A HISTORY OF INFORMATION VISUALIZATION II

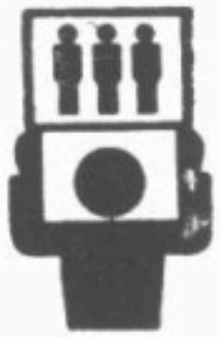
Overview

1. Visual Education

2. Visualizing Nature

3. Trees & Networks

VISUAL EDUCATION



ISOTYPE

International
System
Of
TYpographic
Picture
Education

Otto Neurath, ISOTYPE, 1936

Team

Scientific Research -> Transformer -> Graphic Designer

Otto Neurath -> Marie Reidemeister (later Neurath) -> Gerd Arntz

Acquire -> Refine -> Represent



shoe



works



shoe-works



shoes produced
by machine



shoes produced
by handwork

Otto Neurath, International Picture Language, 1936

DOCUMENTATION AU TELECOMMUNICATIONS (SUITE)

T.D. 53

II SEANCE DE COMITE (NATIONAL OU INTERN.)

LES MEMBRES SONT RELIES LES UNS AUX AUTRES PAR TELEPHONE, A L'INTERMEDIAIRE D'UN CONNECTEUR AU BUREAU CENTRAL. ILS PEUVENT ECOUTER ET PARLER.

BRUXELLES.

LA HAYE

I SEANCE DE CONGRES, TENUE EN PRESENCE DE MEMBRES, A DISTANCE ET SUR PLACE.

III DOCUMENT TRANS. TELEVISE (DOCUMENT GRAPHIQUE)

IV DOCUMENTATION SONORE (DISQUE OU FILM) TELEPHONEE OU RADIO-FUSEE.

VI

COLLECTIONS

LIVRES FILMS DISQUES OBJETS

CATALOGUES

A B C D E

LE RESEAU UNIVERSEL

(A) LA DOCUMENTATION (LES COLLECTIONS ET CATALOGUES) SERA RASSEMBLEE A L'ETAT UNIVERSEL DANS LE MUNDANEUM (B+C). LA, DES MACHINES AIDERONT AUX OPERATIONS COMPLEMENTAIRES, D'ANALYSES ET DE SYNTHESES, REQUISES POUR EN CONSTITUER LE TOUT ENCYCLOPEDIQUE DESIRABLE.

(D) LES ELEMENTS DEMANDES SERONT MECANIQUEMENT EXTRAITS. (E) LES EMETTEURS LES LANCERONT DANS LE RESEAU UNIVERSEL. (F) OU ILS SERONT REÇUS PAR LES STATIONS.

Fe Fe Fe

DOCUMENT 8441 P. OTLET

ENCYCLOPAEDIA UNIVERSALIS MUNDANEUM. — . PALAIS MONDIAL - BRUXELLES

INDICES — 001 T.D. 53

Otto Neurath, Gesellschaft und Wirtschaftmuseum, 1924

Paul Otlet, Mundaneum, 1934

1. Picture statistics are designed to express amounts of the same thing or relations between amounts of different things. The number of repetitive signs should be countable, each sign expressing a given basic quantity (e.g., 1,000 people, 100 ships, 1 million tons of iron, etc.). A larger amount of something must be represented by a larger amount of signs, not by a larger sign. 'The eye is able to say: in that case the amount is 2 times greater than in another case.'

2. The signs should be highly stylized, endowed with the power to make them clear and pleasing to the eye. They should be used consistently, such that different pictures can be related to each other.

3. The selection of educational material is not simple. The one who can leave things out is the best teacher. Less is more. A simple picture kept in the memory is better than any number of complex ones which have gone out of it.

4. The 'transformation' of ideas in clear lay-outs is the next difficult step. The basic guidelines of transformation are to select, round off and arrange.

5. Graded symbols to express amounts should not be used. Graded circles and squares have no place in the system because their areas are difficult to compare.

6. Continuous lines for expressing the relationship between amounts and time should not be used. The individual points between two successive years have no meaning.
- 14 - . Color should be used consistently (e.g., green for farming, red for industry, blue for business).

8. Signs and colors are to be distributed over the plane of the picture in such a way that the attention is guided to certain points which have to be looked at first.

9. At the first look one should see the most important points, at the second, the less important points, at the third, the details, at the fourth nothing more - if you see more, the teaching picture is bad.

10. It is unnecessary to say in words what we are able to make clear by pictures. And on the other hand, it is frequently hard to make a picture of a simple statement. Education has to put the two together, and a system of education has to see which language is best for which purpose.

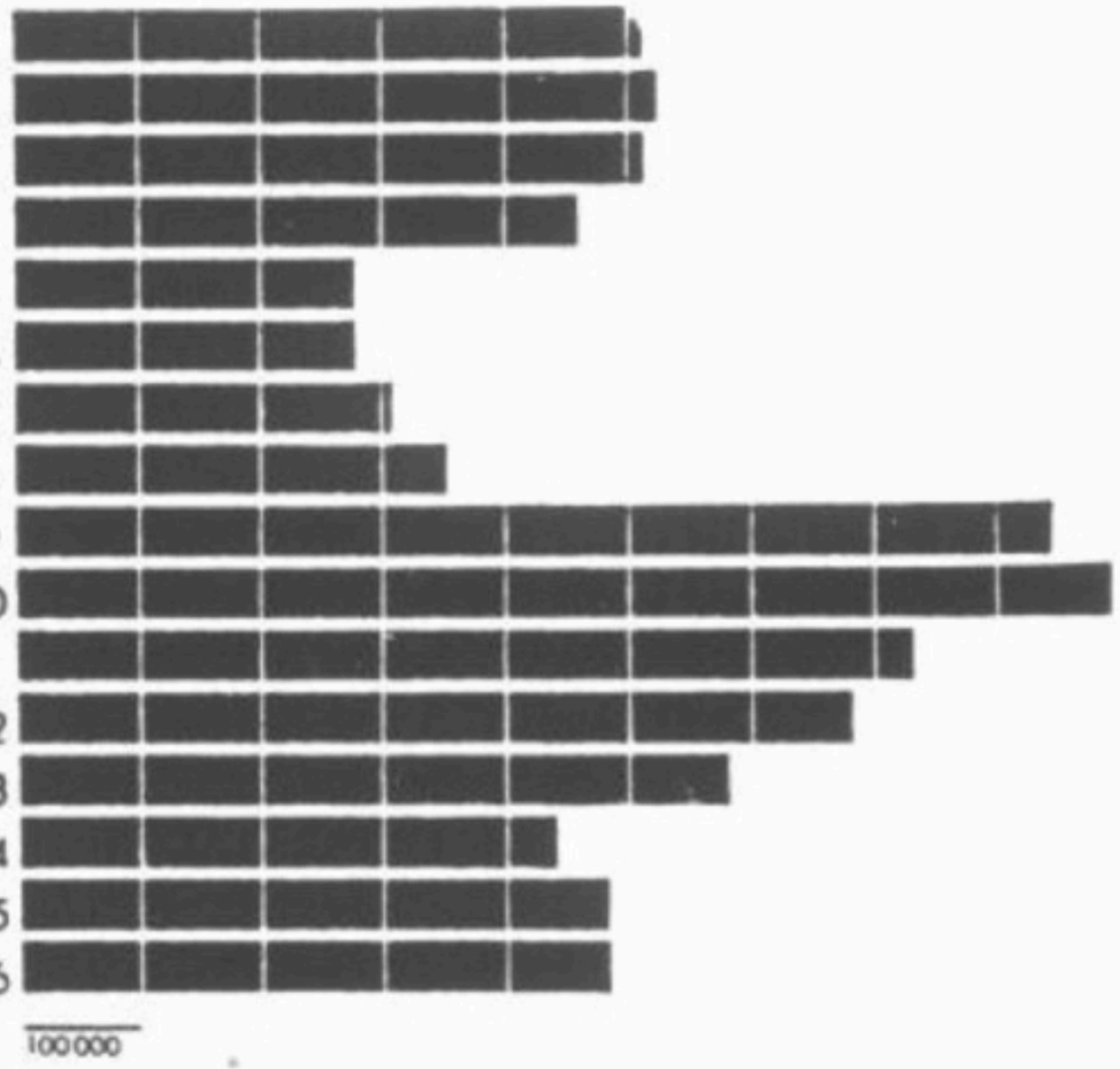
11. All pictures together make one unit, and it is important for the reader not to be troubled in any way if he is conscious of all the marks which teaching pictures have made on his memory.
Neurath made a distinction between teaching pictures and advertisements [23]: 'Every business advertisement is in competition with every other and necessarily has the tendency to put all other such pictures out of memory of the onlooker. Every advertisement has to be different from others. This is not so with the teaching pictures.'

12. One has to be like another so far as it gives the same details, and to be different
from another so far as the story it gives is different!

1.
Picture statistics are designed to express amounts of the same thing or relations between amounts of different things. The number of repetitive signs should be countable, each sign expressing a given basic quantity (e.g., 1,000 people, 100 ships, 1 million tons of iron, etc.). A larger amount of something must be represented by a larger amount of signs, not by a larger sign. 'The eye is able to say: in that case the amount is 2 times greater than in another case.'

Men getting married in Germany

1911	512 819
1912	523 491
1913	513 283
1914	460 608
1915	278 208
1916	279 076
1917	308 446
1918	352 543
1919	844 339
1920	894 978
1921	731 157
1922	681 891
1923	581 277
1924	440 039
1925	482 792
1926	483 198



Otto Neurath, International Picture Language, 1936

Men Getting Married in Germany in a Year

1911-14



1915-18



1919-22



1923-26



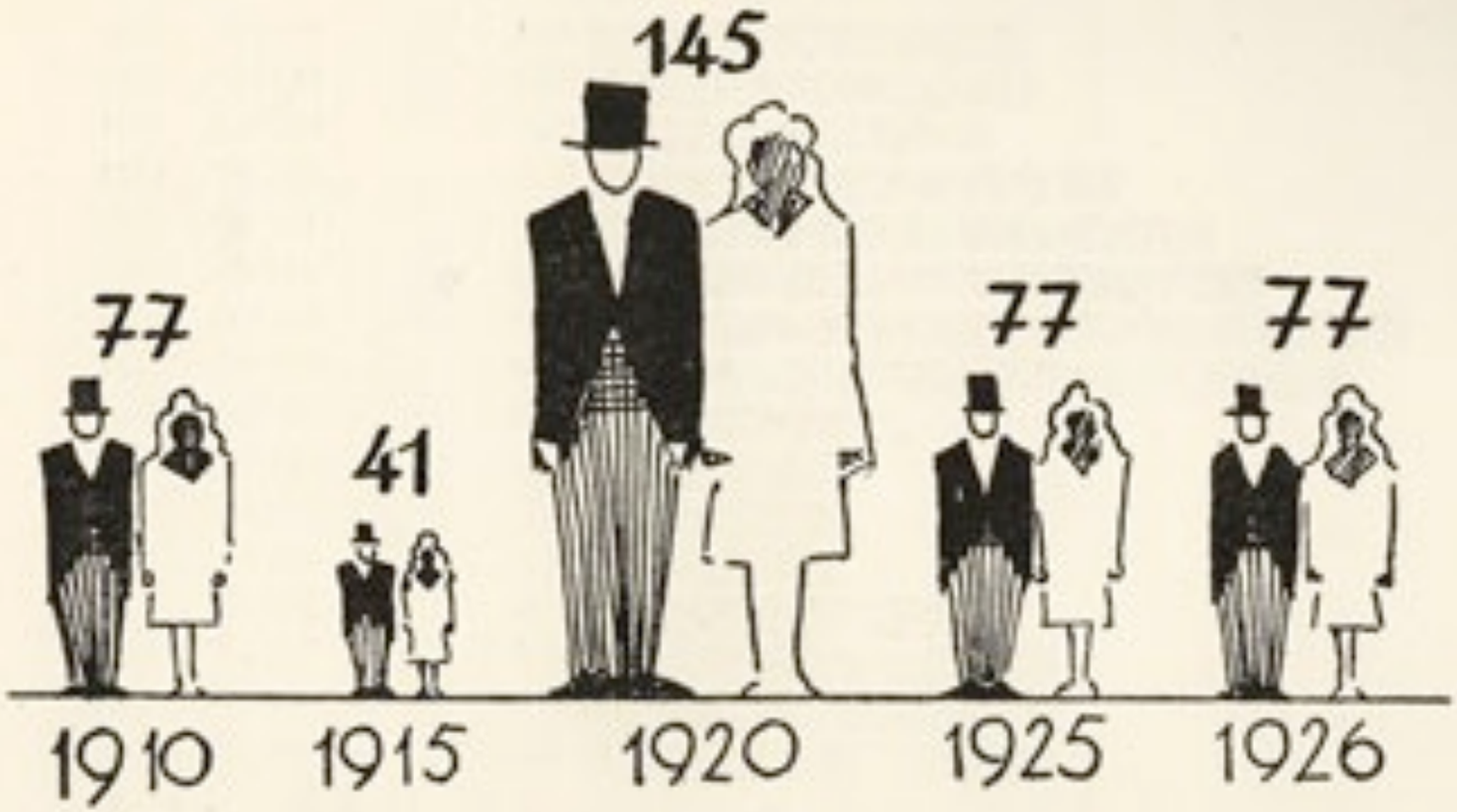
1 sign for 100,000 a year

PICTURE 27

Otto Neurath, International Picture Language, 1936

Example of bad system : signs of different sizes

Number of men getting married in Germany out of every 10,000 persons



PICTURE 25

Otto Neurath, International Picture Language, 1936

9.
At the first look one should see the most important points, at the second, the less important points, at the third, the details, at the fourth nothing more - if you see more, the teaching picture is bad.

-Iron-Production



United States | Great Britain | France | Germany | Soviet Union

1900
1901
1902
1903
1904
1905
1906
1907
1908
1909
1910
1911
1912
1913
1914
1915
1916
1917
1918
1919
1920
1921
1922
1923
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1933
1934
1935
1936
1937
1938

World War

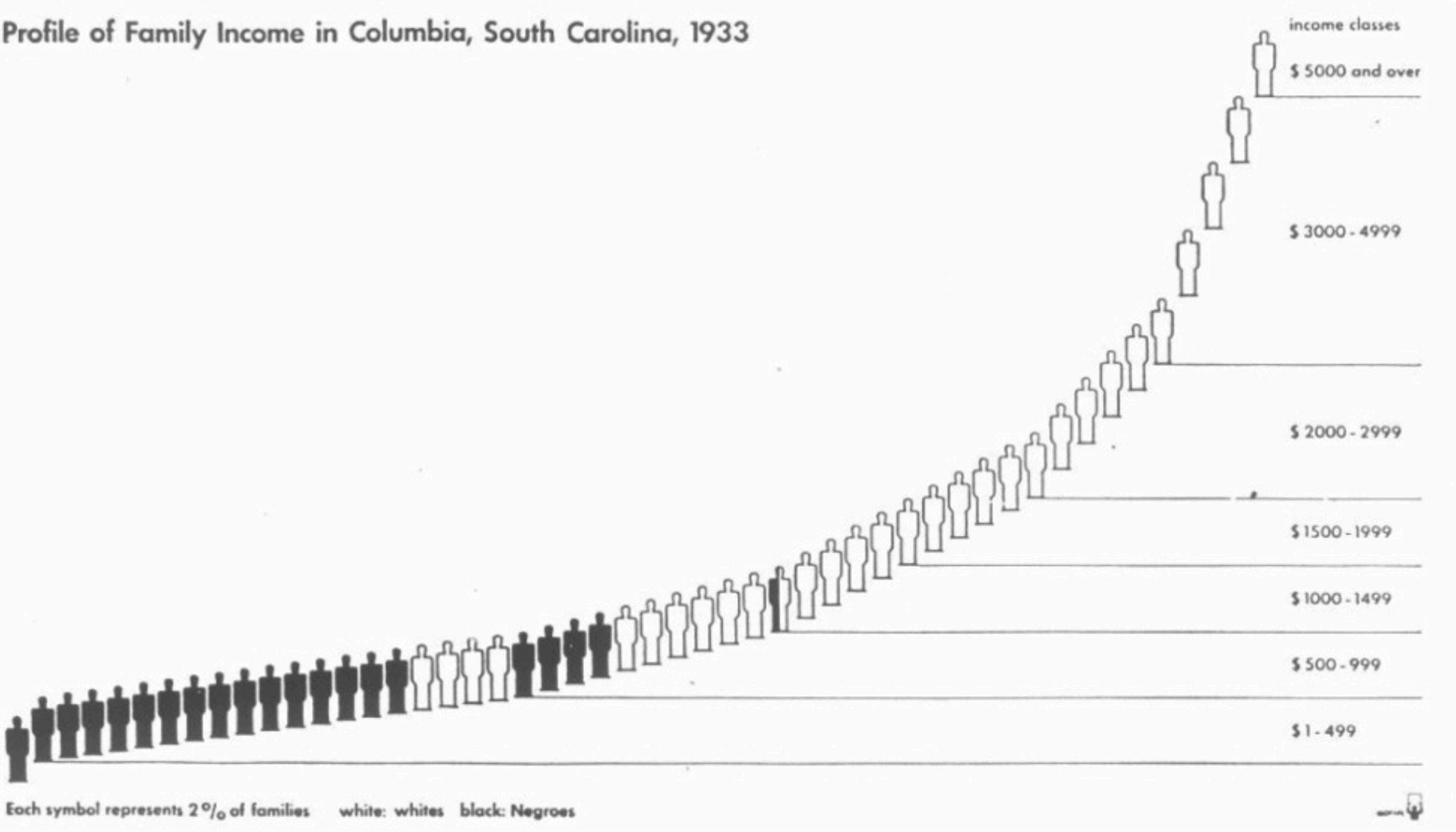
Strike

World Depression

Civil War

Each unit represents 1 million long tons

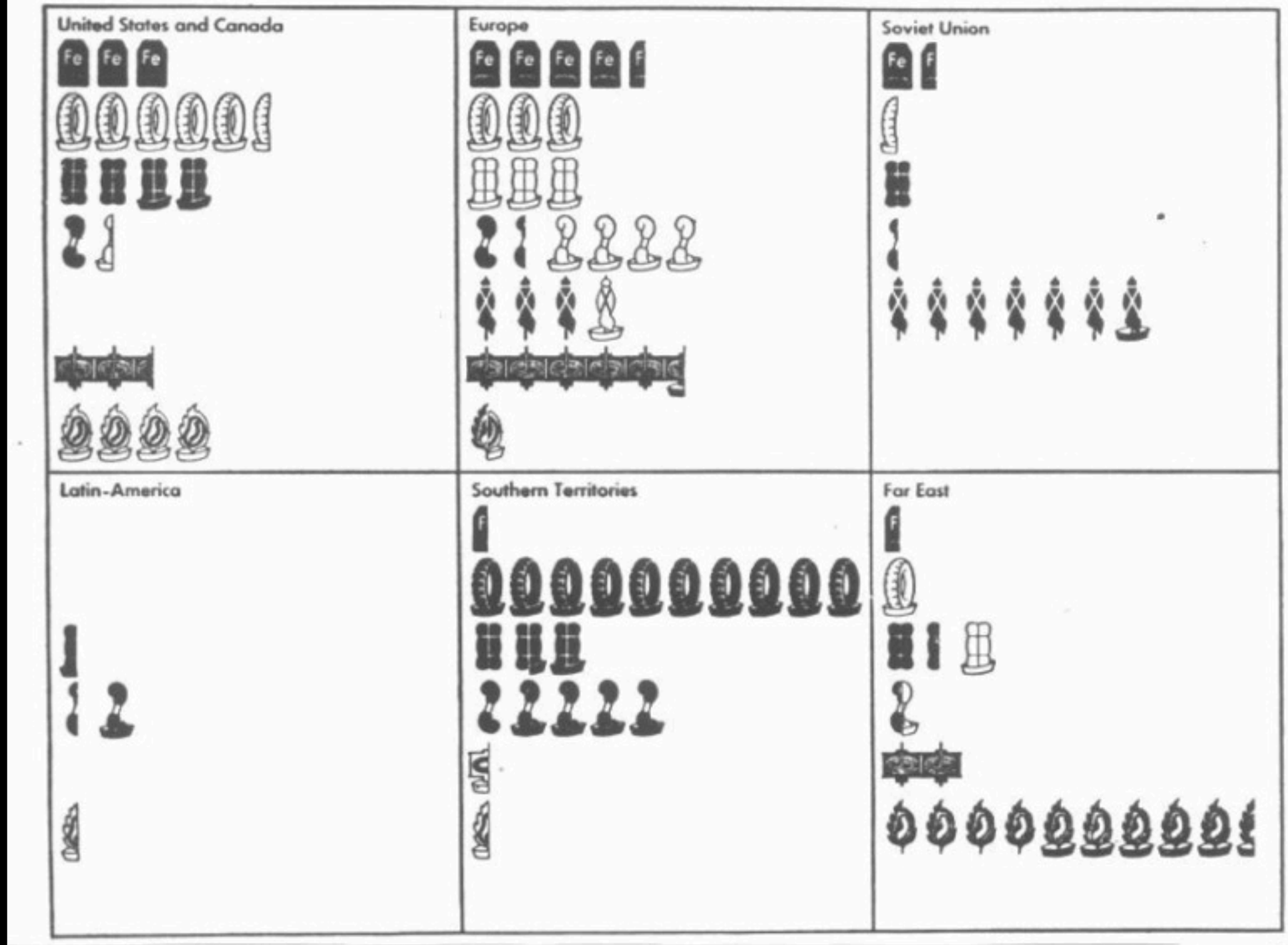
Otto Neurath, ISOTYPE from Modern Man in the Making, 1939



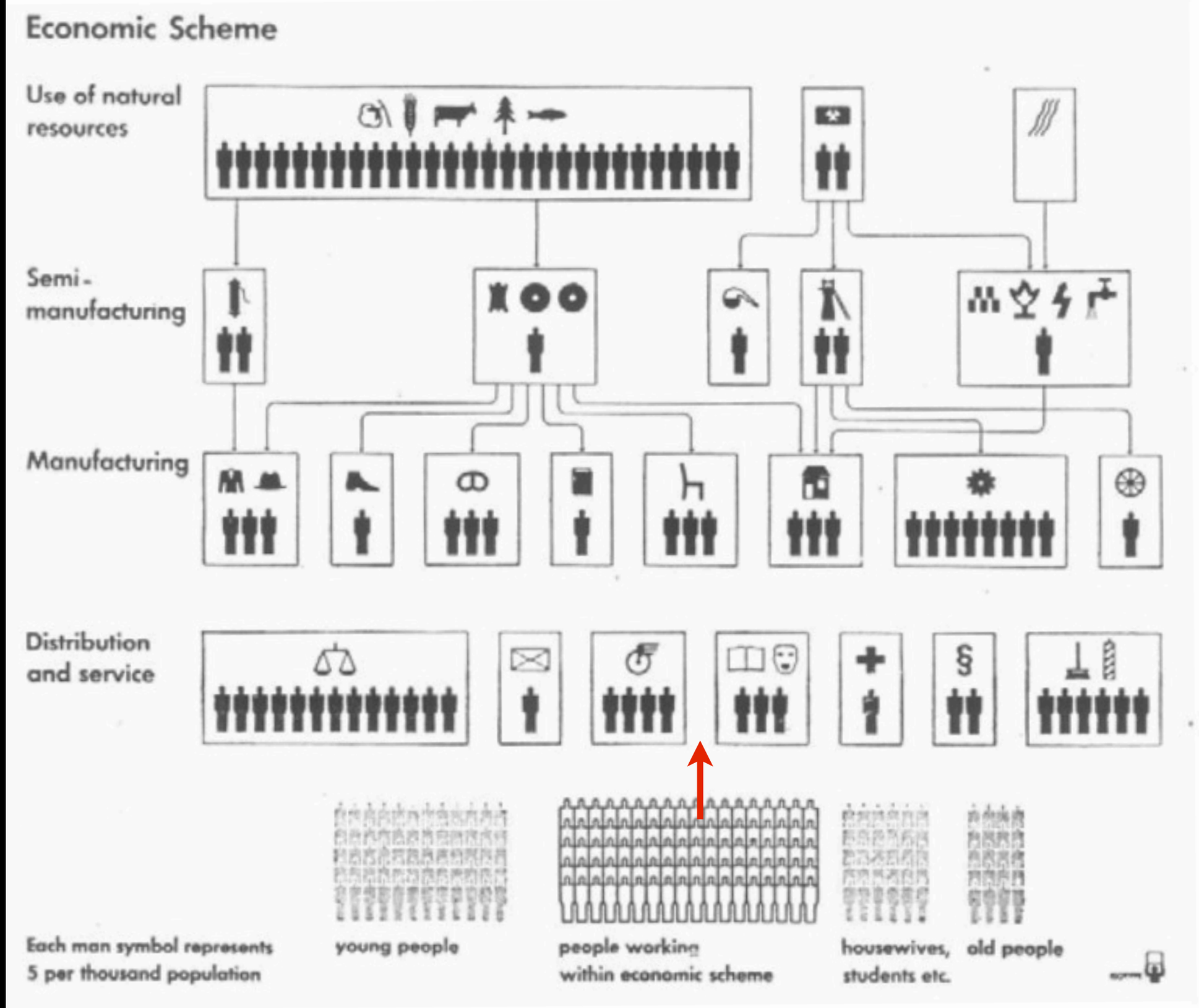
Otto Neurath, ISOTYPE from Modern Man in the Making, 1939

»A bird's-eye view of the inter-
connections between all parts of a
society in actions makes it possible
to analyze the state of the world or
the structure of a single country.«

Raw Materials



Otto Neurath, ISOTYPE (Production, import and export of raw materials in six world regions around 1935) from: Modern Man in the Making, 1939



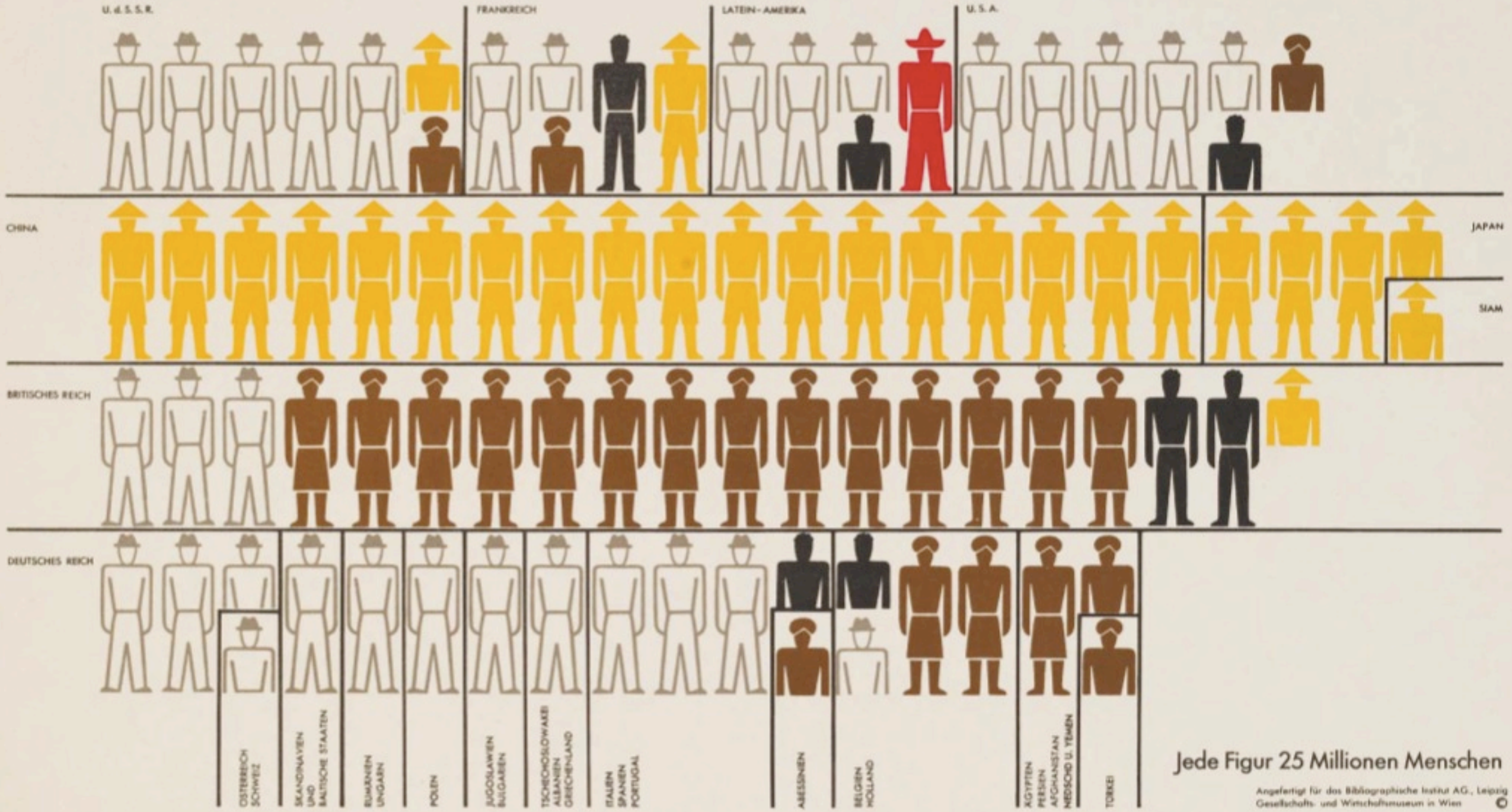
90 people = active working population

200 people = whole population

5 people of every 1000 people (0.5%) of the whole population of X

Otto Neurath, ISOTYPE (Schematic of economic interconnections between parts of society) from: Modern Man in the Making, 1939

Mächte der Erde



Otto Neurath, Mächte der Erde

ASIEN OHNE SELBSTÄNDIGE STAATEN OSTASIENS, AUSTRALIEN









Jede Figur = 25 Millionen Menschen

Flaggen am Boden: herrschende Kolonialmacht

14

VÖLKERGRUPPEN DER ERDE



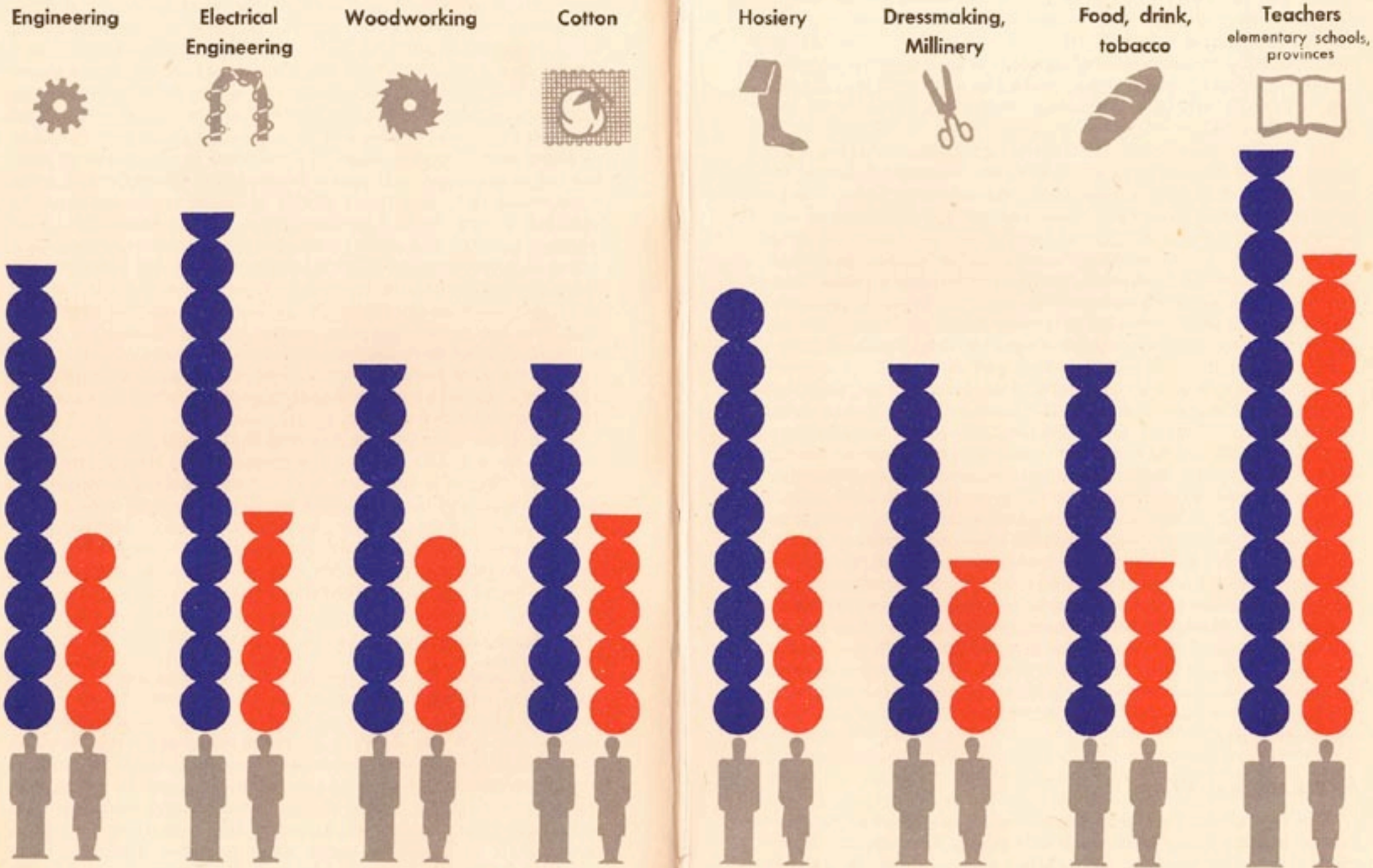
Weiße (z. B. Engländer, Deutsche, Franzosen, Italiener, Polen, Russen usw.)
Rote (Mestizen und Indianer), Schwarze (Neger und Mulatten), Braune (Orientalen, Inder, Malaien usw.)
Gelbe (Chinesen, Japaner, Indochinesen usw.)

Jede Figur = 50 Millionen Menschen, abgerundet

6

Otto Neurath, Aus: Die Bunte Welt, 1929

Weekly Earnings of Men and Women, 1940



Each circle represents 10 shillings

blue: average weekly wages or middle salaries per week of men
red: average weekly wages or middle salaries per week of women

ISOTYPE INSTITUTE

Otto Neurath, ISOTYPE, 1940

10.
It is unnecessary to say in words what we are able to make clear by pictures. And on the other hand, it is frequently hard to make a picture of a simple statement. Education has to put the two together, and a system of education has to see which language is best for which purpose.

Gewerbebetriebe im Deutschen Reich 1933

	Betriebe	Männl. Beschäftigte	Weibl. Beschäftigte
Bergbau usw	1 305	437 807	4 776
Eisen- und Stahlgewinnung	1 458	473 570	7 657
Herstellung v. Eisen Stahl- u. Metallwaren	155 833	492 694	92 952
Elektrotechnische Industrie	27 551	183 992	63 198
Chemische Industrie	7 699	182 443	63 986
Papierindustrie	10 886	118 936	62 171
Textilindustrie	67 579	385 840	460 991
Holz- und Schnitzstoffgewerbe	214 640	555 179	52 638
Kautschuk- und Asbestindustrie	1 948	27 775	20 519
Bekleidungsgewerbe	535 266	528 264	517 037

Otto Neurath, International Picture Language, 1936

EDITOR Professor P. Sargant Florence

AMERICA AND BRITAIN

OUR PRIVATE LIVES

BY LELLA SECOR FLORENCE

FOREWORD BY NORA WALN

WITH 16 ISOTYPE CHARTS IN COLOUR AND 32 PHOTOGRAPHS



GEORGE G. HARRAP & COMPANY LTD.
LONDON TORONTO BOMBAY SYDNEY

Otto Neurath with the Isotype Institute, Our Private Lives, 1944

Mr Bevin has said in the House of Commons that plans are on foot to attract tourists to Britain after the war. But if visitors are to come, and to go away pleased, Mr Bevin will have to roll up his sleeves and turn his genius to educating cooks. Many English people agree on this matter. Sir Norman Angell, discussing (in *Lilliput*) Britain's reluctance to use the skill of foreigners, put the matter tersely :

> But it is quite certain that we can never develop that tourist trade, or, indeed, continue to maintain our foreign trade, if we make it a rule never to employ a foreigner. The rich American . . . who comes to Europe with his family for a good time will not make Britain his headquarters (nor travel on British ships), if the hotels in our centres of great historic interest continue to offer him for dinner "a nice leg of mutton, with greens and potatoes, followed by a nice suet pudding."

English cooking, when it is skilfully done, can be superb—like the meals, I am told, served at the high tables in Oxford and Cambridge colleges. I've an idea that cooking done exclusively for men—and perhaps by them—is of a higher standard. The trouble is that English cooking frequently is not skilfully done, and that British housewives show little interest in perfecting this essential art. War scarcity has done a great deal to stimulate an interest in food and in new recipes, which, let all the people pray, may benefit post-war cookery. I don't suggest that in the small average restaurant or the average home in America you won't sometimes find a poor standard of cooking. You possibly will ; in England you probably will.

Meal-times and menus vary considerably from farms to cities and as between industrial workers and professional people in both countries. In America farm-workers, where it is very hot, often start work at dawn, and take time off for rest during the heat of the day. The eating habits of the upper and the working-class in Britain vary more than in any sections of America. In Britain the workers have breakfast, dinner, tea, and supper (biggest meals at week-ends) ; in the upper-income groups the order is breakfast, lunch, tea, and dinner. Americans take three meals a day—the main one at midday, though in cities the habit of evening dinner has become fairly common. They drop into the corner drug-store for a snack between meals at all times of the day—maybe a piece of pie or cake or a doughnut and a cup of coffee, or perhaps only an ice-cream soda or Coca-Cola, or a glass of milk. Americans drink coffee when the British drink tea, but they don't have as many cups during a single day. The average British housewife drinks at least eight or nine cups of tea every day, starting the first thing in the morning before breakfast and finishing the last thing before going to bed. Tea is served in offices and factories in mid-afternoon.

It is characteristic of the average American that he wants to be doing something all the time—if he's not eating or drinking he is smoking or chewing gum. The gum-chewing habit is not as universal as Britons believe, but it is wide spread enough to merit the criticism of those who regard it as unpleasant.

Americans and Britons are amused by each other's table manners. Americans eat with the fork in the right hand, while the British tackle the matter with knife in right hand and fork in left. The Englishman likes meat, vegetables, sauces, and gravies all combined on one plate. He then puts a small mound of salt on the side, assembles on his fork a portion of each of the foods on the plate, adds a little salt from the mound,

London

Beginning of the 19th Century



Beginning of the 20th Century

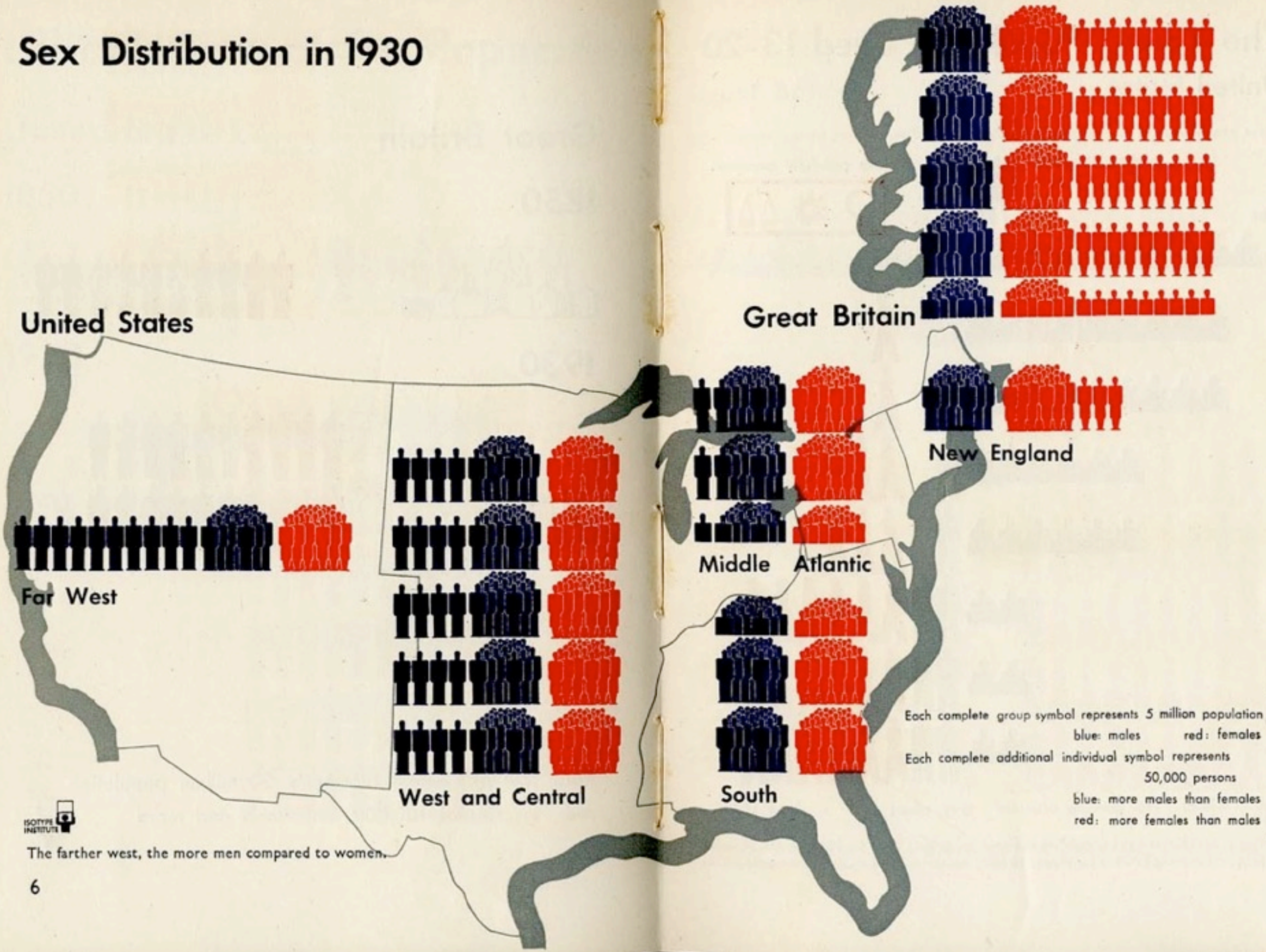


ISOTYPE INSTITUTE

Compared with New York (chart 3), London's lay-out mostly grew up as need arose.

Otto Neurath with the Isotype Institute, Our Private Lives, 1944

Sex Distribution in 1930



The farther west, the more men compared to women.

Otto Neurath with the Isotype Institute, Our Private Lives, 1944

Popular Festivals

Calendar	United States
January	NEW YEAR
February	LINCOLN'S BIRTHDAY WASHINGTON'S BIRTHDAY
March	
April	
May	MOTHERS' DAY MEMORIAL DAY
June	
July	INDEPENDENCE DAY
August	
September	LABOUR DAY
October	HALLOW-E'EN
November	ARMISTICE DAY THANKSGIVING DAY
December	CHRISTMAS DAY

Festivals falling on a Sunday, as Easter Sunday, Whit Sunday, are not included
Blue: church festivals and days after church festivals
Red: commemoration of historical events
Grey: national sporting event
Green: custom or legally appointed

Calendar	England
January	
February	
March	
April	BOAT RACE (OXFORD-CAMBRIDGE) GOOD FRIDAY EASTER MONDAY
May	DERBY DAY WHIT MONDAY
June	
July	
August	BANK HOLIDAY
September	
October	
November	GUY FAWKES ARMISTICE DAY
December	CHRISTMAS DAY BOXING DAY

ISOTYPE INSTITUTE

Both countries celebrate on about as many days throughout the year, but American festivals depend more on historical occurrences and English more on movable Church feasts and sporting events which may, in some years, be in a neighbouring month to that charted. Scots, like Americans, celebrate the New Year and do not follow English Bank Holidays or sporting fixtures. Guy Fawkes Day and Hallow-e'en appeal particularly to the young.

Otto Neurath with the Isotype Institute, Our Private Lives, 1944

Designed and produced by
ADPRINT LIMITED LONDON

face to face with CHINA

by

HAROLD B. RATTENBURY
AUTHOR OF "UNDERSTANDING CHINA" "CHINA, MY CHINA"

WITH
45 PHOTOGRAPHS
by CECIL BEATON
AND
15 PICTORIAL CHARTS IN COLOUR
DESIGNED BY
THE ISOTYPE INSTITUTE

LONDON
GEORGE G. HARRAP & CO. LTD.
SYDNEY TORONTO BOMBAY STOCKHOLM

Otto Neurath with the Isotype Institute, Face to Face with China, 1945

Urbanization in the West



United States



Great Britain



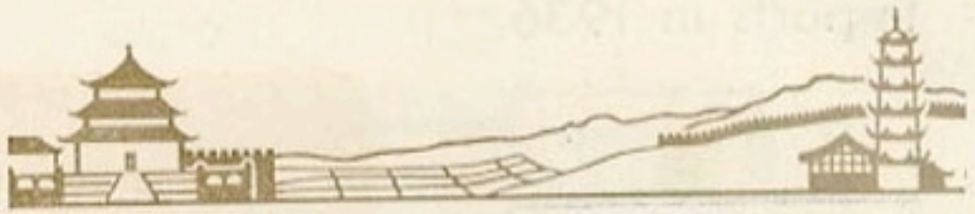
France



Each row of man symbols represents 45 million population
red : in cities of 100,000 inhabitants and more



Urbanization in China



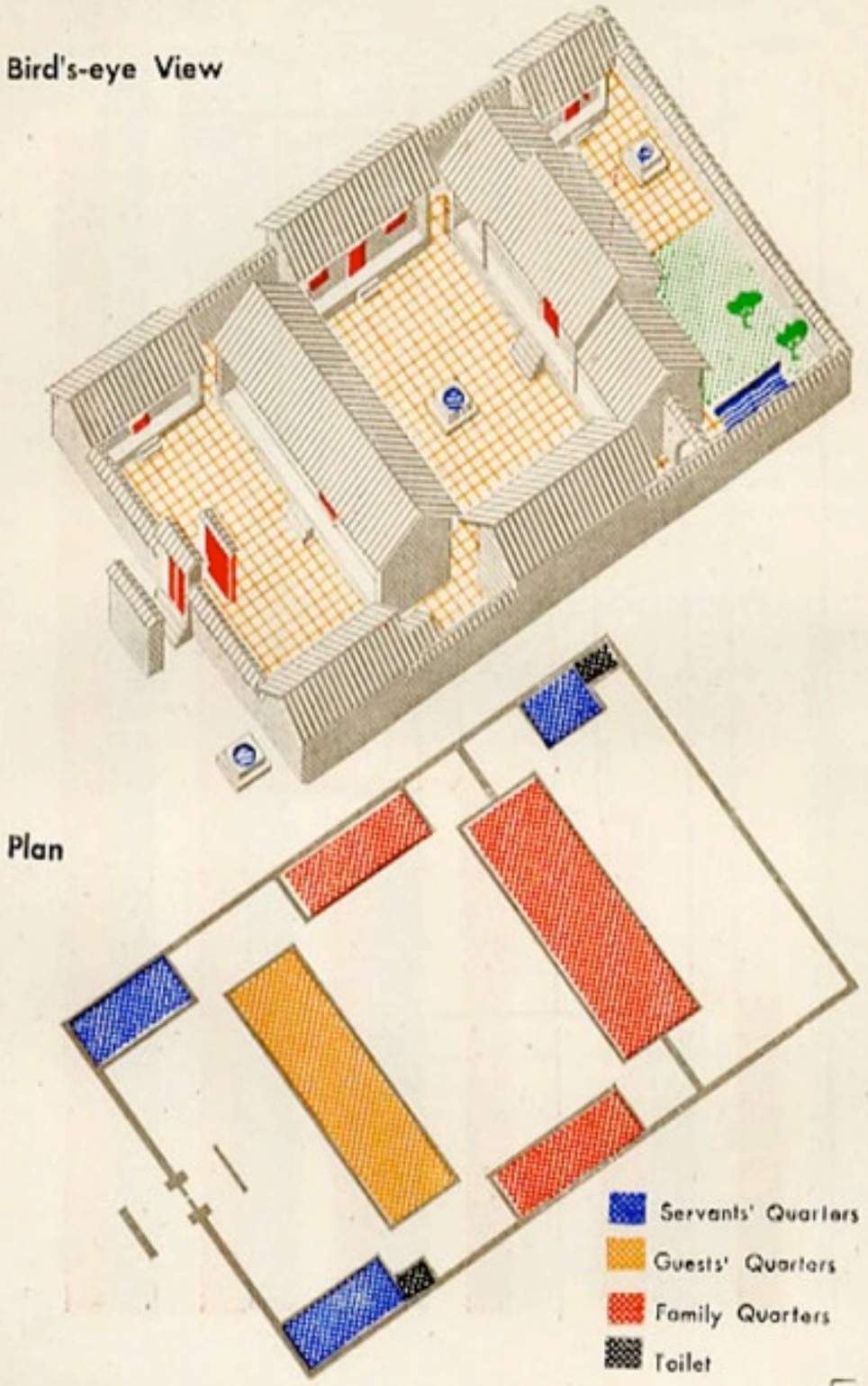
China



CHART 2

Otto Neurath with the Isotype Institute, Face to Face with China, 1945

A Comfortable Suburban House



Otto Neurath with the Isotype Institute, Face to Face with China, 1945

Religious Contacts between West and East

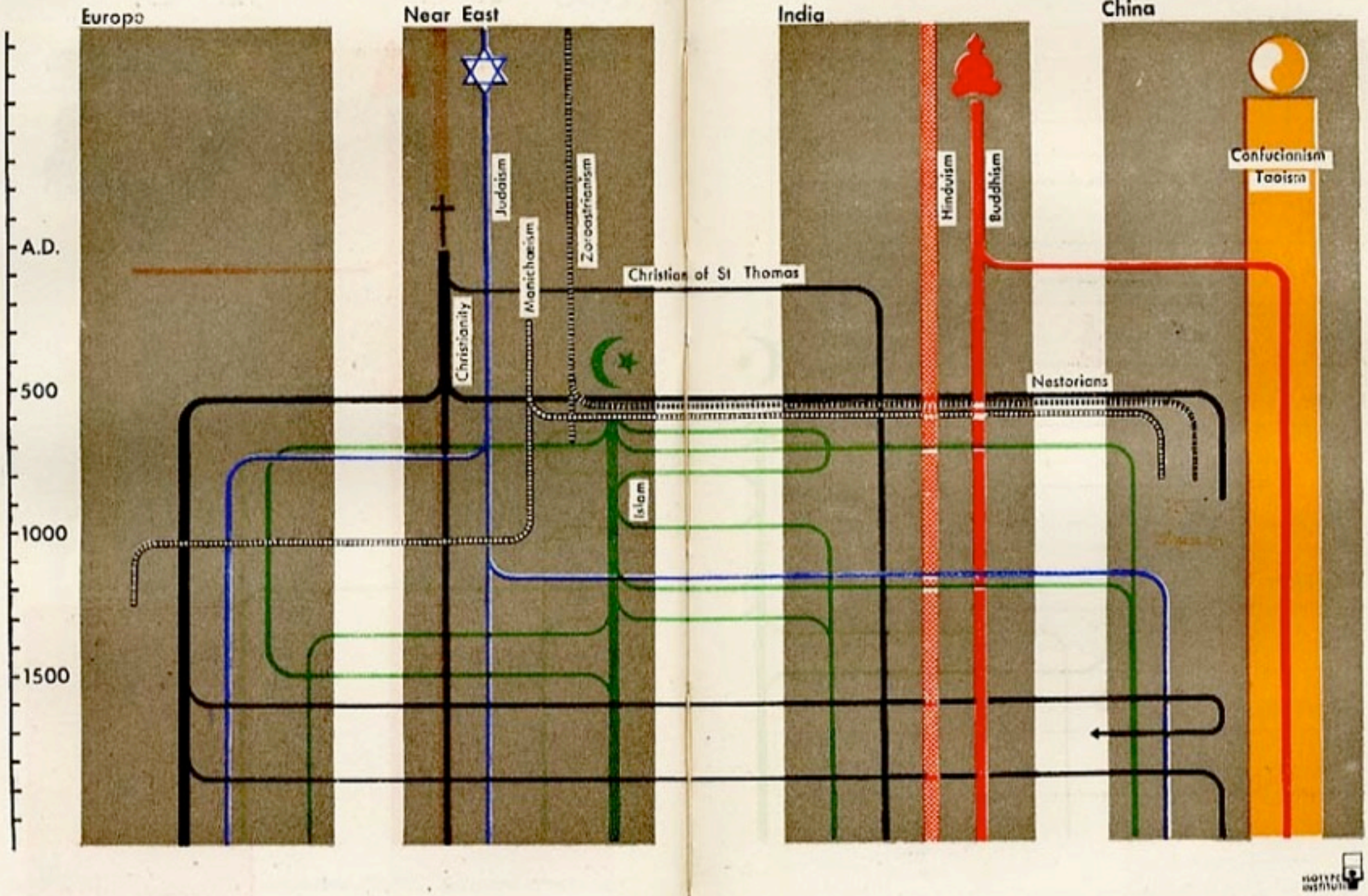
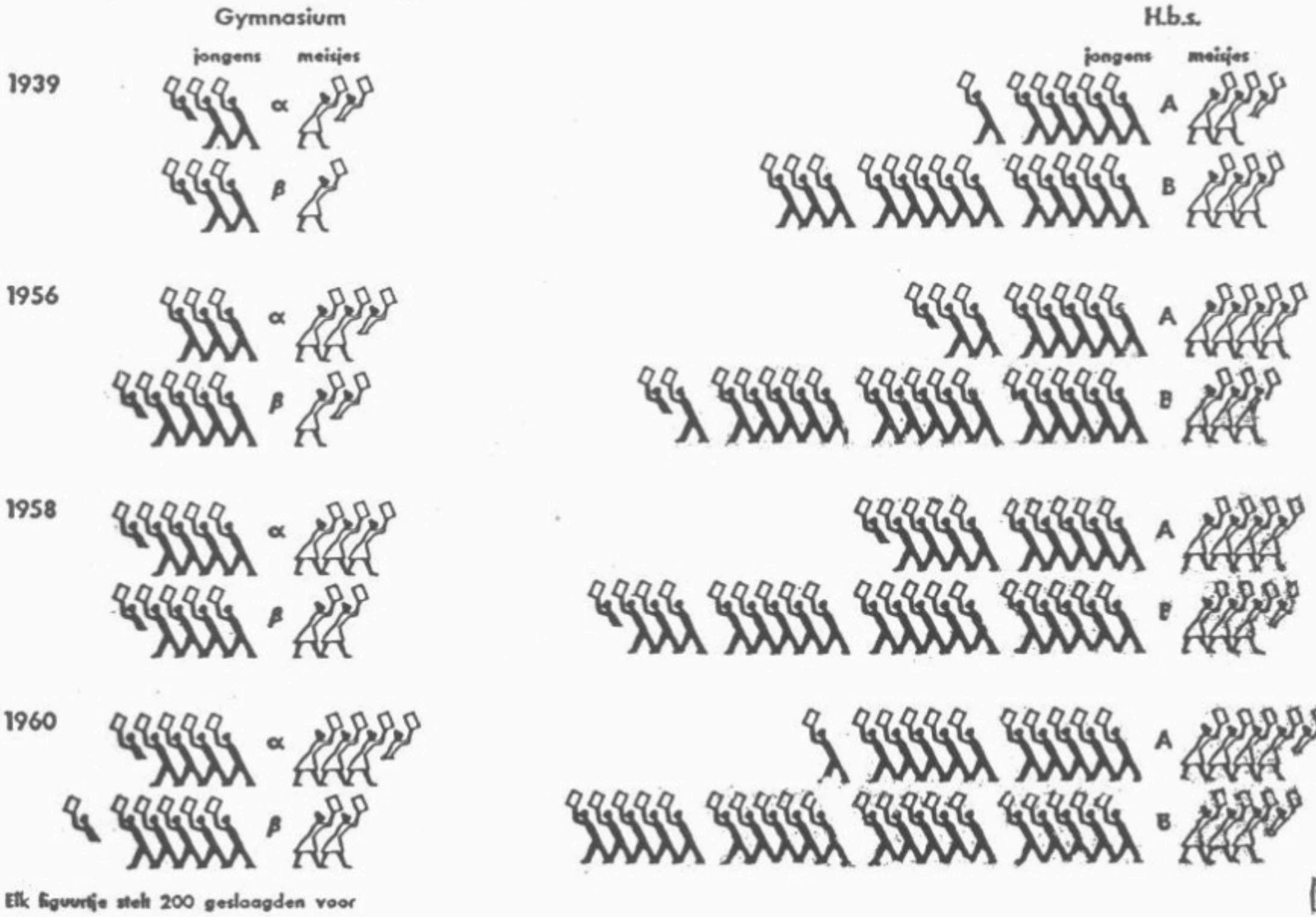


CHART 13

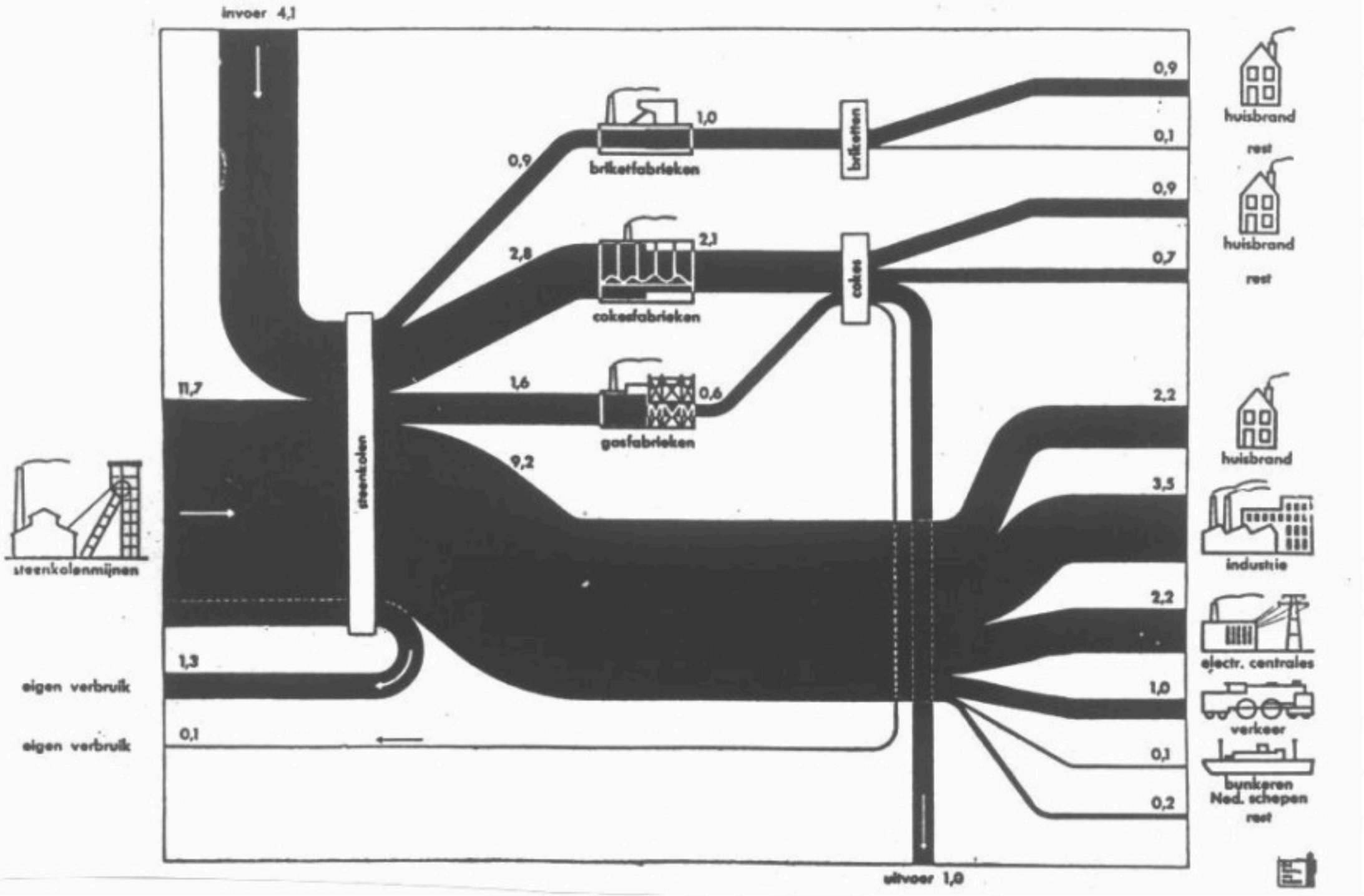
Otto Neurath with the Isotype Institute, Face to Face with China, 1945

Geslaagden eindexamens gymnasium en h.b.s.



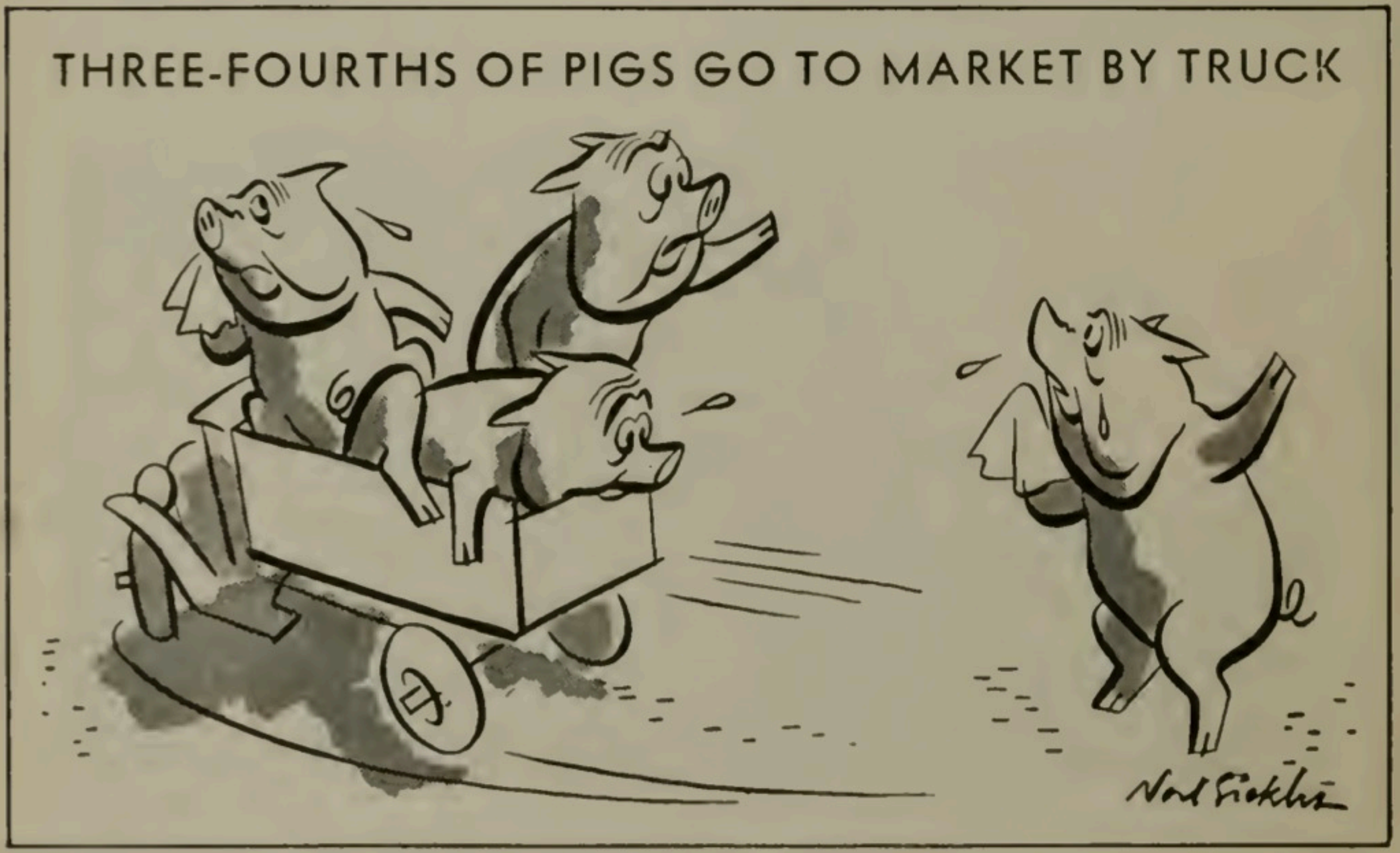
Gerd Arntz, Dutch Statistical Yearbook 1953–1962, 1963

Productie en verbruik van steenkolen, cokes en briketten in 1949 (in millioenen ton)



Gerd Arntz, Dutch Statistical Yearbook 1953–1962, 1963

ISOTYPE:
shortcomings and legacy



Automobile Manufacturers Association, "Automobile Facts," September 1938

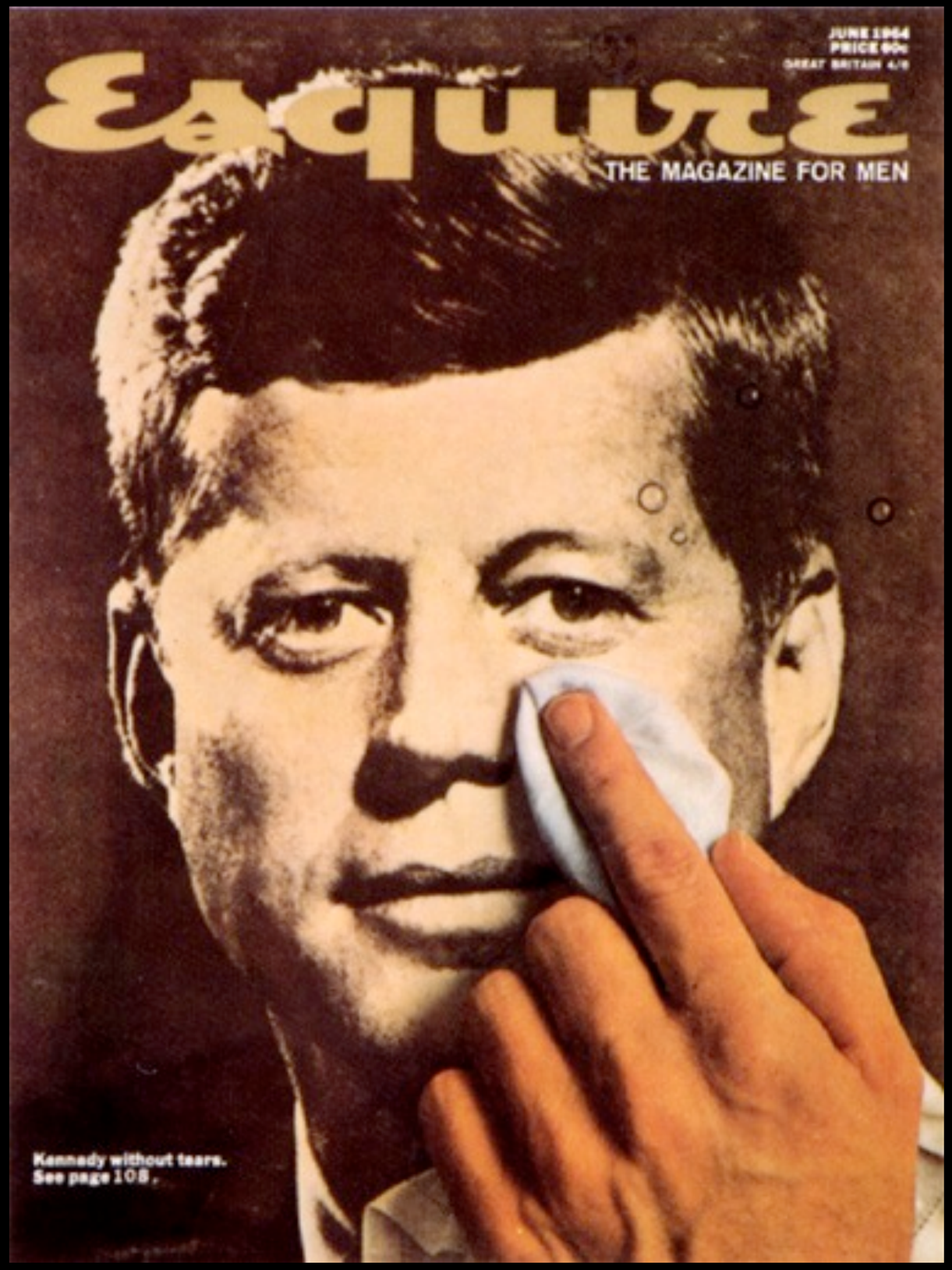
Automobile Manufacturers Association, 1938



Irene Fawkes, London Underground, 1929



Henry Wolf, Esquire Cover Design, 1952



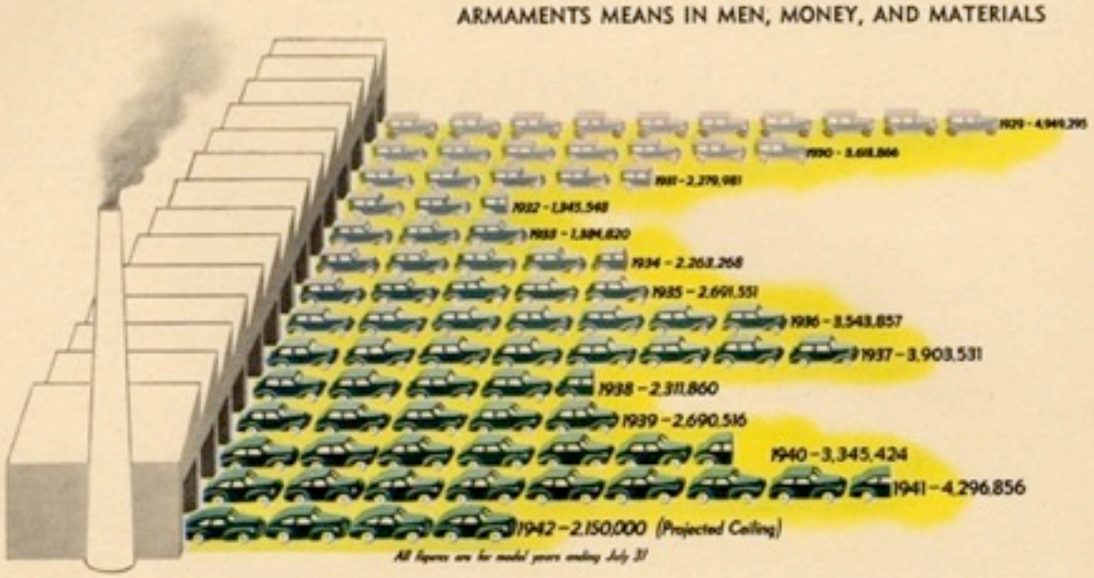
George Lois, Esquire Cover Design, 1964



Otto Storch, McCalls Spread, 1960

THE AUTOMOBILE INDUSTRY SHIFTS GEARS

WHAT THE CHANGE-OVER FROM PASSENGER CARS TO ARMAMENTS MEANS IN MEN, MONEY, AND MATERIALS



AGE OF CARS IN 1940



HOW MANY CARS ARE TWO MILLION?

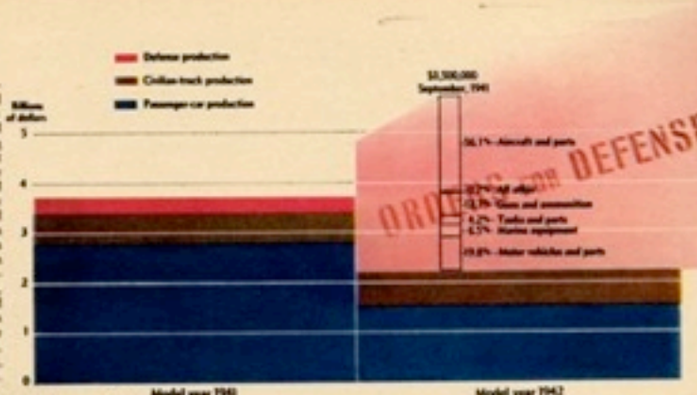
WHEN OPM announced that passenger-automobile production for the 1942 model year would be cut to half the previous year's, few citizens had a clear conception of what that meant in terms of past performance. The chart above provides a frame of reference wherein it plainly appears that 1942 will see fewer new motorcars than any other year since 1933, although 1938 only topped it by a small margin. The chart also traces the undulating wave of U.S. prosperity; the boom of 1929 and the recovery boom of 1937, each followed by an abrupt drop in automobile production. Undoubtedly 1941 would have been followed by some recession—perhaps to 3,500,000—due to panicky overbuying of new cars. As things stand, the proposed 2,150,000 year is merely a ceiling. If shortages of critical materials become more acute, production may be shut off entirely.

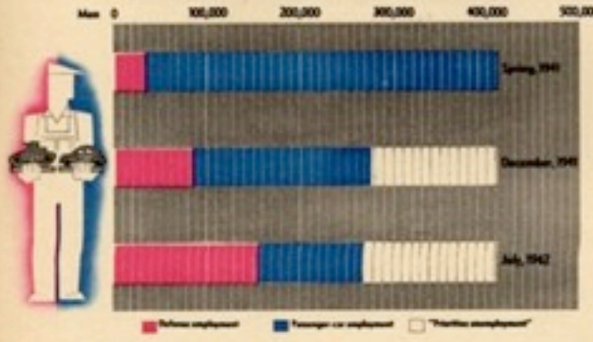
HOW OLD IS AN OLD AUTOMOBILE?

THE chart at the left illustrates the age groups of automobiles on the road in 1940, the latest year for which statistics have been tabulated. Most striking is the heavy proportion of models 1936 and 1937 (ages three to five), constituting 25 per cent of the total. As shown in the sketch at the top of the page, that group includes the survivors of two particularly heavy production years. Equally conspicuous is the meager residue of the lean years 1932-33 (ages seven to nine), followed by a hardy band of old-timers. The nine-year-olds and older, including the record-breaking class of 1929, comprise one in four of all cars on the road. Generally it is the owners of the old cars, which go to scrap at the rate of around two million a year, who will be hardest hit by curtailment, since it will automatically brake the downward flow of used cars on which they depend for replacements.

ON HAND AND ON ORDER

THE chart at the right indicates how little defense production from the automotive industry is yet on hand and how much is still on order. In the model year of 1941—July 31, 1940, to July 31, 1941—the industry produced more than four million passenger cars worth nearly $5 billion plus nearly 800,000 commercial trucks worth almost $600 million. In the same period deliveries for defense amounted to only about $350 million mostly in trucks and marine equipment. In the model year of 1941-42 the story will be different with passenger-car production curtailed by at least 50 per cent. Estimated value of car production will be down to $2,500,000,000; civilian trucks will run around $650 million. Meanwhile, new plant construction and tooling, accomplished this year, should allow the industry to bite into its mounting military backlog. As indicated, that backlog stood at nearly $5 billion in early summer, had climbed by September to $5,500,000,000 and is still on the way up. Actual military production for the 1941-42 period is estimated at anywhere between $2 and $3 billion. But the automotive potential is far greater than that, given a shooting war with possible complete car curtailment.



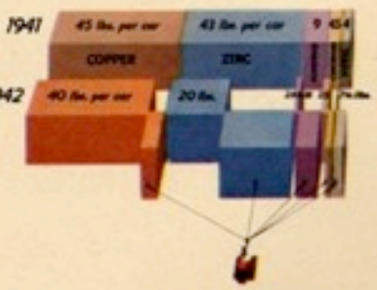


PASSENGER-CAR EMPLOYMENT AND DEFENSE

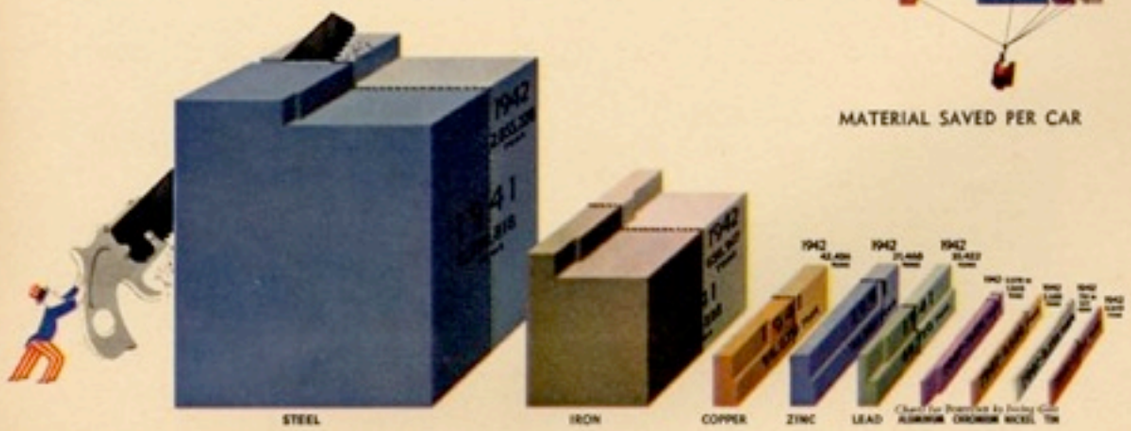
THE meaning of the charts at left is an ominous one: unemployment caused by curtailment of passenger-car production in eight major companies will not be counterbalanced by defense employment in the auto industry even by July of 1942. The "priorities unemployment" that will result promises so much hardship for the automobile country that President R. J. Thomas of the United Automobile Workers Union has been talking of "ghost towns." Meanwhile the automobile companies count on a troubled labor lobby to drum up new war orders for silent Michigan factories. Assuming a forty-hour work week, a 50 per cent auto curtailment for the big companies, and a 30 per cent cut for the small companies, 137,274 men will be displaced by December of this year, as the second bar chart shows. By July of 1942 (see the bottom bar chart) the displacement will have swelled to 142,260. The assumption that underlies the figures for the bottom chart is that the large companies will be producing 25 per cent of their 1941 monthly passenger-car output and the small companies 50 per cent, all on a forty-hour week. A thirty-two-hour working schedule would naturally mean a shrinkage in labor displacement figures. Total suspension of passenger-car production would create such misery in the automobile country that it is virtually out of the question unless England and the U.S. face a debacle.

SHORT OF MATERIALS, THE AUTOMOBILE GOES ON HUNGER RATIONS

IF 2,150,000 passenger automobiles are produced in the 1942 model year (the top number now indicated) they will contain 3,700,000 tons less of critical materials than did the automobiles of 1941. Of that total 3,505,000 tons represent iron and steel saved, the remaining 195,000 tons represent copper, nickel, aluminum, zinc, etc. While that saving was mostly due to curtailment, it reflects also the ingenuity of the engineers who designed the new cars with substitute materials long before curtailment was invoked. Indeed, their savings alone amounted to 43,000 tons—an average of forty pounds per car, as depicted in the inset sketch at the right (and explained on pages 196 to 199). Least success was achieved with copper, since no other material has been found for radiators and electric wiring. In fact a shortage of copper offers the most imminent danger of a complete shutdown of automobile production.

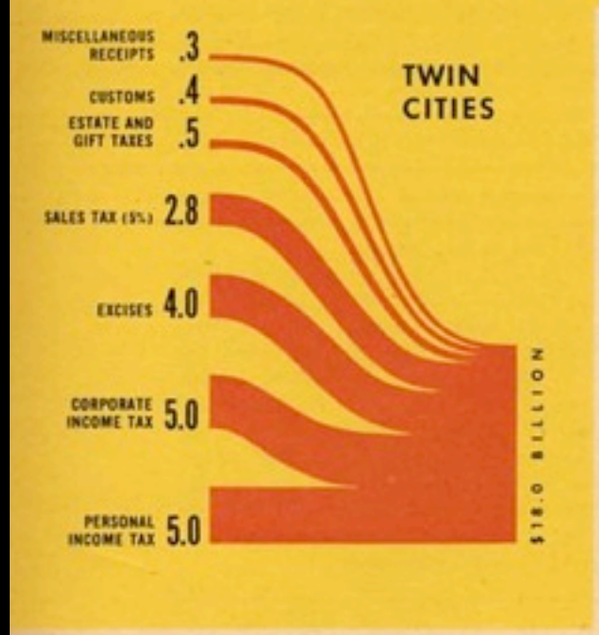


MATERIAL SAVED PER CAR

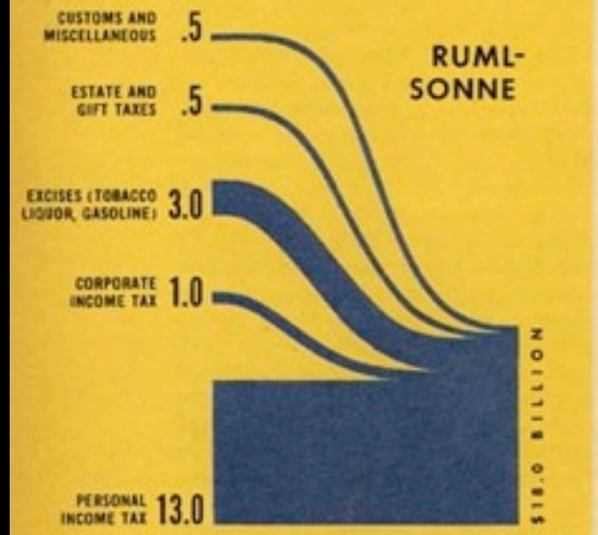


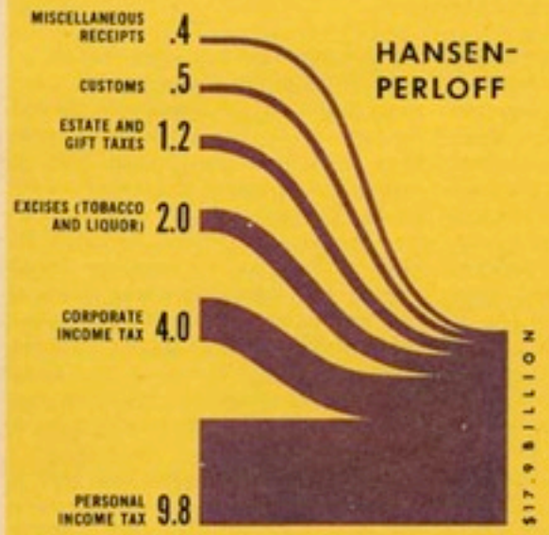
Irvine Geis, Automobile Industry shifts gears (Fortune Magazine), 1941

FOUR TAX PLANS (ALL FIGURES IN BILLIONS)

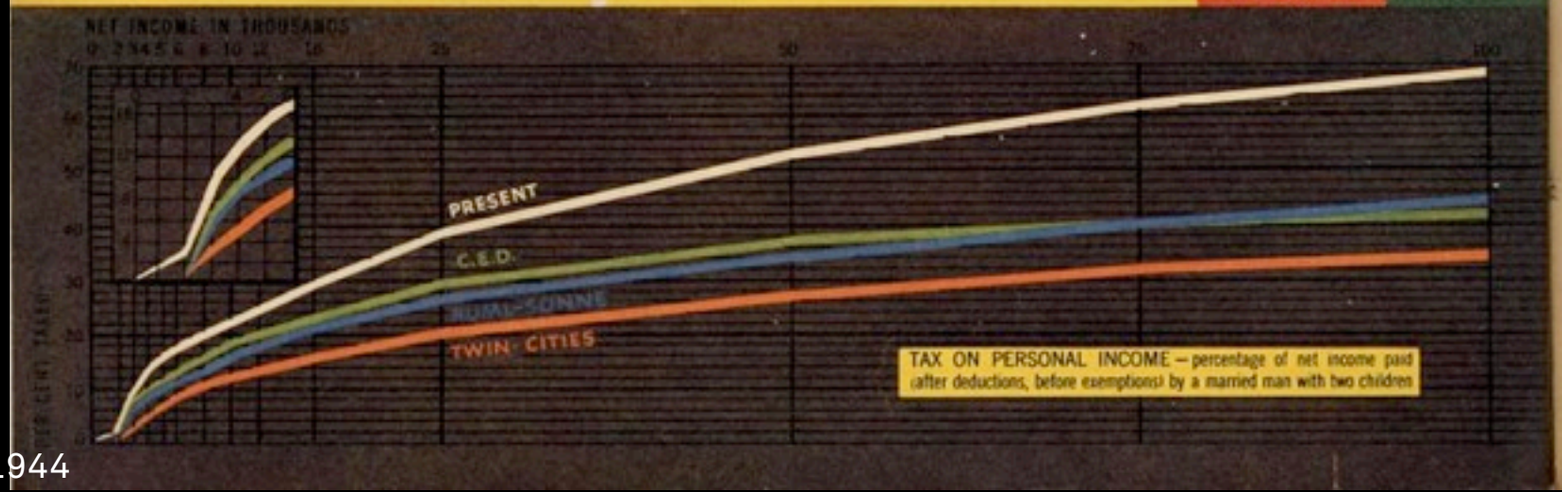




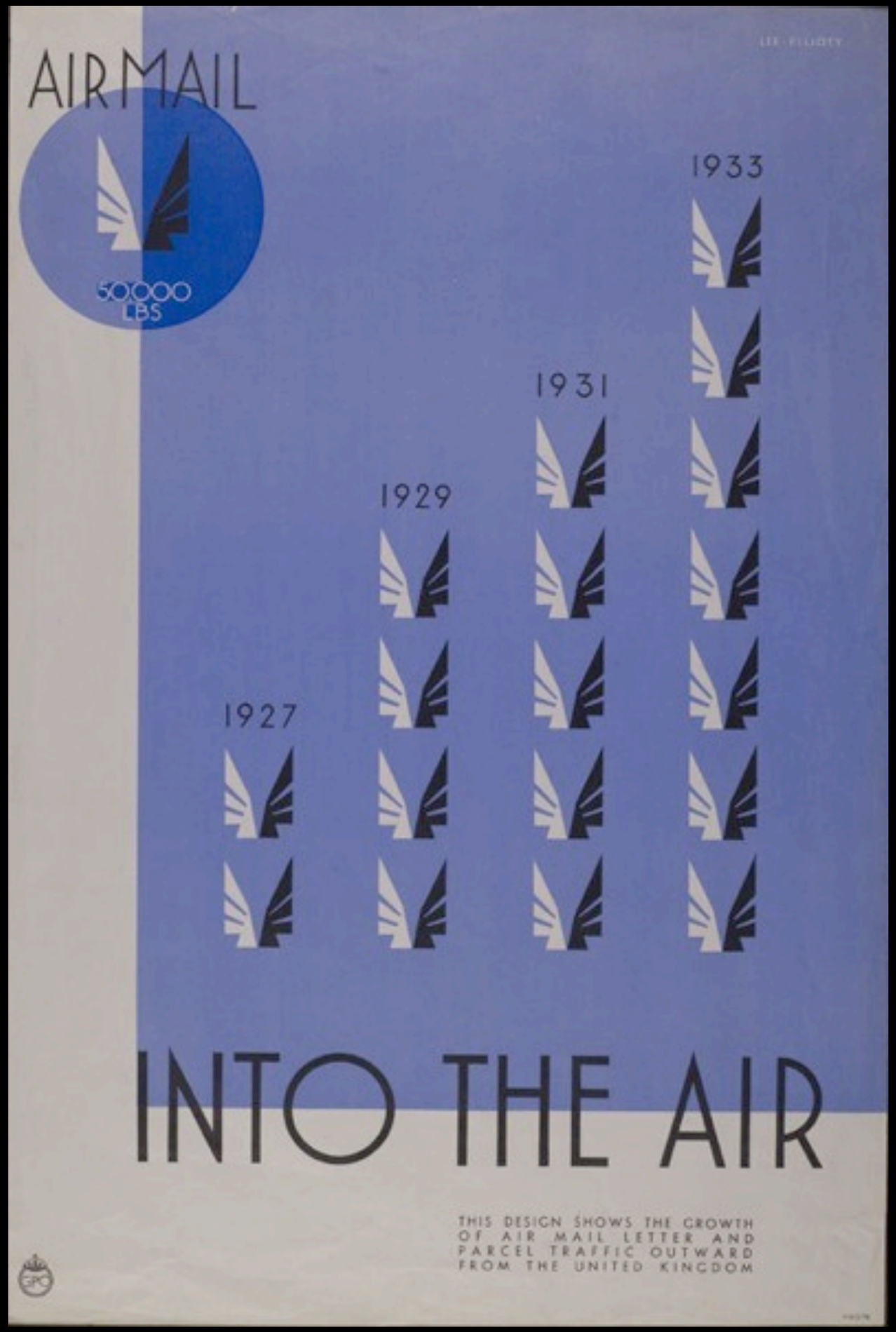








Irvine Geis, Tax Plans (Fortune Magazine), 1944



Theyre Lee-Elliott, Airmail-poster, 1939

A Twentieth Century Fund Survey

USA

IN NEW DIMENSIONS

THE MEASURE AND PROMISE OF AMERICA'S RESOURCES

by THOMAS R. CARSKADON *and* GEORGE SOULE *Graphics by* RUDOLF MODLEY

Thomas Carskadon Georg

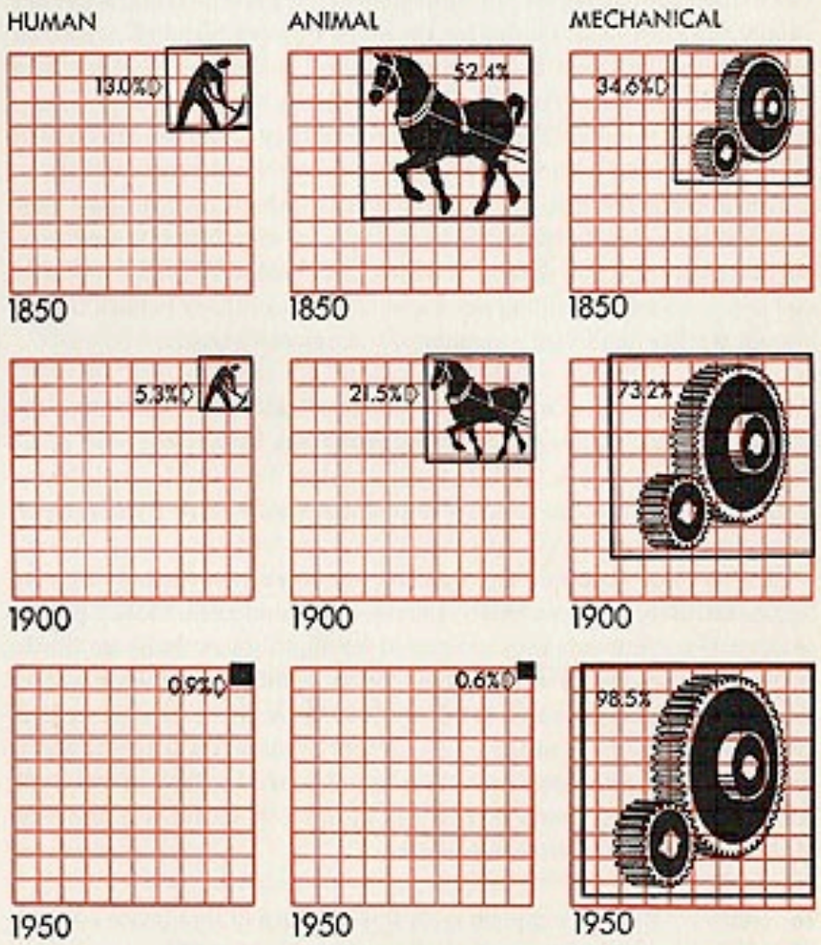
as many workers. Allowing for the shorter work week of 1950, we used less than five times as large an actual input of human energy—which means a nearly sixfold increase in productivity.

But we used 74 times as much nonhuman energy. In other words, one man with today's power-driven mechanical equipment can do as much work in 40 hours as three men working 70 hours a week with the primitive tools of a century ago.

A Recurring Theme

There is the central principle of our success, the secret of our phenomenal rise in productivity. We shall encounter the results of this principle many times as we look into every part of our entire economic system to get the full aspect of America's new dimensions.

Work Output of Sources of Energy



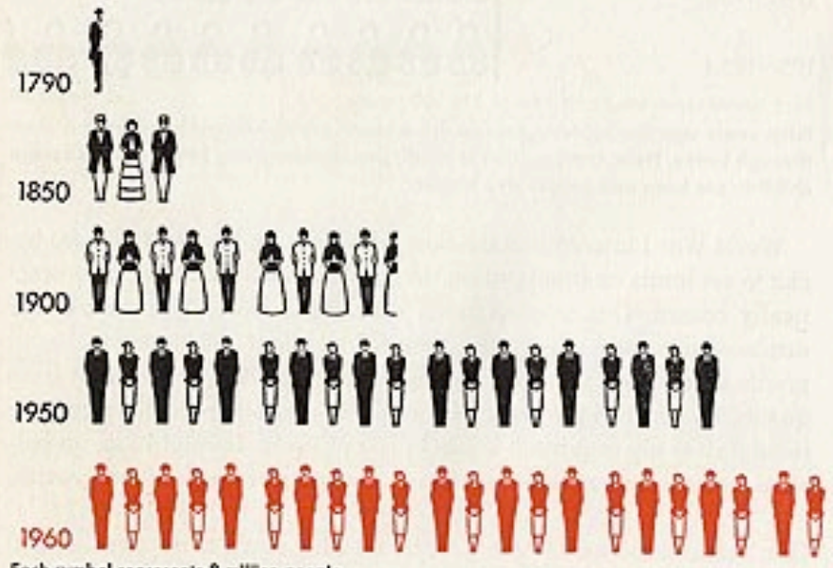
Back in 1850 men and animals did most of the work. Today, most of the work is done by inanimate machines fed with oil, coal or natural gas.

The American People

In the broadest sense, our nation consists of its people. What happens to our people—how many of us there are, how old we are, the rates at which we are born, die, marry, get divorced or have babies—vitally affects us all.

Throughout our history we have always grown rapidly in population. We faltered only once—during the long depression of the 1930s—but our growth speeded up again in the first years of World War II and expanded further with the "baby boom" of the late 1940s and 1950s. Today we face a new outlook and new dimensions in the number of our people.

Population Growth



Each symbol represents 8 million people

In its first hundred years, the country's population doubled about every 25 years. After that, population grew more slowly. Since World War II it has been growing faster again.

Thomas Carskadon George Soule, usa in new dimensions, 1957

UNDERGROUND
MAP OF ELECTRIC RAILWAYS OF LONDON

REFERENCE

DISTRICT RLY.
LONDON ELECTRIC RAILWAY — BAKERLOO LINE; PICCADILLY LINE; HAMPSTEAD LINE
METROPOLITAN RLY.
CITY & SOUTH LONDON RLY.
CENTRAL LONDON RLY.
EAST LONDON RLY.
BAKERLOO LINE & L.&N.W.R.
INTERCHANGE STATIONS

TO PINNER, BUSHEY AND WATFORD
TO UXBRIDGE
TO HARROW & UXBRIDGE
M.E. TRAMS TO FINCHLEY
MOTOR BUS TO MUSWELL HILL
M.E. TRAMS TO FINCHLEY AND BARNET
M.E. TRAMS TO WOOD GREEN, ALEXANDRA PALACE, NEW SOUTHGATE, ENFIELD AND TOTTENHAM AND WALTHAM CROSS
TO BROMLEY, UPTON PARK, PLAISTOW, EAST HAM, BARKING & SOUTHEND

Golders Green
MOTOR BUS TO ST. ALBANS, HENDON AND KILBURN
Preston Rd.
Wembley Park
South Harrow
Sudbury Hill
North Wembley
Neasden
Dollis Hill
Sudbury Town
Wembley for Sudbury
Willesden Green
Kilburn
Brondesbury
Hampstead
Belsize Park
West Hampstead
Finchley Rd.
Chalk Farm
Tufnell Park
Kentish Town
South Kentish Town
Highgate
Finsbury Park
Gillespie Rd.
Holloway Rd.
Caledonian Road
Drayton Park
Highbury
Alperton
Stonebridge Park
Harlesden
Willesden Junction
Kensal Green
Queen's Park
Kilburn Park
Swiss Cottage
Camden Town
Marlboro Road
Mornington Crescent
York Rd.
Essex Road
Park Royal
Maida Vale
St. John's Wood Road
Euston for L.&N.W.R.
Gt. Portland Street
Baker St.
Angel
Kings + for G.N.R.
City Road
Mile End
Bow Road
Old St.
Shoreditch
Stepney Green
Whitechapel
Shadwell
Wapping
Rotherhithe
Surrey Docks
North Ealing
Ealing Broadway
Ealing Common
East Acton
Westbourne Park
Warwick Avenue
Maryleboro' for G.C. & G.N.
Edgware Rd.
Ladbroke Grove & N. Kensington
Royal Oak
Paddington
Oxford Circus
Keppel's Park
Tottenham Court Rd.
Goodge St.
British Museum
Warren St.
Euston
Russell Sq.
Chancery Lane
Farringdon St.
Aldersgate
Liverpool St for G.E.R. & G.N.R.
St. Mary
Aldgate East
Aldgate
Mark Lane
Monument
Tower
Bank
Post Office
Mansion House
Cannon St.
Blackfriars
Holborn
Temple
Strand
Covent Garden
Leicester Square
Piccadilly Circus
Bond St.
Marble St.
Queen's Rd.
Lancaster Gate Arch
Bayswater
Hammersmith Rd.
Notting Hill Gate
Uxbridge Rd.
Holland Park
Wood Lane
L.U. TRAMS TO HANWELL, SOUTHALL, HAYES AND UXBRIDGE
L.U. TRAMS TO HANWELL, SOUTHALL, HAYES AND UXBRIDGE
Acton Town
South Acton
Goldhawk Rd.
Shepherd's Bush
Turnham Green
Ravenscourt Park
South Ealing
Northfields
Chiswick Park
Boston Manor
Gunnersbury
Stamford Brook
Addison Rd.
Earls Court
Hammersmith
High St. Knightsbridge
Hyde Park Corner
Brompton Rd.
Down St.
Dover St.
Trafalgar Square
Westminster
Charing Cross for S.E.&C.R.
Waterloo for L.S.W.R.
Lambeth (North)
London Bridge for S.E.&C.R. & L.B.&S.C.R.
Borough
Elephant & Castle
St. James' Park
Victoria for L.B.&S.C.R. & S.E.&C.R.
Sloane Square
South Kensington
Gloster Road
Barons Court
West Kensington
West Brompton
Walham Green
Parsons Green
Putney Bridge
East Putney
Southfields
Wimbledon Park
Wimbledon
Kennington (New St.)
Oval
Stockwell
Clapham Road
Clapham Common
New Cross
L.B.&S.C.
S.E.&C.

MOTOR BUS TO BARNES AND EAST SHEEN, L.U. TRAMS TO BRENTFORD, ISLEWORTH, HOUNSLOW, TWICKENHAM & HAMPTON COURT
MOTOR BUS TO BATTERSEA, CLAPHAM JUNC. & STREATHAM
L.U. TRAMS TO TOOTING, KINGSTON, & HAMPTON COURT. MOTOR BUS TO TOOTING AND MERTON PARK
MOTOR BUS TO BALHAM, MITCHAM, BELMONT & DORKING
MOTOR BUS TO SLOUGH & WINDSOR
MOTOR BUS TO TWICKENHAM & KINGSTON
Osterley
Hounslow Town
Heston Hounslow
Hounslow Barracks
Richmond
Kew Gardens

THROUGH ORDINARY TICKETS.

The Underground Railways are treated as a whole, and tickets are sold at any station to all other stations on the system to which there is a reasonable and convenient route. When two or more routes are available, passengers are in many cases given a choice on the one ticket.

SEASON TICKETS.

Central Offices for the sale of Season Tickets are open at :—

CITY OFFICE. Garlick Hill (adjoining Mansion House Station).

WEST END OFFICE. Argyle Street, W.C. (adjoining Oxford Circus Stn.)

Office Hours, Monday to Friday, 9 a.m. to 5 p.m.; Saturday, 9 a.m. to 1 p.m.

LOST PROPERTY

The Offices at which enquiries in connection with lost articles should be made are situated as follows :—

DISTRICT RAILWAY . . . . . Victoria Station.
CENTRAL LONDON RLY., CITY & SOUTH LONDON RLY., LONDON ELECTRIC RLY. (Bakerloo, Piccadilly, Hampstead Lines) . . . . . Argyle St., W.C. (adjoining Oxford Circus Station).

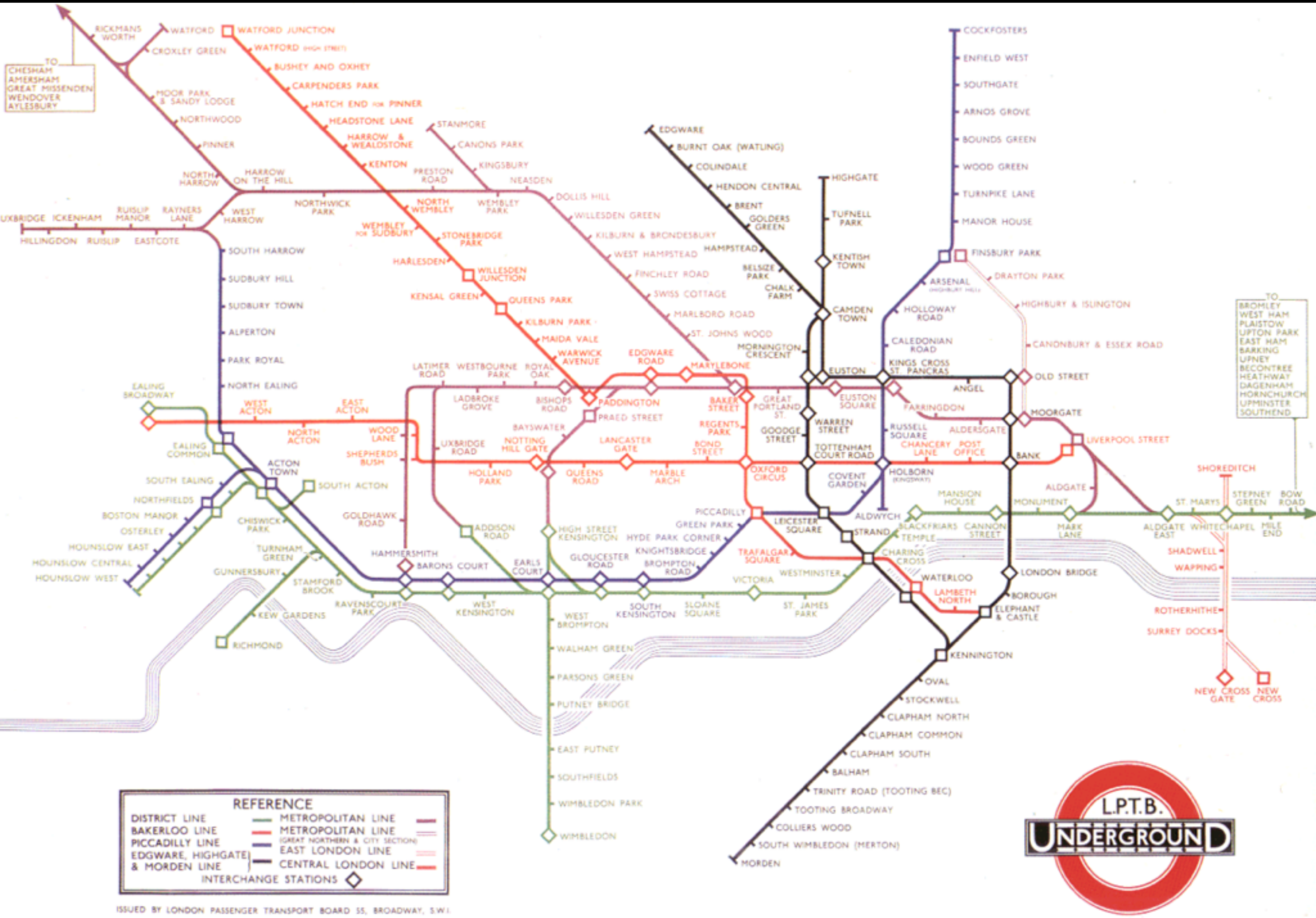
MacDonald Gill 1920

TRAIN SERVICES

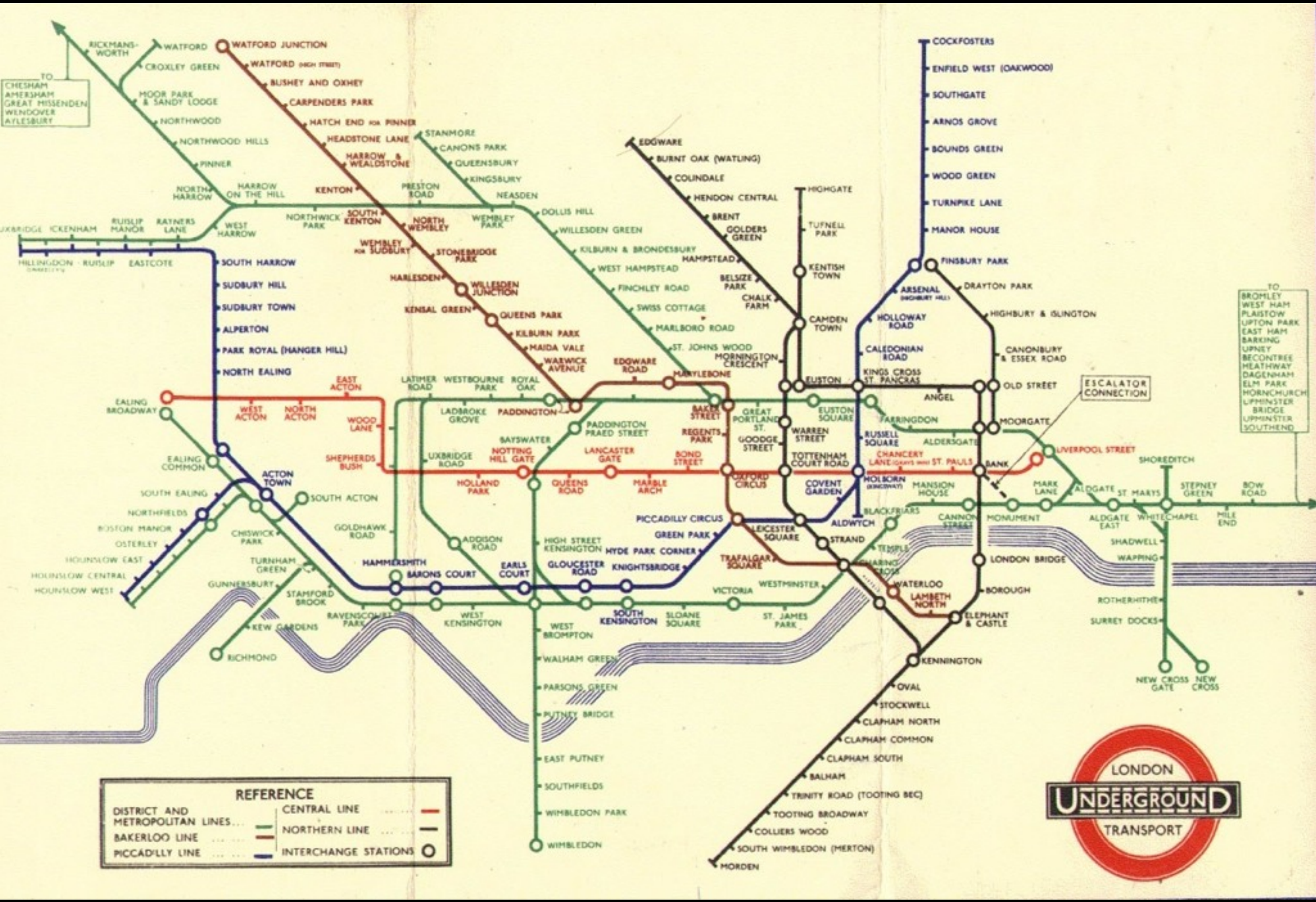
DISTRICT RAILWAY. At intervals of 6–8 minutes to all outgoing termini
First trains about 5 after 4 a.m. Last train about 12.30 a.m.
PICCADILLY RAILWAY. Interval of 2½ minutes
First train about 5 a.m. Last train about 12.30 a.m.
BAKERLOO LINE. LOCAL trains run at 2½ minutes interval.
First train about 5 a.m. Last train about 12.30 a.m.
Trains to Watford every ¼ hour Weekdays & every ½ hour Sundays
First train about 5 a.m. Last train (from Watford) 10.45 p.m.
Last train (from E. & C.) 11.15 p.m.
HAMPSTEAD LINE. Trains every 3 minutes.
First train south 5.30 a.m. Last train 12.40 a.m.
First train north 5.30 a.m. Last train 1.0 a.m.
CENTRAL LONDON RAILWAY (Wood Lane to Liverpool St.) Every 2 minutes.
First train west 5.50 a.m. Last train west 12.30 a.m.
First train east 5.20 a.m. Last train east 12.0 mid.
(Ealing Broadway & Liverpool St.)
First train from Ealing 6.0 a.m. Last train from Ealing 12.9 a.m.
First train from Liverpool St. 5.50 a.m. Last train from Liverpool St. 12.15 a.m.
CITY & SOUTH LONDON RAILWAY. Interval 2 minutes.
First train about 5.4 a.m. northbound. Last train about 11.13 p.m. northbound
First train about 5.15 a.m. southbound. Last train about 11.35 a.m. southbound

The Company cannot be responsible for the exact adherence to the times of trains stated above though every effort will be made to keep them.

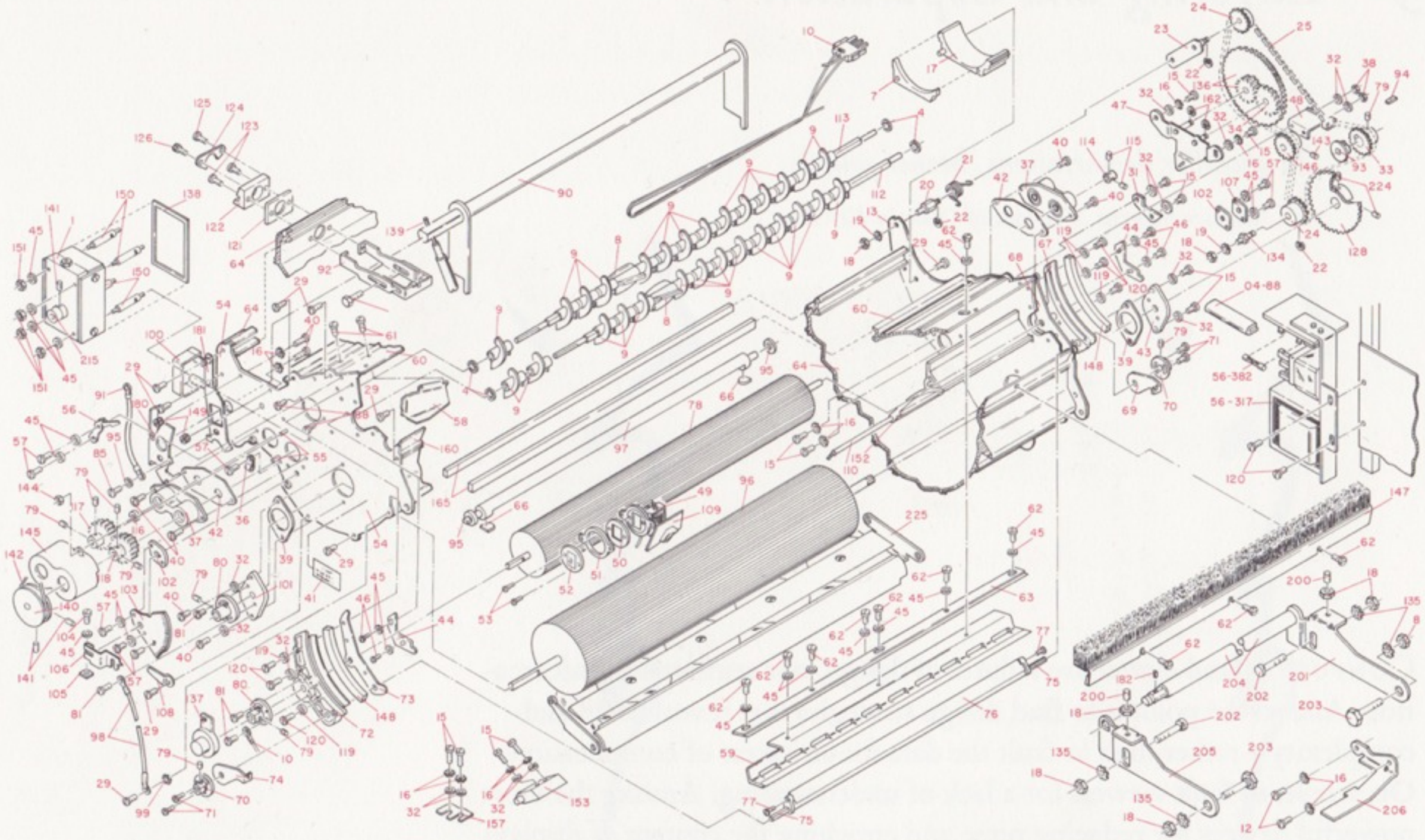
London Tube Map, 1921



Henry C. Beck, London Tube Map, 1933

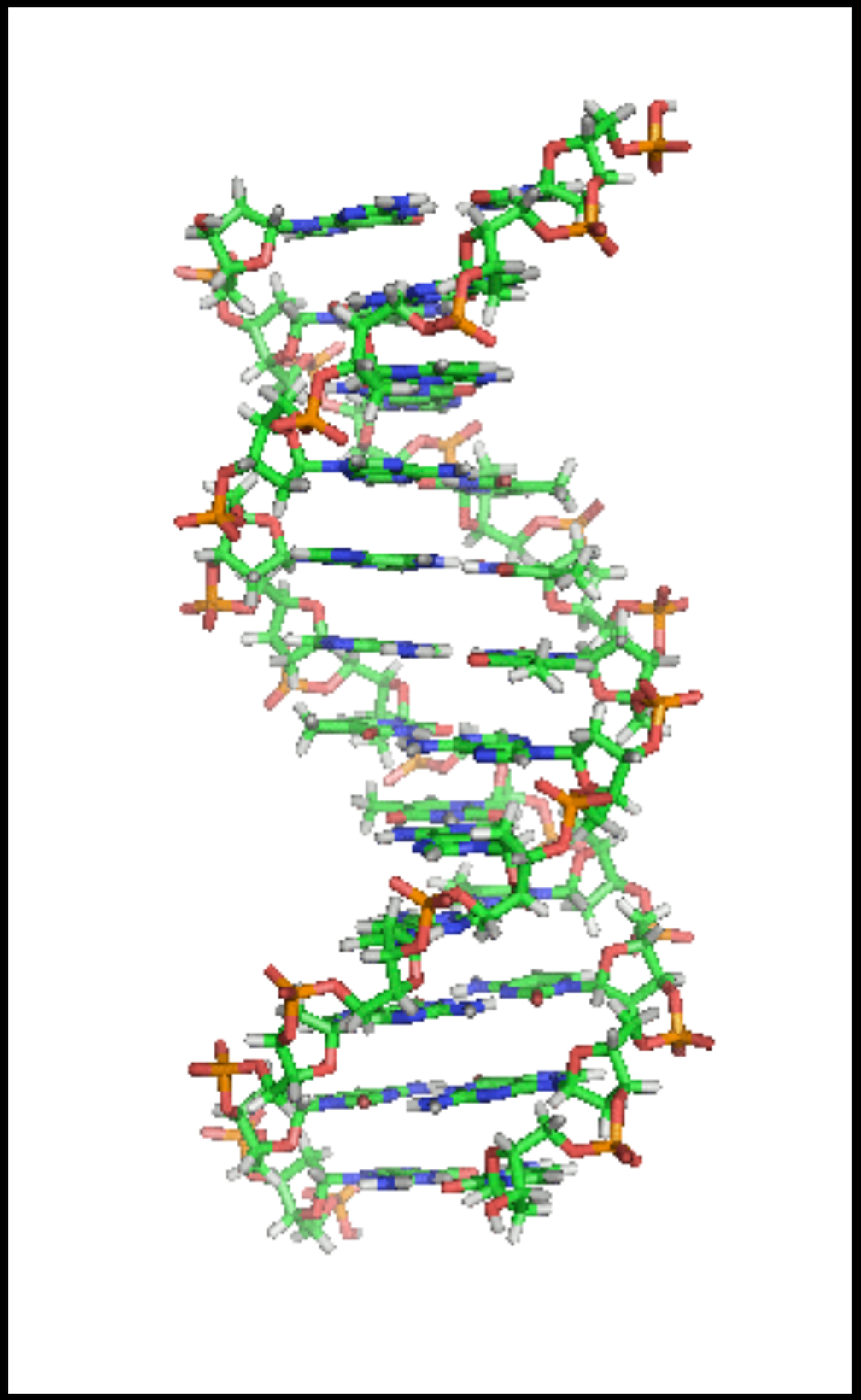


Henry C. Beck, London Tube Map, 1938



IBM Series III Copy machine, 1976

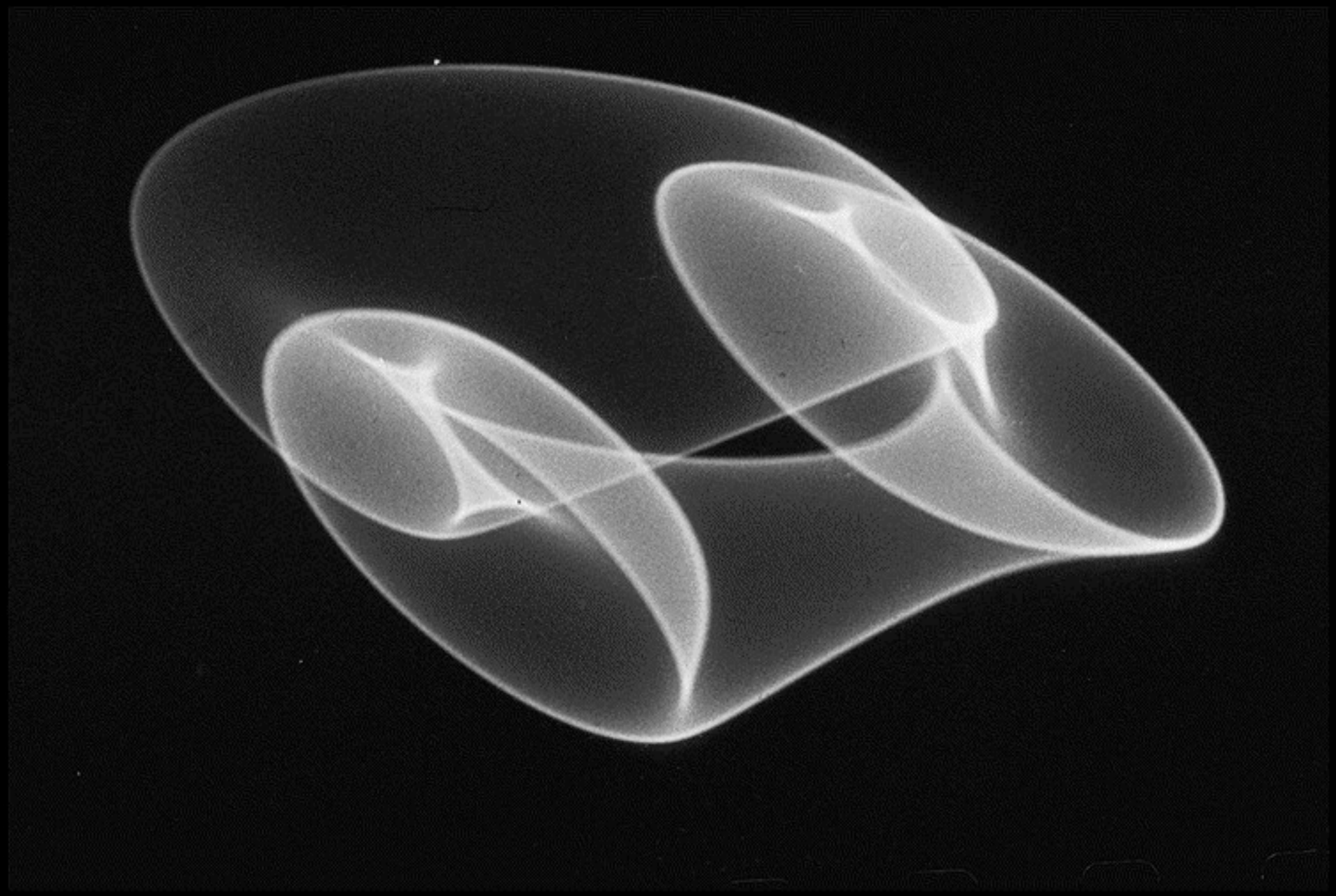
VISUALIZING NATURE



DND Double-Helix as discovered by James D. Watson and Francis Grick, 1953

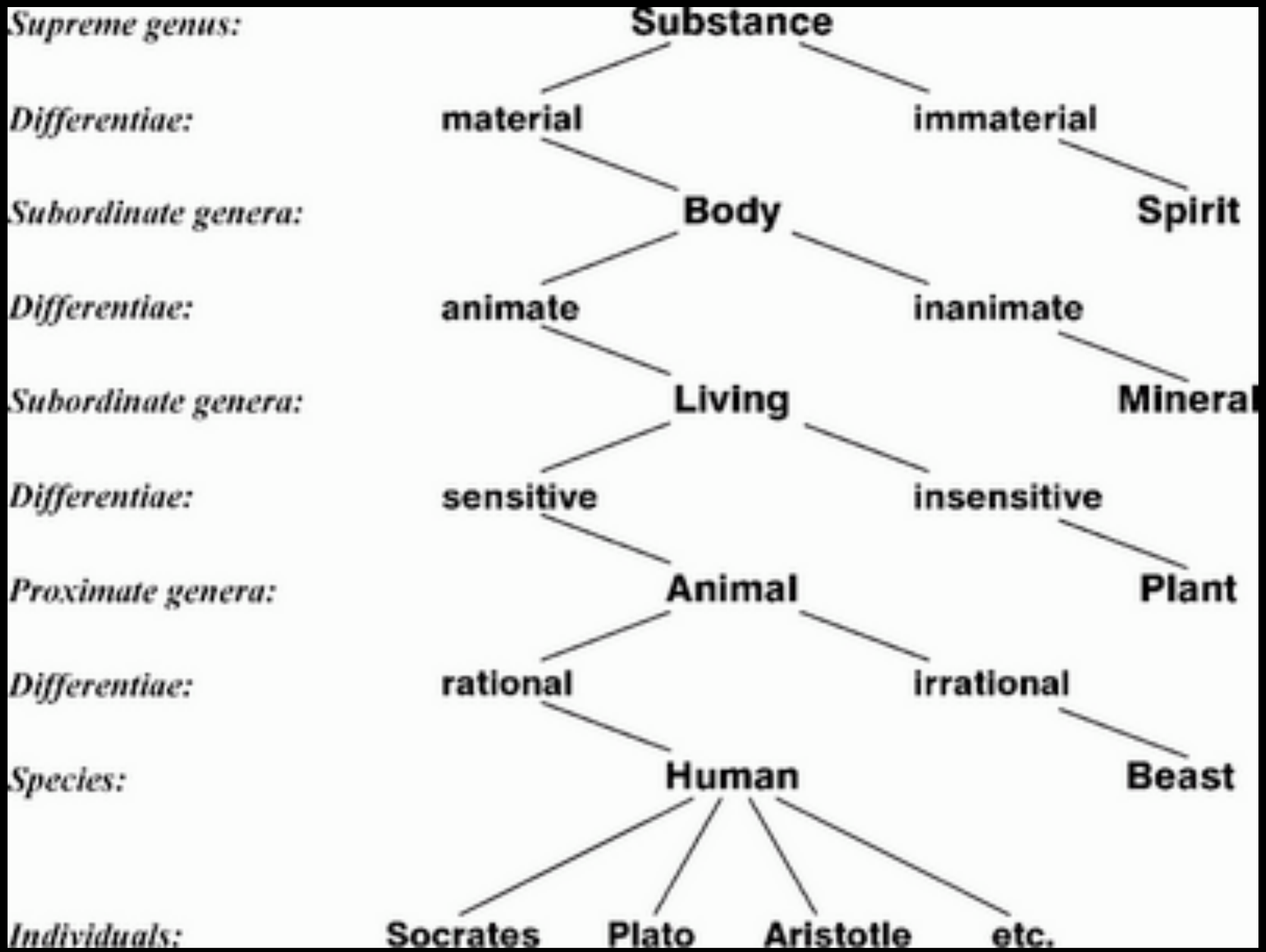


The earth from Apollo 17, 1972

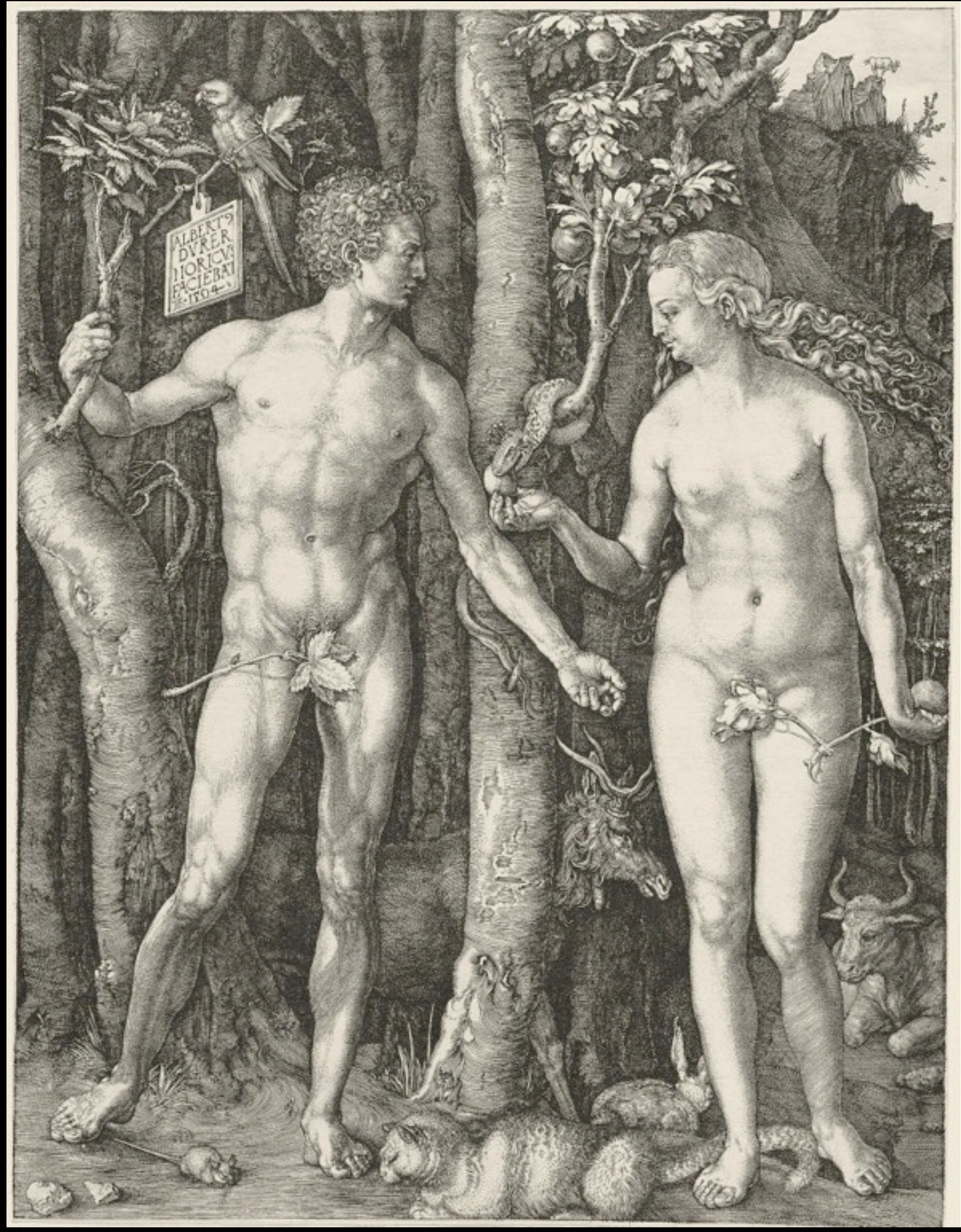


Herbert W. Franke, Computer graphics, 1956

TREES
&
NETWORKS



Porphyry, The porphyrian tree (metaphorical tree of knowledge), ca. 300 AD

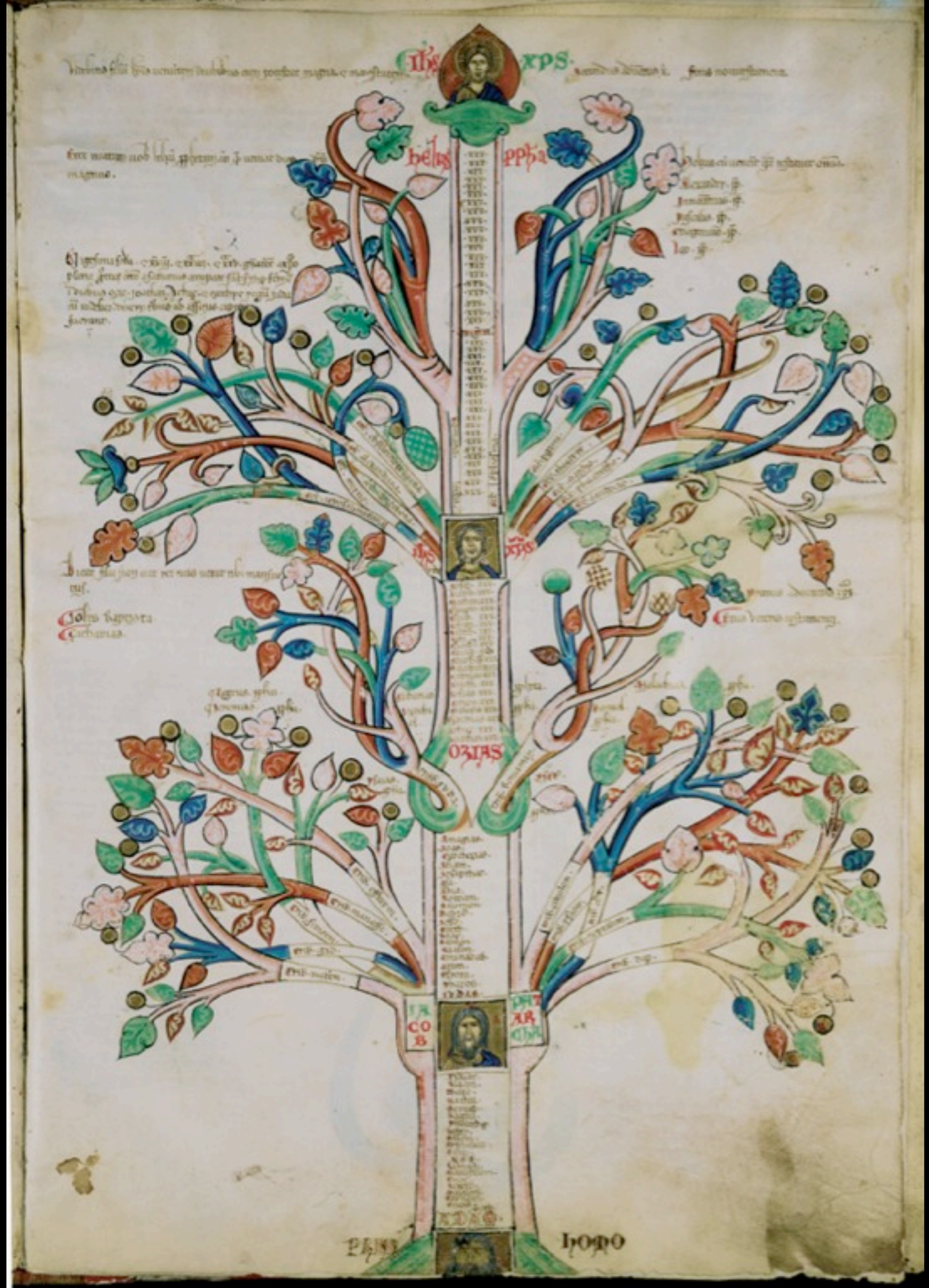


Albrecht Dürer, Adam und Eva, 1504

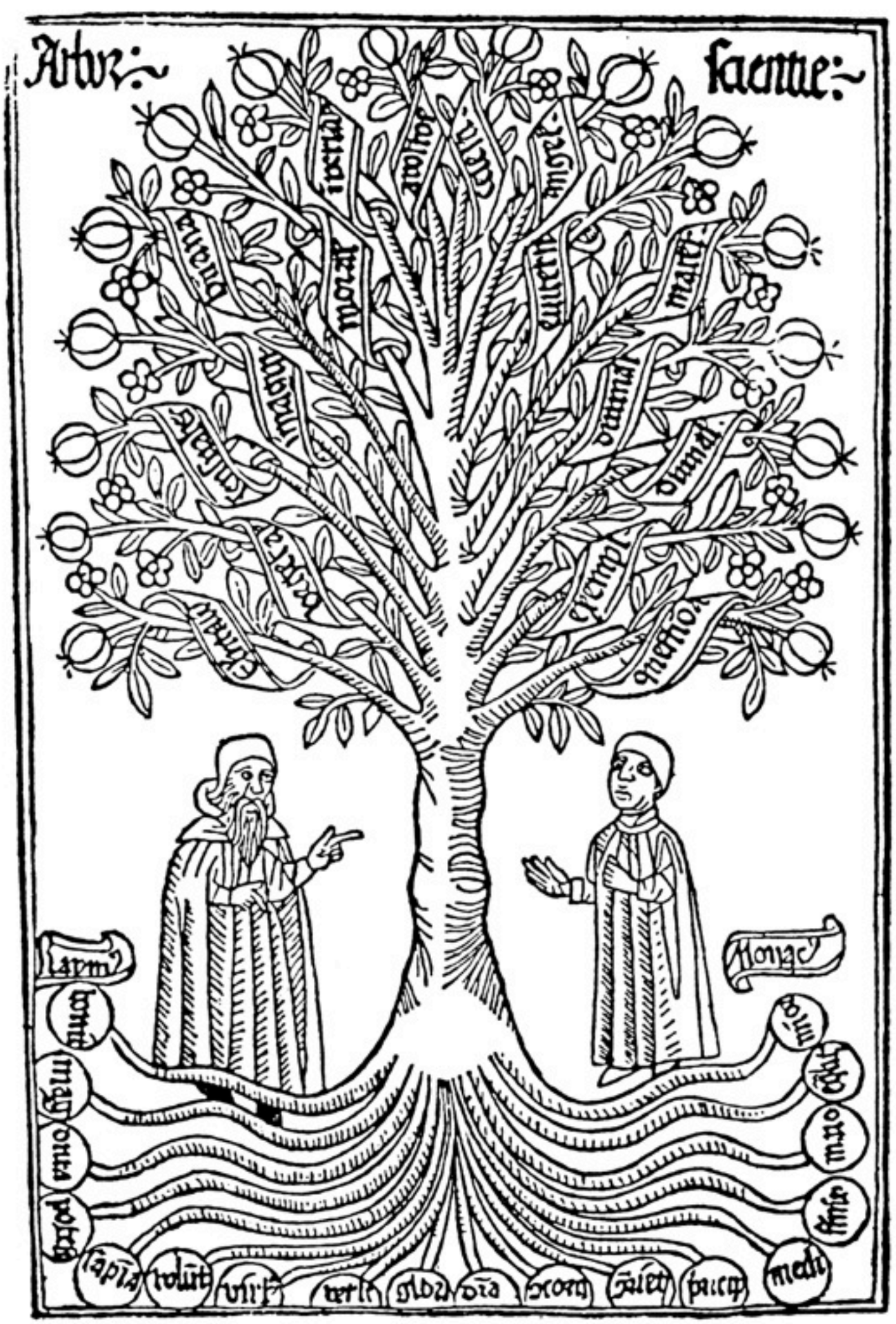
second Coming

Redemption

The first coming



Joachim of Fiore, The tree of the two Advents, 1202



Ramon Llull, Arbor scientiae, 1296

Geome
trie trai
cte de

magnitude ou grandeur

ou fault considerer

ligne

simple

droite

circonferẽce ronde

oblique ou courbe

tortuë

droit

angulaire ou perpendiculaire

double

equidistante ou parallele

angle

obtus

oblique

agu

& diuision

affections

figure

les parties

centre ou poinct

circonference

le reiglet

diametre

altitude

ordonnee

premiere

raison des isoperimetres

lineament

auquel on considere les

de ligne droite

les affections de

simple

rationale

figure

ronde

proportiondes premieres

double en

similitude

triangle

orthogone

obligone

obliquãgle

oxygone

quarré

longuet

rectangle

remplissage de lieu

plate

triangulaire

quadrãgle

parallelogramme

multangle

trapeze

obl quangle

rhombe

rhomboide

superfice ou la plaine

oblique

le cercle

secteur

circulaire

demicercle

cube

boſſue

conique

section

diuerſe

lõgue & rõde

inegalau dem cercle

rectangle

longuet

pyramide

terracedrõ

pentacedre

parallelepipede

rhombe

plat

obliquãgle

prisme

hexacedron

Trapeze

romboide

pyramidale

cõpoſé des pentaedres

polyedre

octocedron

corps

triangle

icoſedron

polyedre meſl. ordonnede

base

quinquangle

dodecedron

sphere

boſſu

cone

diuers

especes ou differences

Naturele ou commune & cognue preſque de tous

communes ſentences

& de la meſure

ou ſe rapportent les

demandes

Arithmetique

Propoſitions ou theoremes qui enſeignent de faire & comparer enuers la meſure, ce qui tombe & aduient ſur elle

Christophe de Savigny, Tableaux accomplis, 1587

KNOWLEDGE, is either

I. *Natural* and *Scientifical*, which is either

Sensible; consisting in the Perception of Phænomena, or External Objects—called PHYSIOLOGY, or NATURAL HISTORY; and which according to the different Kinds of such Objects, divides into
- METEOROLOGY [1].
- HYDROLOGY [2].
- MINEROLOGY [3].
- PHYTOLOGY [4].
- ZOOLOGY [5].

OR,

Rational; consisting in the Perception of the intrinsick Characters or Habitudes of sensible Objects—either

Their *Powers* and *Properties*—called PHYSICKS, and NATURAL PHILOSOPHY [6].

Abstracts thereof—called METAPHYSICS [7] which subdivides into
- ONTOLOGY.
- PNEUMATOLOGY.

Quantities thereof, called MATHEMATICS—which divides, according to the Subject of the Quantity, into
- ARITHMETIC [8]—whence
  - ANALYTICS [9].
  - ALGEBRA [10].
- GEOMETRY [11]—whence
  - TRIGONOMETRY.
  - CONICS.
  - SPHERICS.
- STATICS [12].

Relations thereof to our Happiness—called RELIGION, or the Doctrine of OFFICES, which subdivides into—
- ETHICS [13], or NATURAL RELIGION—whence
  - POLITICS [14].
  - LAW [15].
- THEOLOGY [16], or REVELATION.

OR,

II. *Artificial* and *Technical*, (consisting in the Application of Natural Notices to further Purposes) which is either

Internal; employ'd in discovering their Agreement and Disagreement; or their Relations in respect of Truth—call'd LOGICS [17].

OR,

External, which is either—

Real, employ'd in discovering and applying the—

Quantities of Bodies—call'd MIX'D MATHEMATICS; which according to the different Subjects resolves into

Further *Powers* and *Properties* of Bodies—called CHYMISTRY [18]—whence
- ALCHEMY.
- NATURAL MAGIC, *&c.*

OPTICS [19], CATOPTRICS, DIOPTRICS—whence
- PERSPECTIVE [20].
- PAINTING [21].

PHONICS—whence MUSICK [22].

HYDROSTATICS [23], HYDRAULICS.

PNEUMATICS [24].

MECHANICS [25]—whence
- ARCHITECTURE [26].
- SCULPTURE [27].
- TRADES [28], and MANUFACTURES.

PYROTECHNIA [29]—whence
- The MILITARY *Art* [30].
- FORTIFICATION [31].

ASTRONOMY [32]—whence
- CHRONOLOGY [33].
- DIALLING [34].

GEOGRAPHY [35], HYDROGRAPHY—whence
- NAVIGATION [36].
- COMMERCE [37].

Structure and *Oeconomy* of Organical Bodies—called ANATOMY [38].

Relations thereof to the Preservation and Improvement—either of

Animals—called
- MEDICINE [39].
- PHARMACY [40].

Vegetables—called
- AGRICULTURE [41].
- GARDENING [42].

Brutes—called
- FARRYING [43],
- MANAGE—whence
  - HUNTING.
  - FALCONRY.
  - FISHING, *&c.*

OR,

Symbolical, employ'd in framing
- *Words*, or Articulate Signs of Ideas—called GRAMMAR [44].
- *Figures*—called RHETORIC [45]—whence The making of *Armories*, called HERALDRY [46].
- *Fables*—called POETRY [47].

Ephraim Chambers, Cyclopaedia, 1728

*SYSTÊME FIGURÉ
DES CONNOISSANCES HUMAINES.

ENTENDEMENT.

MEMOIRE.

HISTOIRE

- Sacrée. (Histoire des Prophetes.
- Ecclesiastique.
- Civile, Anc. et Moderne. — Hist. Civile, proprement dite. — Memoires. Antiquités. Histoire complete.
- Hist. Litteraire.
- Naturelle.
  - Universalité de la Nature. — Histoire: Histoire celeste. Des Meteores. De la Terre et de la Mer. Des Mineraux. Des Vegetaux. Des Animaux. Des Elemens.
  - Ecarts de la Nature: Prodiges celestes. Meteores prodigieux. Prodiges sur la Terre et la Mer. Mineraux monstrueux. Vegetaux monstrueux. Animaux monstrueux. Prodiges des Elemens.
  - Usages de la Nature: Arts. Metiers. Manufactures.

Traité ou Usages de l'Or et de l'Argent: Monnoies. Mines d'Or. Fleuve d'Or. Toison d'Or. Orfevrerie. Filigrane. Matieres de Mevre, &c.

Traité ou Usages du Fer: Laboureur. Clouterie. Jardinier, &c.

Traité ou Usages du Fer: Coignée. Forges. Tuyaux. Armes. Arquebusier, &c.

Traités ou Usages du Feu: Verrerie. Glaces. Miroirs. Lunettes. Vitres, &c.

Traités ou Usages des Pierres: Tuiles. Chaux. Plomb. Gluten, &c.

Traités ou Usages de la Pierre, du Plomb, &c.: Architecture pratique. Sculpture pratique. Mosaïque. Couvreur, &c.

RAISON.

Métaphysique générale, ou Ontologie, ou Science de l'Etre en général, de la Possibilité, de l'Existence, de la Durée, &c.

Science de Dieu.
- Théologie naturelle. — Religion, D'où est née, Superstitions.
- Théologie révélée.
- Science des Esprits bien et mal faisans. — Divination. Magie noire.

PHILOSOPHIE.

Science de l'Homme.

Pneumatologie ou Science de l'Ame: Raisonnable. Sensitive.

Logique.

Art de penser:
- Apprehension. — Science des Idées.
- Jugement. — Science des Propositions.
- Raisonnement. — Syllogisme.
- Methode. — Divination: Analyse. Synthese.

Art de retenir:
- Memoire. — Naturelle. Artificielle: Préparation, Execution.
- Supplément de la Memoire. — Ecriture. Imprimerie. — Alphabets. Chiffres. — Art d'écrire, d'employer, &c. Orthographe.

Art de communiquer:
- Science de l'Enchaînement des Discours. — Grammaire. Signes: Gestes. Caractères. Hiéroglyphes. Chiffres. Premiers. Caractéristique. Ecriture. Prosodie. Cartilages. Perfection. Cause des Erreurs. Moyens d'enseigner.
- Science des qualités du Discours. — Rhétorique. Philosophique de la Poésie de l'Eloquence.

Morale:
- Generale. — Science du Bien et du Mal en général. Des devoirs en général. De la vertu. De la facilité d'être vertueux, &c.
- Particulière. — Science des Loix, ou Jurisprudence divine: Naturelle. Oeconomique. Politique. — Des Loix naturelles, divines, de Terre, de Mer.

Science de la Nature.

Métaphysique des Corps, ou Physique générale. De l'Etendue, de l'Impénétrabilité, du Mouvement, du Vuide, &c.

Mathématiques pures:
- Arithmétique: Numérique. Algebre: Elementaire. Impossibilités: Doubles. Irrationnelles.
- Géométrie: Elementaire. (Architecture Militaire. Tactique. Transcendante. (Théorie des Courbes.

Mécanique:
- Statique: Statique, proprement dite. Hydrostatique.
- Dynamique: Dynamique, proprement dite. Balistique. Hydraulique: Hydraulique. Hydrostatique. Pneumatique. Aimant. Navale.

Astronomie: Chronologie: Usage. Gnomonique. Sphere.

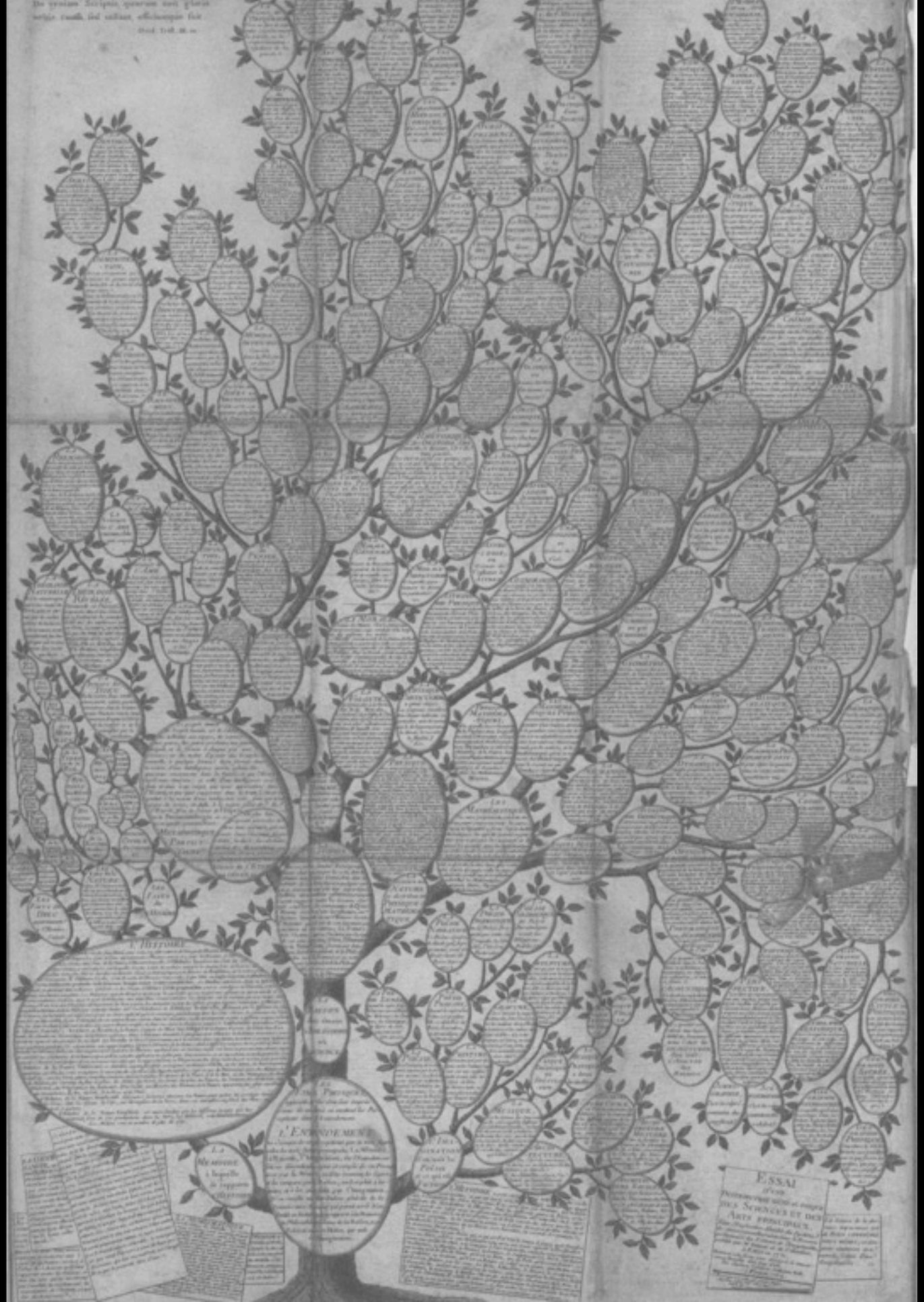
IMAGINATION.

Poesie:

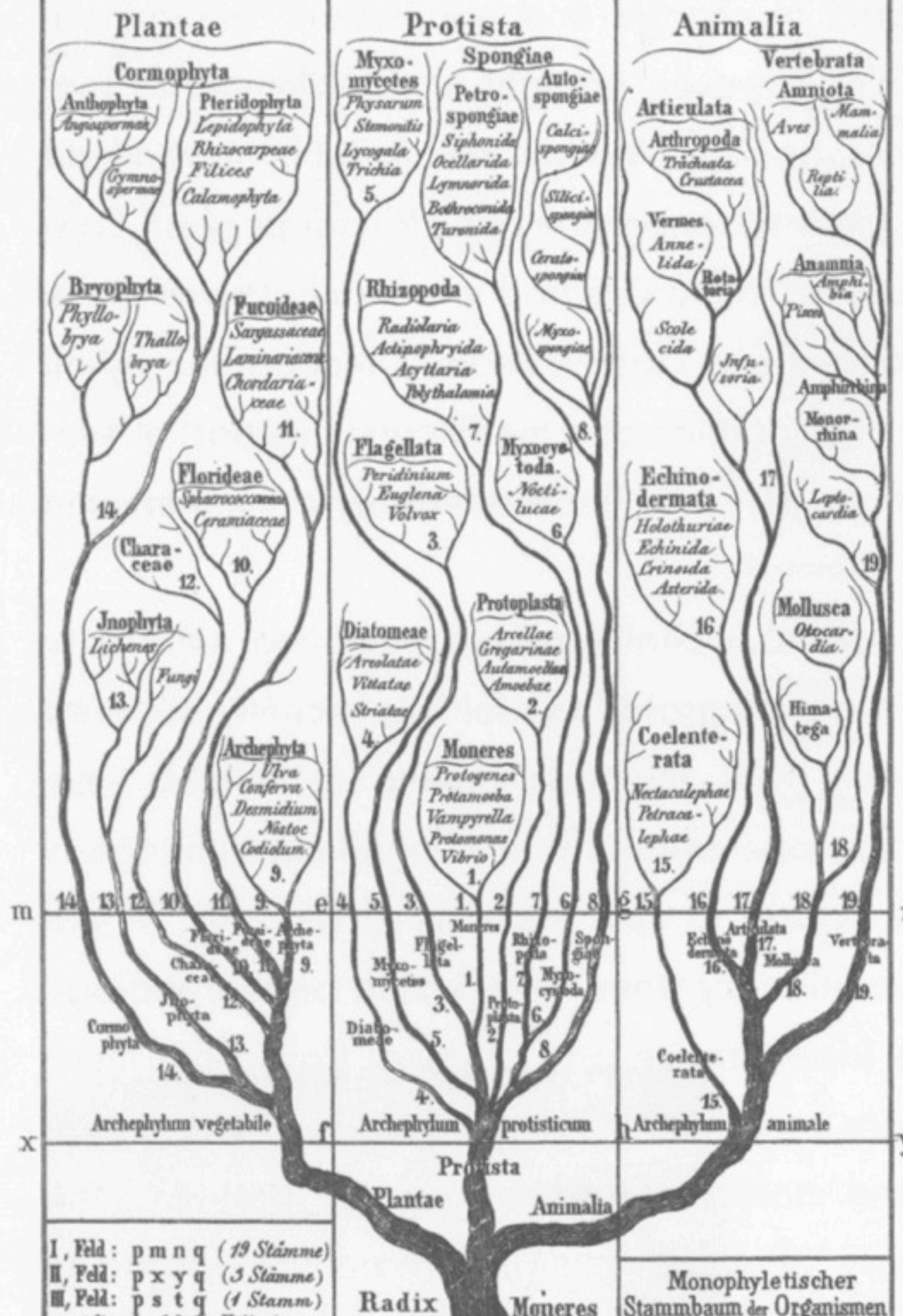
Sacrée. Profane.

- Narrative: Poeme Epique. Madrigal. Figurine. Roman, &c. — Musique: Théâtrale. Pastorale. Instrumentale. Vocale. — Peinture. Sculpture. Architecture civile. Gravure.
- Dramatique: Tragedie. Comedie. Opera. Pastorales, &c.
- Parabolique: Allegories.

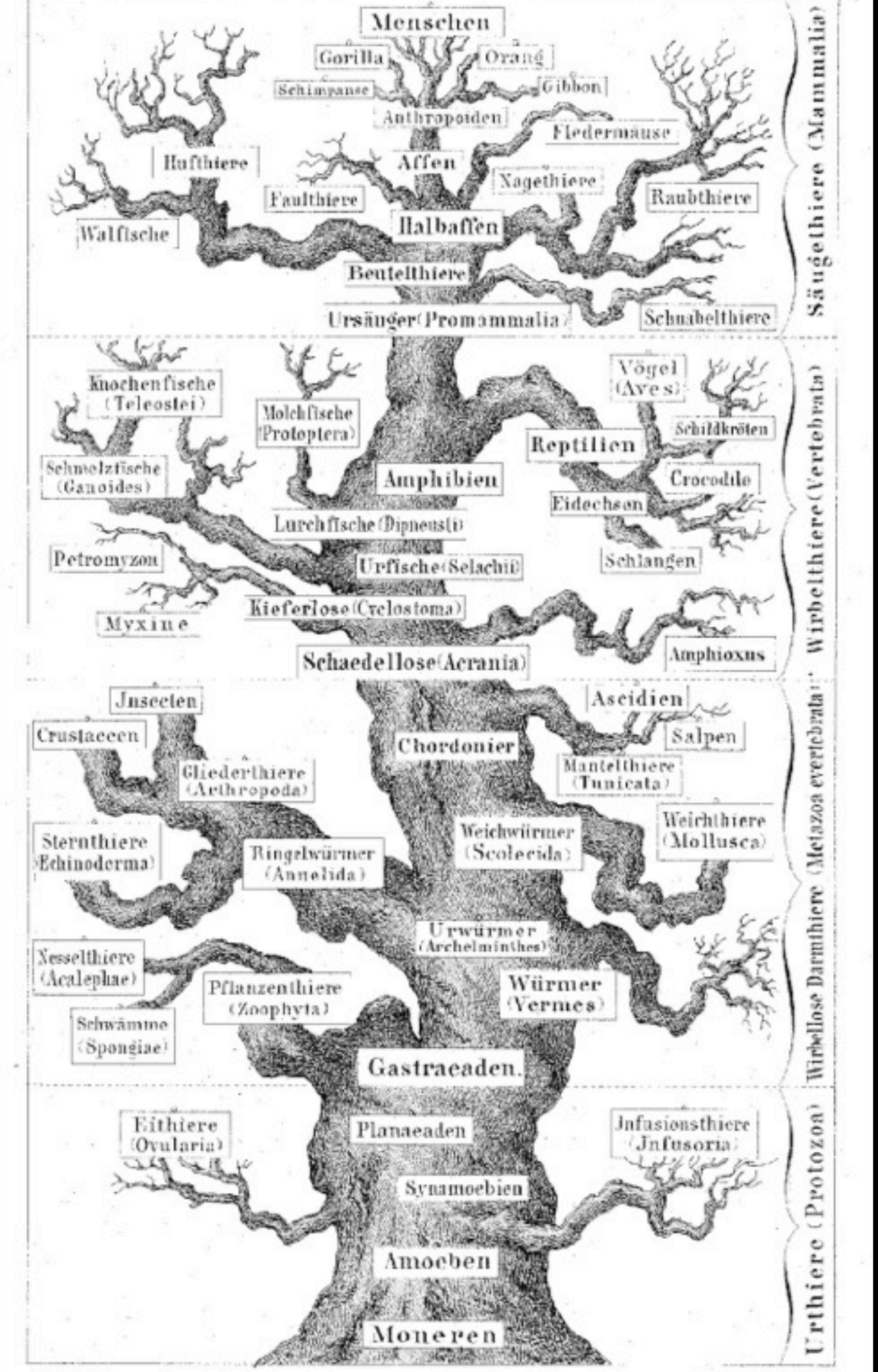
Dennis Diderot and Jean le Ron D'Alambert, Encyclopédie, 1751



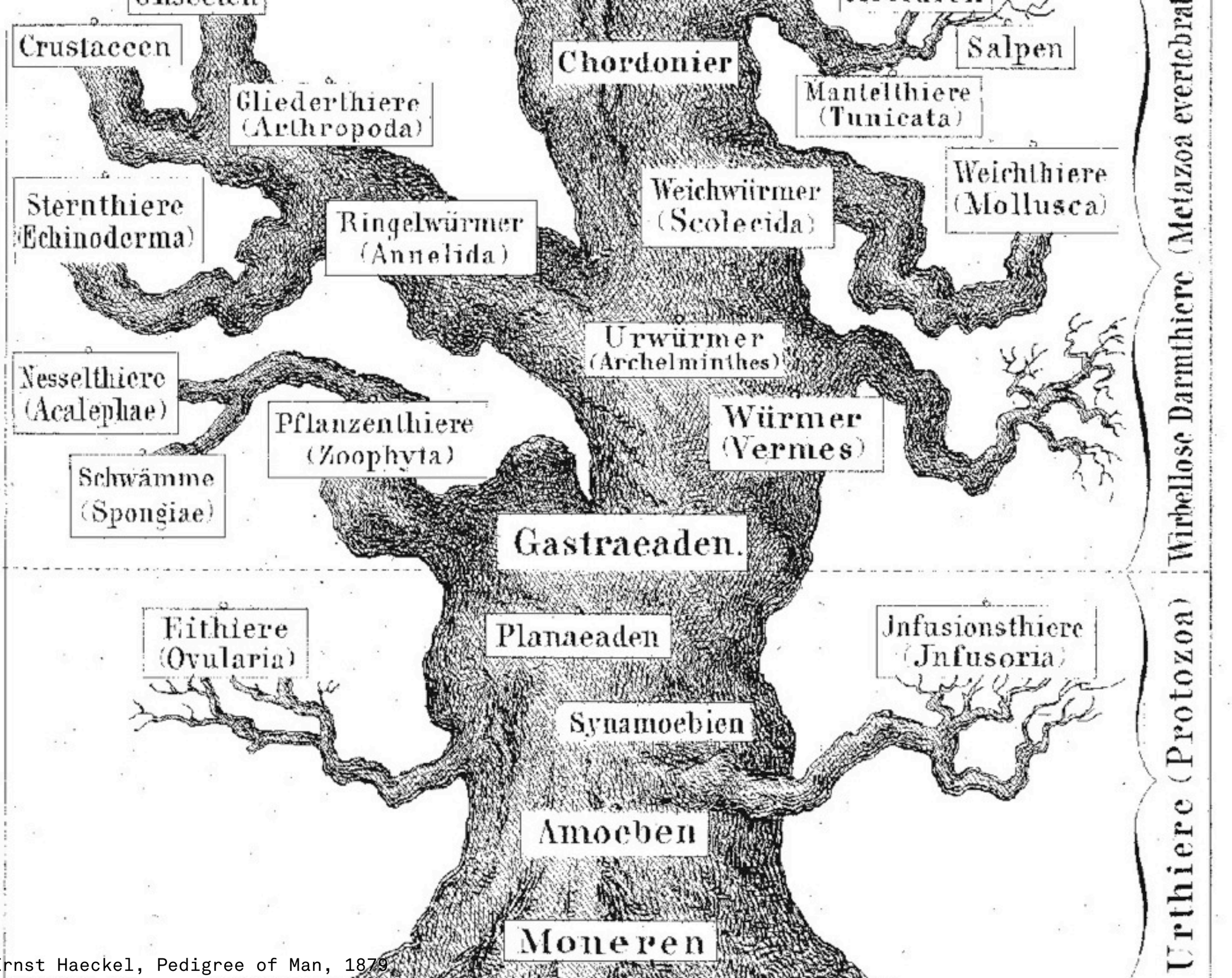
Chrétien Frederic Guillaume Roth, Essai..., 1769



Ernst Haeckel A diagram of the tree of life, 1866



Ernst Haeckel, Pedigree of Man, 1879



Ernst Haeckel, Pedigree of Man, 1879

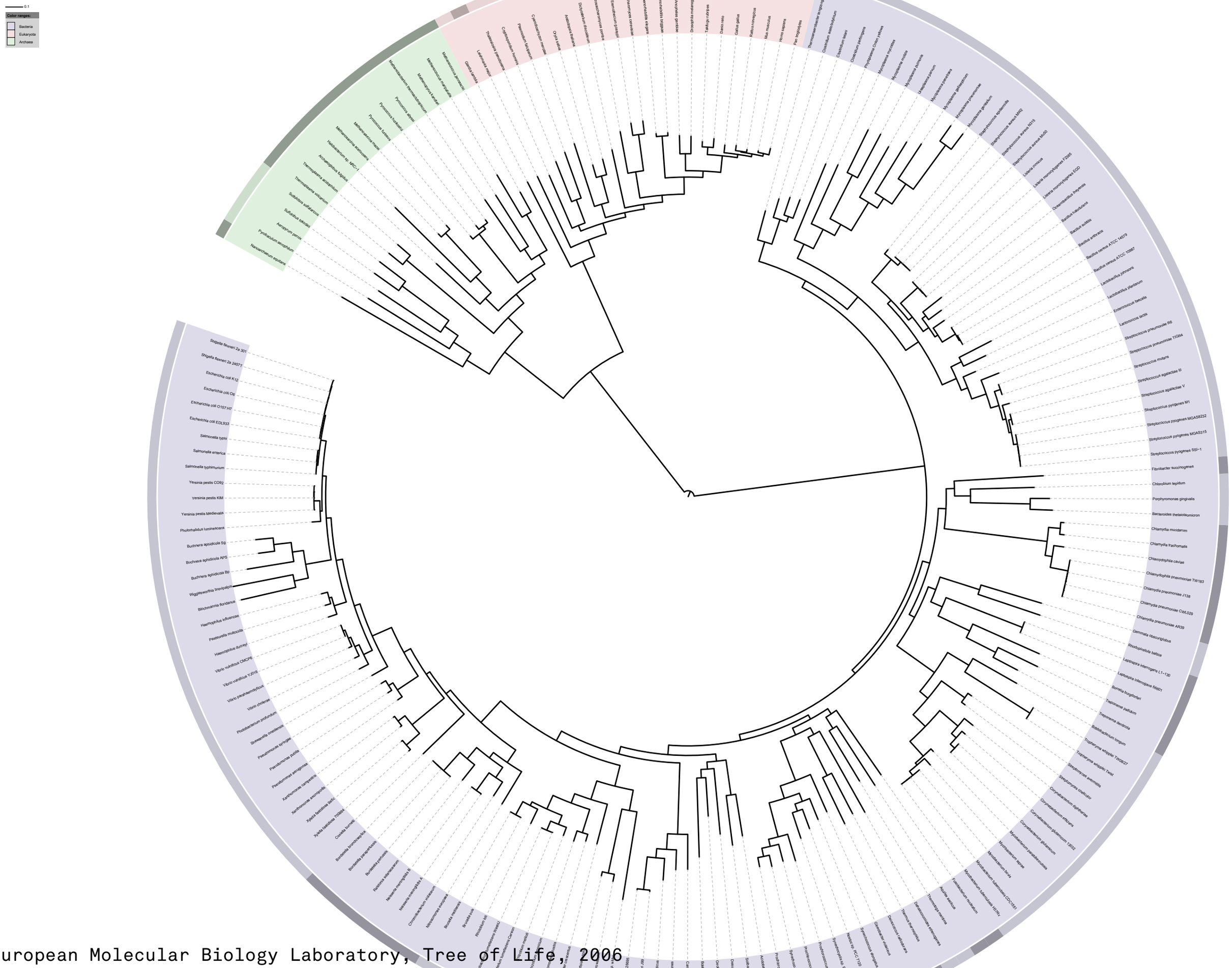
Stammbaum des Menschen.

Taf. XII.

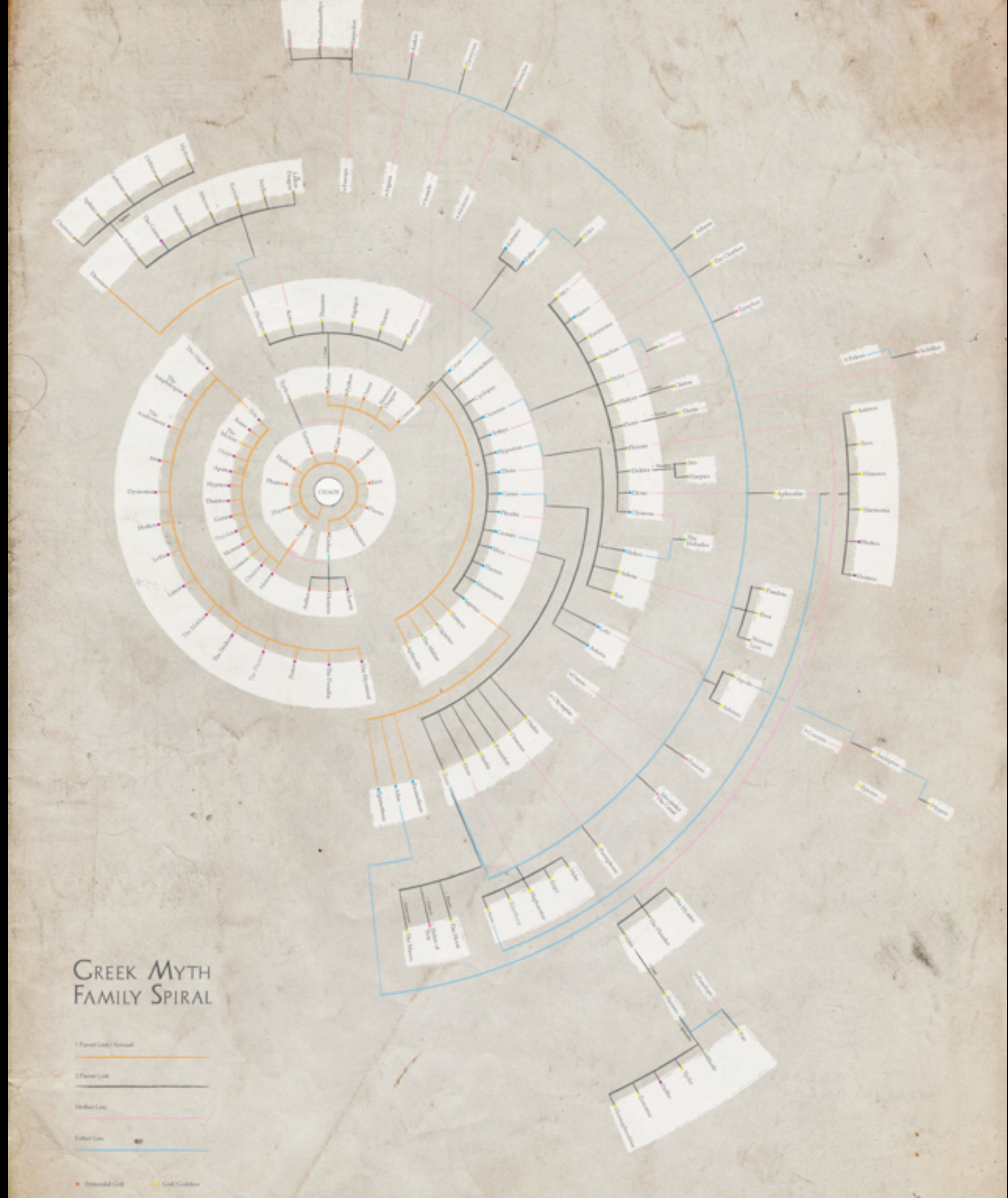
Menschen
Gorilla
Orang
Schimpanse
Gibbon
Anthropoiden
Hufthiere
Affen
Fledermäuse
Nagethiere
Faulthiere
Raubthiere
Walfische
Halbaffen
Beutelthiere
Ursäuger (Promammalia)
Schnabelthiere
Säugethiere (Mammalia)

Knochenfische (Teleostei)
Molchfische (Protoptera)
Vögel (Aves)
Schildkröten
Schmelzfische (Ganoides)
Amphibien
Reptilien
Crocodile
Eidechsen
Lurchfische (Dipneusti)
Petromyzon
Urfische (Selachii)
Schlangen
Wirbelthiere (Vertebrata)

Ernst Haeckel, Pedigree of Man, 1879



European Molecular Biology Laboratory, Tree of Life, 2006



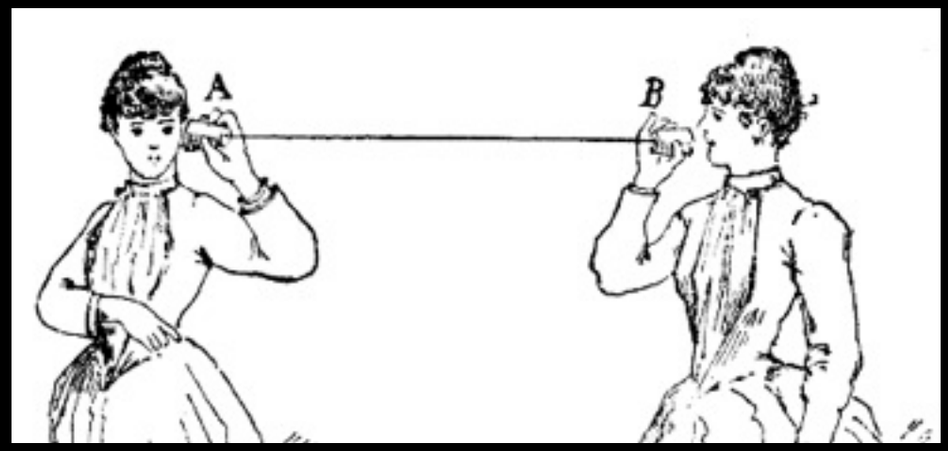
Severino Ribecca Family Tree
Diagram of Greek Mythology, 2012

CHAOS

Severino Ribecca Family Tree
Diagram of Greek Mythology, 2012

Problems of simplicity (two variables), 1600-1900

Radio, Telephone, Automobile, etc.

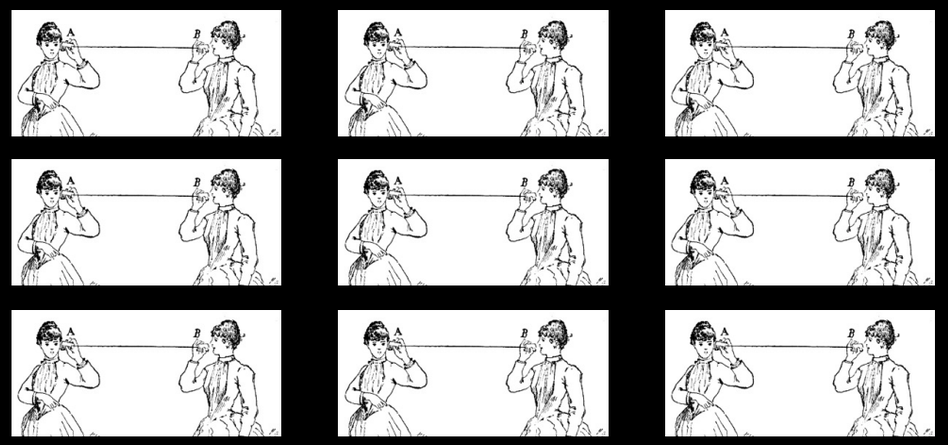


A -> B

How does one effect the other?

Problems of disorganized complexity (undefined no. of variables), 1900-1950

Thermodynamics, Physics, etc.

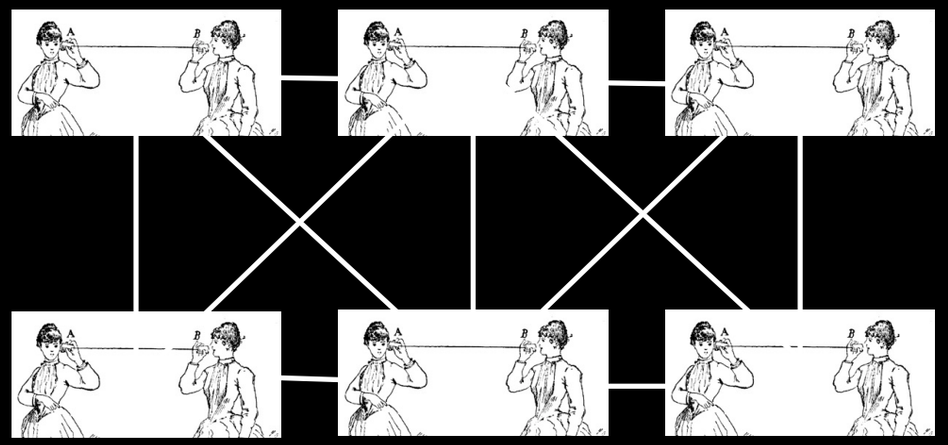


Statistics

What is the average?

Problems of organized complexity (defined no. of variables), since 1950

Genetics, stock market, society, etc.



Interconnections

How does one knot effect the whole?

Warren Weaver, Science and Complexity, 1948

Chart Size of Lead | Chart Electoral Votes

← MORE DEMOCRATIC MORE REPUBLICAN →

≥50% +40% +30% +20% +10% +10% +20% +30% +40% ≥50%

As Goes Ohio
Ohio, which has voted for the winner in every election since 1964, provided the decisive electoral votes in 2004, and it is the state likeliest to play that role again this year, according to the FiveThirtyEight model.

Highlight Ohio

Incumbent Stability
When an incumbent runs for re-election, fewer states typically change party affiliation: only three states shifted from 2000 to 2004, and five from 1992 to 1996. Yet incumbency is no guarantee of victory. Bill Clinton defeated the first President George Bush by winning 22 previously Republican states.

Former Swingers
Although now labeled a "safe" Democratic state, New Jersey was once considered a swing state. California, now another "safe" Democratic state, voted Republican in 9 out of 10 elections from 1952 to 1988.

Highlight New Jersey & California

Kerry Bush 2004
Gore Bush 2000
Clinton Dole 1996
Clinton Bush 1992
Dukakis Bush 1988
Mondale Reagan 1984

Over the Decades, How States Have Shifted, New York Times, 2012
http://www.nytimes.com/interactive/2012/10/15/us/politics/swing-history.html

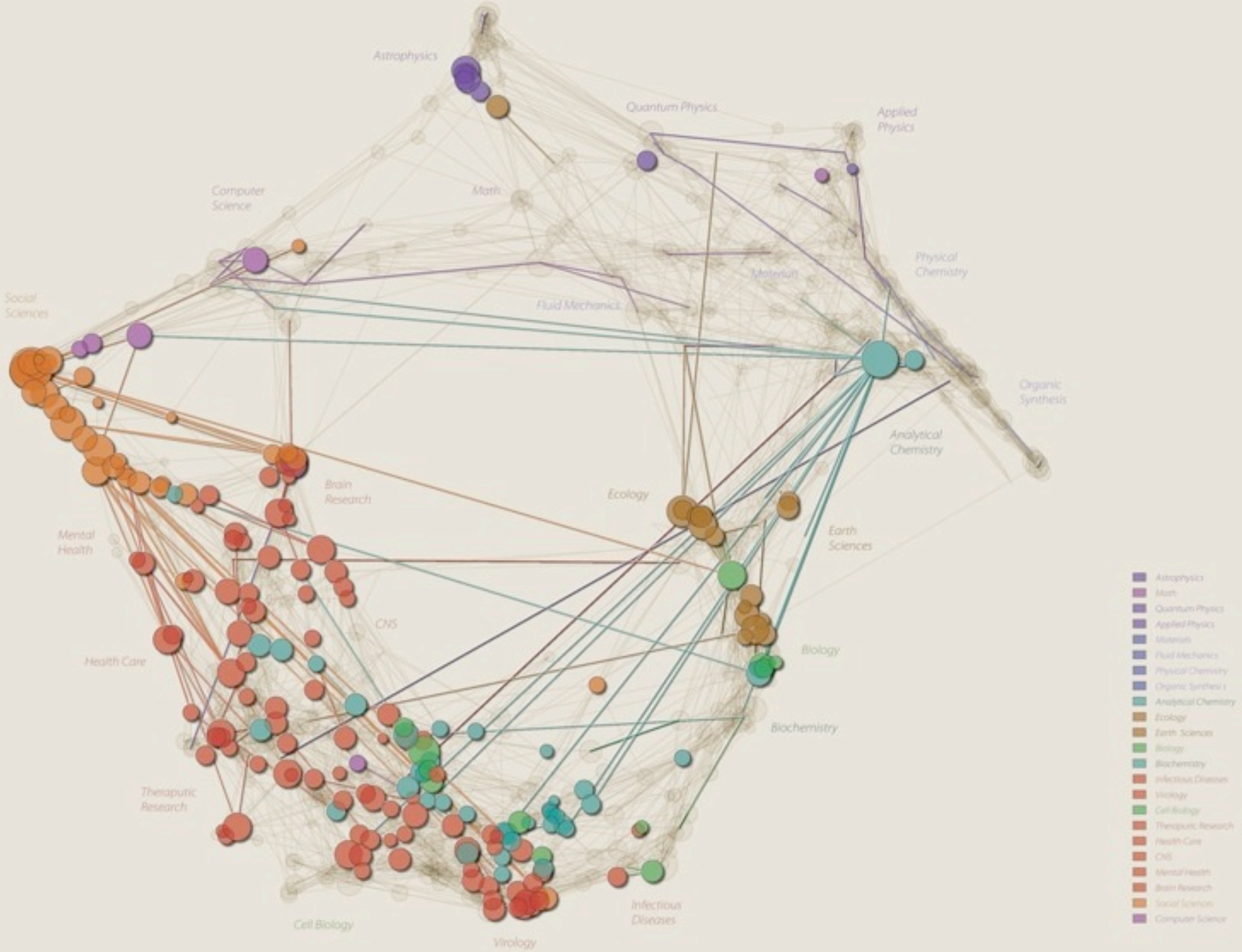
»We‘re tired of trees. We should stop believing in trees, roots and radicles. They‘ve made us suffer too much. All of arborescent culture is founded on them, from biology to linguistics. Nothing is beautiful or loving or political aside from underground stems and aerial roots, adventious growths and rhizomes.«

– Gilles Deleuze and Felix Guattari, A Thousand Plateaus, 1980, p. 15

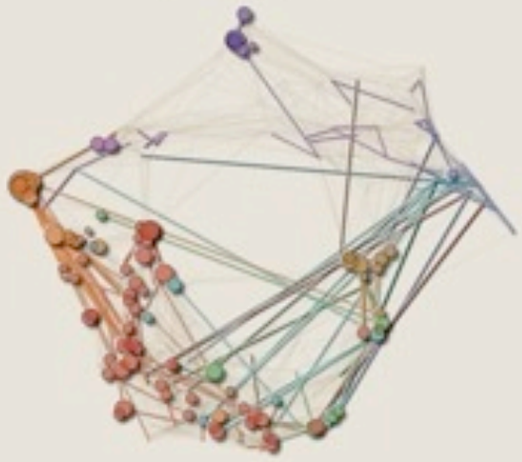
rhizome



The United States of America



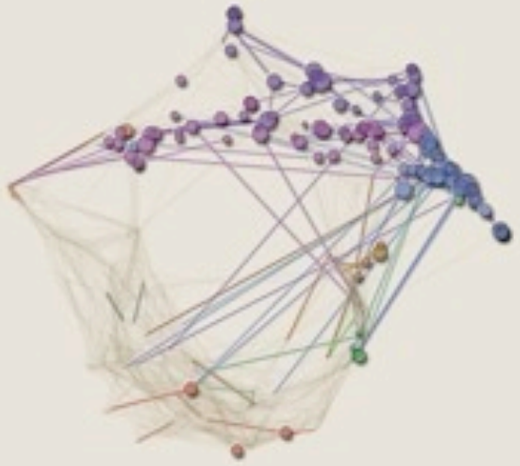
The United Kingdom



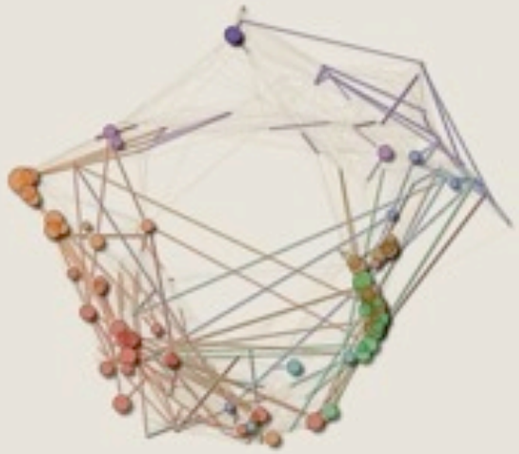
France



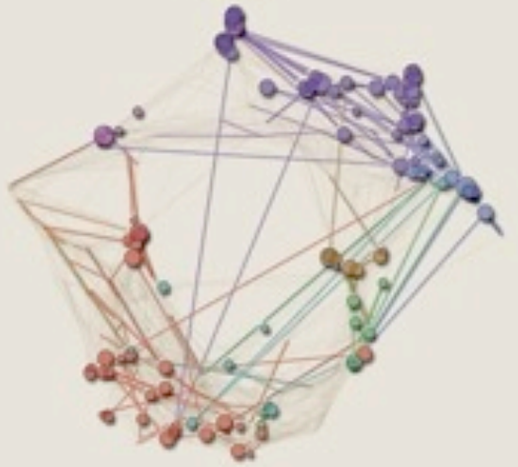
China



Australia



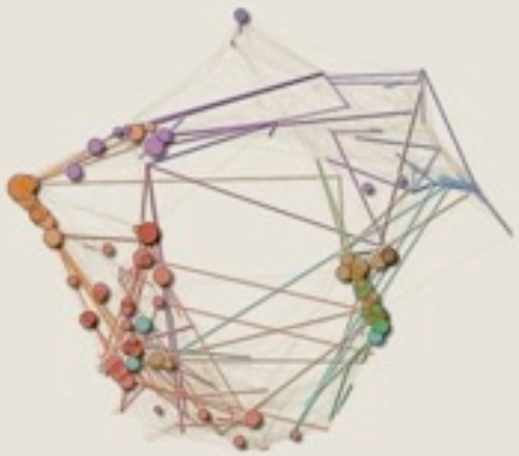
Germany



Taiwan



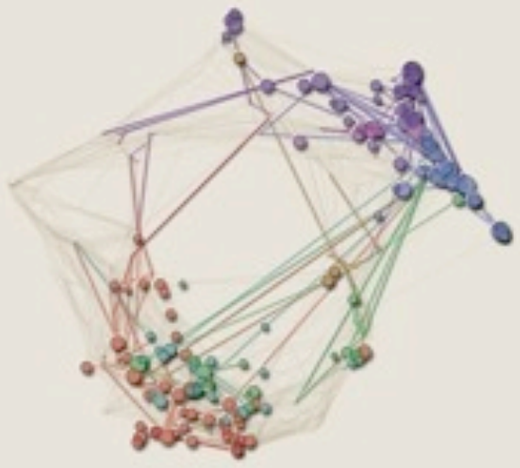
Canada



Spain

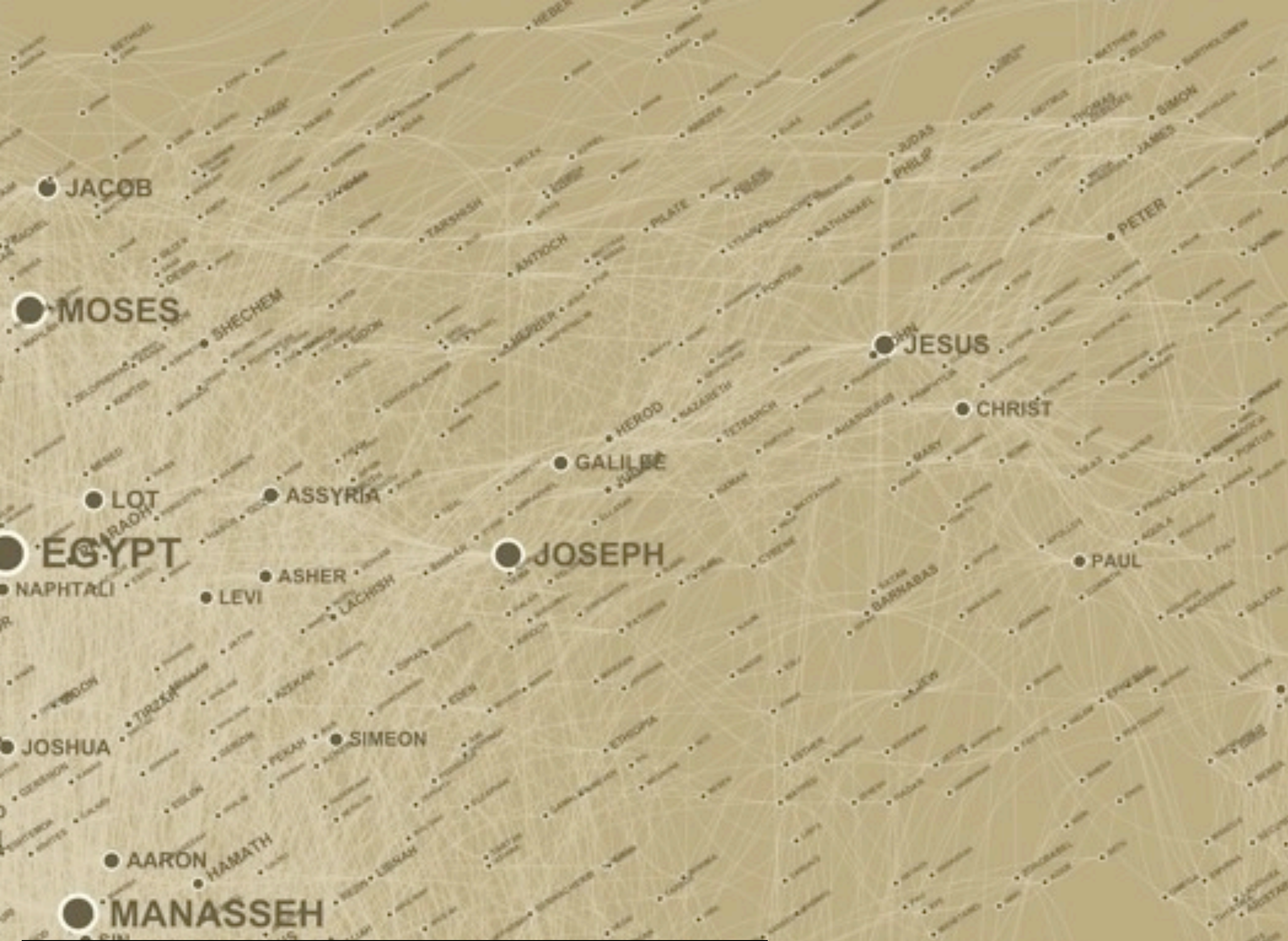


Japan

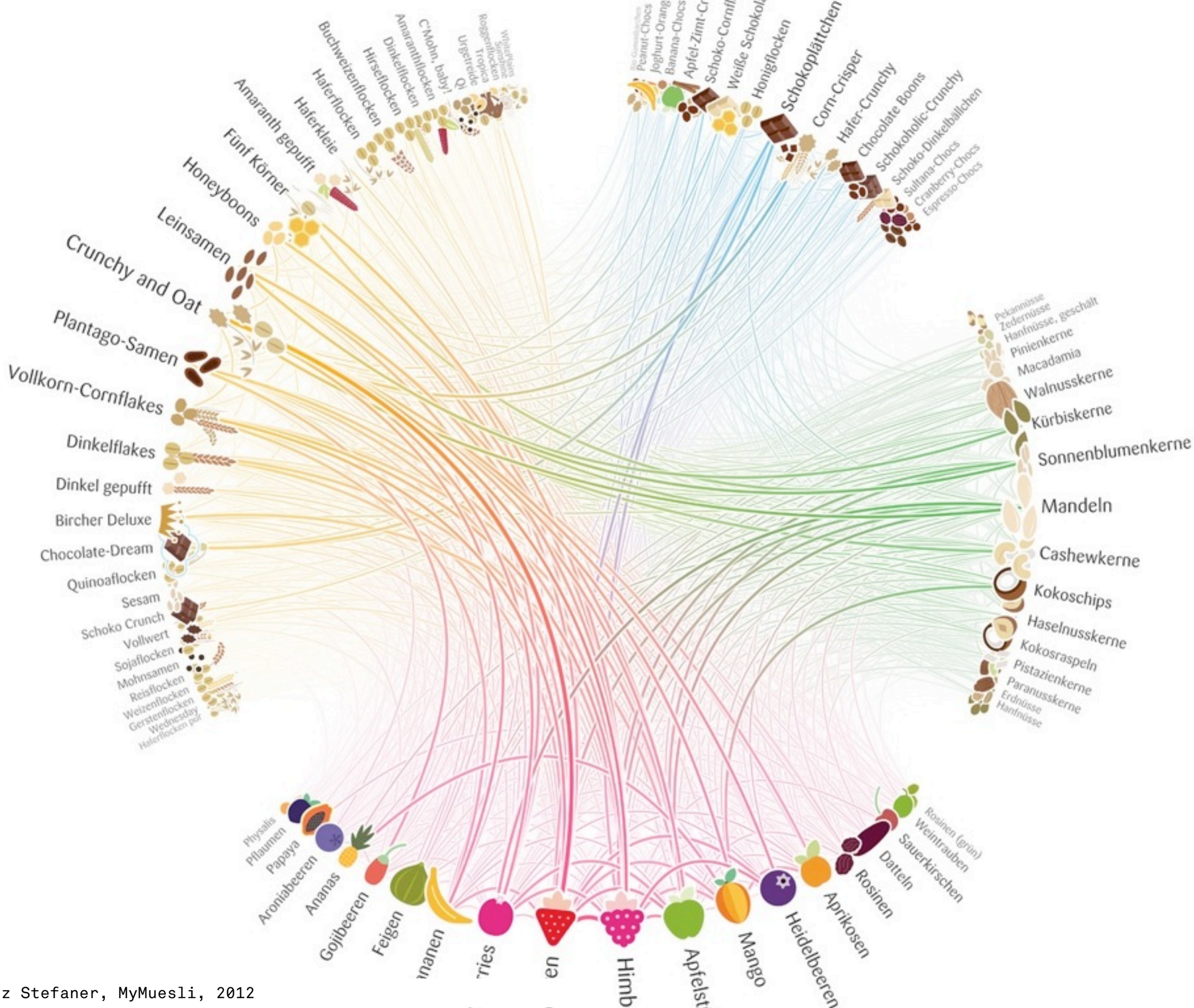




Chris Harrison and Christoph Roemhild, Bible Cross-References, 2011



Chris Harrison and Christoph Roemhild, Bible Cross-References, 2011



Moritz Stefaner, MyMuesli, 2012

Small Arms and Ammunition — Imports & Exports

An interactive visualization of government-authorized small arms and ammunition transfers from 1992 to 2010.

+ − GERMANY SEARC ABOU



$0.18B
AMMUNITION

$97.2M
AMMUNITION

$98.6M
CIVILIAN WEAPONS

$20.7M
CIVILIAN WEAPONS
$1.28M

$21M
MILITARY WEAPONS

1992 93 94 95 96 97 98 99 2000 01 02 03 04 05 06 07 08 09 2010

MILITARY CIVILIAN AMMO

IMPORT

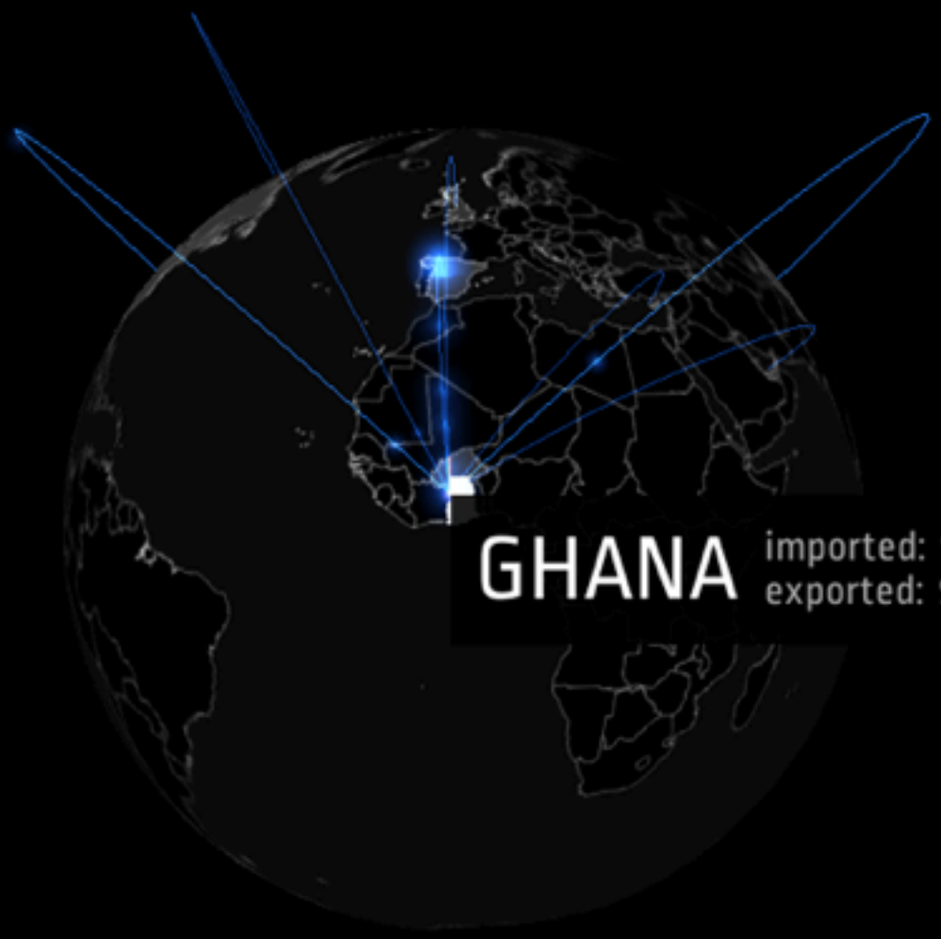
EXPORT

Google Data Team, Small Arms and Ammunition, 2012
http://workshop.chromeexperiments.com/projects/armsglobe/

Small Arms and Ammunition — Imports & Exports

An interactive visualization of government-authorized small arms and ammunition transfers from 1992 to 2010.









Google Data Team, Small Arms and Ammunition, 2012

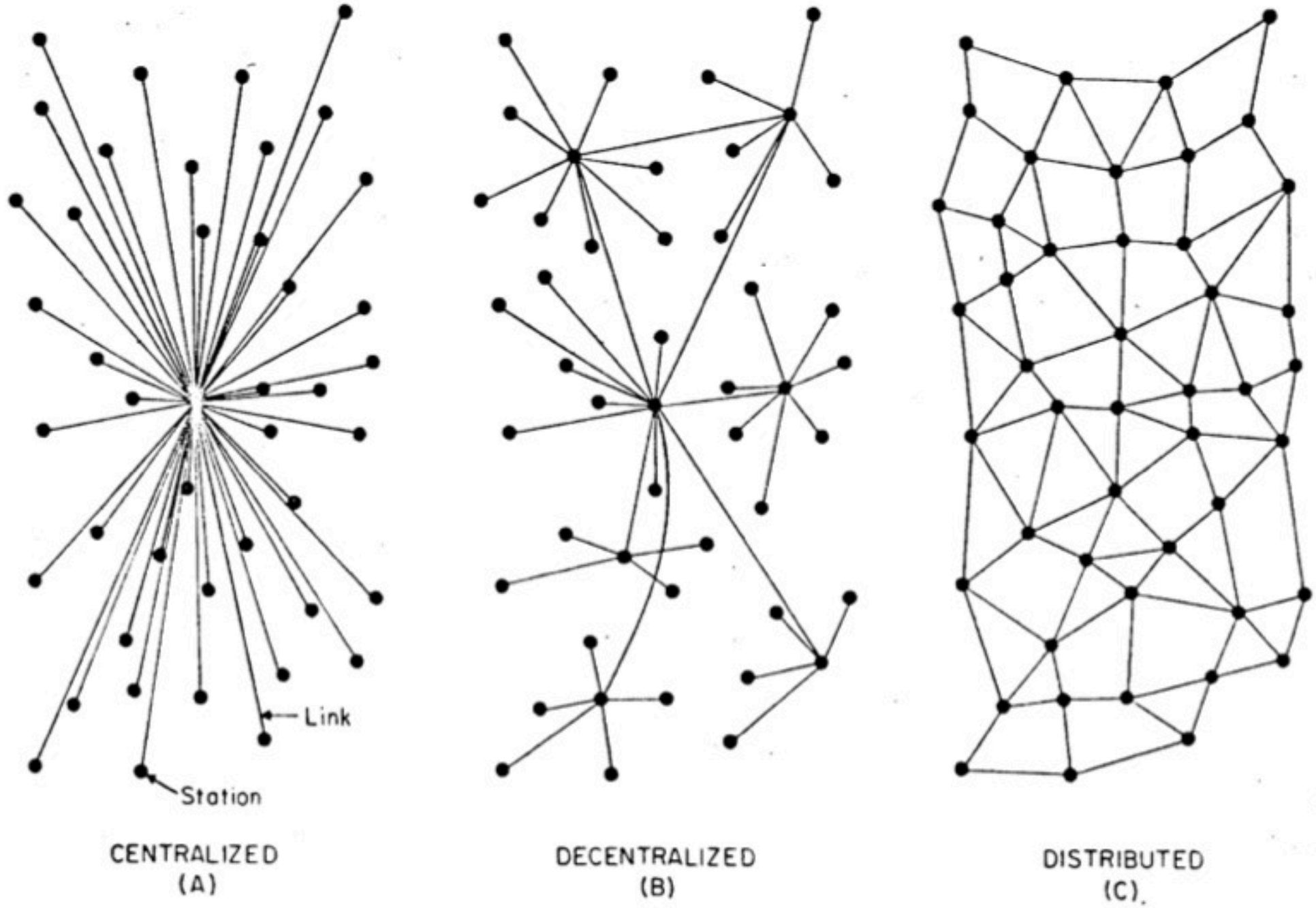
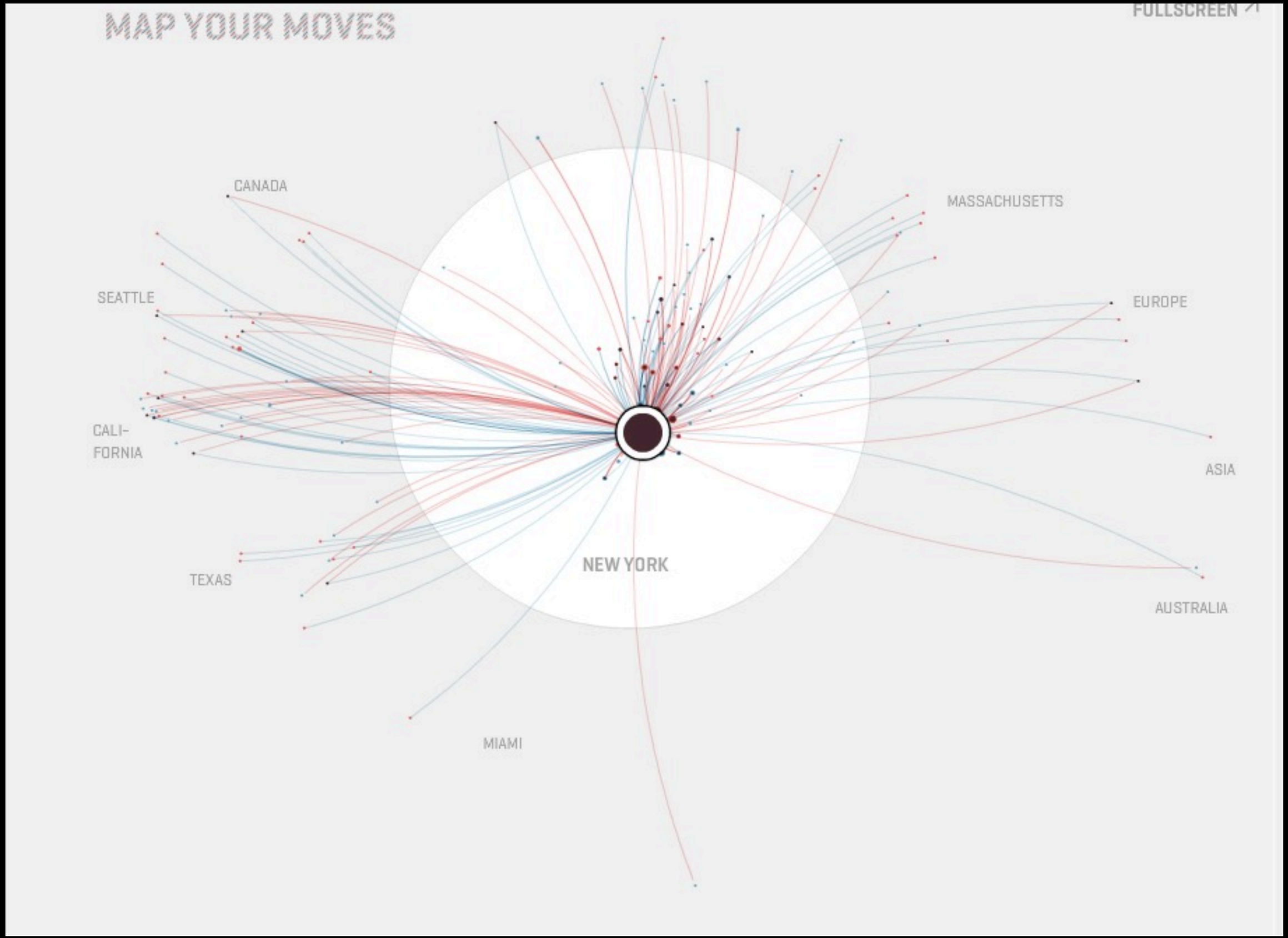
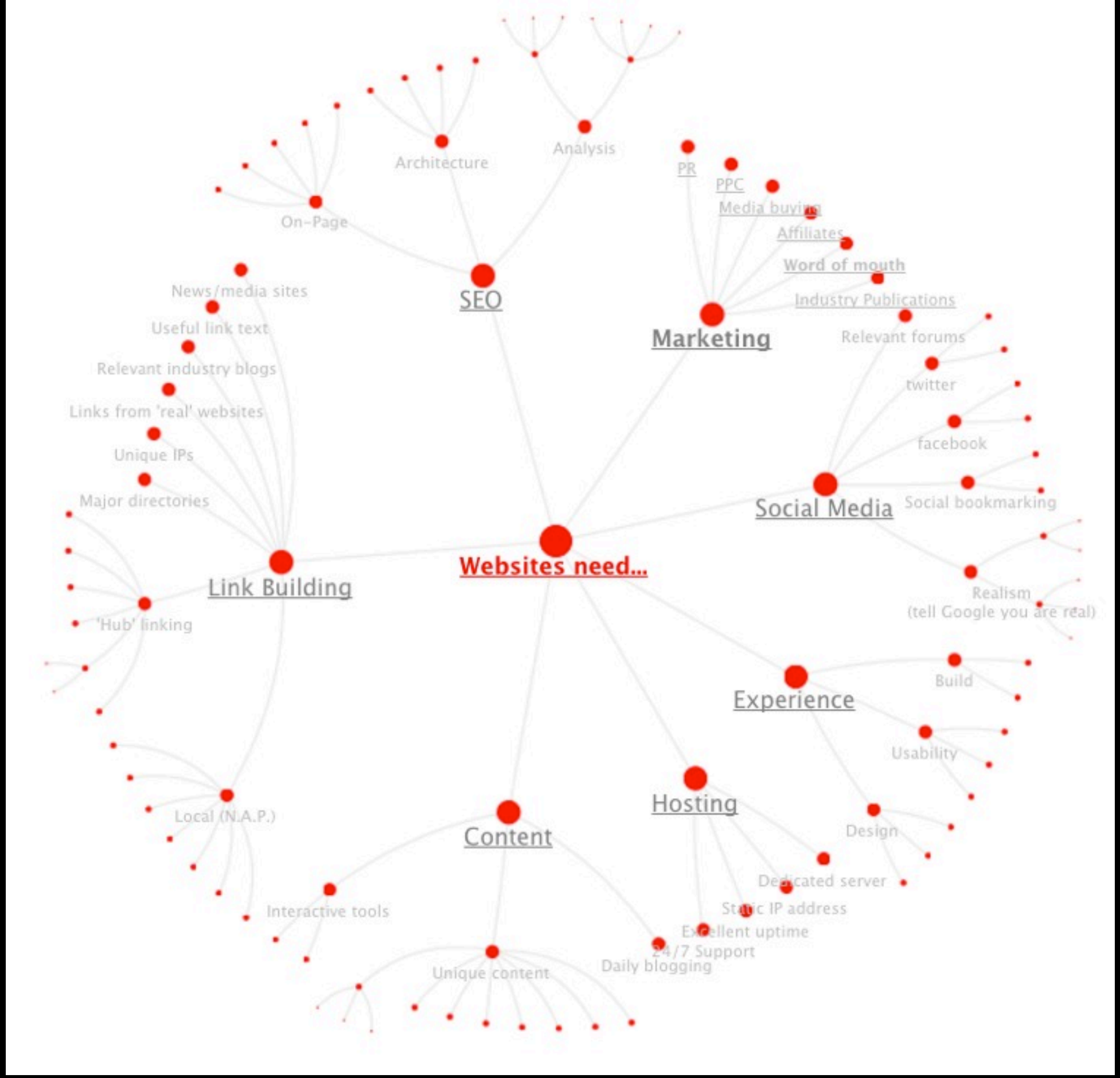


FIG. 1 – Centralized, Decentralized and Distributed Networks

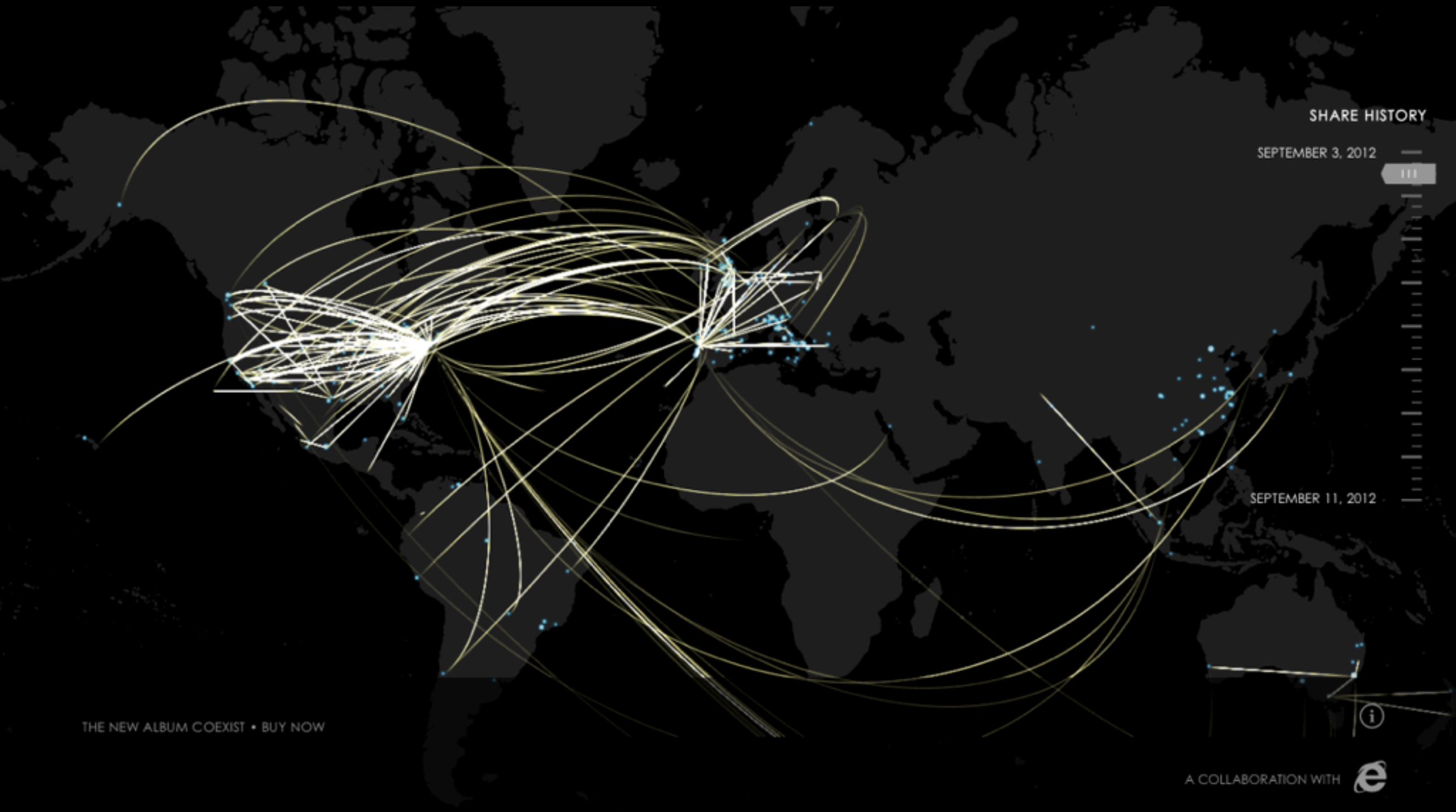
Paul Baran, Network Models (»On distributed Networks«), 1962



Centralized – Moritz Stefaner, Map your Moves, 2010



Decentrelized – James Welch, website need..., 2012



Distributed – http://coexist.thexx.info/, 2012

Read:

Warren Weaver, Science and Complexity, 1948
Paul Baran, On distributed Networks, 1962