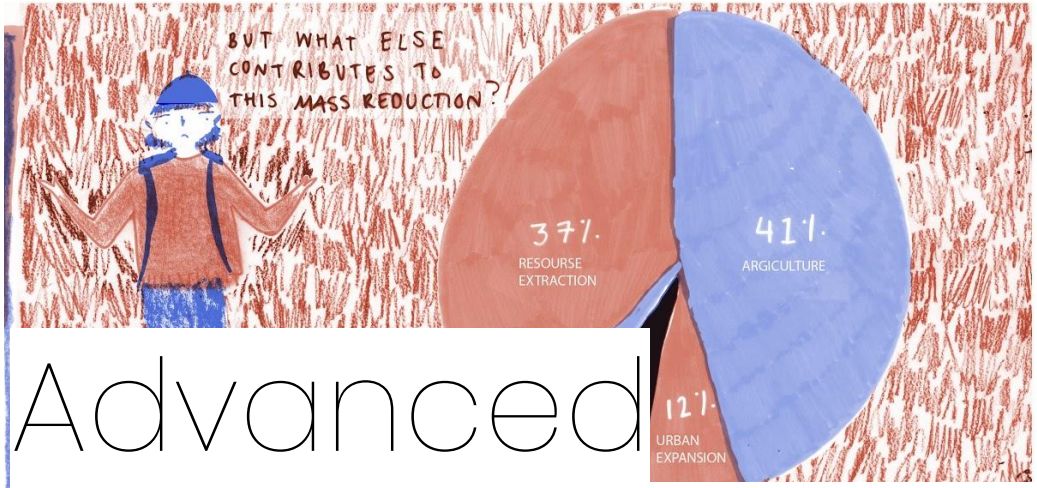
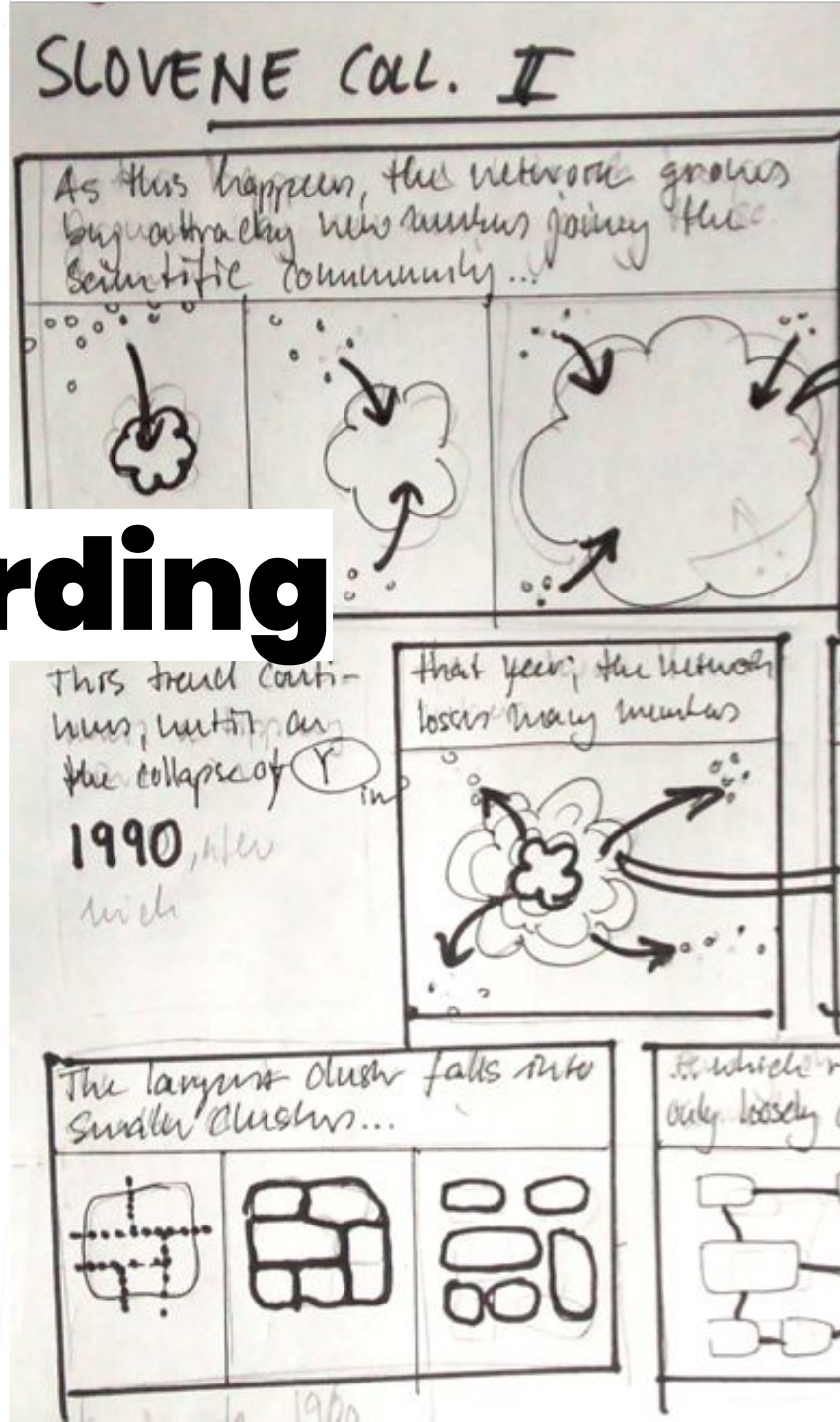


Advanced
Data-Storyboarding

Benjamin Bach
http://benjbach.me
University of Edinburgh
2020



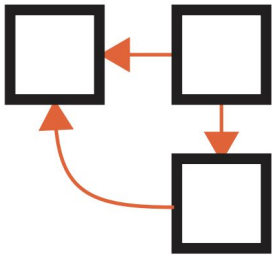
Today

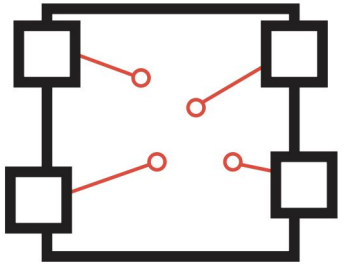
- Problem
- Narration / Story
- (Design)

Recap:

- Audience, messages, context
- Beginning, middle, end
- Author-driven vs. reader driven
- Narrative Patterns (contract, repetition, scales, ...)
- Storytelling genres ("formats")
  - Infographic, comic, interactive, ...

Narrative Structures





Linearity

Author driven

Heavy messaging

No interactivity

Interactivity

Reader driven

No messaging

Free interactivity

Exercise 1: **Audience**

- Audience:
  a. Who is your audience?
  b. What does your audience know about the topic?
  c. What does your audience know about visualization and data analysis?

Exercise 2: **Messages**

- **Facts & Information**
  a. …
  b. …
  c. …
- **Take-home message**? (–> “Insight”)
  a. …
- **Data/Vis. Literacy:** What does your audience need to know about visualization and analysis?
  a. …
  b. …

Exercise 3: **Narrative**

- Beginning
  - what is topic?
  - What is my data?
  - why does that matter?
- Middle
  - Which facts do you need to communicate?
  - Which visualizations do I need?
  - How can I explain each visualization?
- End
  - summary of important findings
  - Take-home message
  - Call to action, if requires

Exercise 4: **Format**

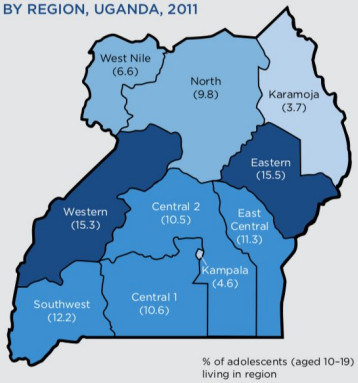
- **Infographic** (mainly reader driven?)
- **Data Comic** (mainly author driven?)
- **Interactive** (mainly author driven?)

Storyboarding

physical, social, political, and economic structures of a region can place residents at varying risks for vulnerability. Areas susceptible to violence or natural disaster pose clear threats to individuals. An individual's environment also affects his or her development and behavioral choices. Resources available in the physical and social environments create the contexts within which decisions are made about health, education, and employment. Political and social environments also dictate whether resources are accessible to all adolescents. An examination of the residential distribution of adolescents provides a baseline for comparing geographical patterns of vulnerability. Within Uganda, by type of residence, the majority of adolescents (87 percent) live in rural versus urban areas. Figure 6 shows the distribution of adolescents aged 10 to 19 living in Uganda. Regional distributions show Karamoja contains only four percent of the adolescent population. Kampala with a much denser population contains 4.6 percent of the population. The Eastern and Western regions contain the largest proportions of the adolescent population.

FIGURE 6

PROPORTION OF ADOLESCENTS AGED 10-19 BY REGION, UGANDA, 2011



Source: DHS 2011.

Household factors influencing vulnerability

Household-level factors have direct impacts on the well-being of adolescents. Households are the primary setting where adolescents live and engage in activities. For this reason, the household environment and the people who live there have significant impacts on the lives of adolescents. Physical conditions of the home influence the health of residents. Family structures and demographic characteristics of household members affect the knowledge, decisions, behaviors and interactions in the environment of the adolescent.

Access to improved water sources and sanitation

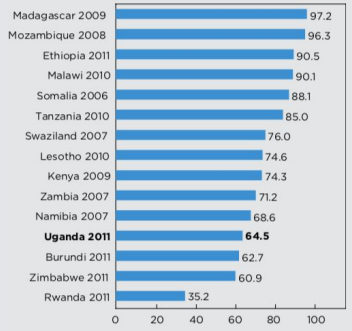
Unsafe water, inadequate sanitation, and poor hygiene are among the five leading risk factors responsible for one quarter of all deaths in the world (WHO 2009). Unsafe water supplies and inadequate sanitation in homes increase exposure to water-borne diseases and can cause diarrhea. Ensuring access to clean water sources and sanitation is key to maintaining hygiene and health. Improved water sources are those that either naturally protect water from contamination or are constructed to do so. These include piped water, public taps, standpipes, boreholes, tube wells, protected wells and springs, and rainwater collection. Improved sanitation includes constructs and systems that prevent fecal contamination. These include flush or pour toilets, ventilated pit latrines, pit latrines with slabs, and composting toilets (UNICEF 2013b).

Housing conditions across East and Southern Africa are largely in need of improvement, and lack of improved sanitation varies by country. In nearly all of East and Southern Africa, over half of adolescents either do not have improved sanitation or share facilities with other households. Conditions are worst in Madagascar and Mozambique where fewer than four percent of adolescents live in households with improved sanitation that is not shared (Figure 7). Rwanda has the lowest proportion of adolescents affected—35 percent—which is still unacceptably high. Lack of access to improved water sources affects lower proportions but is still a problem in the region. In five countries, fewer than half of adolescents have access to improved water sources (Figure 8). Water conditions are best in Namibia, where only 15 percent of adolescents have no access to improved water.

In Uganda, overall access to improved water and sanitation increased by a small but significant percentage between 2006 and 2011 (Figure 9). In 2006, 33 percent of adolescents had no access to improved water; in 2011, it is 30 percent. The proportion of adolescents without access to improved

FIGURE 7

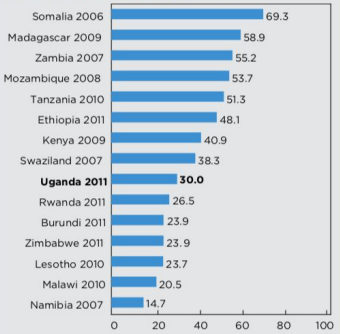
PERCENT OF ADOLESCENTS AGED 10-19 LIVING IN HOUSEHOLDS WITH NO IMPROVED OR WITH SHARED SANITATION, EAST AND SOUTHERN AFRICA



Source: DHS 2007-2011; MICS 2006-2008.

FIGURE 8

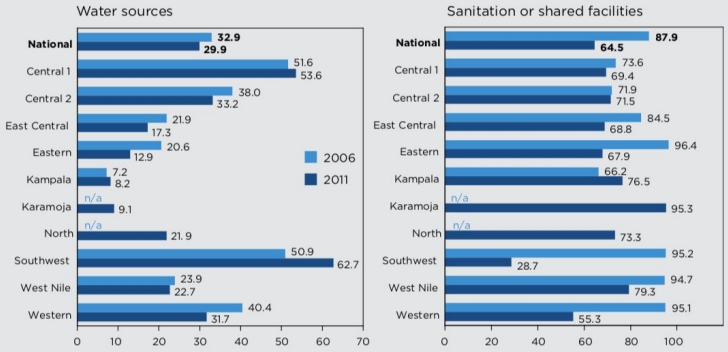
PERCENT OF ADOLESCENTS AGED 10-19 LIVING IN HOUSEHOLDS WITH NO IMPROVED WATER SOURCE, EAST AND SOUTHERN AFRICA



Source: DHS 2007-2011; MICS 2006-2008.

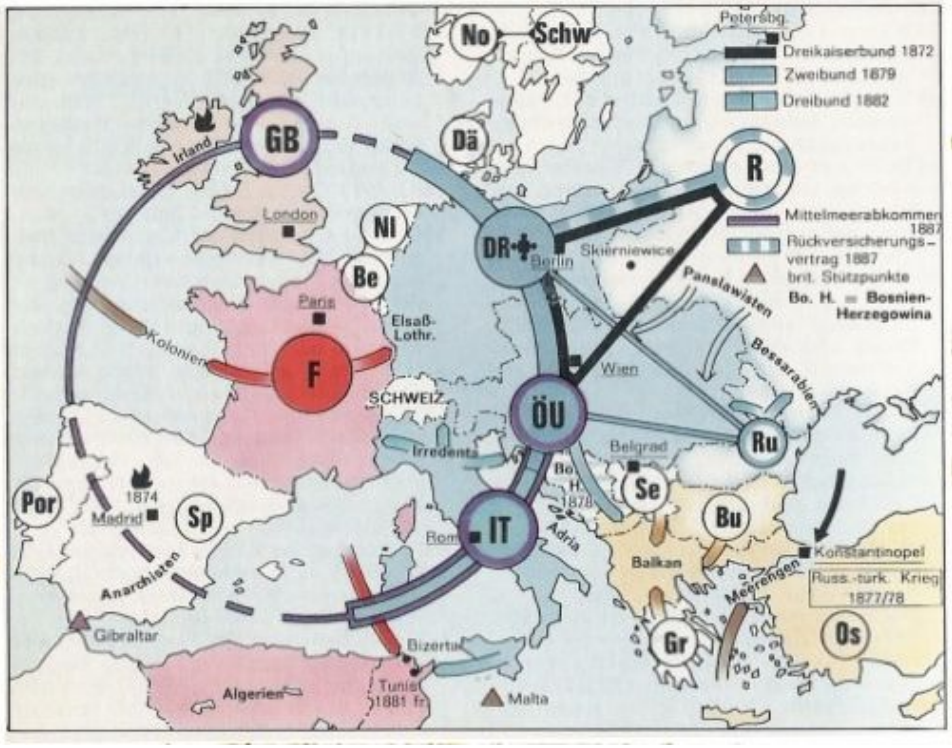
FIGURE 9

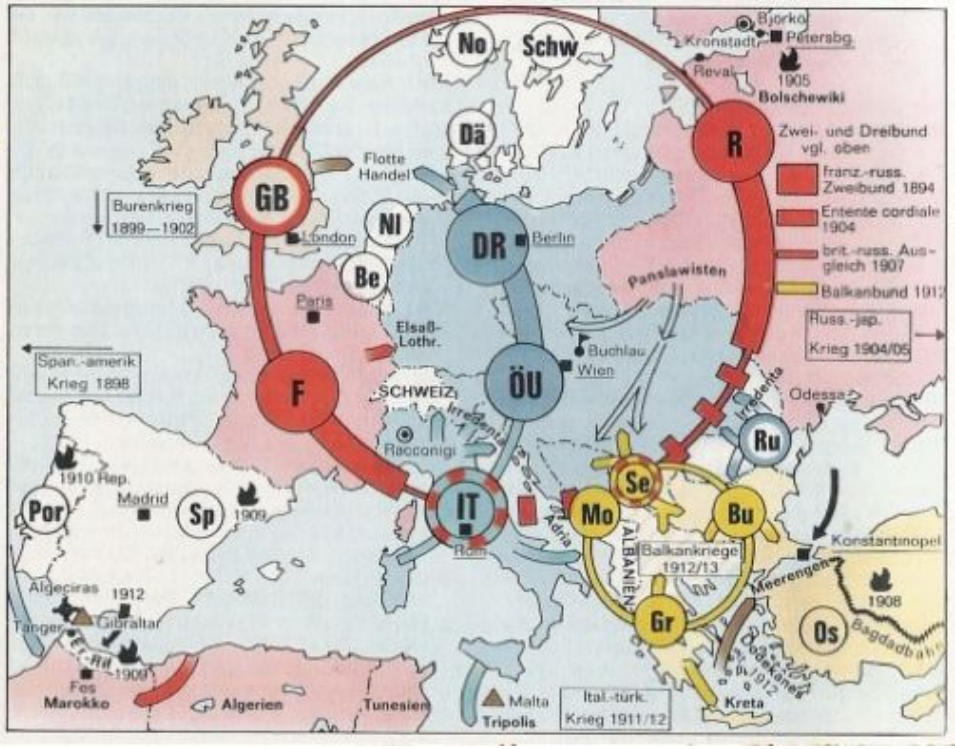
PERCENT OF ADOLESCENTS AGED 10-19 LIVING IN HOUSEHOLDS WITHOUT ACCESS TO IMPROVED WATER AND WITHOUT ACCESS TO IMPROVED OR WITH SHARED SANITATION, IN UGANDA, BY REGION, 2006 AND 2011



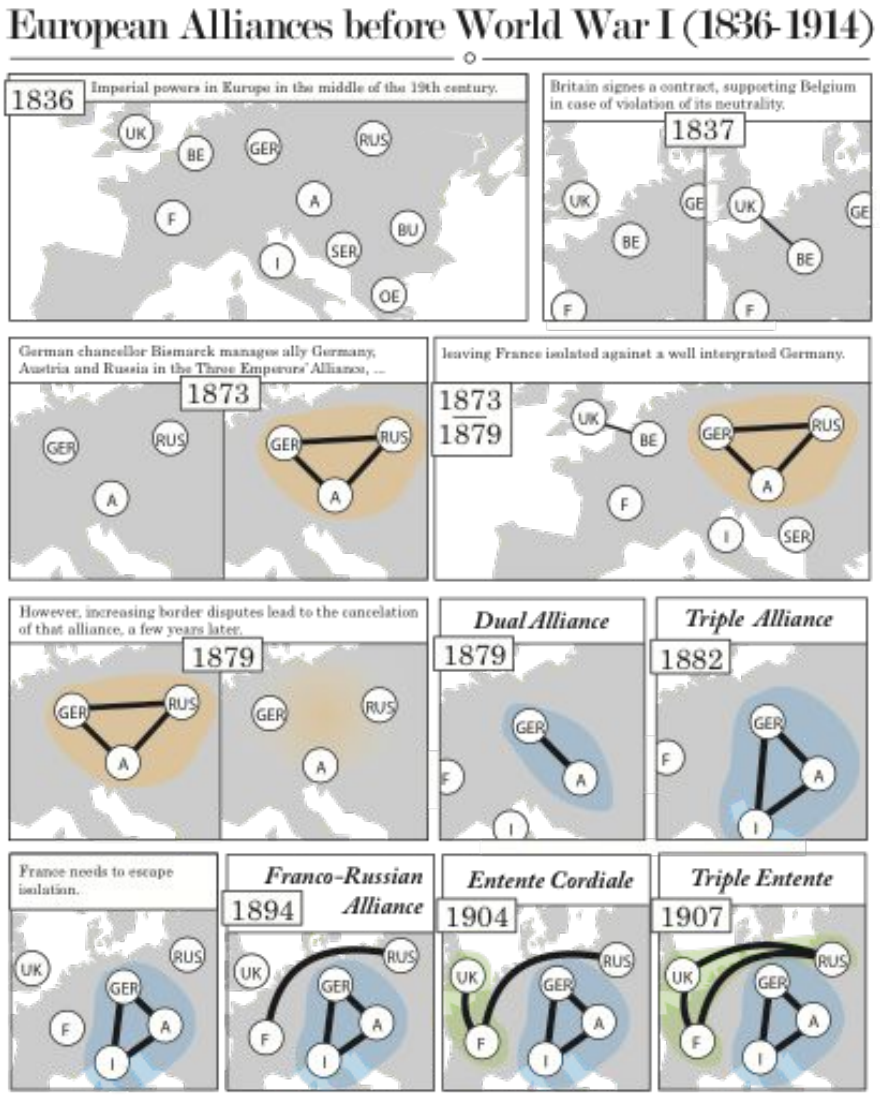
Source: DHS 2006 and 2011.
Note: Changes to the geographic boundaries were made to the North region in the 2011 DHS. The 2006 DHS North region is now divided into the North and Karamoja. For this reason, rates for 2006 are not shown for the North since it is not comparable and Karamoja was not identified in the previous survey.

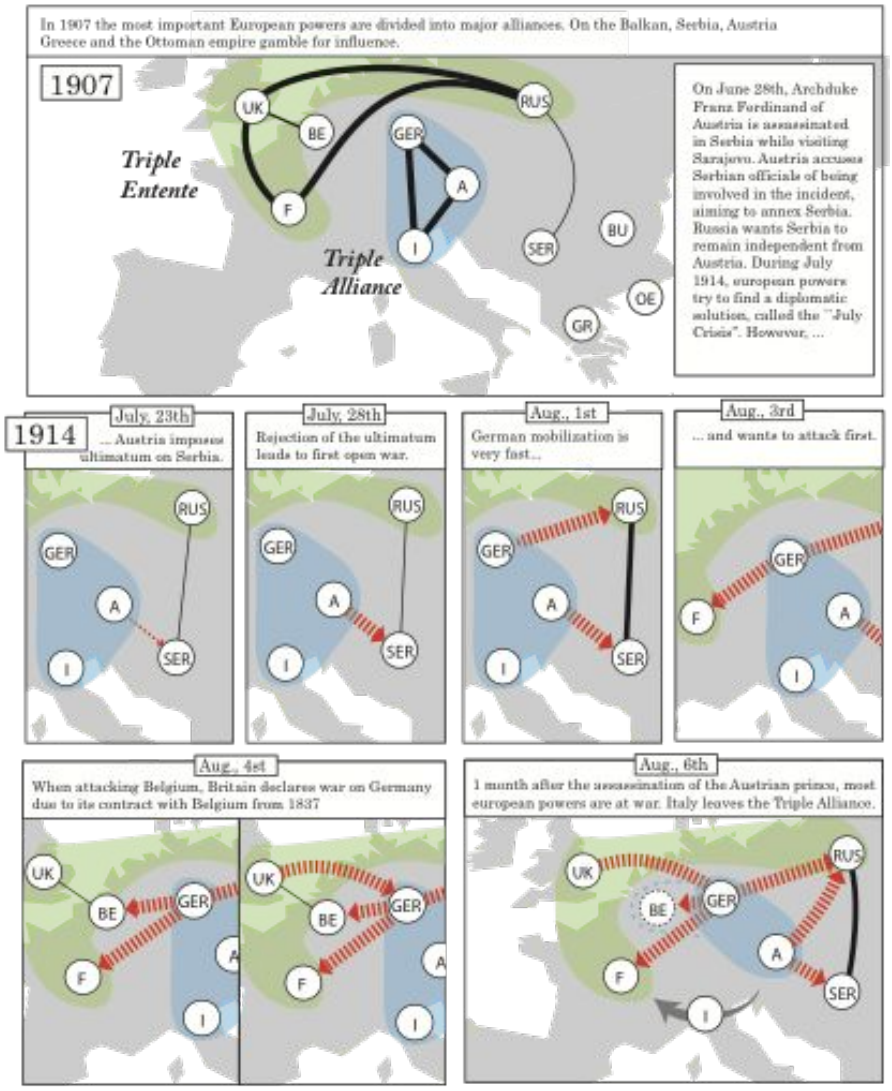
Data Comics


No
Schw
Petersbg
Dreikaiserbund 1872
Zweibund 1879
Dreibund 1882
GB
Irland
Dä
R
London
Nl
Be
DR
Berlin
Skierniewice
Mittelmeerabkommen
Rückversicherungs-vertrag 1887
brit. Stützpunkte
Bo. H. = Bosnien-Herzegowina
Paris
Elsaß-Lothr.
Panslawisten
Kolonien
F
Wien
Bessarabien
SCHWEIZ
ÖU
Irredenta
Belgrad
Ru
Por
1874
Madrid
Sp
Se
Bu
IT
Rom
Adria
Konstantinopel
Anarchisten
Balkan
Meerengen
Russ.-turk. Krieg 1877/78
Gibraltar
Bizerta
Gr
Os
Algerien
Tunis
1881 fr.
Malta


No
Schw
Björko
Kronstadt
Petersbg.
Reval
1905
Bolschewiki
Dä
R
Zwei- und Dreibund vgl. oben
Flotte
Handel
GB
franz.-russ. Zweibund 1894
Entente cordiale 1904
brit.-russ. Ausgleich 1907
Balkanbund 1912
Burenkrieg 1899—1902
London
Nl
DR
Berlin
Be
Panslawisten
Paris
Elsaß-Lothr.
Russ.-jap. Krieg 1904/05
Buchlau
Wien
Span.-amerik. Krieg 1898
F
ÖU
SCHWEIZ
Irredenta
Odessa
Racconigi
Ru
1910 Rep.
Se
Por
Madrid
Sp
1909
IT
Mo
Bu
Adria
ALBANIEN
Balkankriege 1912/13
Konstantinopel
Rom
Algeciras
1912
Meerengen
1908
Gr
Os
Tanger
Gibraltar
Bagdadbahn
Fes
1909
Marokko
Algerien
Tunesien
Malta
Tripolis
Ital.-türk. Krieg 1911/12
Kreta

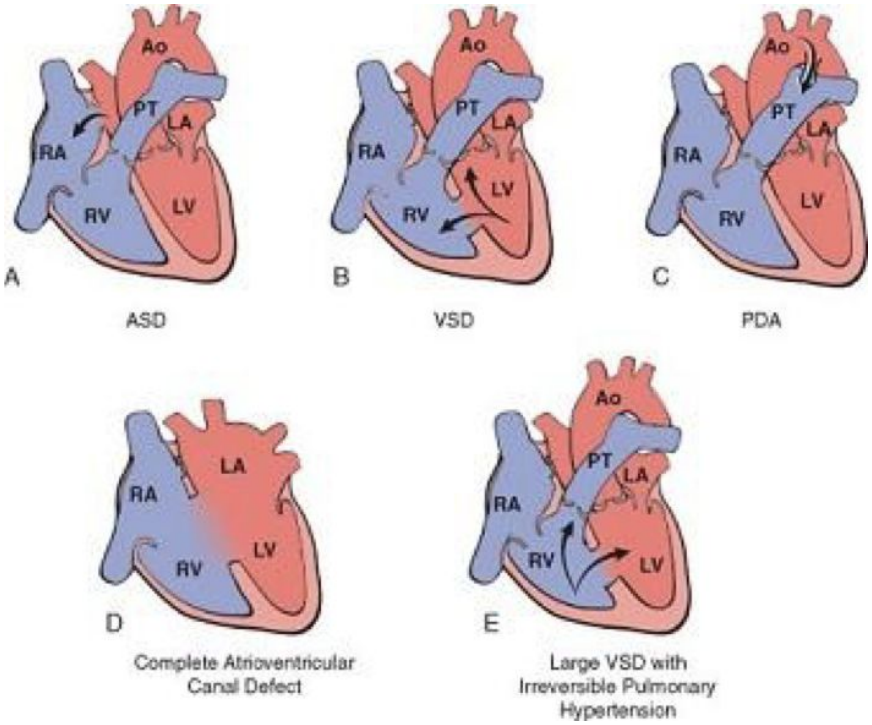
Data Comics

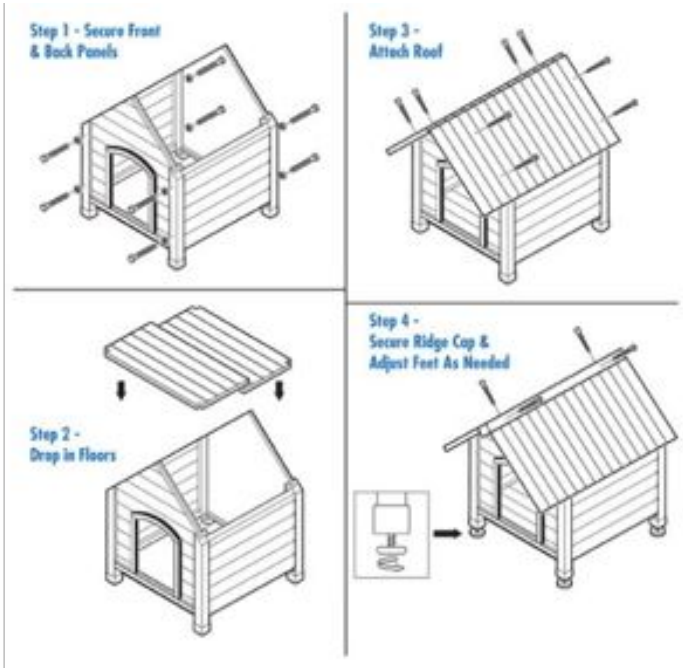




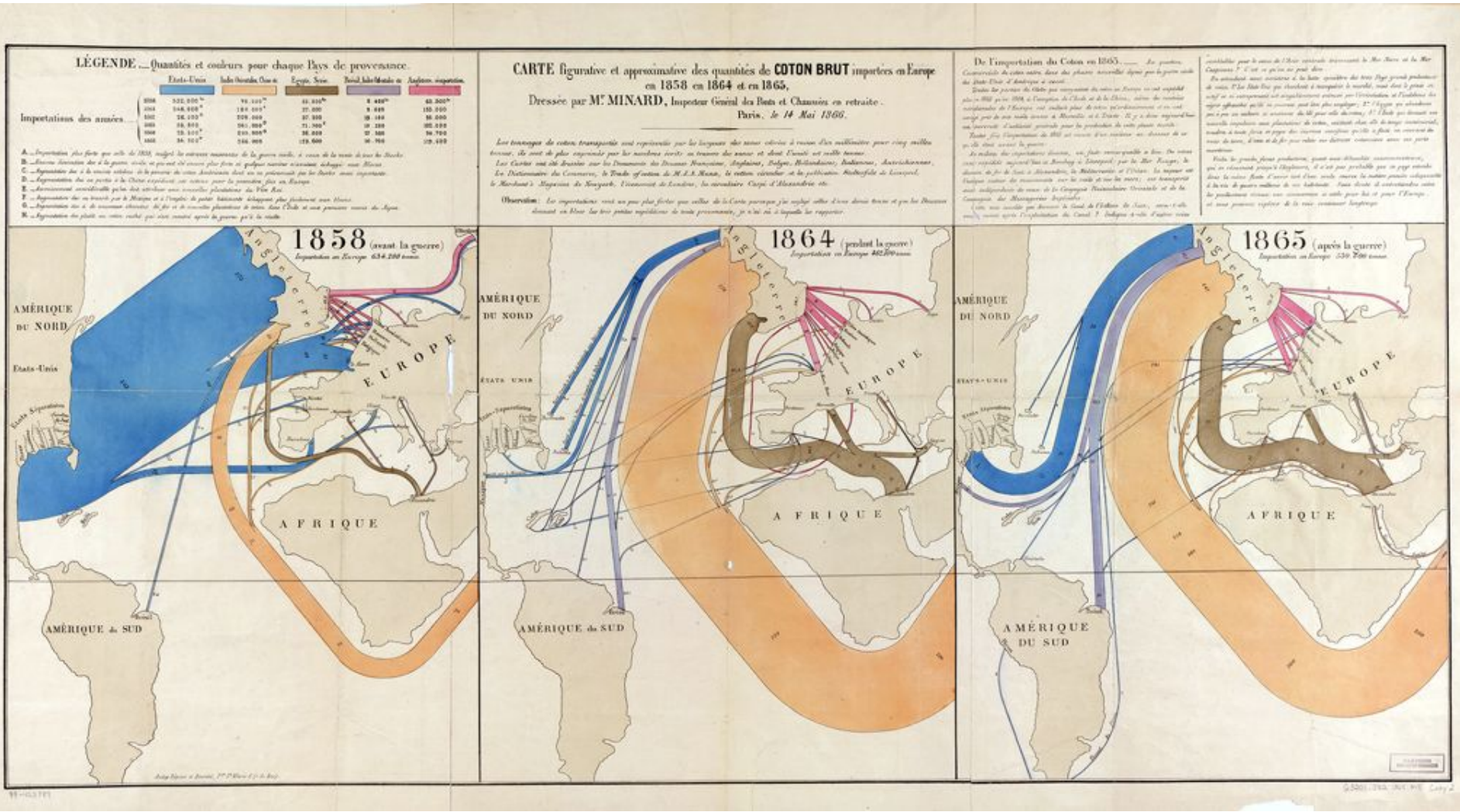
Bach, B., Kerracher, N., Hall, K. W., Carpendale, S., Kennedy, J., & Henry Riche, N. (2016, May). Telling stories about dynamic networks with graph comics. In *Proceedings of the 2016 CHI Conference on Human Factors in Computing Systems* (pp. 3670-3682). ACM.

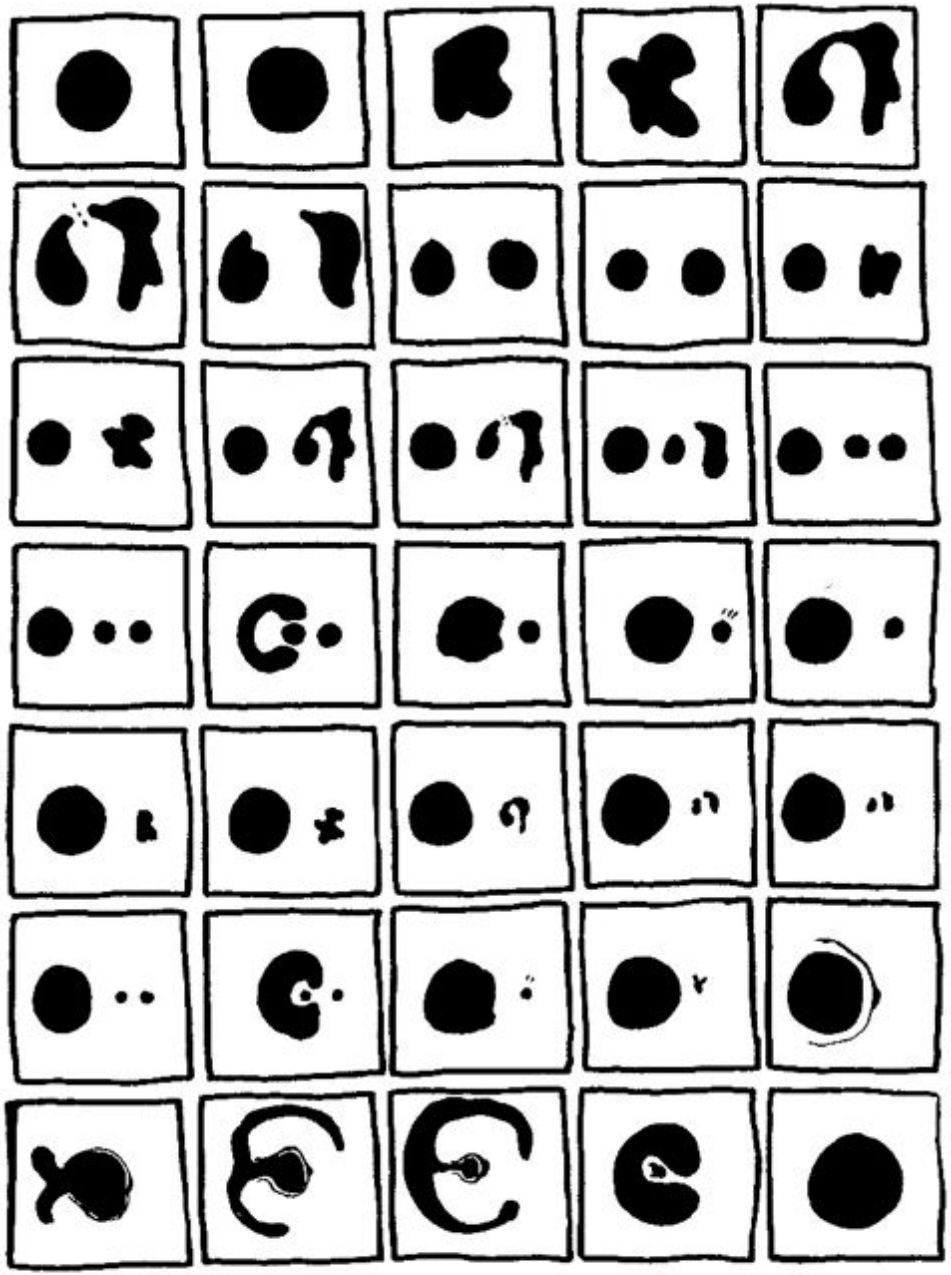
Sequential Explanations





Consistency and flow

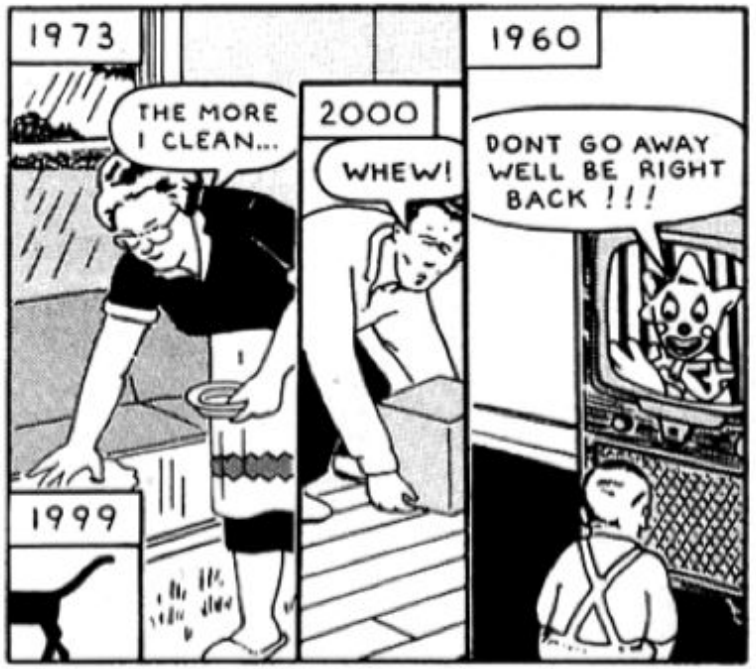


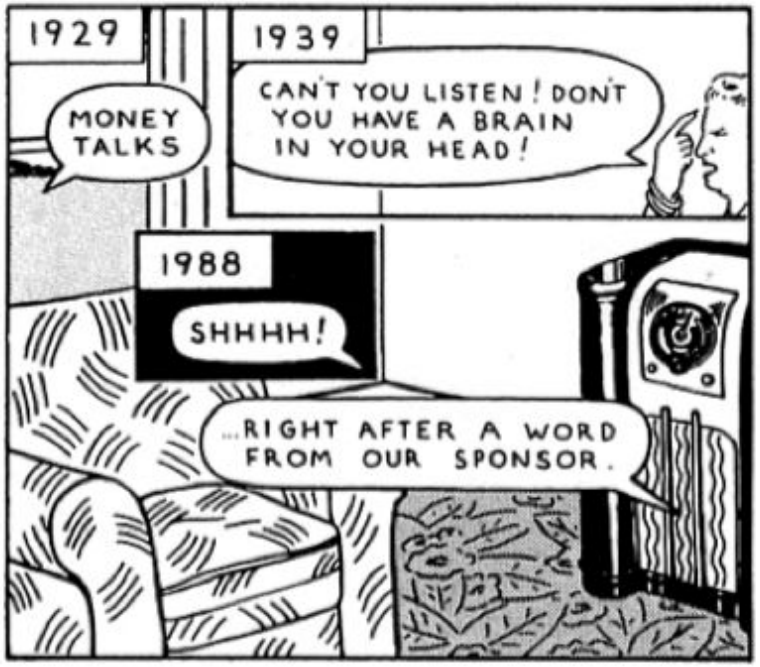


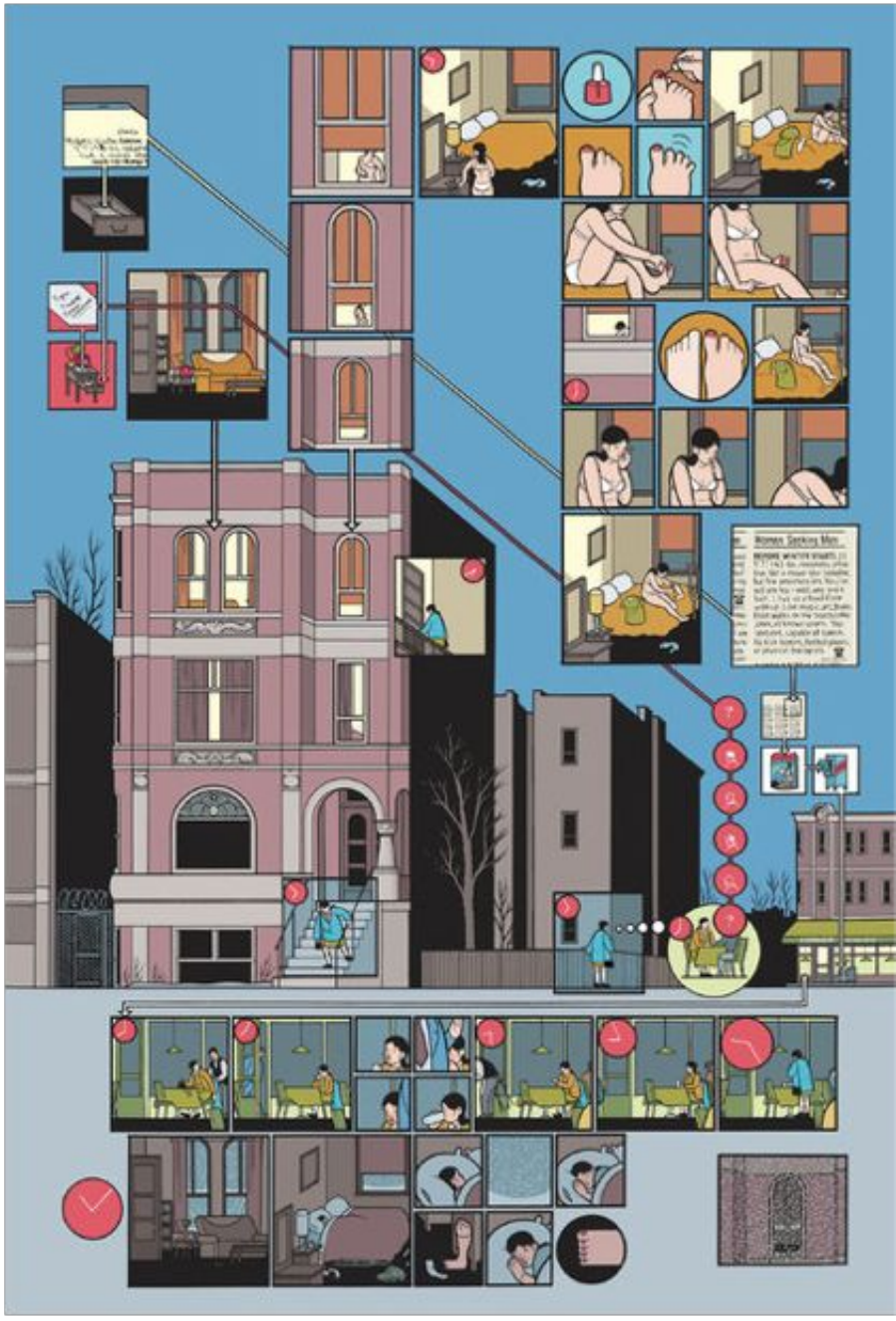
L'empire contre attaque.

1940
HAPPY NEW YEAR!!
1999

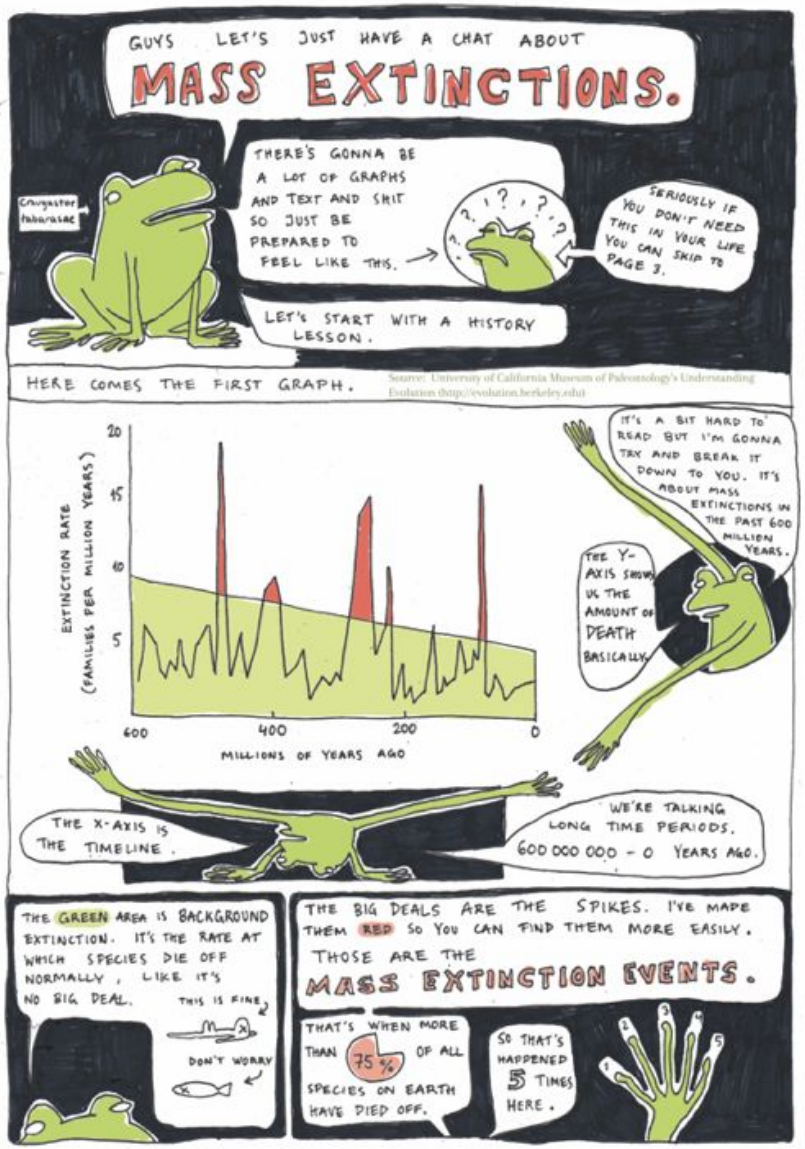
1975
HAPPY BIRTHDAY DEAR BILLY
1920
1959
1999

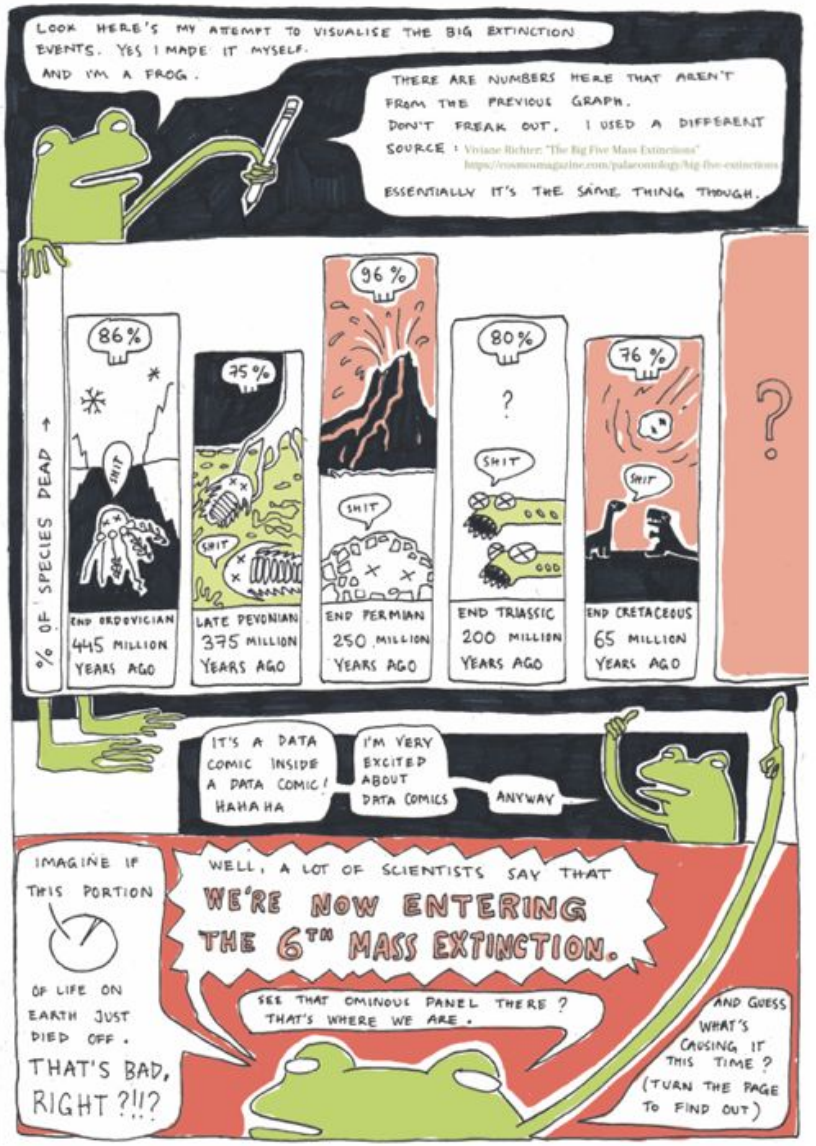

1973
THE MORE I CLEAN...
1999
2000
WHEW!
1960
DONT GO AWAY WELL BE RIGHT BACK !!!


1929
MONEY TALKS
1939
CAN'T YOU LISTEN! DON'T YOU HAVE A BRAIN IN YOUR HEAD!
1988
SHHHH!
...RIGHT AFTER A WORD FROM OUR SPONSOR.



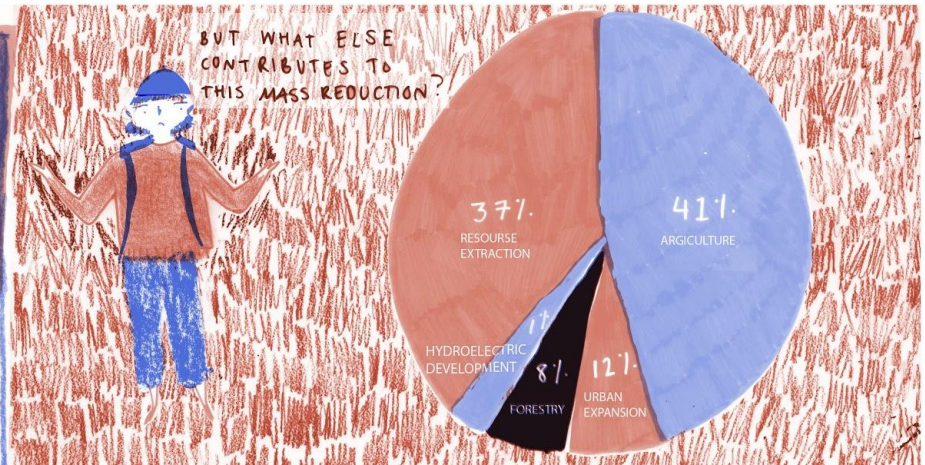
Data Comics *http://datacomics.net*





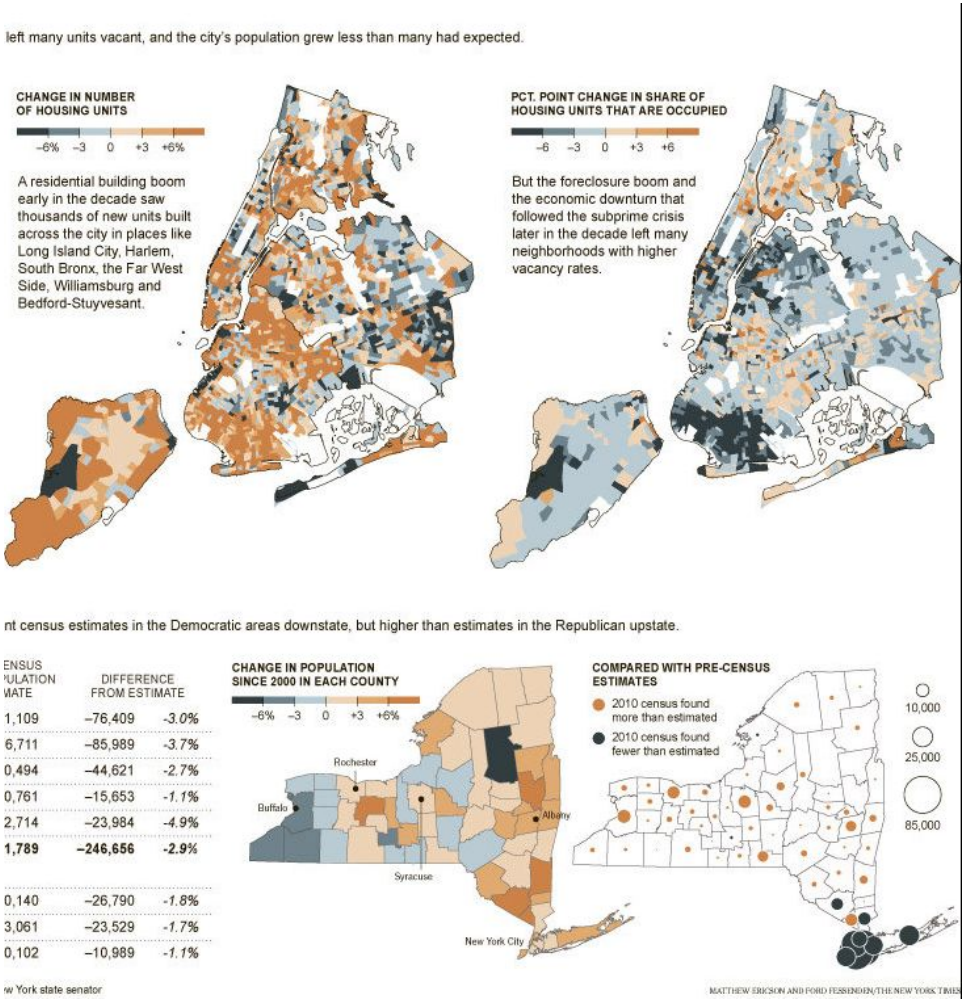
TREES STORE UP TO 300 MILLION TONNES OF CARBON

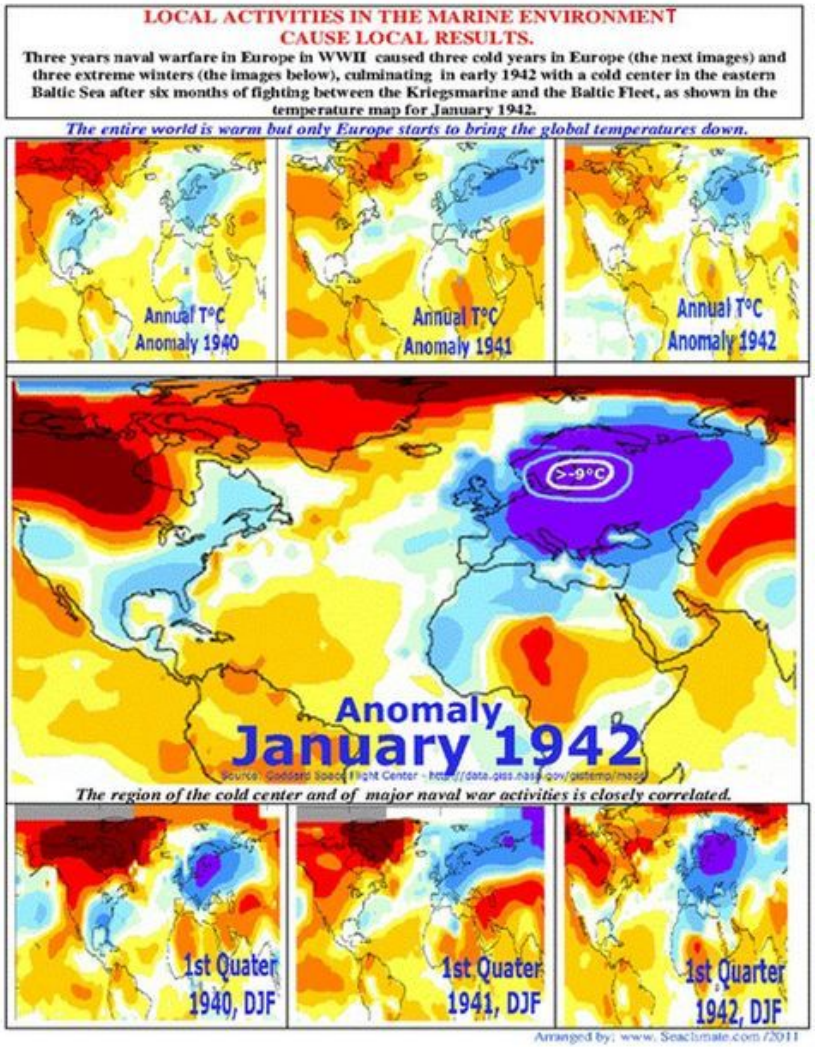
EXCUSE ME SIR, ARE YOU AWARE OF THE DAMAGE IT CAUSES THE EARTH BY CUTTING DOWN TREES?



HOWEVER, ALL IN ALL, 18 MILLION ACRES OF FOREST ARE LOST PER YEAR

These are data comics, too...?

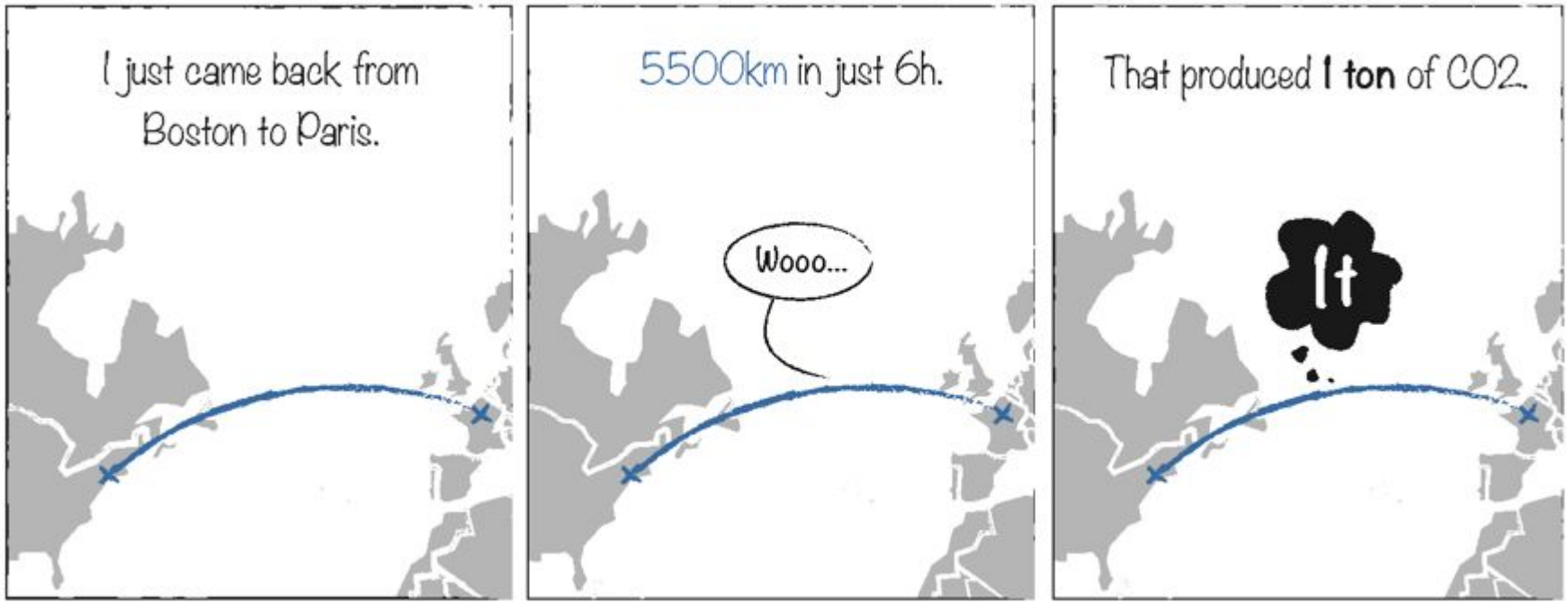




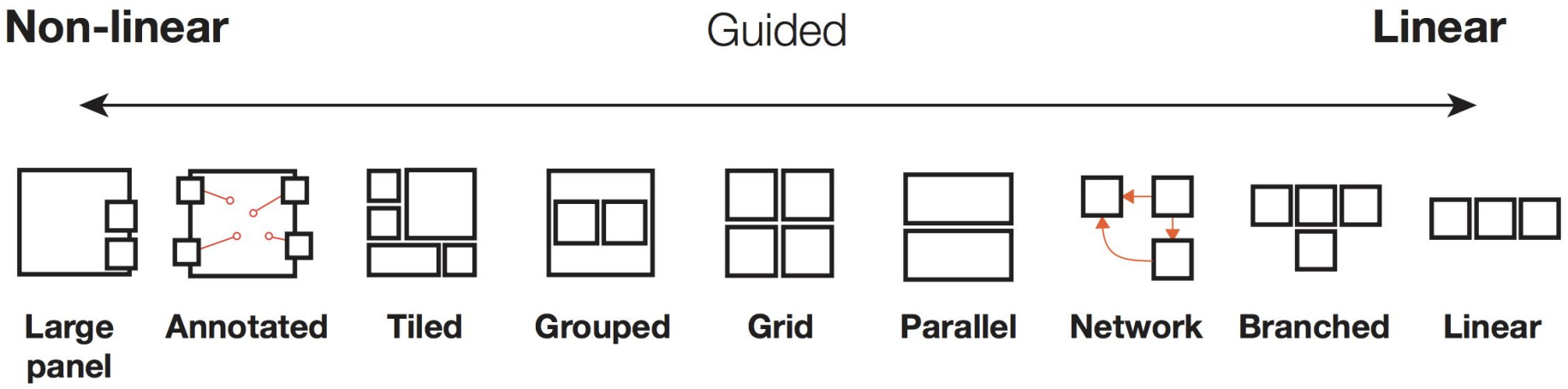
Data Comics

Bach, Benjamin, Nathalie Henry Riche, Sheelagh Carpendale, and Hanspeter Pfister. "The emerging genre of data comics." *IEEE computer graphics and applications* 37, no. 3 (2017): 6-13.

Data Comics

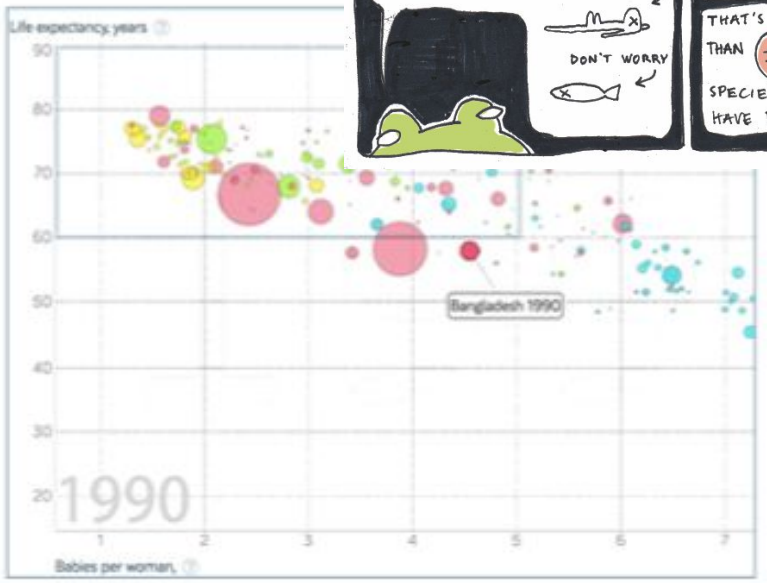

I just came back from Boston to Paris.
5500km in just 6h.
Wooo...
That produced 1 ton of CO2.
It

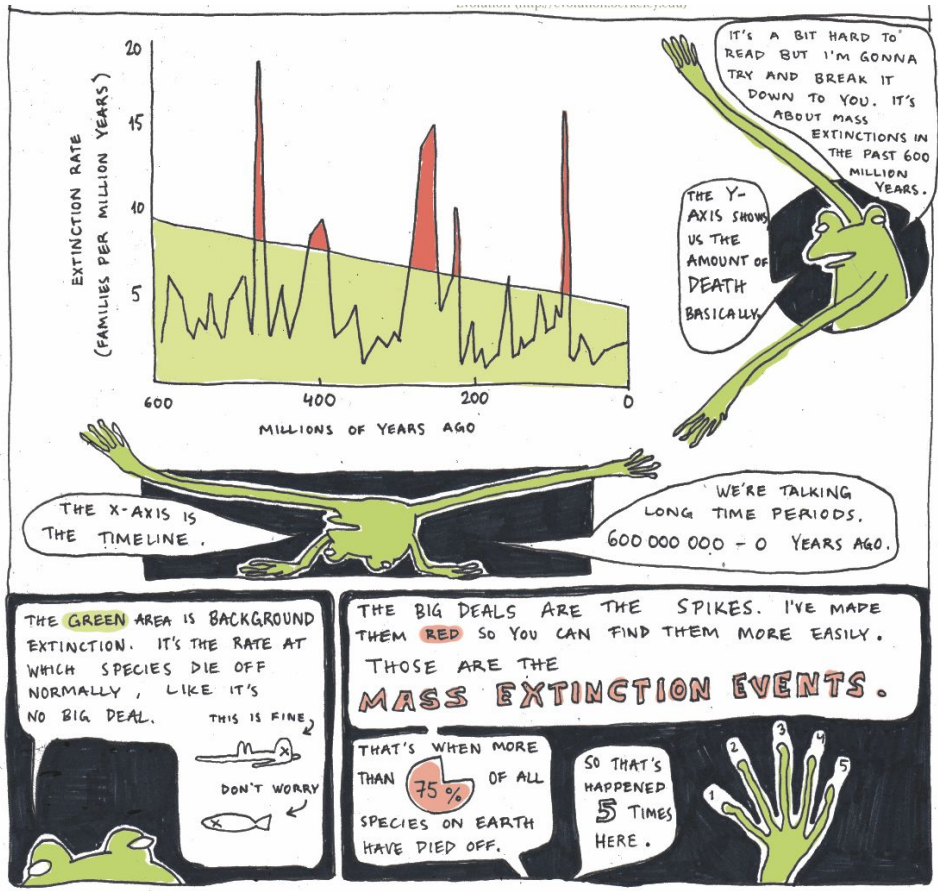
Sequence



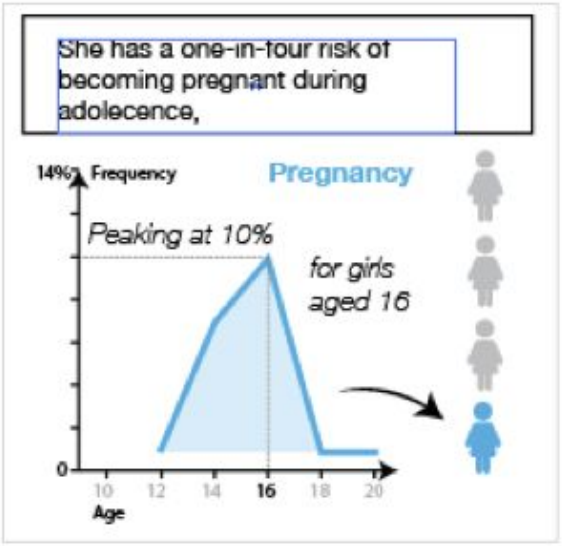
Bach, B., Wang, Z., Farinella, M., Murray-Rust, D., & Henry Riche, N. (2018, April). Design patterns for data comics. In *Proceedings of the 2018 CHI Conference on Human Factors in Computing Systems* (p. 38). ACM.

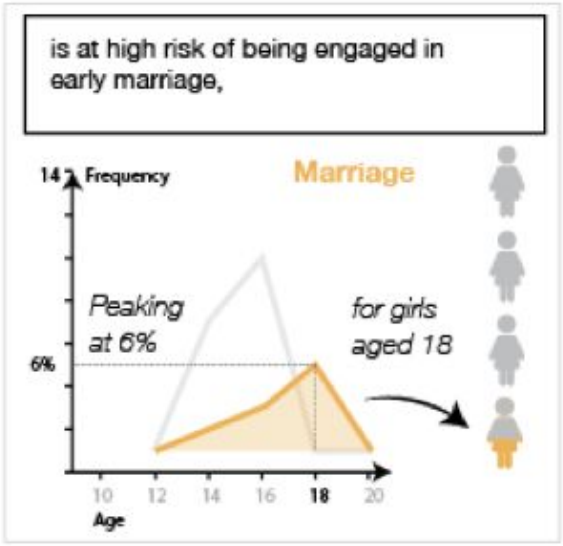
Visual Explanation

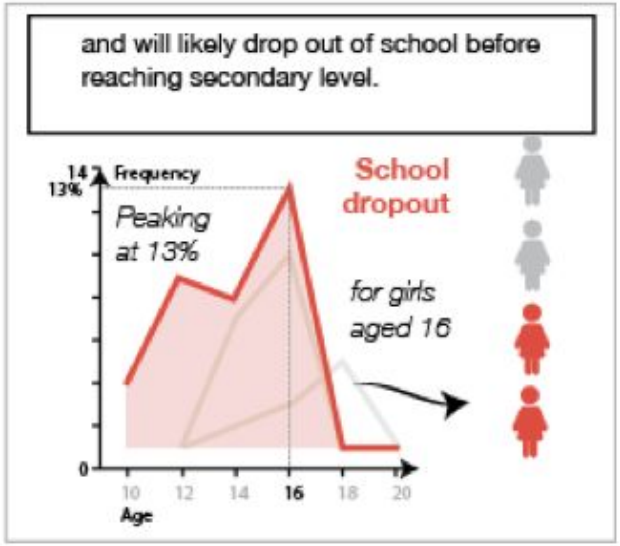


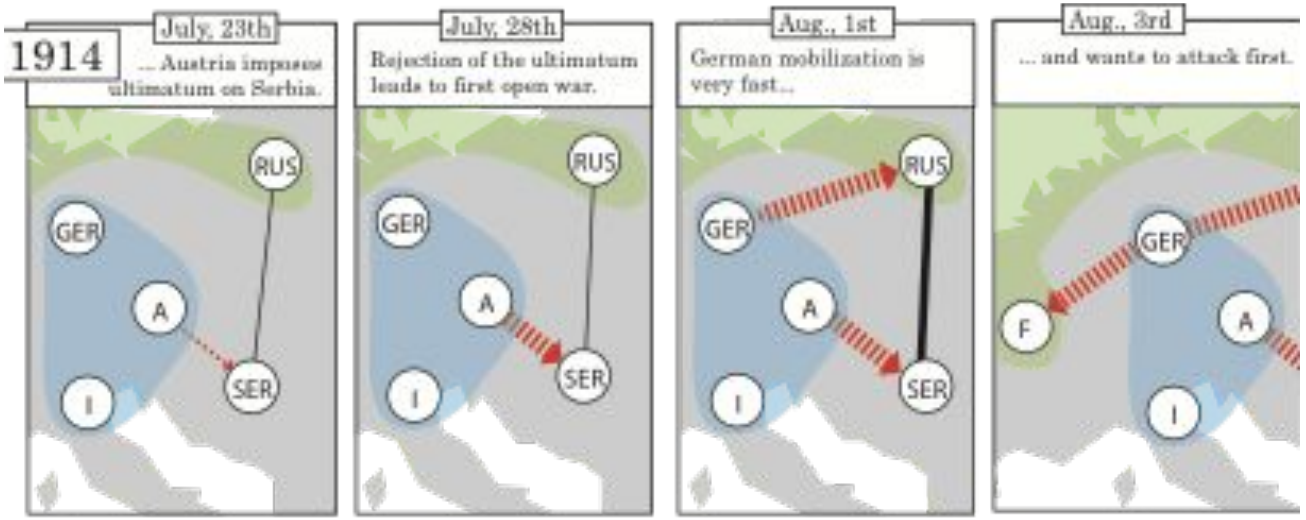


Consistency

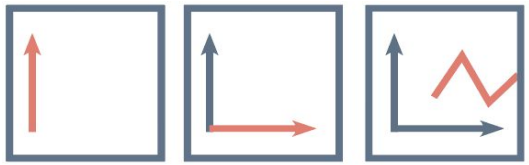




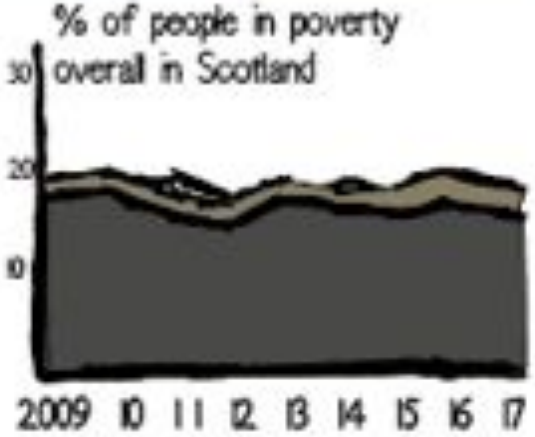




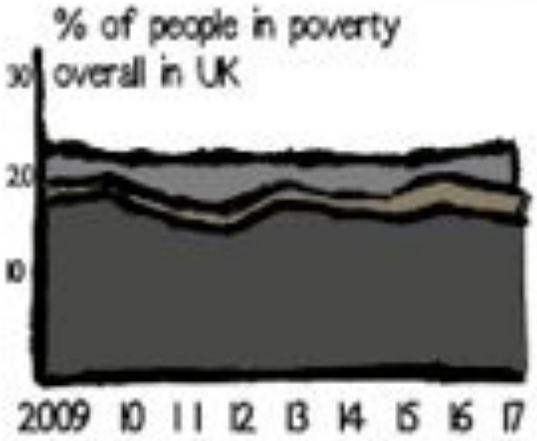
Pattern: Build-up



For the last decade, this poverty rate has remained virtually unchanged, hovering around 16%.

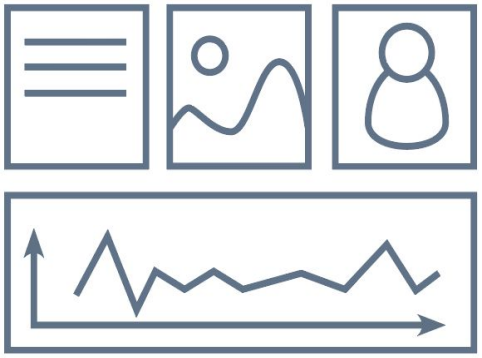


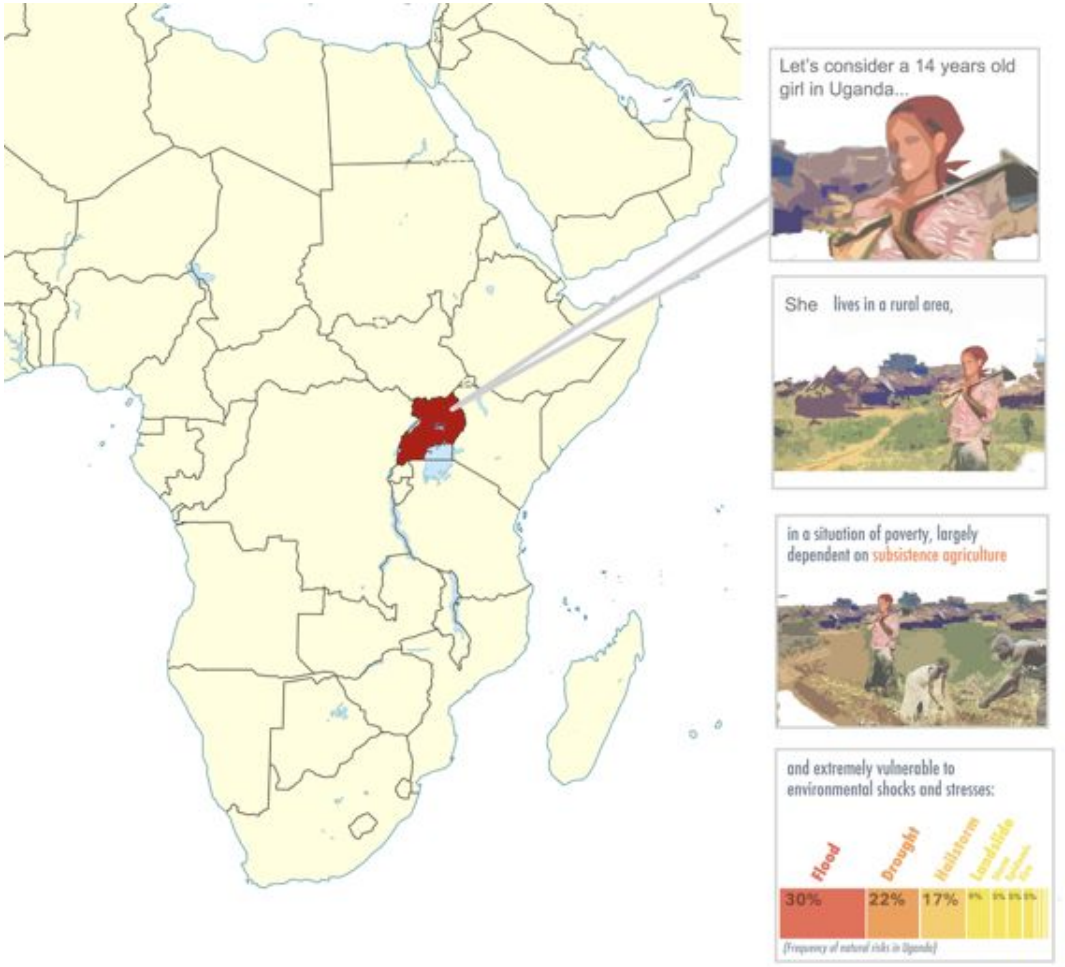
This is only slightly better than the poverty rate in Scotland overall, which in 2017 reached 19%.

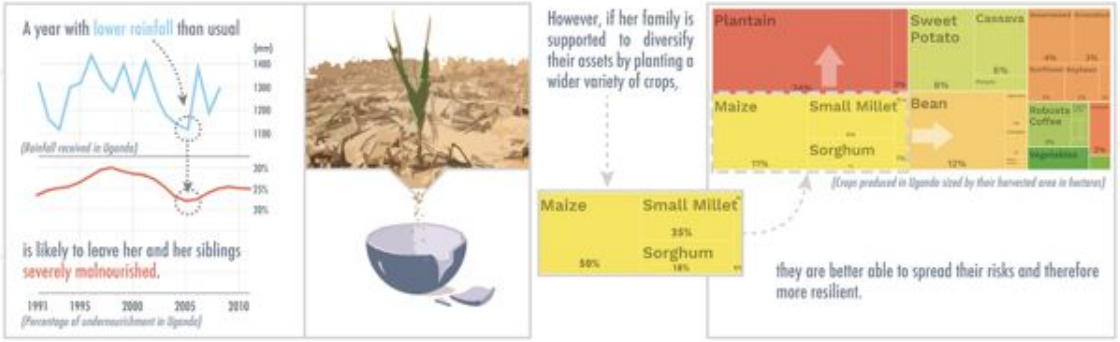


... which itself is lower than the overall UK rate at around 22%.

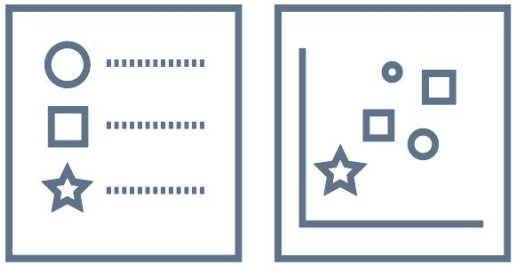
Exposé




Let's consider a 14 years old girl in Uganda...
She lives in a rural area,
in a situation of poverty, largely dependent on subsistence agriculture
and extremely vulnerable to environmental shocks and stresses:
Flood
Drought
Hailstorm
Landslide
30%
22%
17%
(Frequency of natural risks in Uganda)


A year with lower rainfall than usual
(mm)
1400
1300
1200
1100
(Rainfall received in Uganda)
30%
25%
20%
is likely to leave her and her siblings severely malnourished.
1993
1995
2000
2005
2010
(Percentage of undernourishment in Uganda)
However, if her family is supported to diversify their assets by planting a wider variety of crops,
Plantain
Sweet Potato
Cassava
Maize
Small Millet
Bean
Sorghum
Robusta Coffee
(Crops produced in Uganda sized by their harvested area in hectares)
Maize
Small Millet
35%
Sorghum
50%
they are better able to spread their risks and therefore more resilient.

Legend



Colors are used as follows:

HoloLens

Tablet AR

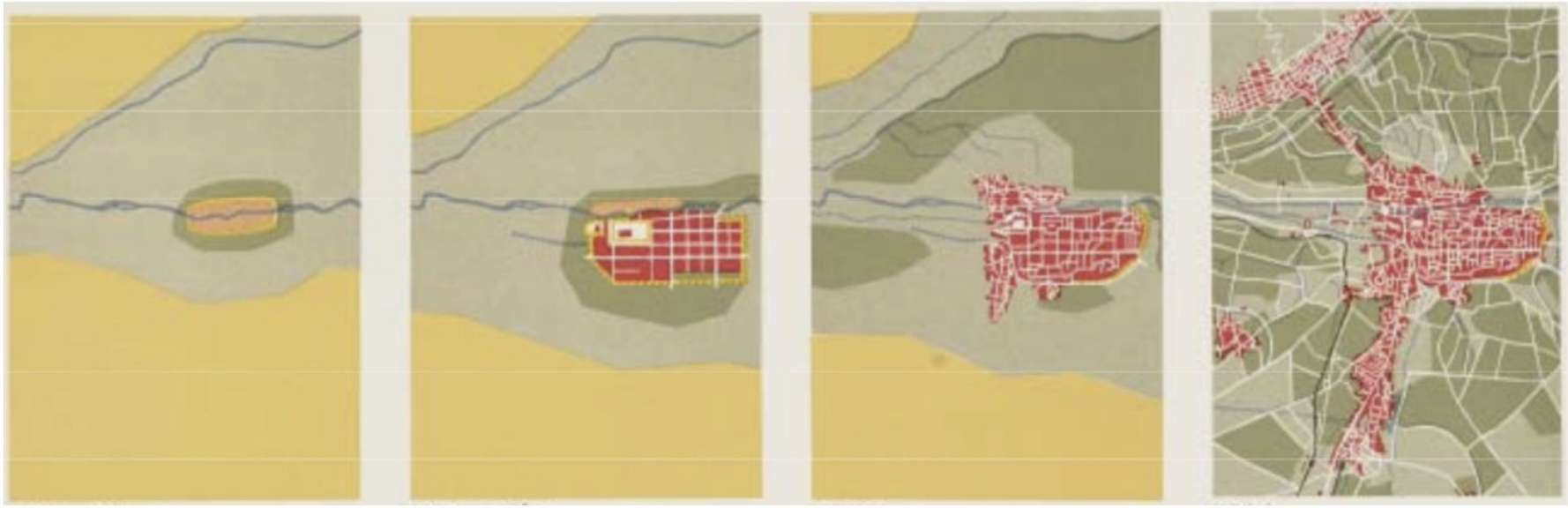
Desktop

Pattern: Zoom

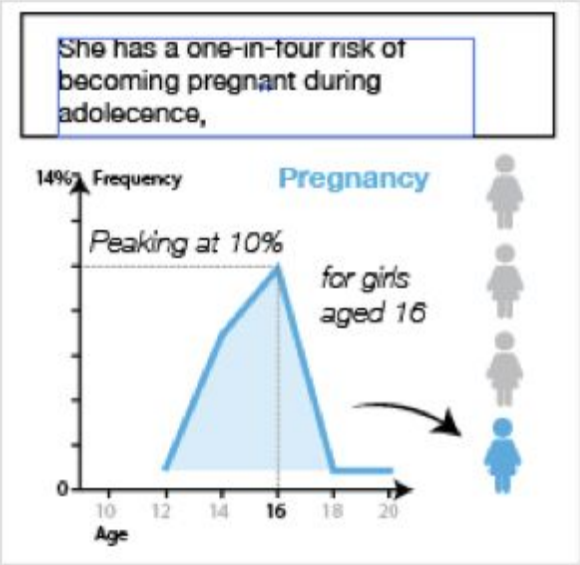
Zoom

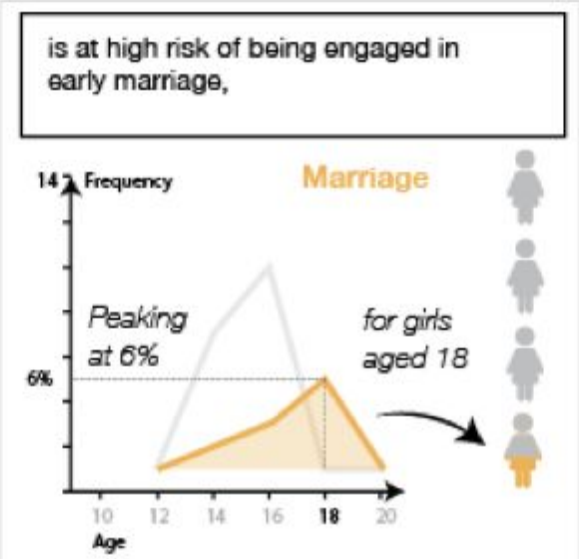
down from 127 in 2010

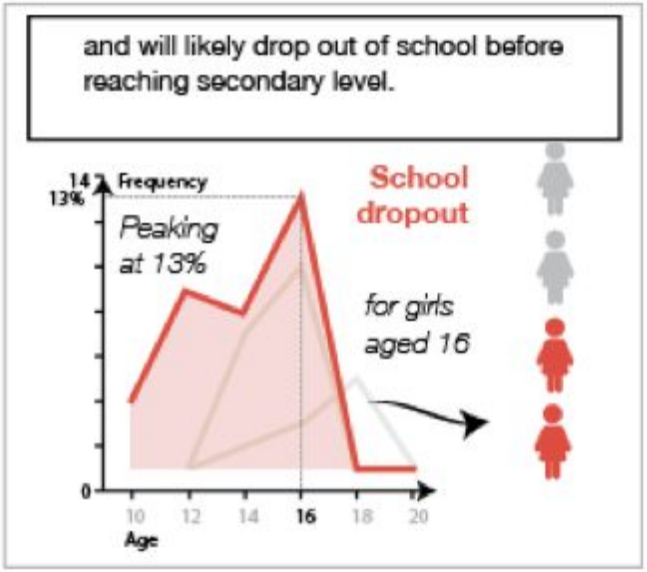
Temporal Change



Pattern: Facets

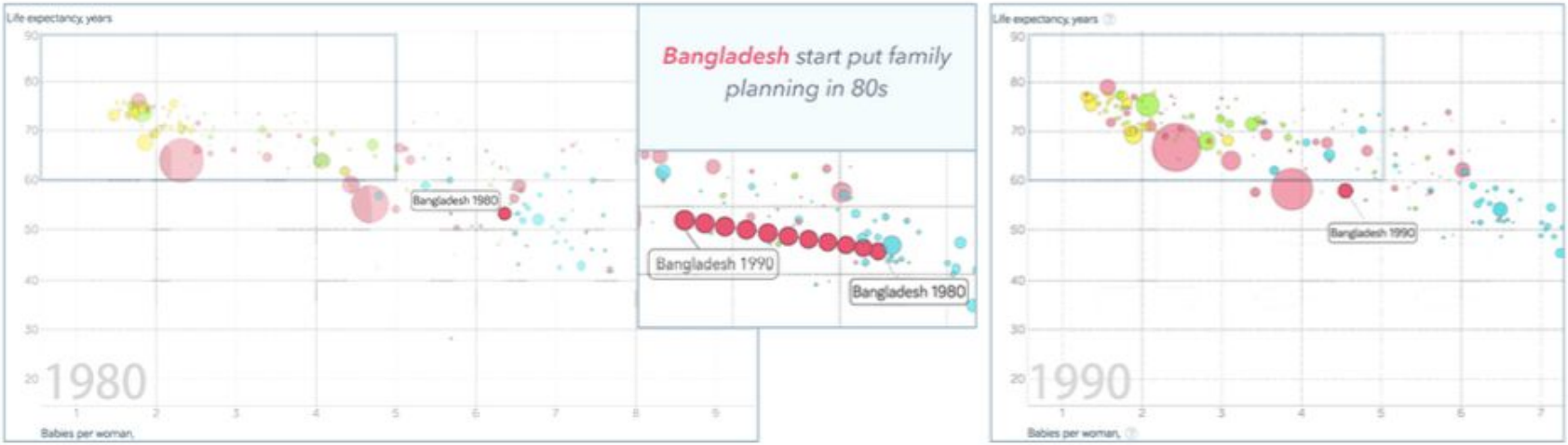




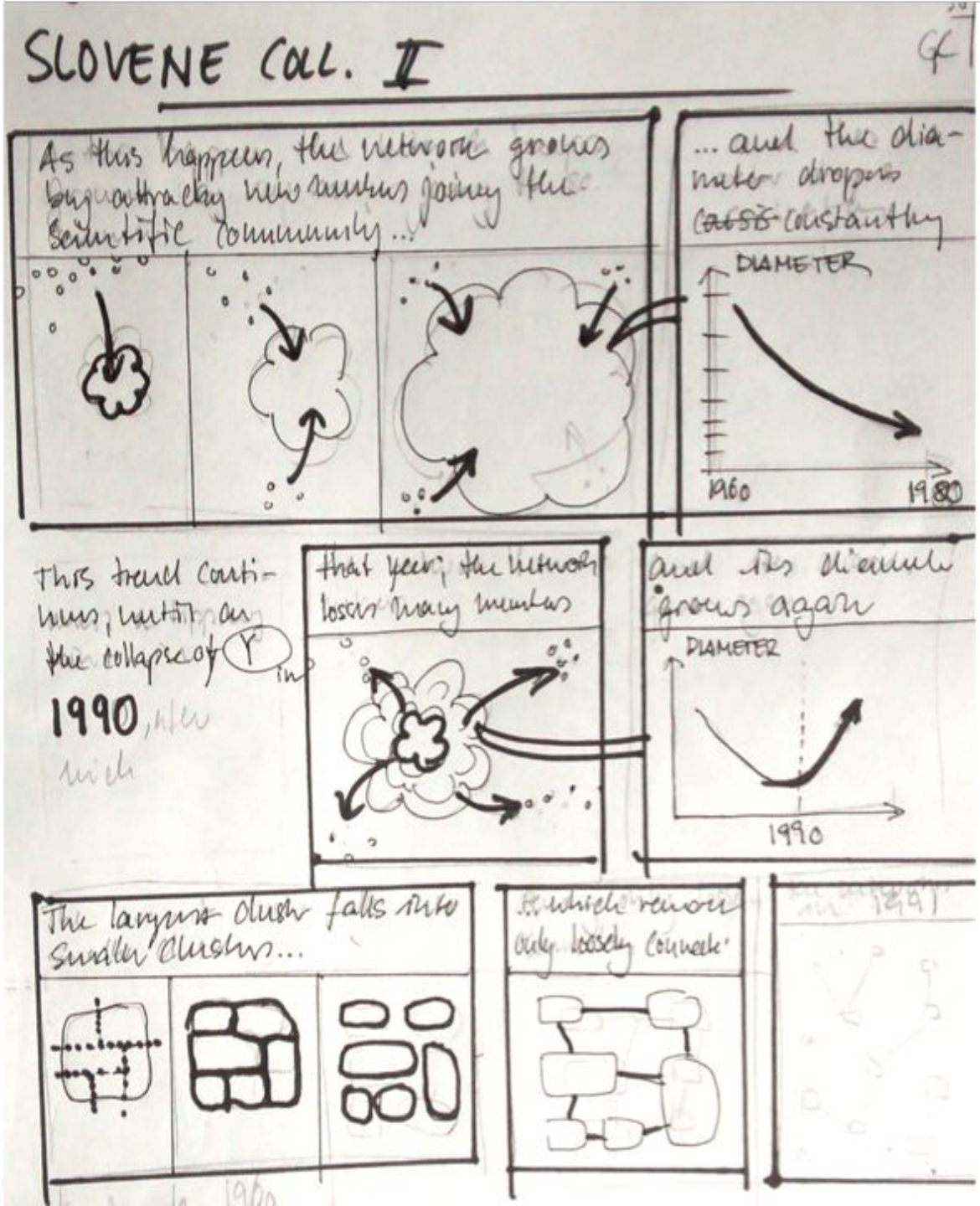


Pattern: Transition

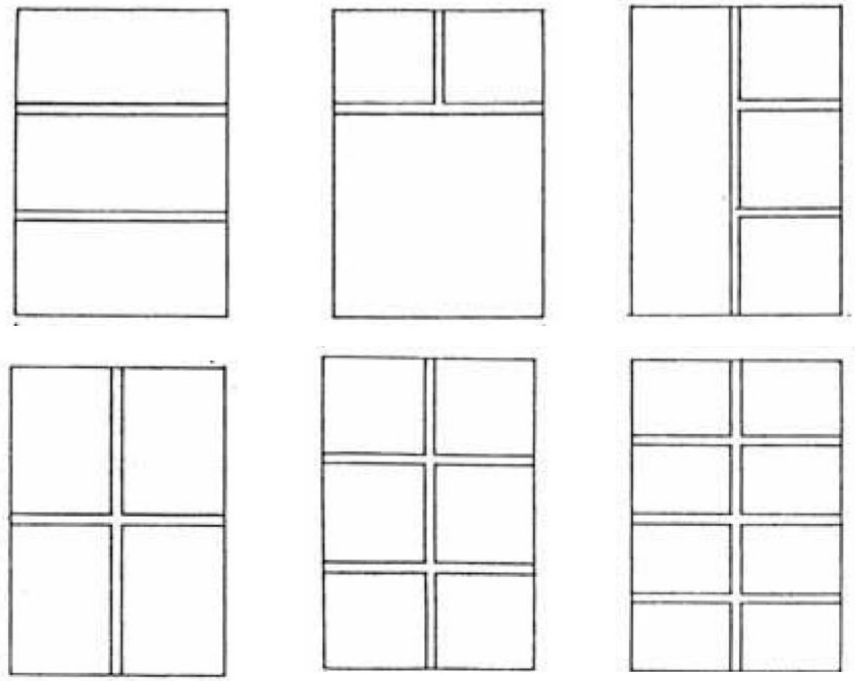
Now let's look at the next decadea from 1980 - 1990

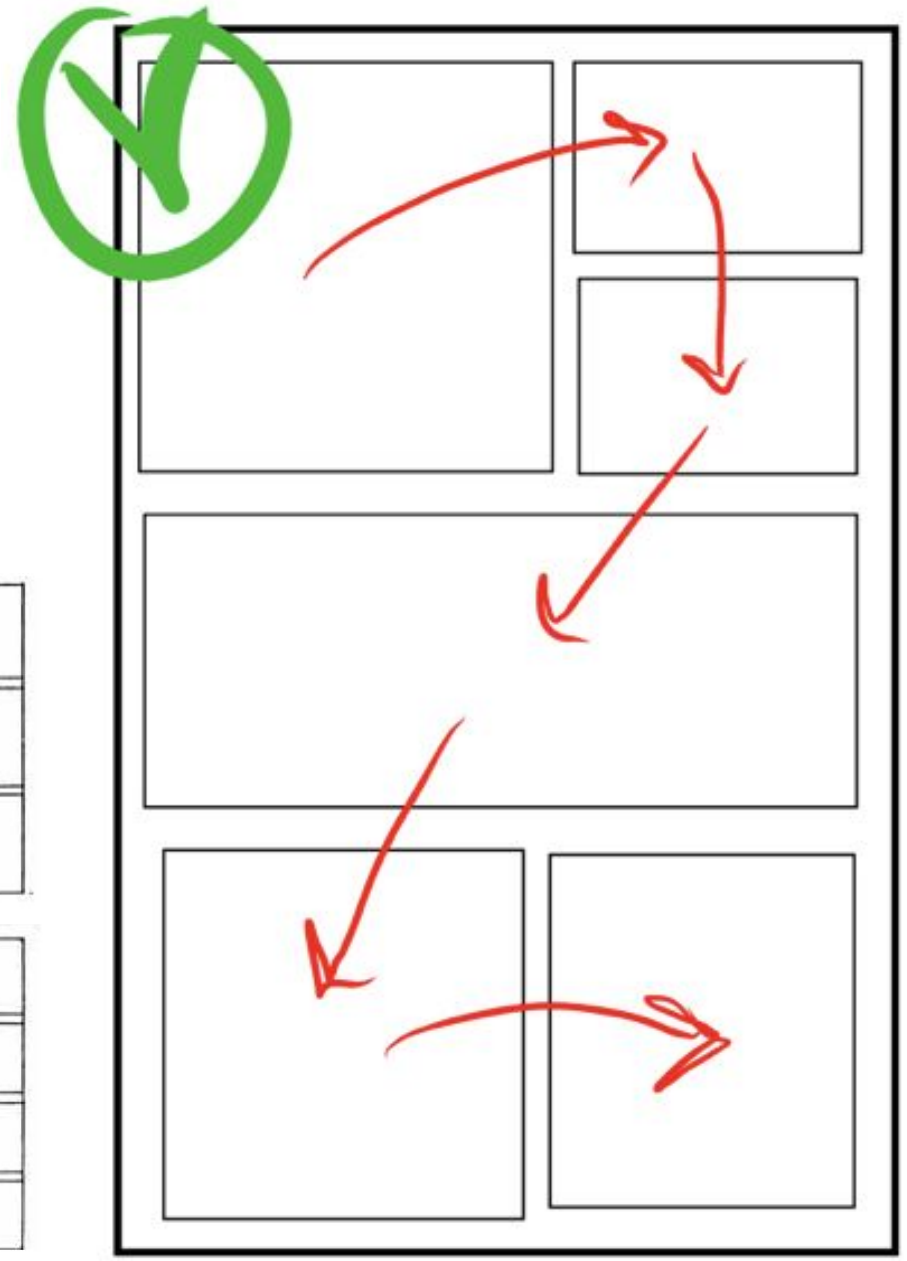


Layout


SLOVENE CAL. II
As this happens, the network grows by attracting new members joining the scientific community...
... and the diameter drops constantly
DIAMETER
1960
1980
This trend continues, until the collapse of Y in 1990, after which
that year, the network loses many members
and its diameter grows again
DIAMETER
1990
The largest cluster falls into smaller clusters...
It, which remains only loosely connected
1991

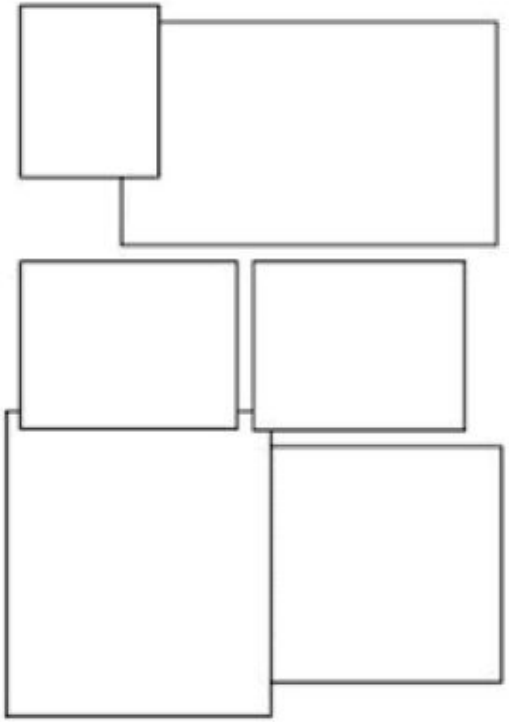
Layout

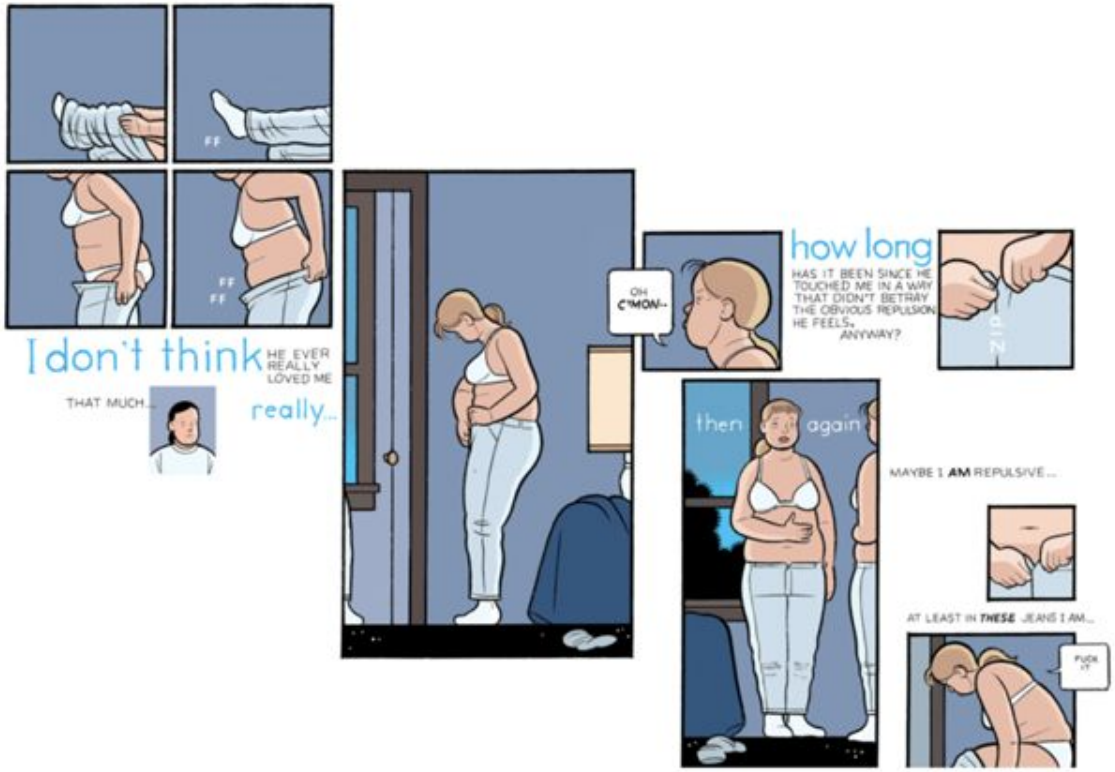


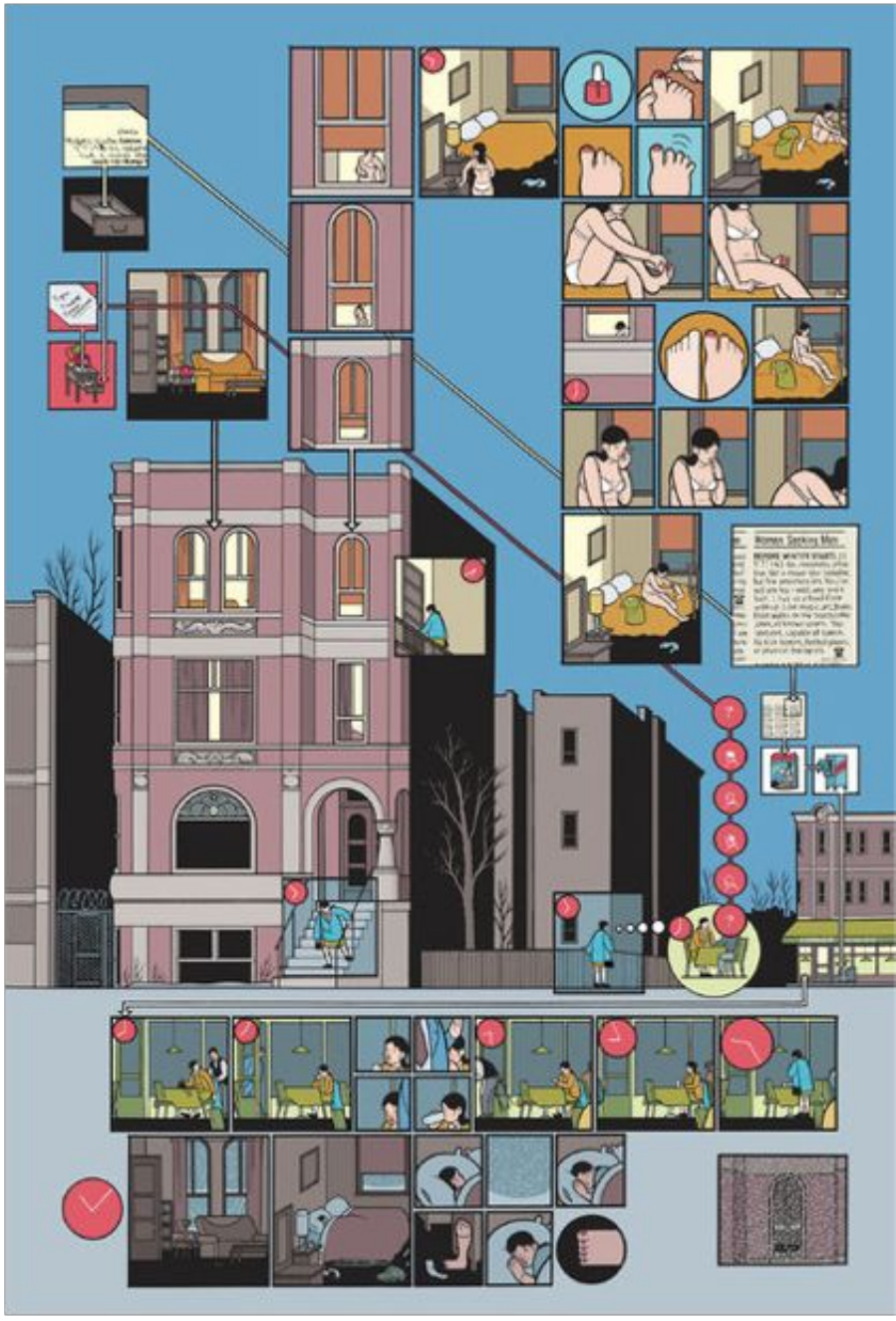


NATHAN!
NATHAN!
I KNOW WHAT YOU'RE GOING TO SAY BUT-
POENA ABSENTIAE NON EXCUSANDAE PROBATIO COLLEGII LEGES QUINQUE ET ADMONITIO PUBLICA EST.
DECEM PRO FURCIFERE LINONIAE.
DAMON?
HA HA!
PYTHIAS!

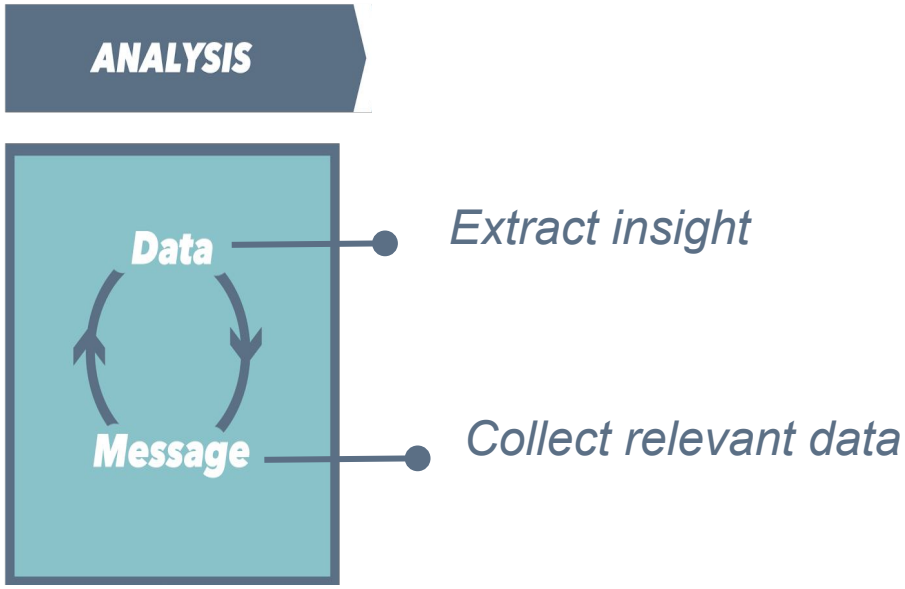
Layouts



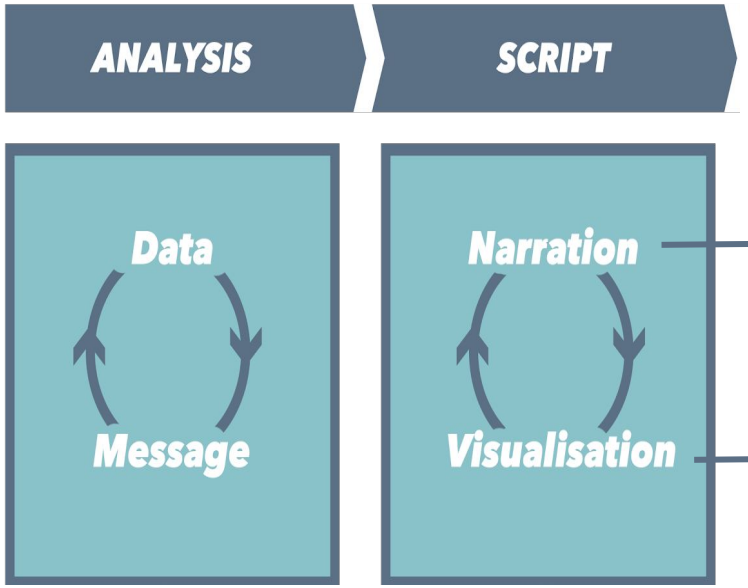

I don't think
HE EVER REALLY LOVED ME
THAT MUCH...
really...
OH C'MON--
how long
HAS IT BEEN SINCE HE TOUCHED ME IN A WAY THAT DIDN'T BETRAY THE OBVIOUS REPULSION HE FEELS. ANYWAY?
then
again
MAYBE I AM REPULSIVE...
AT LEAST IN THESE JEANS I AM...
FUCK IT



Making Process



Making Process

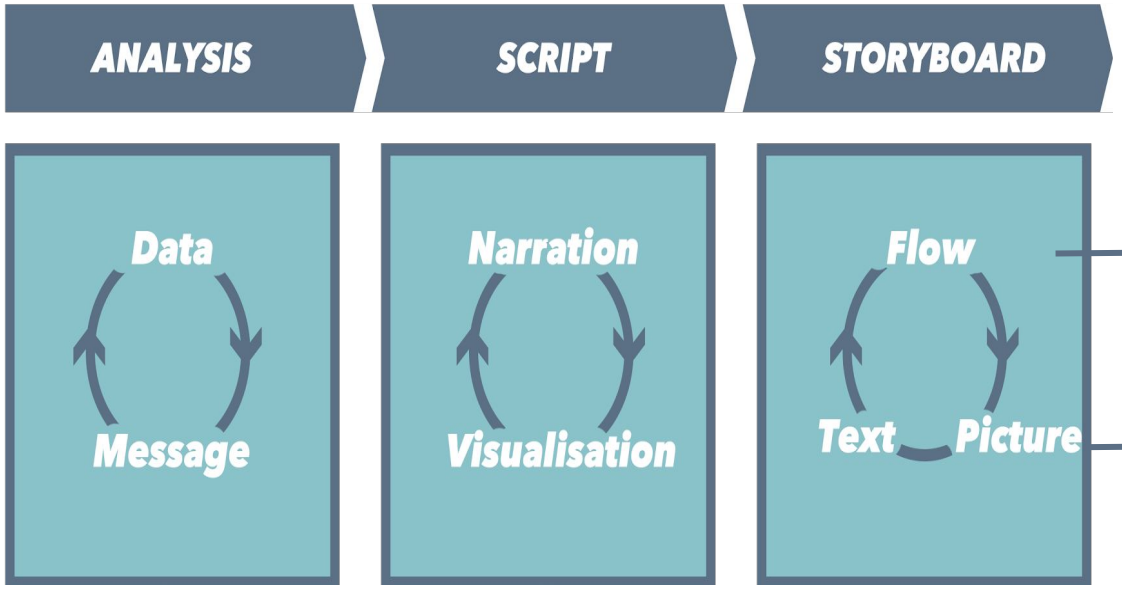


Sequence of messages, arguments and data points

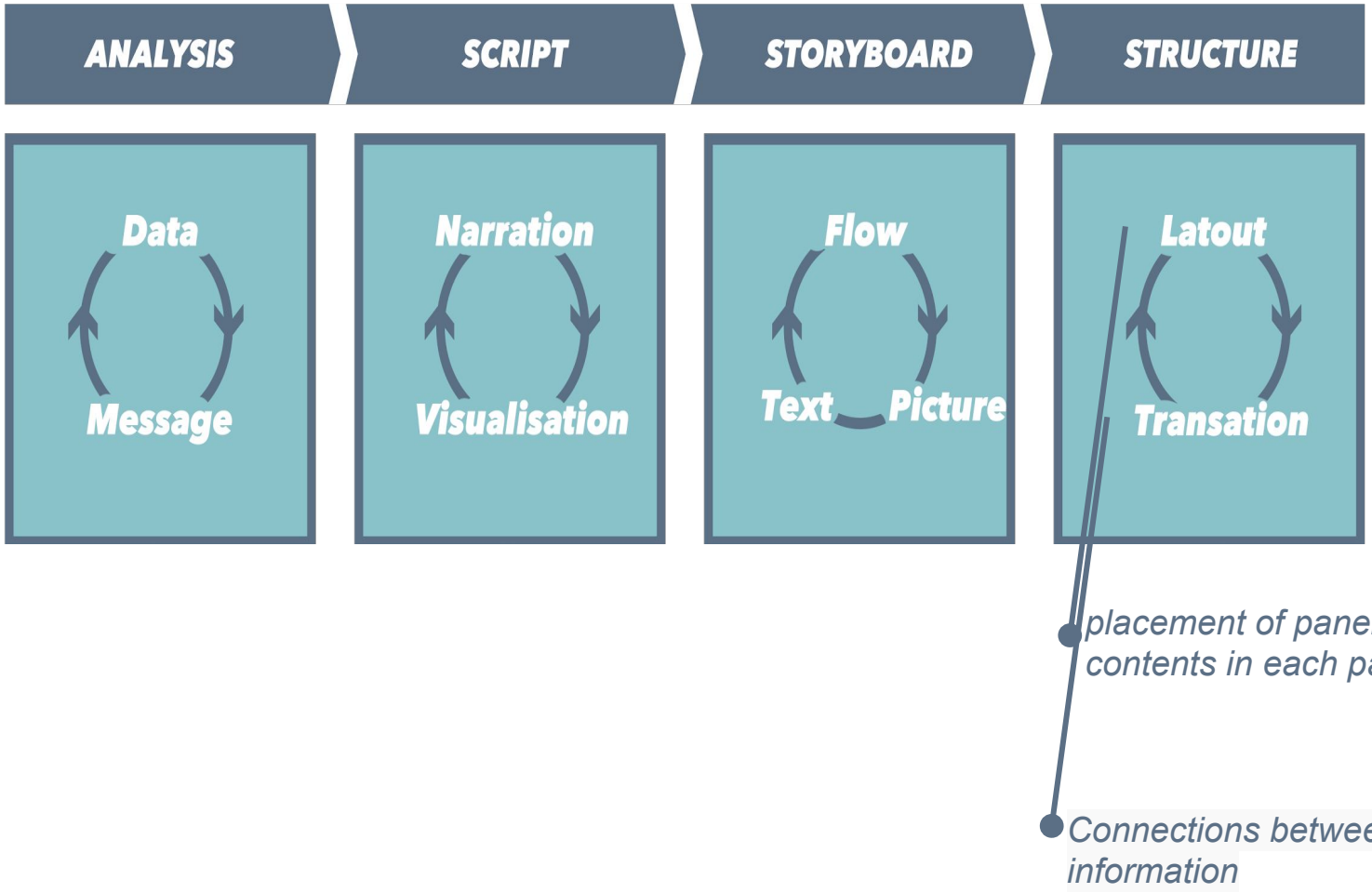
Introduction, middle and end

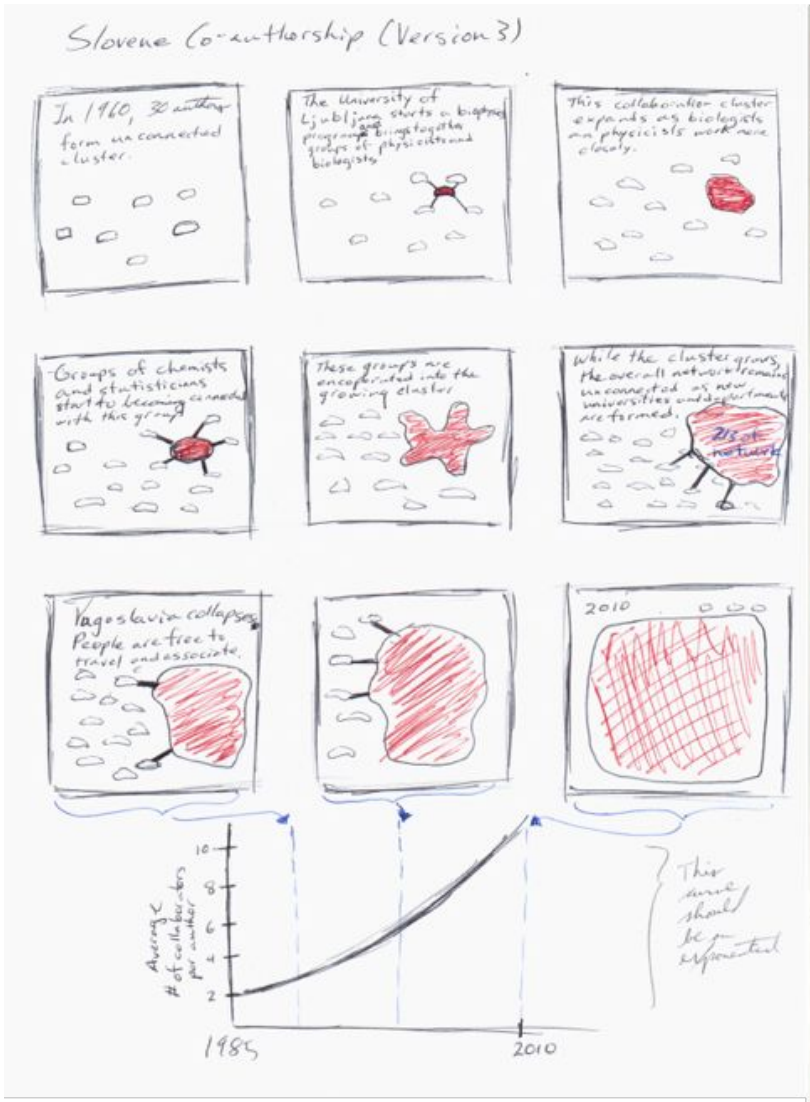
Visualising the data

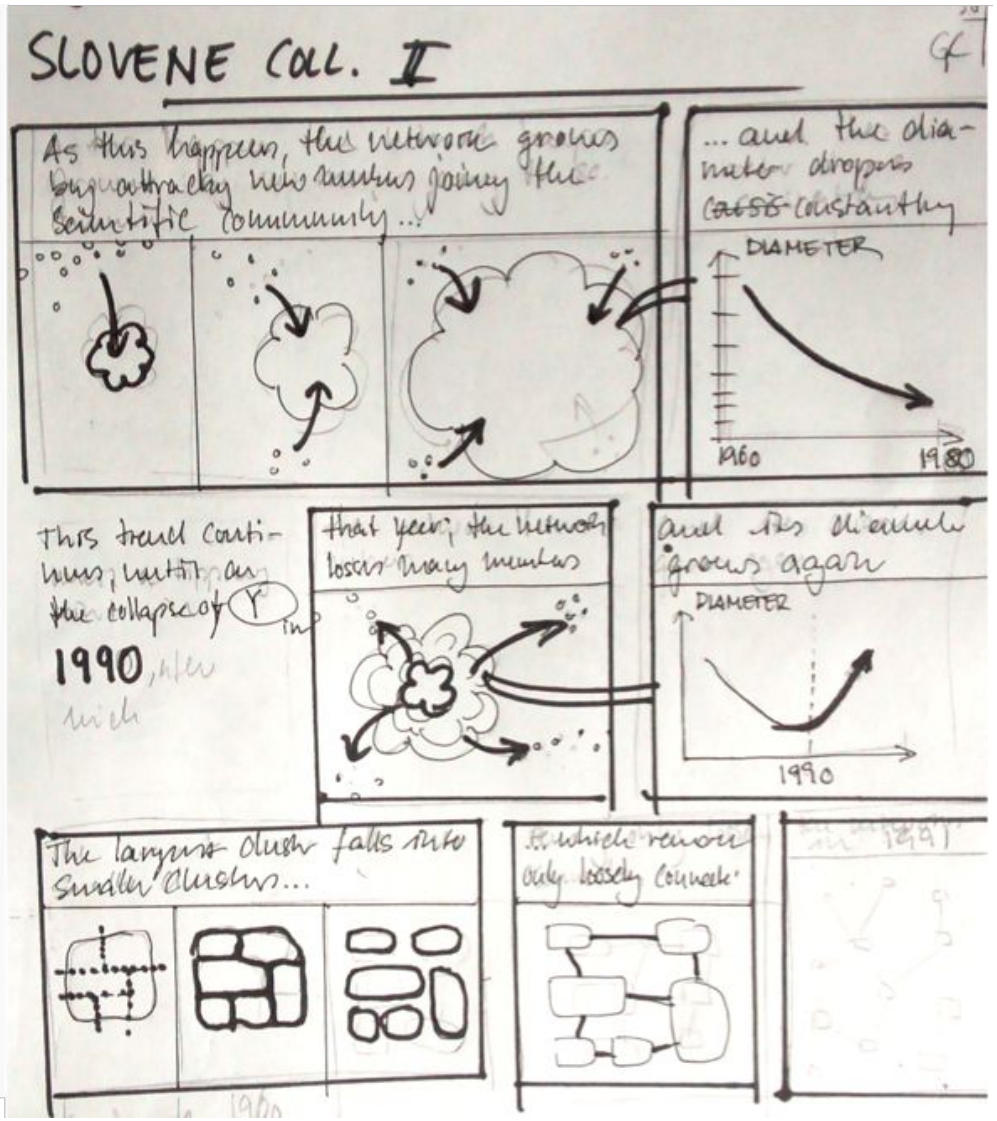
Making Process



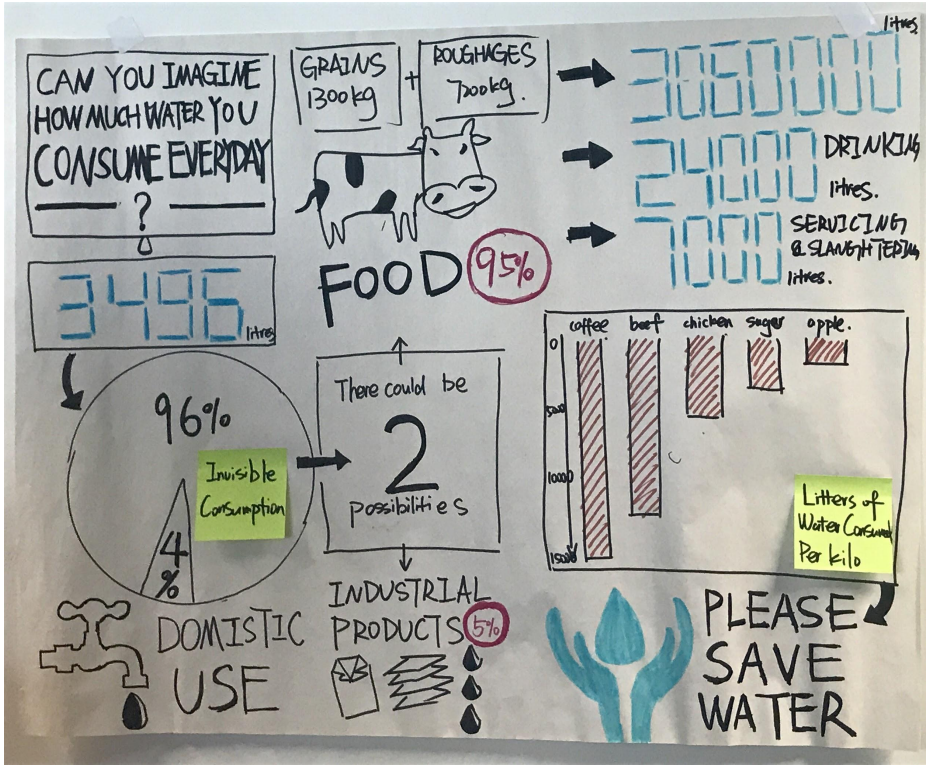
Making Process

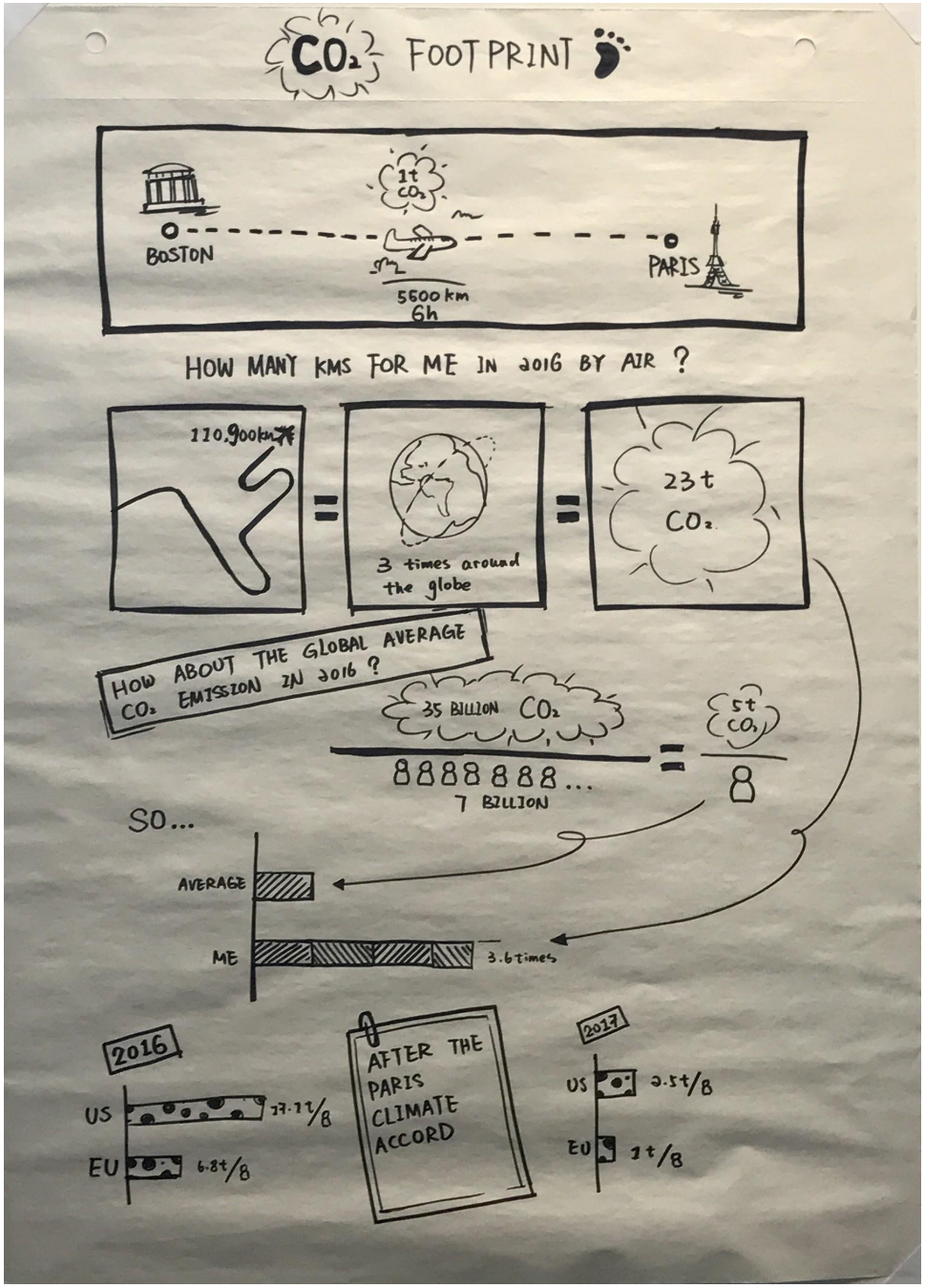


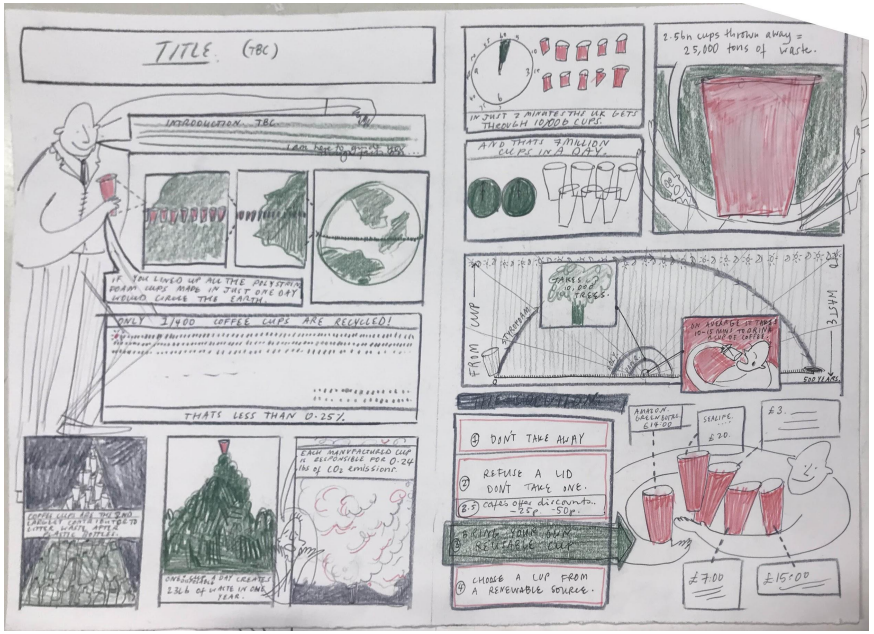

Slovene Co-authorship (Version 3)
In 1960, 30 authors form unconnected cluster.
The University of Ljubljana starts a biophysics program and brings together groups of physicists and biologists.
This collaboration cluster expands as biologists and physicists work more closely.
Groups of chemists and statisticians start to become connected with this group.
These groups are encorporated into the growing cluster
While the cluster grows, the overall network remains unconnected as new universities and departments are formed.
213 of network
Yugoslavia collapses. People are free to travel and associate.
2010
Average # of collaborators per author
10
8
6
4
2
1985
2010
This curve should be exponential

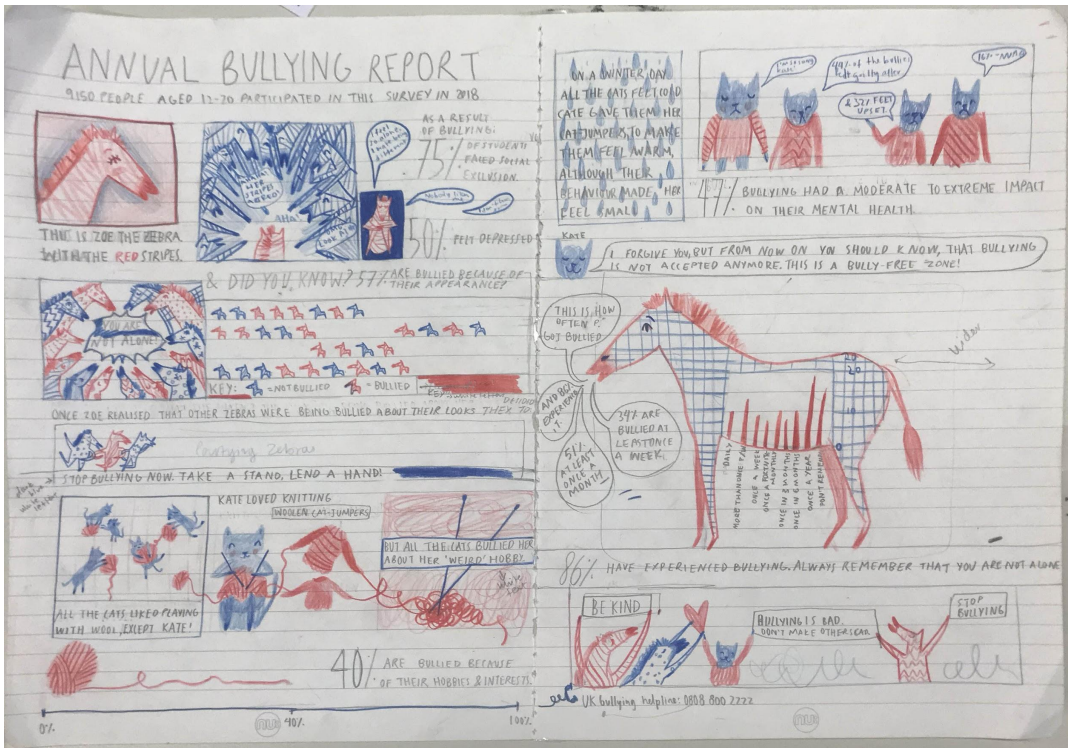

SLOVENE COLL. II
As this happens, the network grows by attracting new members joining the scientific community...
... and the diameter drops constantly
DIAMETER
1960
1980
This trend continues, until on the collapse of Y in 1990, after which
that year, the network loses many members
and its diameter grows again
DIAMETER
1990
The largest clusters falls into smaller clusters...
... which remain only loosely connected
1991

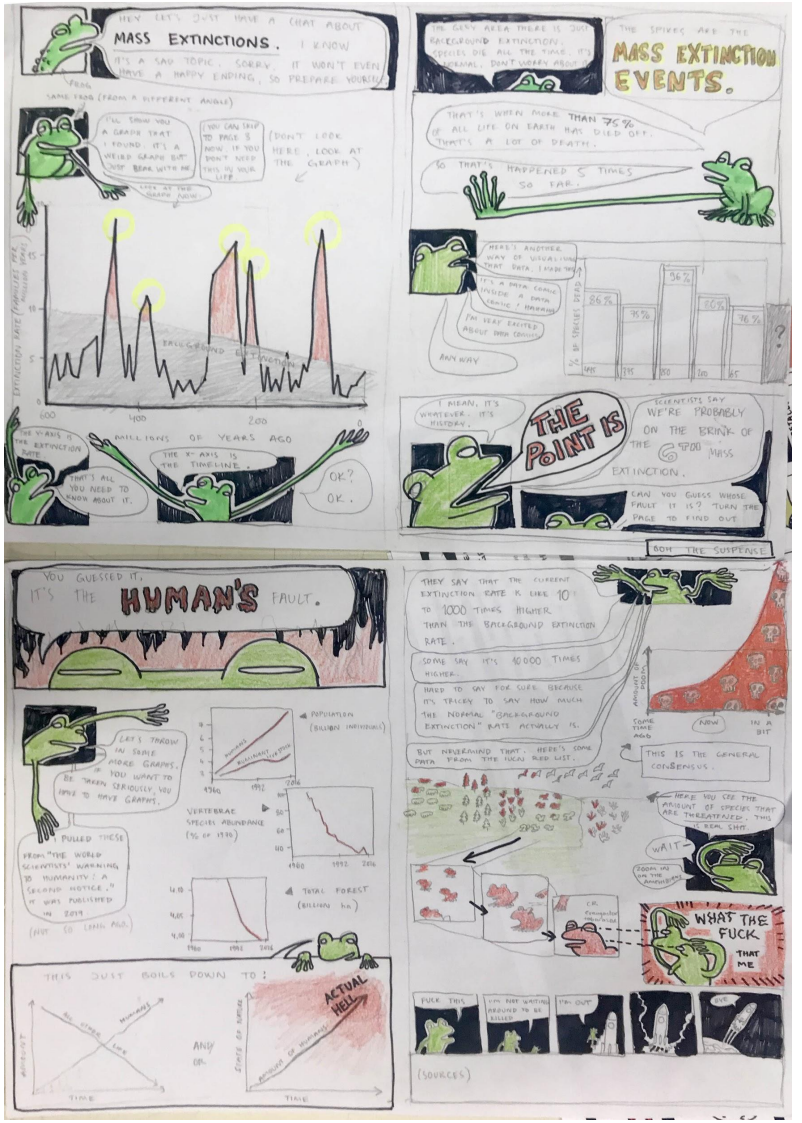
Draft


CAN YOU IMAGINE HOW MUCH WATER YOU CONSUME EVERYDAY ?
3496 litres
96%
Invisible Consumption
4%
DOMISTIC USE
There could be 2 possibilities
INDUSTRIAL PRODUCTS 5%
GRAINS 1300kg
+
ROUGHAGES 7000kg.
FOOD 95%
litres
3060000
24000 DRINKING litres.
7000 SERVICING & SLAUGHTERING litres.
coffee
beef
chicken
sugar
apple.
Litters of Water Consumed Per kilo
PLEASE SAVE WATER


CO₂ FOOTPRINT
1t CO₂
BOSTON
PARIS
5500 km
6h
HOW MANY KMS FOR ME IN 2016 BY AIR ?
110.900km
3 times around the globe
23t CO₂
HOW ABOUT THE GLOBAL AVERAGE CO₂ EMISSION IN 2016 ?
35 BILLION CO₂
8888888...
7 BILLION
5t CO₂
8
SO...
AVERAGE
ME
3.6times
2016
US
17.11/8
EU
6.81/8
AFTER THE PARIS CLIMATE ACCORD
2017
US
2.51/8
EU
1t/8


TITLE (TBC)
INTRODUCTION - TBC
IF YOU LINED UP ALL THE POLYSTYRENE FOAM CUPS MADE IN JUST ONE DAY AROUND GLOBE THEY WOULD CIRCLE THE EARTH.
ONLY 1 IN 400 COFFEE CUPS ARE RECYCLED!
THAT'S LESS THAN 0.25%
EACH MANUFACTURED CUP IS RESPONSIBLE FOR 0.24 lbs of CO_2 emissions.
ONE LONDON CAFE CREATES 2.3t OF WASTE IN ONE YEAR.
2.5bn cups thrown away = 25,000 tons of waste.
IN JUST 7 MINUTES THE UK GETS THROUGH 10,000 CUPS.
AND THAT'S 7 MILLION CUPS IN A DAY.
FROM CUP
TO LANDFILL
DON'T TAKE AWAY
REFUSE A LID DON'T TAKE ONE.
CHOOSE A CUP FROM A RENEWABLE SOURCE.
£7.00
£15.00


ANNUAL BULLYING REPORT
9150 PEOPLE AGED 12-20 PARTICIPATED IN THIS SURVEY IN 2018
AS A RESULT OF BULLYING:
75% DEVELOPED FAILED SOCIAL EXCLUSION.
50% FELT DEPRESSED
& DID YOU KNOW? 57% ARE BULLIED BECAUSE OF THEIR APPEARANCE!
THIS IS ZOE THE ZEBRA WITH THE RED STRIPES.
ONCE ZOE REALISED THAT OTHER ZEBRAS WERE BEING BULLIED ABOUT THEIR LOOKS, THEY TO
STOP BULLYING NOW. TAKE A STAND, LEND A HAND!
KATE LOVED KNITTING
WOOLEN CAT-JUMPERS
BUT ALL THE CATS BULLIED HER ABOUT HER 'WEIRD' HOBBY.
ALL THE CATS LIKED PLAYING WITH WOOL, EXCEPT KATE!
40% ARE BULLIED BECAUSE OF THEIR HOBBIES & INTERESTS.
0% 40% 100%
ON A WINTER DAY, ALL THE CATS FELT COLD. KATE GAVE THEM HER CAT-JUMPERS, TO MAKE THEM FEEL WARM. ALTHOUGH THEIR BEHAVIOUR MADE HER FEEL SMALL.
47% BULLYING HAD A MODERATE TO EXTREME IMPACT ON THEIR MENTAL HEALTH.
KATE
I FORGIVE YOU, BUT FROM NOW ON YOU SHOULD KNOW, THAT BULLYING IS NOT ACCEPTED ANYMORE. THIS IS A BULLY-FREE "ZONE!
THIS IS HOW OFTEN P. GOT BULLIED
AND HOW OFTEN
5% ATTEMPT ONCE A MONTH
34% ARE BULLIED AT LEAST ONCE A WEEK.
86% HAVE EXPERIENCED BULLYING. ALWAYS REMEMBER THAT YOU ARE NOT ALONE
BE KIND
BULLYING IS BAD. DON'T MAKE OTHERS CRY.
STOP BULLYING
UK bullying helpline: 0808 800 2222


HEY LET'S JUST HAVE A CHAT ABOUT MASS EXTINCTIONS. I KNOW IT'S A SAD TOPIC, SORRY. IT WON'T EVEN HAVE A HAPPY ENDING, SO PREPARE YOURSELF.
FROM SAME FROG (FROM A DIFFERENT ANGLE)
I'LL SHOW YOU A GRAPH THAT I FOUND. IT'S A WEIRD GRAPH BUT JUST BEAR WITH ME
YOU CAN SKIP TO PAGE 5 NOW, IF YOU DON'T NEED THIS IN YOUR LIFE
(DON'T LOOK HERE, LOOK AT THE GRAPH)
EXTINCTION RATE (families per million years)
BACKGROUND EXTINCTION
600
400
200
0
MILLIONS OF YEARS AGO
THE X-AXIS IS THE TIMELINE.
OK? OK.
THAT'S ALL YOU NEED TO KNOW ABOUT IT.
THE SPIKES ARE THE MASS EXTINCTION EVENTS.
THAT'S WHEN MORE THAN 75% OF ALL LIFE ON EARTH HAS DIED OFF. THAT'S A LOT OF DEATH.
SO THAT'S HAPPENED 5 TIMES SO FAR.
HERE'S ANOTHER WAY OF VISUALISING THAT DATA. I FOUND THIS IT'S A DATA COMIC, I THINK?
I'M VERY EXCITED ABOUT DATA COMICS
ANYWAY
% OF SPECIES DEAD
86%
95%
96%
80%
96%
?
I MEAN, IT'S WHATEVER. IT'S HISTORY.
THE POINT IS
SCIENTISTS SAY WE'RE PROBABLY ON THE BRINK OF THE 6TH MASS EXTINCTION.
CAN YOU GUESS WHOSE FAULT IT IS? TURN THE PAGE TO FIND OUT
BOY THE SUSPENSE
YOU GUESSED IT. IT'S THE HUMAN'S FAULT.
LET'S THROW IN SOME MORE GRAPHS, IF YOU WANT TO HAVE GRAPHS.
BE "GREEN" (BADLY). YOU HAVE TO HAVE GRAPHS.
POPULATION (BILLION INDIVIDUALS)
VERTEBRATE SPECIES ABUNDANCE (% OF 1970)
TOTAL FOREST (BILLION ha)
I PULLED THESE FROM "THE WORLD SCIENTISTS' WARNING TO HUMANITY: A SECOND NOTICE." IT WAS PUBLISHED IN 2019
(JUST GO LOOK AT)
THIS JUST BOILS DOWN TO:
ACTUAL HELL
AND
STATE OF NATURE
TIME
THEY SAY THAT THE CURRENT EXTINCTION RATE IS LIKE 10 TO 1000 TIMES HIGHER THAN THE BACKGROUND EXTINCTION RATE.
SOME SAY IT'S 10000 TIMES HIGHER.
HARD TO SAY FOR SURE BECAUSE IT'S TRICKY TO SAY HOW MUCH THE NORMAL "BACKGROUND EXTINCTION" RATE ACTUALLY IS.
BUT NEVERMIND THAT. HERE'S SOME DATA FROM THE IUCN RED LIST
AMOUNT OF SPECIES
SOME TIME AGO
NOW
IN A BIT
THIS IS THE GENERAL CONSENSUS.
HERE YOU CAN SEE THE AMOUNT OF SPECIES THAT ARE THREATENED. THIS
WAIT
ZOOM IN ON THE ANNOTATIONS
WHAT THE FUCK
THAT
ME
REA SHIT
FUCK THIS
I'M NOT WAITING AROUND TO BE KILLED
I'M OUT
(SOURCES)

Structure

Visible water
drinking
cooking
washing
137 litres
30%
35%
20%
5%
10%
Advice:
One meat free day a week
Choose meat raised on grass
Reduce food waste
1 kg beef
167 litres
7000 litres for farmhouse & slaughter
24000 litres of water to drink for cow
total 3091 000 litres for producing 200 kilos of beef.
3060 000 litres of water to produce all grains
Cow consumes 1300 kg of grains
92% of all water
consumption is in the food we
3496 litres
food consumption
eat