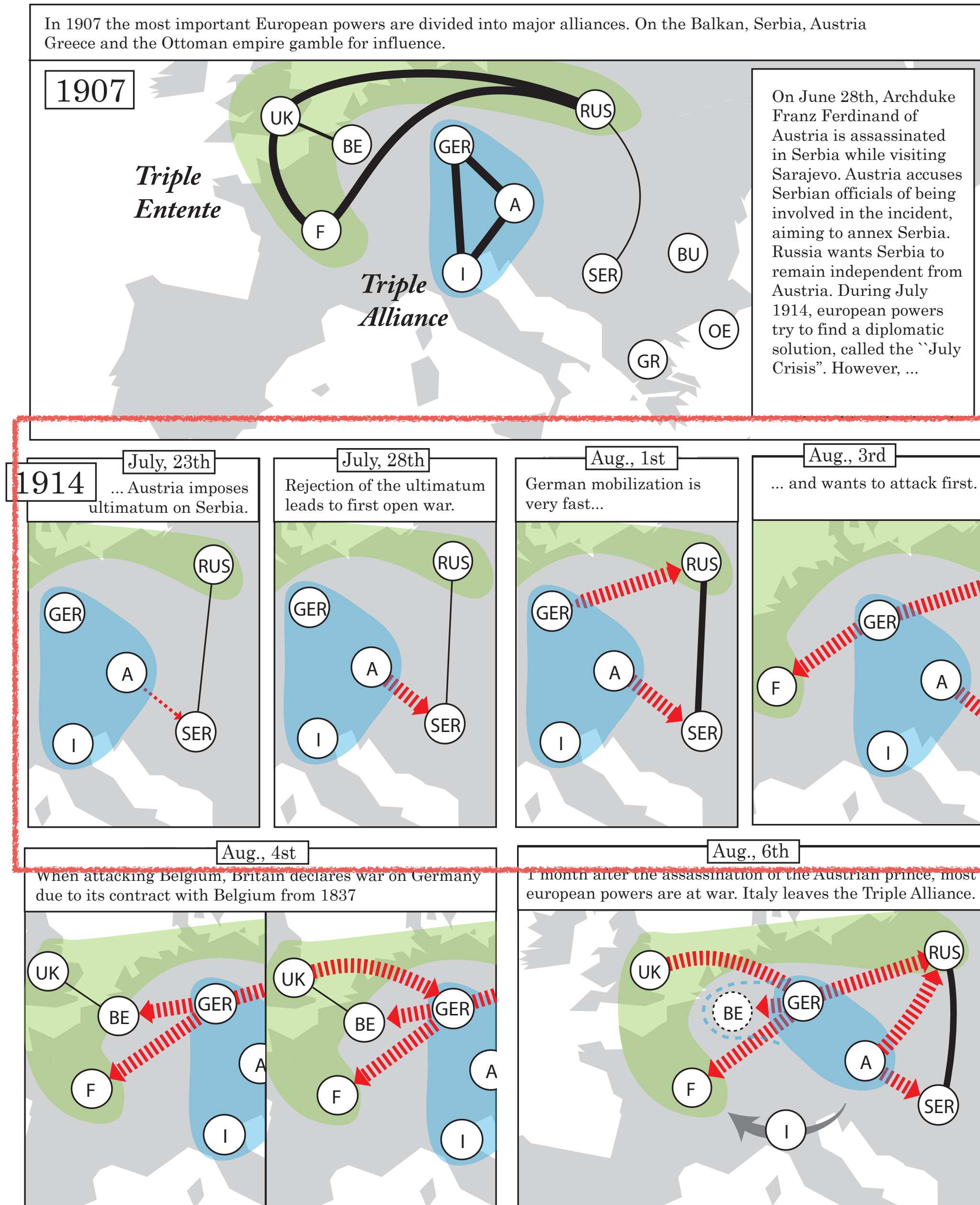
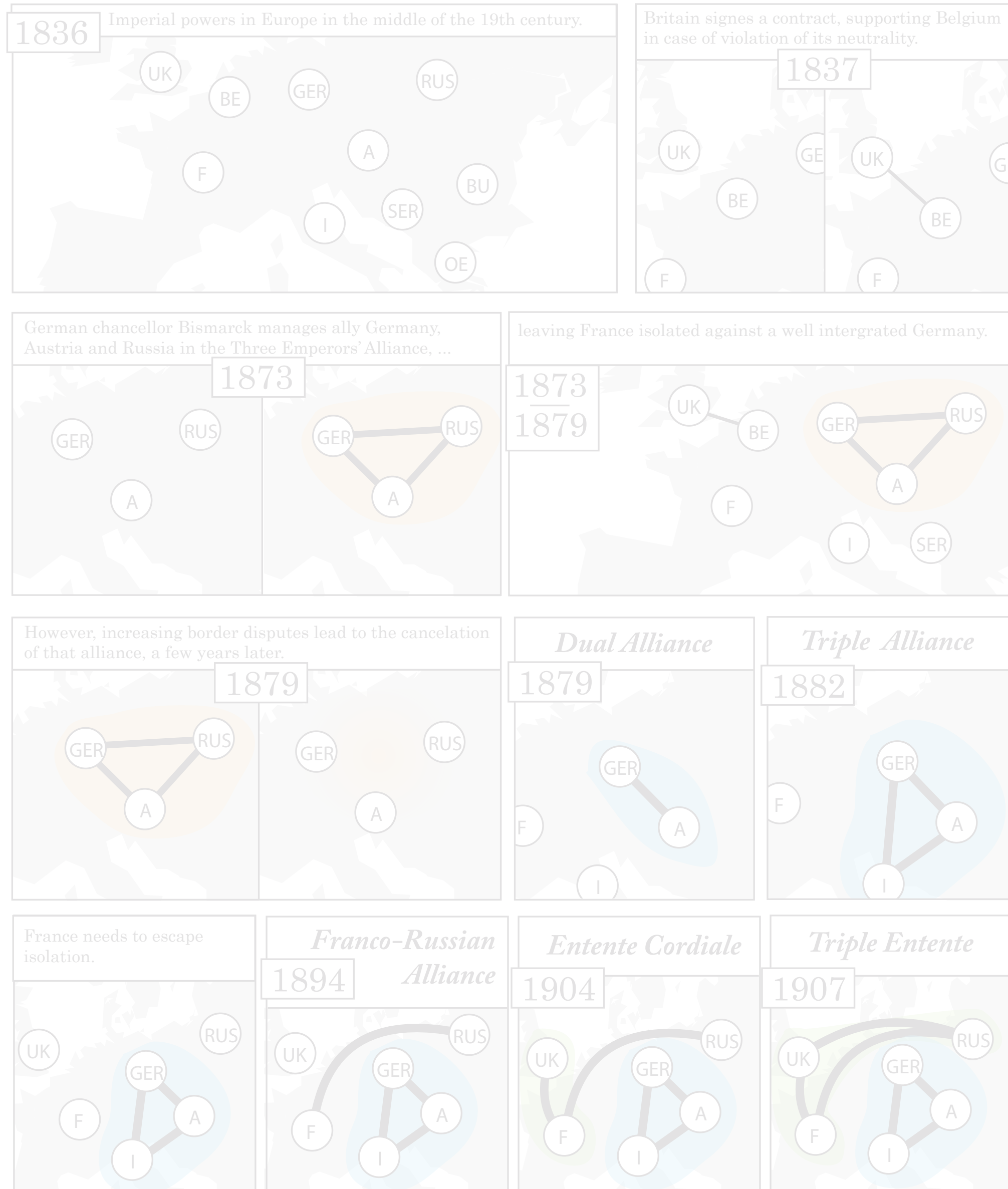
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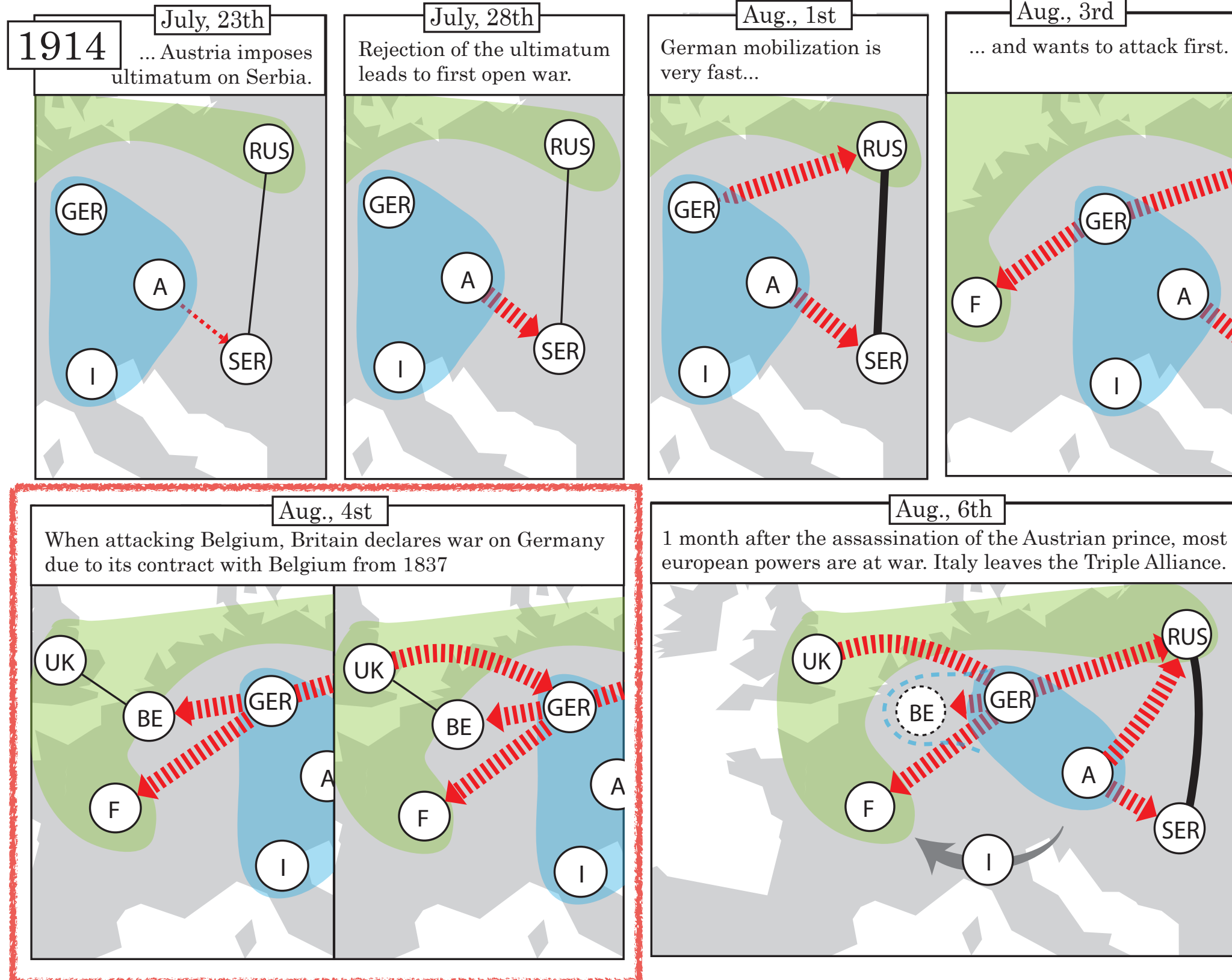
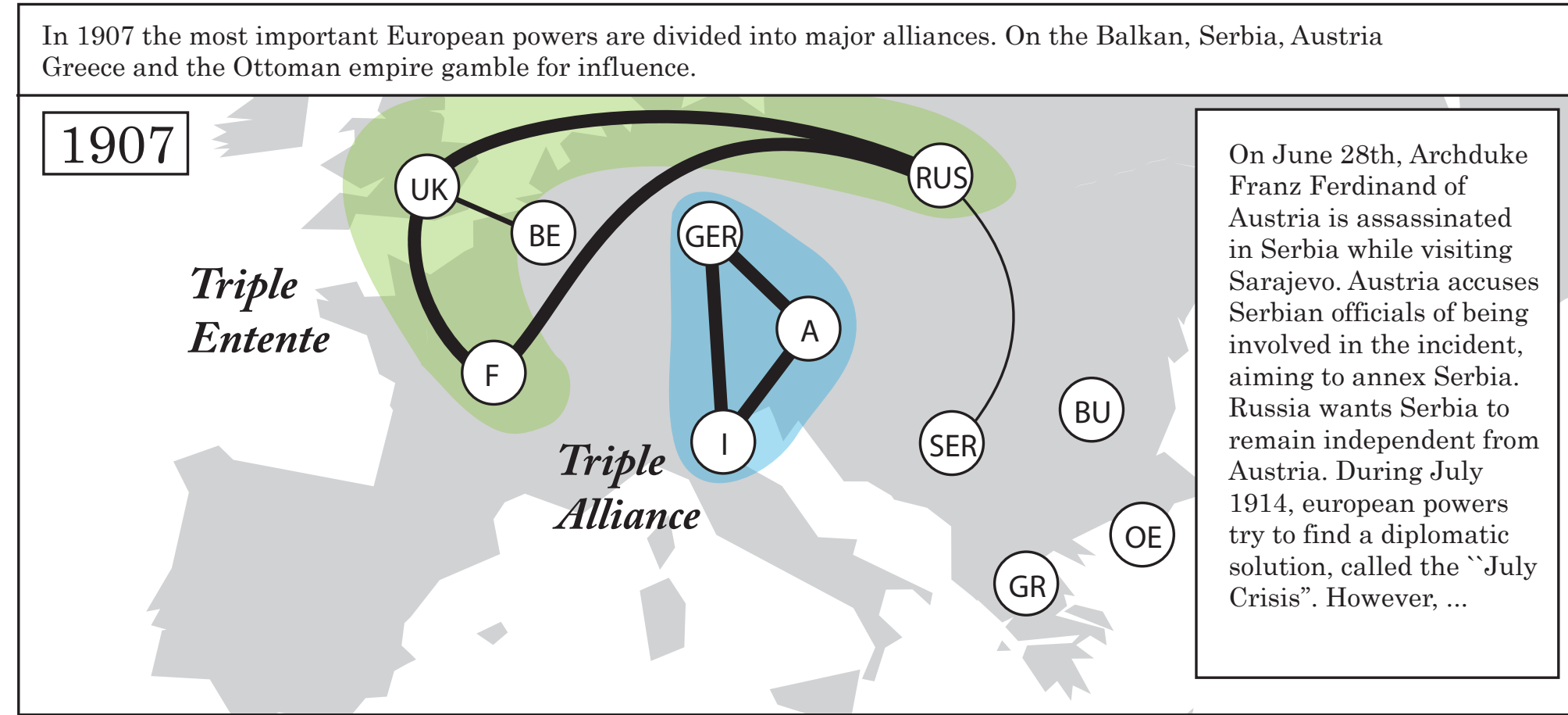
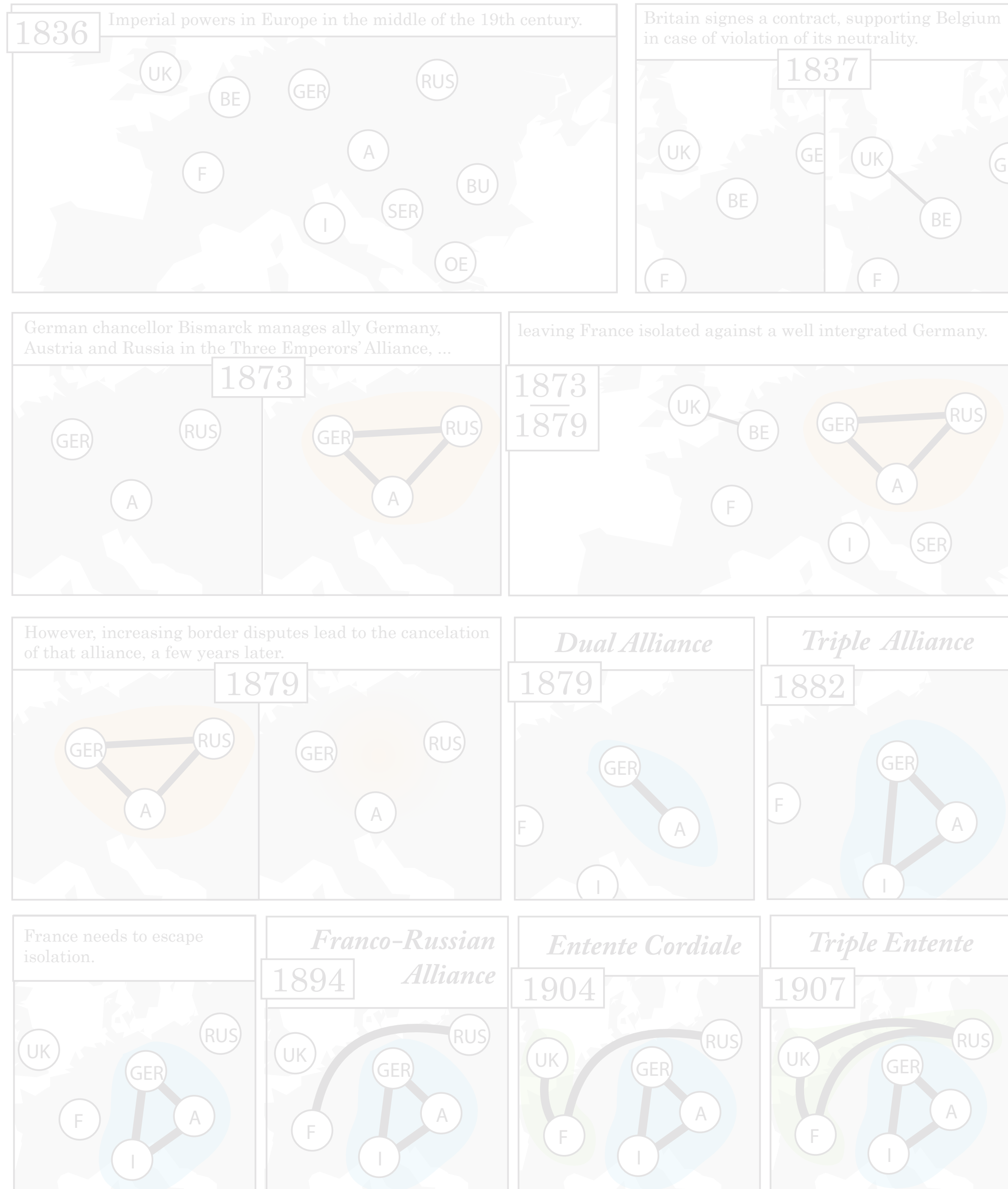
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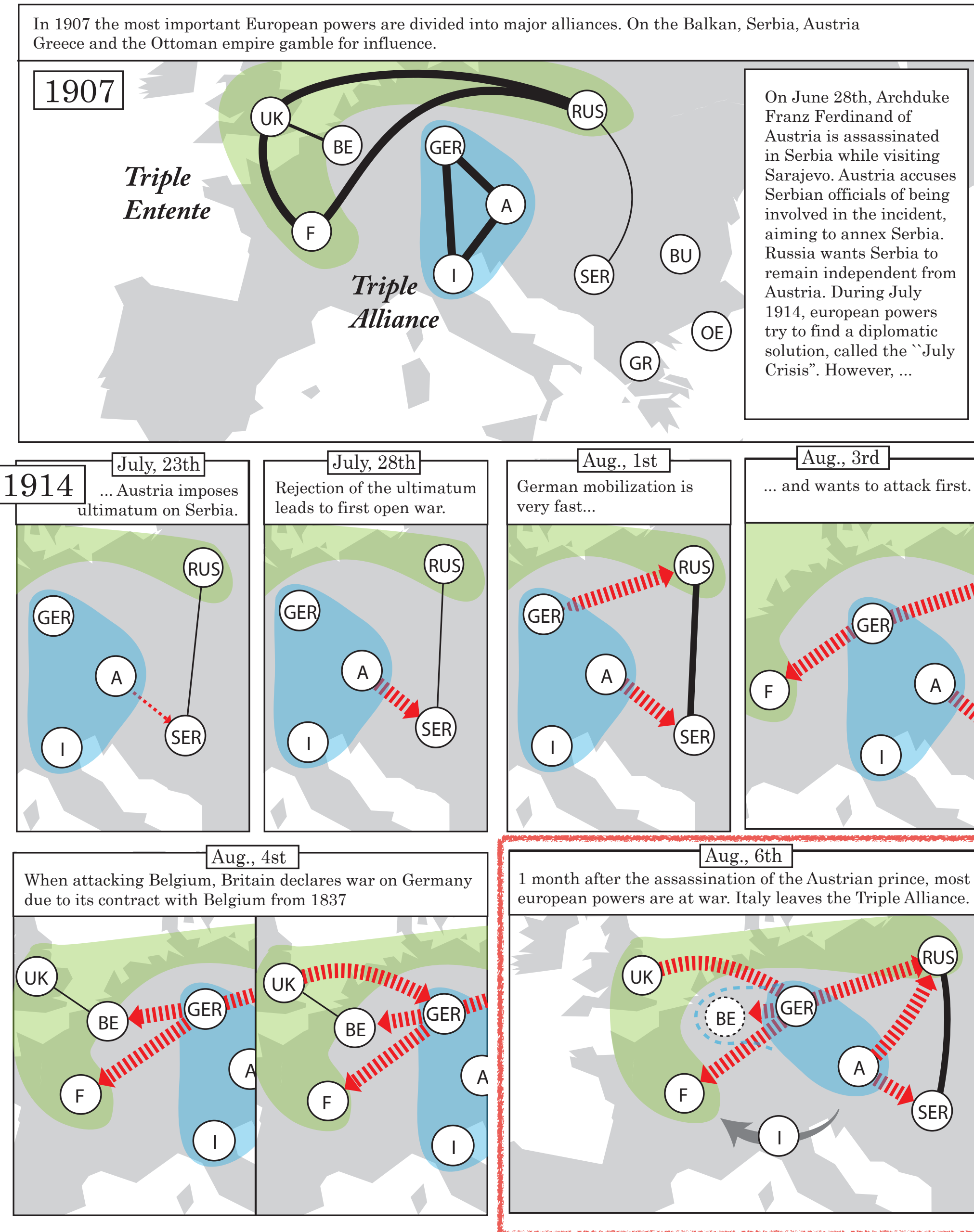
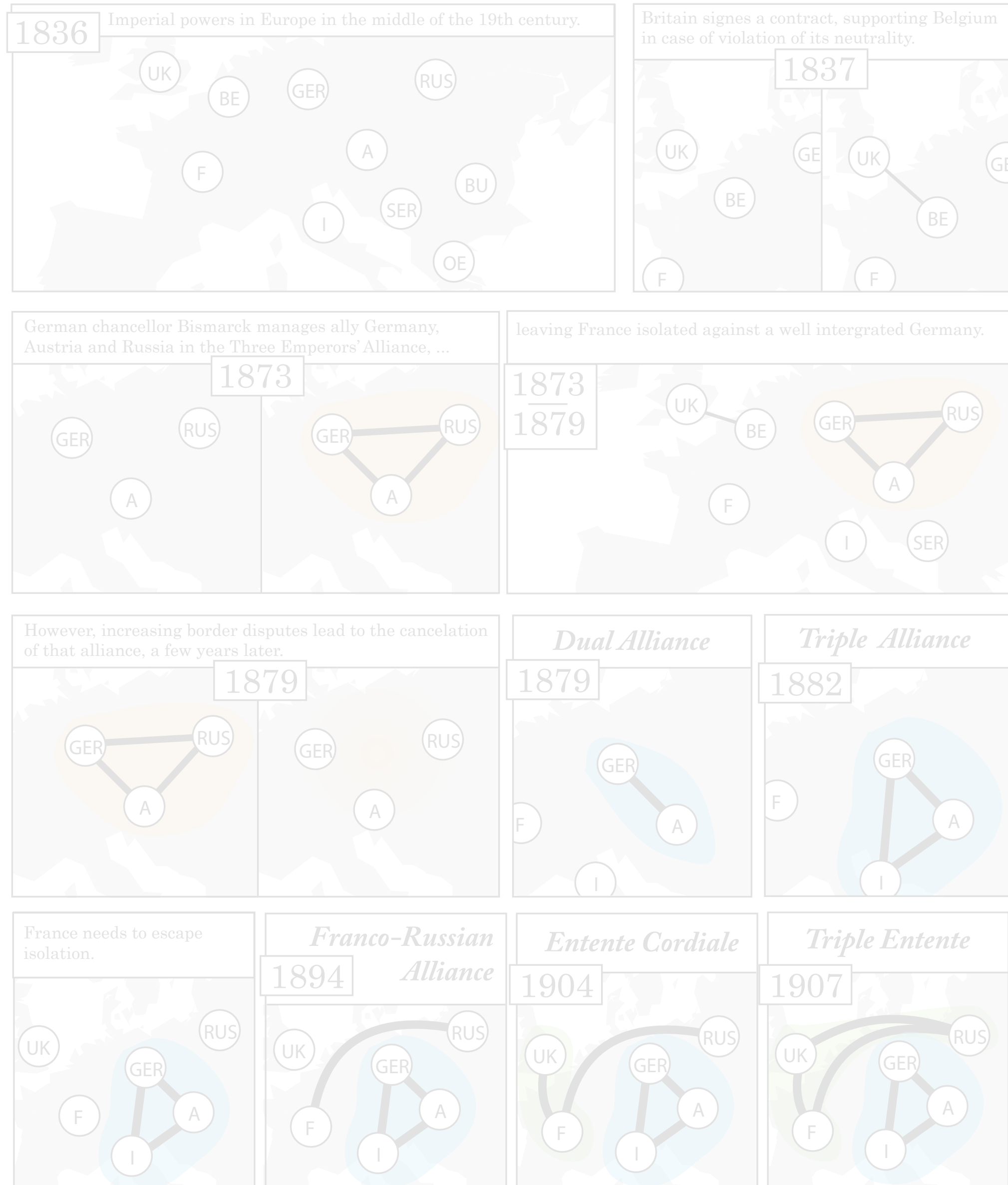
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