



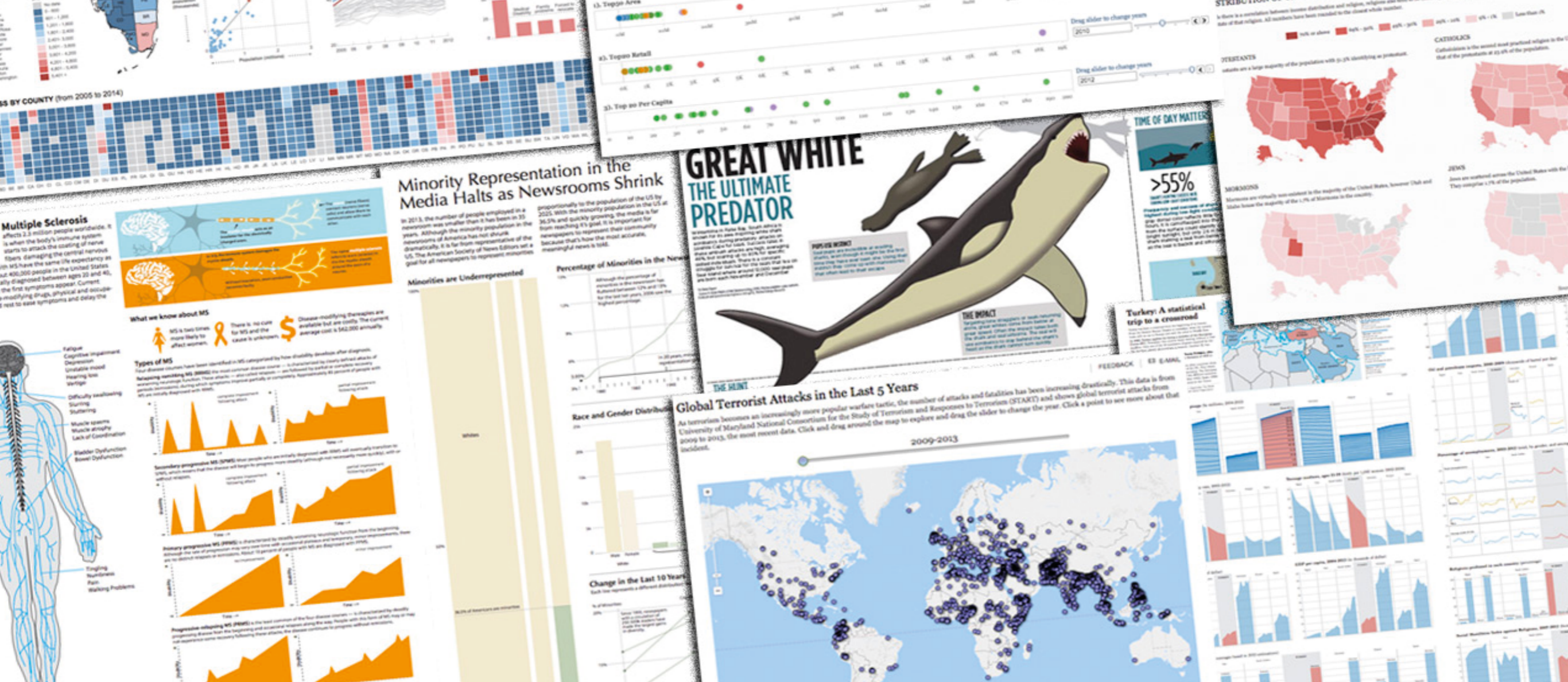
Best Actuarial Practices in Health Studies Seminar

June 13-14, 2016 | Philadelphia, PA

Session 8: Data Visualization – the Functional Art

Presenter:

Alberto Cairo



VISUALIZATION FOR EVERYONE

Charts, Maps, and Diagrams for Effective Communication

elmundo.es (Spain), 2000-2005

Mars Exploration Rover: Misión a Marte

Portada | Introducción | El Marte

Estructura
El vehículo, de 355 kg de peso, tiene una vida útil de 90 días marcianos (un poco más largos que los de la Tierra). Puede avanzar 100 metros por jornada. Puesto que su batería se alimenta de luz solar, sólo está operativo durante el día.

Fuente: NASA / Agencia Espacial Europea / Alberto Cairo

Esgrima

Portada | Introducción | Modalidades | Equipamiento | Materias | Historia

El área y las reglas básicas
El primer combatiente que consiga 5 tocos en las rondas preliminares y 15 tocos en la eliminación directa gana el combate.

Fuente: Fencing (ABC Black London) / Fencing (Brian Pinna) / Alberto Cairo

El calamar gigante

Portada | El animal | Hábitat y distribución | Comparativa de longitudes

El calamar gigante
El Architeuthis es el invertebrado más grande que existe. Suele vivir a grandes profundidades, por lo que nunca se lo ha observado en su hábitat natural. Todos los especímenes que se han realizado sobre él se han hecho a partir de restos.

Fuente: SeaBismarck Inc. / guatemaladivertida.com / Alberto Cairo

Cassini-Huygens: cita con Saturno

Portada | La misión | Saturno

Sonda Cassini
El proyecto Cassini comenzó a gestarse en 1982 como misión que completaría observaciones anteriores (de sondas Voyager o del Hubble).

Peso total con combustible	5.712 kg
Peso sin combustible	2.125 kg
Peso de sonda Huygens	350 kg
Ranurada hasta Saturno	3.506 mil. km
Lanzamiento	15 octubre 1997
Llegada	1 julio 2004
Misión Huygens en Titán	24 diciembre 2004
Duración de la misión principal	4 años
Coste de la misión	3.000 mil. de \$

Fuente: NASA / Space.com / Elabórame propia / Alberto Cairo

Los portaaviones clase 'Nimitz'

Portada | Datos | Estructura | Despegue | Aterrizaje | Radar

Estructura del buque
Los portaaviones clase 'Nimitz' tienen un puntal de más de 12 pisos (unos 40 metros). Se suelen dividir en diversas cubiertas de carga, de hangares, etc.

Fuente: Fantasy / US Navy (Shark) / Alberto Cairo

Masacre en Madrid

Portada | Introducción | Atocha | El Pozo | Santa Eugenia | Glorieta Carlos V

7 explosiones en Atocha
En la vía 2, un C-1, esperaba para salir con destino a Alcobendas. El tren que se dirigía a Chamartín (línea C-1) estaba en la entrada de la estación en el momento del atentado.

Fuente: Elabórame propia / Alberto Cairo

La presa de las Tres Gargantas

Portada | El río | Construcción | La presa

Potencia instalada
En MW: 17.680 (Presa instalada del embalse) vs 18.050 (Presa hidroeléctrica instalada en España (2001)).

Capacidad del embalse
Millones de litros: 39.300.000 (Capacidad del embalse) vs 4.300.000 (Caudal anual de agua en lagunas españolas).

Fuente: Agencia / Elabórame propia / Alberto Cairo

Tiro con arco

Portada | Arco y flechas | Dicha y tirada | Disparo | Prueba su justicia

Disparo
El arquero debe controlar con total precisión sus movimientos. En cada disparo repite exactamente los del anterior. Además de los accesorios mostrados, se permite el uso de sujetamuecas y salvatajes (petos).

Fuente: Manual de tiro con arco (Tiro) / Sports (Flecha) / Alberto Cairo

Tiroteo en Ciudad Lineal

Portada | Los hechos

El tiroteo
El primer sicario se sienta tras las víctimas y les dispara tres ráfagas con su Kalashnikov (la policía ha recogido más de 50 casquillos de bala). Uno de los hombres sobrevive a los primeros disparos, pero el asesino lo remata en el suelo. Según algunos testigos, una de las víctimas intentó repeler la agresión con una pistola, pero no pudo disparar.

Fuente: Elabórame propia / Alberto Cairo / Mariano Zabala

UNC-Chapel Hill, 2005-2010

The screenshot shows the website's header with the UNC logo and navigation links: Directory, Park Library, Student Resources, UNC, Webcam, Jobs, Give. Below the header is a navigation bar with links: I am..., Academics, Research, News & Events, Resources & Directories, About, and a search box. The main content area features a large image of Joan Cates on the left and a blue text box on the right that reads: "NIH-funded project at UNC to see if texts, games and web portals can increase HPV vaccination". Below this is a white text box stating: "Joan Cates will lead a team to communicate the importance of vaccinating against the most common sexually transmitted infection in the U.S." Below the main content is a "News & Events" section with three items: 1. "JE SUIS CHARLIE" with the caption "Journalism school deans respond to the Charlie Hebdo attack". 2. A photo of a trophy with the caption "UNC J-school students place in Hearst broadcast, photojournalism and writing competitions". 3. A photo of Stuart Scott with the caption "Stuart Scott, 1965 - 2015". To the right of these items is a Twitter post from @UNCJschool: "RT @Sarah_Kaylan: Learning about the basics of #visualcontent and framing in #JOMC 221 today! @UNCJschool http://t.co/ta2null2rb". At the bottom right are social media icons and a "1 of 10" indicator.

Editora Globo, Época magazine (Brazil) 2010-2011

DIAGRAM NEWS IN PERSPECTIVE

Brazil's Demographic Opportunity

How Brazil can take advantage of a future with fewer children per couple.

Alberto Cairo, Francisco Lima, Marco Veiga

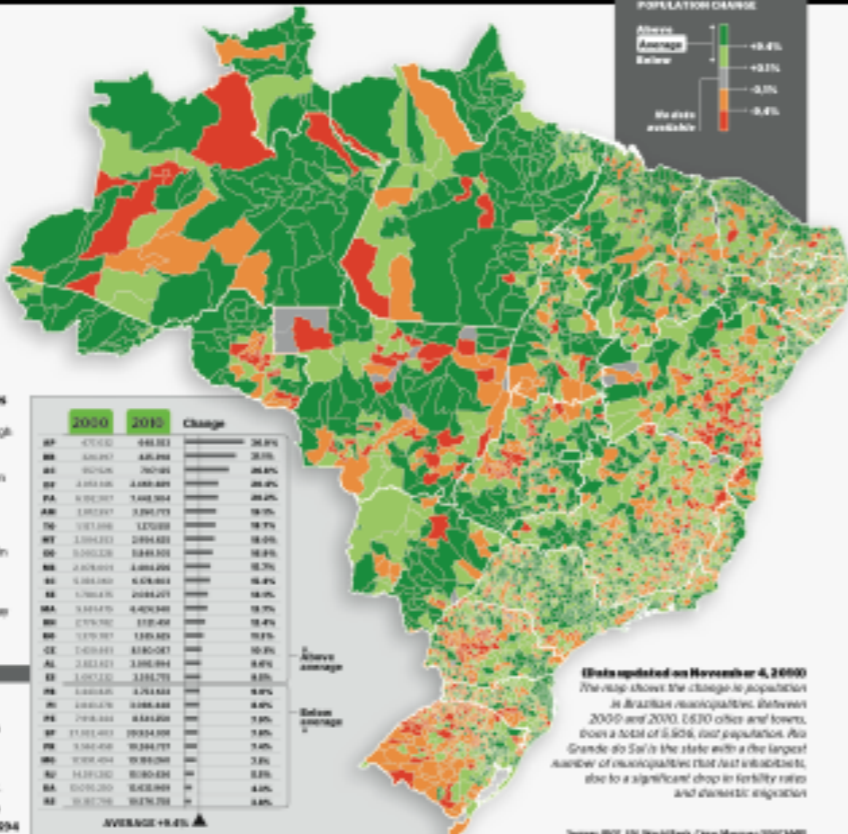
PRELIMINARY DATA FROM THE 2010 CENSUS creates an interesting picture of the changes that the 1.8-billion population has gone through in the past ten years. Brazil's population grew, on average, 17% between 2000 and 2010, but the fertility rate is below 2.1 children per woman, the minimum to keep a population from shrinking. According to César Marques, a demographer from the University of Campinas, the main challenge Brazil will face in the future is how to maintain a healthy social security system if the number of older and retired people will likely be much larger than it is today. Read on to learn about all the variables at play in this story.

1. BRAZIL'S POPULATION IS BIGGER

The 2010 Census has revealed a 0.4% population increase between 2000 and 2010. The differences between states, as you can see on the chart on the right, are noticeable. Most rich states, such as São Paulo and Rio, didn't grow as fast as the ones in the north-east.

2000: 168,706,170
2010: 180,712,694
AVERAGE +0.4%

State	2000	2010	Change
AP	471,632	443,353	-5.9%
AM	3,063,973	3,416,898	11.5%
BA	9,767,846	10,765,928	10.3%
CE	4,453,448	4,688,884	5.3%
DF	2,572,927	2,846,934	10.7%
ES	4,193,297	4,494,934	7.2%
GO	6,200,228	6,846,934	10.4%
MA	3,200,000	3,200,000	0.0%
MT	3,100,000	3,100,000	0.0%
MS	2,700,000	2,700,000	0.0%
PA	10,000,000	10,000,000	0.0%
PE	7,000,000	7,000,000	0.0%
PI	3,000,000	3,000,000	0.0%
PR	11,000,000	11,000,000	0.0%
RS	10,000,000	10,000,000	0.0%
SC	7,000,000	7,000,000	0.0%
SP	40,000,000	40,000,000	0.0%
TO	1,000,000	1,000,000	0.0%



2. BUT THE FERTILITY RATE IS MUCH LOWER THAN EXPECTED

A study in 2004 estimated that in 2010, the fertility rate would be 2.4 children per woman, on average. But new data collected by the IBGE prove that the fertility rate is already 1.9, below the threshold called "replacement rate". When the fertility rate drops below this number, the population of a country will eventually start to shrink and grow older.

3. AS A CONSEQUENCE, POPULATION WILL STOP GROWING

Forecasters made in 2004 anticipated that Brazil's population would stop growing in 2040. But the most recent data from the IBGE suggests that this could happen much earlier, in 2030.



4. —AND IT WILL BECOME OLDER—

Comparing the current population pyramid with the one predicted for 2050 shows a significant shift towards an older population. The pyramid for 2050 shows a much larger proportion of the population in the 65+ age group.

How Brazil can transform the population challenge into an opportunity

- As the population ages, the proportion of people of working age increases. The country will therefore have more people producing wealth of the labor market can absorb them and fewer children to consume investments. It's a window of opportunity, because in some cases the number of people of working age to fall back when older people are leaving the market.
- The population under 15 years of age is falling today. A smaller number of students in public schools will facilitate the quality of teaching, if the amount invested in education stays the same.
- Educational policy focused on low-income youth favors the formation of more skilled workforce and greater social mobility.
- In the future, Brazil will reach the stage of Europe and Japan, which struggle to support their elders. This is why it's so important to prepare a more balanced retirement system, which will include retirement at a later age.

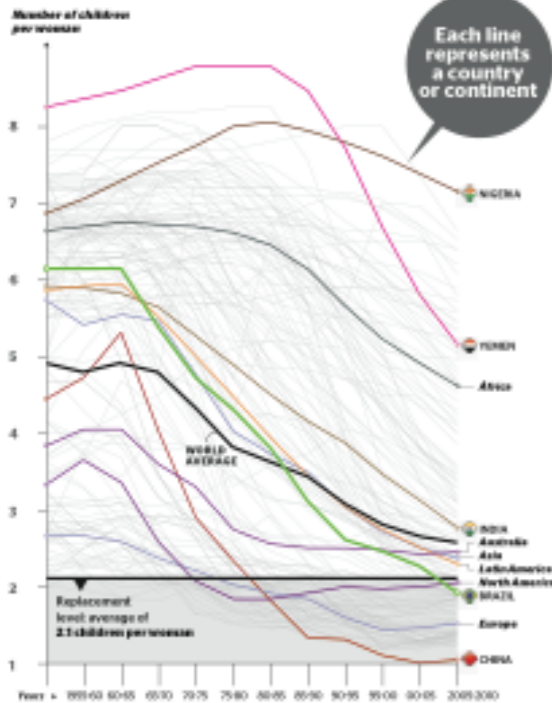


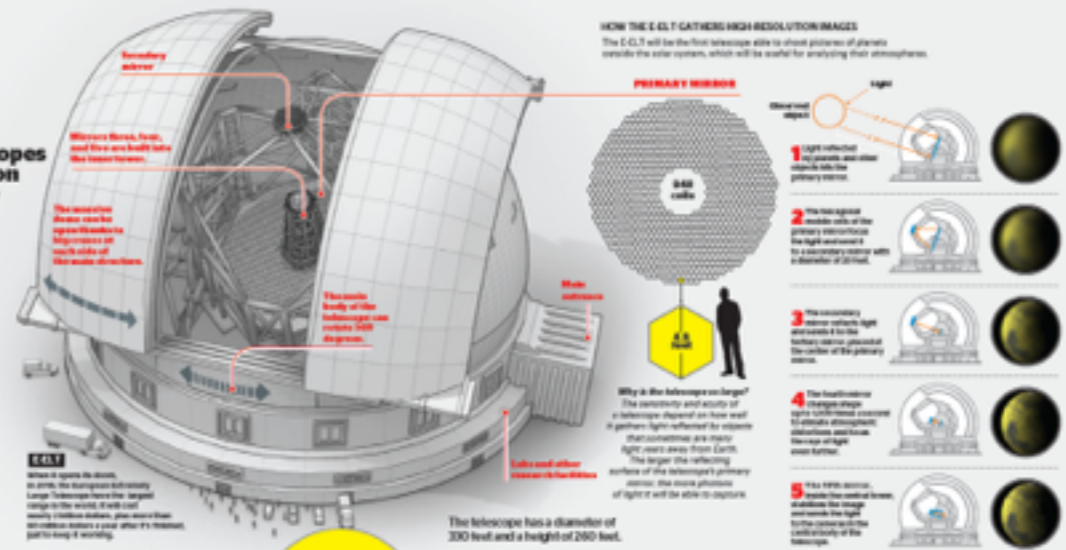
Diagram NEWS IN PERSPECTIVE

400 years after Galileo, mega-telescopes rule space exploration

A new generation of observatories is under construction. Brazil needs to decide if it's going to be part of this new revolution in astronomy.

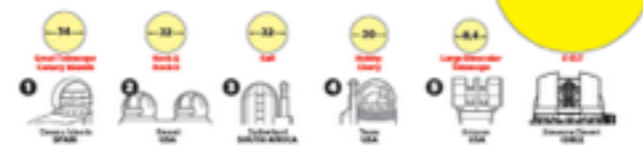
Peter Weiss, Alberto Cairo, Carmen More

In 1610, Galileo Galilei performed the first astronomical observations with a telescope. Today, the largest telescopes are in Hawaii and northern Chile. Equipped with mirrors 24 to 30 feet in diameter, they allow the observation of galaxies billions of light years away from us, but with little clarity. In a new generation of mega-telescopes is being built. The largest is the European Extremely Large Telescope (E-ELT), an initiative of the European Space Agency that is under construction in the Atacama Desert in Chile, and will open in 2026. The Ministry of Science and Technology of Brazil defends participation in the project, but the huge investment has unleashed concerns in other areas of the government. The total cost for Brazil would be \$500 million over 20 years.



THE SUPER TELESCOPE RANKING

The E-ELT is a giant compared to the existing mega-telescopes. Its primary mirror is four times the size of the one in the largest telescope in the Canary Islands, Spain.



TELESCOPES WITH BRAZILIAN INVOLVEMENT

Brazil participates in just two of the largest telescopes.



OTHER LARGE TELESCOPE UNDER CONSTRUCTION

Besides the E-ELT, there are other projects in development.



Diagram NEWS IN PERSPECTIVE

Brazilian Population Grows More in Prisons

With 236 inmates per 100,000 people, Brazil has one of the largest prison populations.

Alberto Cairo, Francisco Lima, Marco Veiga

BRAZIL IS IN the worldwide ranking of countries with the largest prison populations. Data released by the Ministry of Justice this week reveal that Brazil had 484,207 inmates in June 2010. Only the US, with 2.3 million, and China, with 1.6 million, have larger prison systems. According to the United Nations Office on Drugs and Crime, Brazil is one of the countries where prison population has grown most rapidly in the world. Between 2007 and 2009, it increased by 10.7% (see chart on the right), while the overall population growth was 0.96% in the same period. Even considering the new prisons that are being built, Brazil has reached a deficit of 200,000 jail spaces.

1. Between 1997 and 2007, Brazil experienced the 10th largest increase in prison population in the world

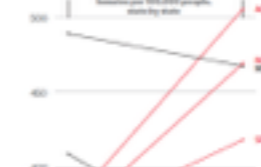


2. Ranking of American countries



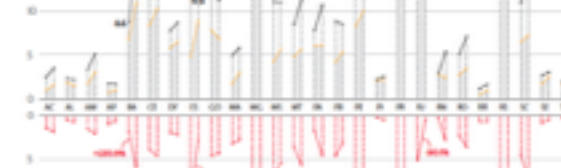
2. The trend continued since 2007

The rate of inmates per 100,000 people has gone down in 10 out of 15 states plus the Federal District.



3. —but government has not been able to create jail spaces at the same pace

Brazil's jails are packed. A comparison between the variation of inmates and the number of jail spaces reveals that neither the federal government nor the states have been able to avoid overcrowding. The only exception is Rio de Janeiro.





the functional art

2012

an introduction to
information graphics
and visualization



the truthful art

data, charts, and maps
for communication

alberto cairo

"Welcome to Alberto's world. Cairo has done it all in The Functional Art: theory, practice, examples. And he's done it brilliantly. It is the most comprehensive and sensible book yet on real-world information graphics; we won't need another one for a long time."

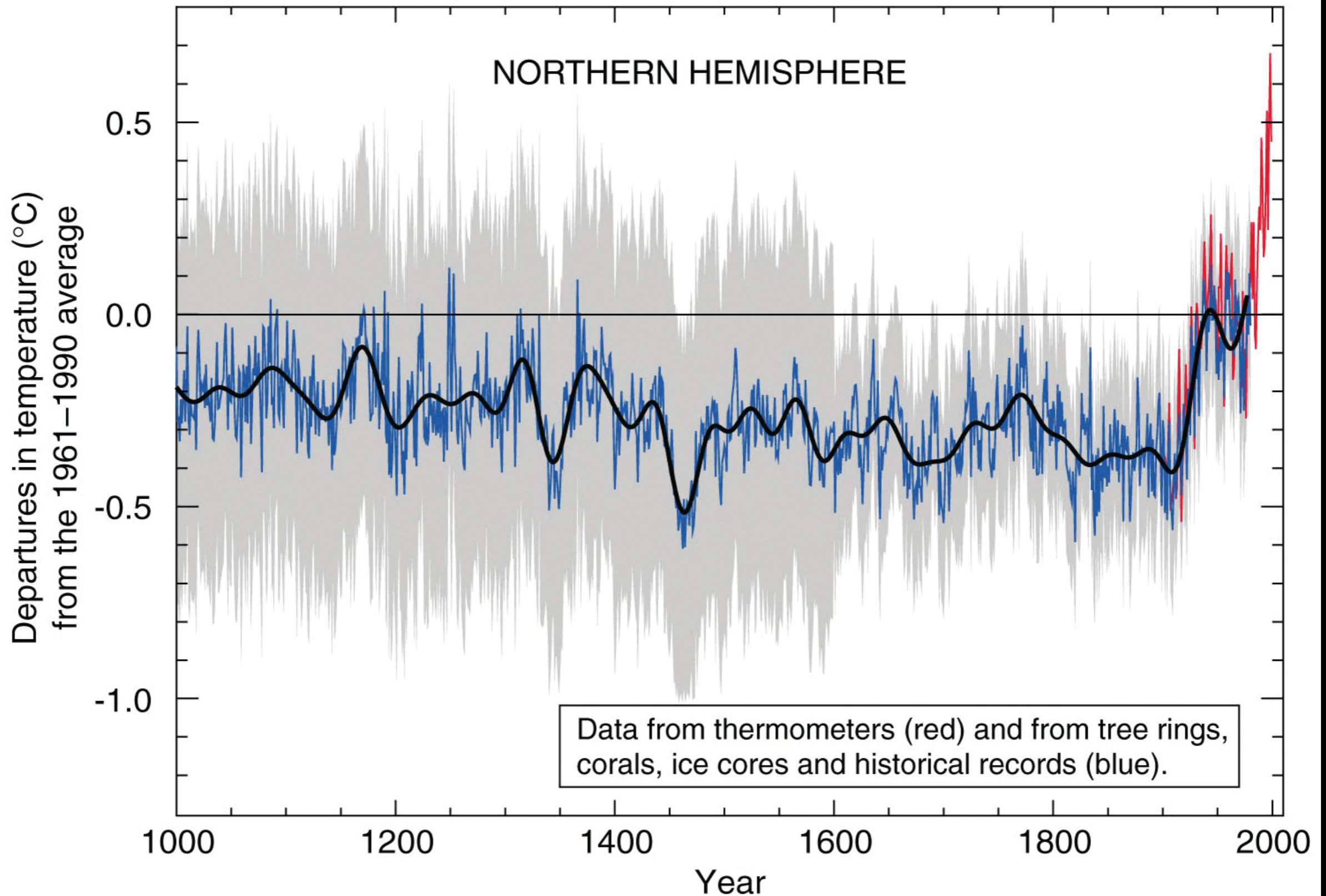
Nigel Holmes, former graphics director for Time magazine and founder of Explanation Graphics

A visualization is a graphical representation designed to enable exploration, analysis, or communication

2016

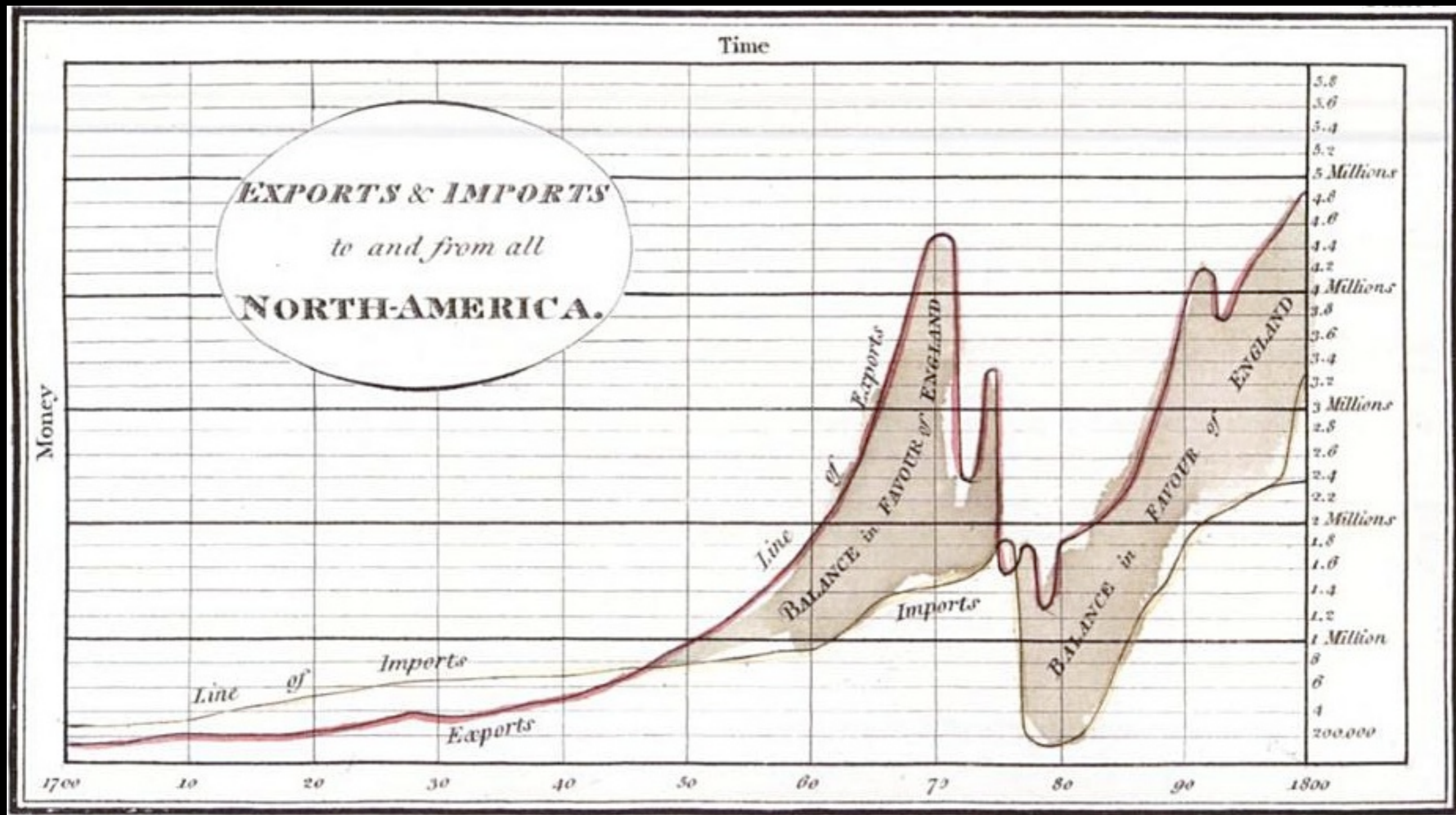
Year	Quelccaya Ice Co	Quelccaya	Quelccaya	Quelccaya	Svalbard	West Gree	Tasmania	north gat	NA treelin	Southeast U.S.	Southeast	Southeast	Yakutia D	Fennosca	Northern Urals	Dendro density
1400	-17.00	0.94	-18.40	1.32	34.90	-0.56	14.60	-0.36	0.72	374.00	455.00	428.00	7.81	-0.55	0.38	
1401	-16.80	1.25	-17.60	1.58	39.50	-0.64	14.60	-0.54	0.72	265.00	344.00	354.00	8.80	0.14	-0.02	
1402	-16.50	1.25	-17.10	1.05	44.20	0.37	14.80	0.06	0.72	240.00	425.00	443.00	6.00	0.68	-0.29	
1403	-15.70	1.25	-17.40	0.78	48.80	0.25	14.50	0.91	0.72	349.00	372.00	340.00	6.61	0.59	-1.81	
1404	-15.20	0.93	-17.30	1.56	51.40	-0.49	14.30	0.11	0.72	324.00	383.00	429.00	7.34	0.88	-0.81	
1405	-19.00	1.09	-17.50	1.04	52.70	-0.04	15.40	-0.24	0.87	318.00	368.00	381.00	4.84	0.91	-0.59	
1406	-20.10	1.55	-17.40	0.78	54.00	-0.54	15.50	0.02	1.03	363.00	403.00	402.00	4.83	0.82	0.22	

	P	Q	R	S	T	U	V	W	X	Y	Z	AA	AB	AC	AD
1	PC_1	PC_2	PC_3	PC_4	PC_5	PC_6	PC_7	PC_8	PC_9	PC_10	PC_11	PC_12	PC_13	PC_14	PC_15
2	1.09	1.23	-0.57	-2.11	0.09	-1.23	0.4	-1.12	-0.63	-1.12	-0.34	-0.79	0.02	-0.13	-0.53
3	-1.68	0.86	0.38	-1.32	-0.1	-0.26	1.39	-0.77	-0.97	-0.79	0.4	0.11	-0.72	-0.15	-0.11
4	-0.53	1.66	-0.82	-1.46	0.51	0.71	-0.68	0.28	-0.72	0.36	0.9	1.42	-1.02	0.06	-0.61
5	-0.46	1.97	-0.93	-2.19	0.95	0.45	0.06	1.2	-0.26	1.78	-0.21	-0.36	1.17	-0.34	-0.3
6	-0.19	2.05	-0.03	-1.63	0.63	-0.39	1.03	0.08	-1.56	0.83	0.19	-0.8	-1.17	-0.78	0.17
7	-0.37	0.72	-2.2	-0.31	-0.87	0.34	-0.97	0.96	-1.12	0.03	0.72	-0.11	0.03	0.76	0.3
8	0.72	0.58	-1.87	0.35	-0.16	0.61	-1.83	1.19	-0.77	-0.38	0.96	0.34	1.7	1.39	0.32
9	-2.6	-0.26	-0.78	0.47	-0.76	0.55	-0.43	0.6	-1.17	0.37	0.42	-0.03	-0.81	-0.35	0.36
10	1.24	0.37	-0.62	1.45	-0.5	0.92	-1	0.58	-0.18	-0.57	0.16	-1.17	-0.05	-0.29	-0.64
11	-1.63	1.31	-1.51	0.86	0.59	0.24	-0.94	0.77	0.12	0.19	0.25	-0.45	-0.78	-0.14	0.21
12	-0.97	0.5	-0.12	0.64	-1.04	0.42	-0.72	0.17	-1	2.42	-0.19	0.24	0.05	-0.18	0.22
13	-0.54	1.45	0.57	0.61	-0.08	1.46	0.09	0.81	-1.33	1.69	0.63	0.24	0.67	-0.39	0.33
14	-1.93	0.6	0.19	0.23	2.48	-0.11	-0.81	-0.78	-0.1	0.45	-0.98	1.63	-0.95	0.74	-0.13
15	0.03	0.79	1.53	0.79	0.18	-0.05	-0.42	0.27	-1.65	-0.7	-0.2	-0.22	-0.24	1.58	0.59
16	-0.23	-0.24	0.08	0.56	0.48	0.52	-1.86	-0.31	-0.68	0.1	-1.2	-0.23	-0.2	-0.03	0.15
17	0.7	0.86	-1.46	0.23	-0.17	0.87	-0.32	1.09	-0.03	0.09	-0.22	0.64	-0.14	-0.19	-0.13
18	-0.13	1.13	-0.54	1.36	-0.34	0.71	-0.1	1.27	-1.21	1.19	-0.89	-0.64	0.36	-0.62	-0.8
19	0.05	0.73	0.61	1.33	-0.42	0.58	-0.7	-0.62	-0.06	-0.13	0.95	-0.74	0.85	0.62	0.56
20	1.83	0.54	-0.82	1.04	-0.01	0.75	-1.19	0.12	-1.01	0.52	-0.7	-0.44	0.5	-0.26	0.33
21	0.2	-0.3	-0.56	-0.15	-0.18	1.3	0.17	1.21	-0.13	0.79	-0.25	-0.04	0.5	0.2	-0.17
22	-0.38	0.04	-0.91	-0.71	0.08	0.39	-0.55	1.07	-0.24	0.01	-0.07	0.71	0.74	1.2	-0.16
23	-1.81	-0.83	-0.04	-0.71	-0.69	0.72	0.16	1.02	-1.2	-0.34	0.92	0.2	-1.04	0.08	-0.16
24	-0.26	-0.23	-1.75	-0.99	-1.87	0.51	-0.08	-0.49	-0.52	-1.35	-0.94	-0.85	0.3	-0.51	0.57
25	-1	0.64	-0.47	-0.91	-0.96	0.88	-0.06	-0.1	-1.26	-1.01	-0.84	-0.14	0.44	-0.73	-0.17
26	0.24	0.94	0.49	-1.07	1.51	1.15	0.13	1.27	-1.86	0.07	-0.38	0.75	0.55	-1.4	-0.57
27	0.97	1.19	-0.44	-0.76	1.81	-0.17	-0.31	0.88	-2.28	-0.87	-0.11	0.3	0.31	0.22	-0.14
28	-0.55	1.09	0.34	-1.03	-1.17	0.58	-0.75	0.55	-1.34	0.34	-0.82	1.13	-0.6	0.26	-0.01
29	-2.33	0.35	0.15	-0.96	-0.52	1.3	0.5	0.93	-1.17	-0.21	1.18	0.21	0.05	-0.4	-0.05
30	0.17	0.21	-0.36	-0.98	-1.38	0.87	1.04	0.7	0.13	-0.83	0.14	-0.87	0.27	0.39	1.25
31	1.77	0.52	0.55	-1.4	-1.22	0.71	0.09	0.31	-0.67	-0.43	1.73	-0.99	0.23	-0.62	0.72
32	1.1	0.66	-0.46	-0.56	-0.25	1.34	0.43	-0.17	0.41	-0.44	0.22	0.66	-1.49	-0.95	0.08
33	-2.82	0.78	-0.45	-0.75	0.52	0.86	0.54	0.33	0.35	0.61	1.03	0.53	0.1	-0.56	0.49
34	1.15	1.72	-0.87	-0.7	-1.21	0.54	1.47	-1.02	-0.74	0.65	0.78	0.56	-2.16	0.18	0.42
35	-0.71	0.64	-0.6	1.22	-1.02	0.48	1.53	0.03	-0.12	0.5	0.09	0.6	-1.25	1.28	0.29
36	1.55	0.23	-1.15	1.02	0.5	0.15	0.35	1.17	-0.43	0.8	0.61	1.03	-0.32	0.65	-0.19
37	1.59	0.23	-2.06	1.07	-1.23	1.77	0.5	1.31	0.33	0.54	0.3	0.13	-0.59	-1.01	0.7
38	0.24	-1.47	-1.62	1.37	-0.61	0.75	0.48	1.98	0.57	-0.2	0.78	0.53	0.8	-0.29	-0.64
39	0.07	0.79	-0.48	0.56	0.44	0.11	0.67	1.81	-0.45	0.52	0.49	-0.25	0.98	0.77	-1.25
40	-0.69	-0.16	-0.26	-0.28	-0.11	0.42	0.61	0.79	-0.05	0.65	0.32	-0.67	-0.61	-1.19	-0.03
41	1.56	0.83	1.13	-0.33	0.36	-0.4	0.15	-1.32	-0.59	-0.5	0.08	-0.53	0.36	-0.94	-0.16
42	-2.42	0.5	0.23	-0.4	-1.16	1.47	1.01	-1.25	-0.94	1.33	-0.97	0.17	-0.39	-0.61	0.31
43	1.44	2.48	1.17	0.78	0.26	1.44	-0.03	0.31	-0.17	-0.84	0.24	0.39	1.09	0.02	-0.32
44	-1.8	0.92	0.08	0	-0.06	-0.74	-0.5	0.25	-0.52	0.11	-0.79	0.15	-0.54	0.53	0.06
45	1.18	1.5	0.31	0.56	0.07	-0.01	-0.1	0.52	0.27	-0.94	-0.59	0.83	0.12	1.49	-0.35
46	-0.47	0.26	0.2	1.28	-0.74	1.57	-0.24	0.72	0.95	-0.27	-1.43	-1.56	-0.11	0.1	-0.3
47	-1.2	0.23	-0.18	-0.55	1.58	0.48	1.16	-1.38	-0.99	1.16	-0.81	0.75	-0.58	-0.77	0.37
48	-0.31	1.35	-0.62	-0.5	0.86	-0.02	0.99	0.09	0.43	0	-0.66	-0.74	0.83	-0.5	0.35



Michael E. Mann, Raymond S. Bradley, and Malcolm K. Hughes
Intergovernmental Panel on Climate Change (IPCC), Third Report, 2001

William Playfair, *The Commercial and Political Atlas*



http://en.wikipedia.org/wiki/William_Playfair

John W. Tukey

EXPLORATORY DATA ANALYSIS



UNDERSTANDING DATA

B.H. ERICKSON AND T.A. NOSANCHUK



SECOND EDITION

INTRODUCTION TO THE PRACTICE OF STATISTICS

FIFTH EDITION



DAVID S. MOORE
GEORGE P. McCABE

How Y'all, Youse and You Guys Talk

What does the way you speak say about where you're from?
Answer all the questions below to see your personal dialect map.

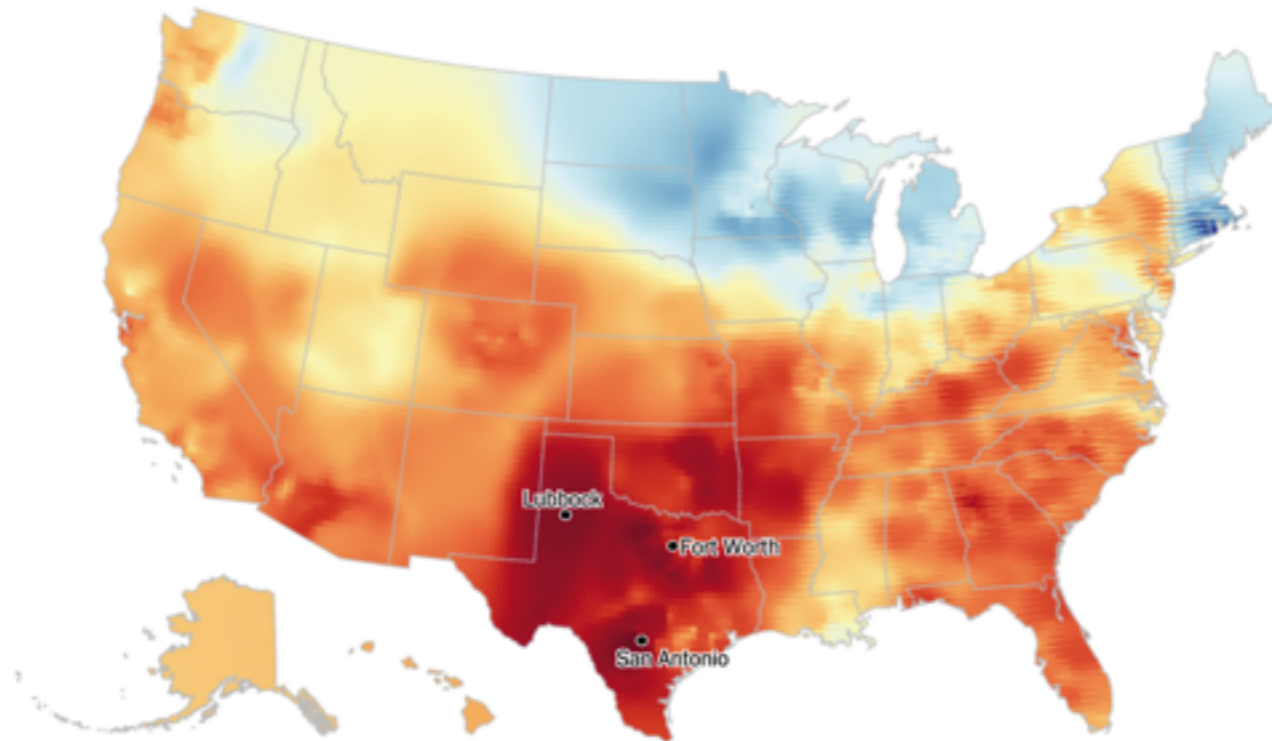
Your Map

See the pattern of your dialect in the map below. Three of the most similar cities are shown.

Least similar Most similar

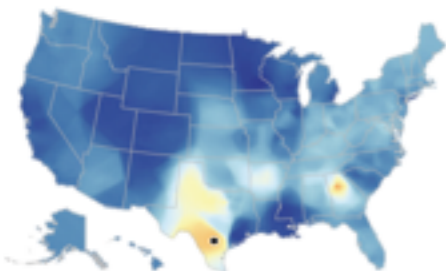
Show least similar

SHARE YOUR MAP:   



These maps show your most distinctive answer for each of these cities.

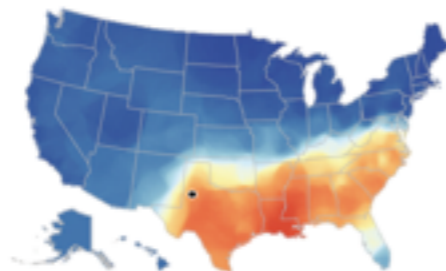
SAN ANTONIO



What do you call the small road parallel to the highway?

access road

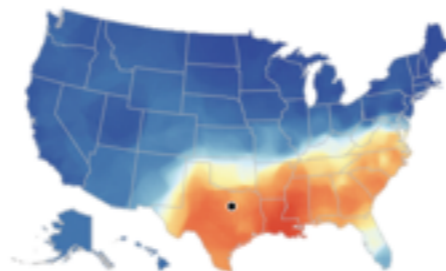
LUBBOCK



How would you address a group of two or more people?

y'all

FORT WORTH



How would you address a group of two or more people?

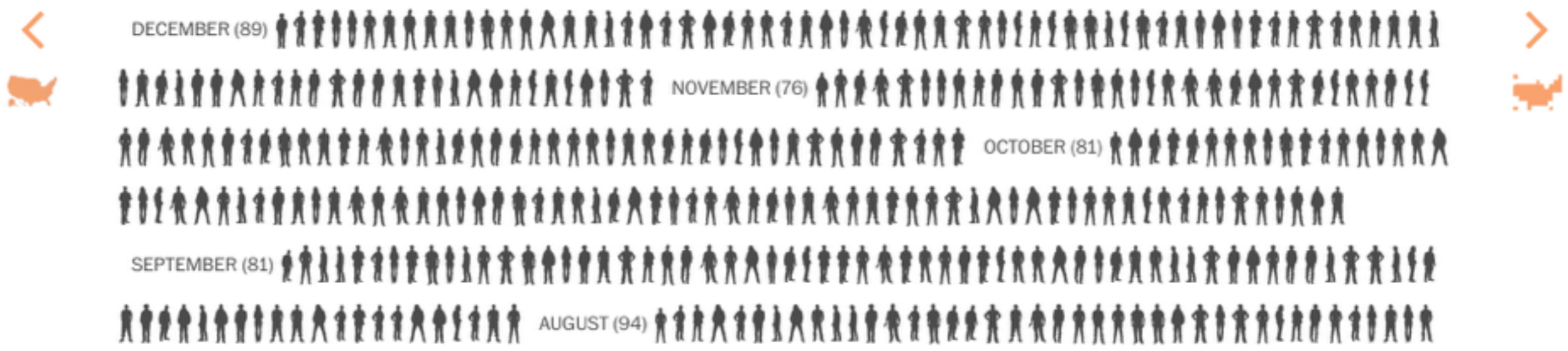
y'all

<http://www.nytimes.com/interactive/2013/12/20/sunday-review/dialect-quiz-map.html>

STATE	GENDER	RACE	AGE
AL AK AZ AR CA CO CT DE DC	Male 948	White 494	Under 18 18
FL GA HI ID IL IN IA KS KY	Female 42	Black 258	18 to 29 330
LA ME MD MA MI MN MS MO MT	Unknown 0	Hispanic 172	30 to 44 353
NE NV NH NJ NM NY NC ND OH	WEAPON	Other 38	45 and up 277
OK OR PA RI SC SD TN TX UT	Deadly weapon 783	Unknown 28	Unknown 12
VT VA WA WV WI WY	Vehicle 54	SIGNS OF MENTAL ILLNESS	THREAT LEVEL
	Toy weapon 34	Yes 250	Attack in progress 730
	Unarmed 93	No or unknown 740	Other 216
	Unknown 26		Undetermined 44

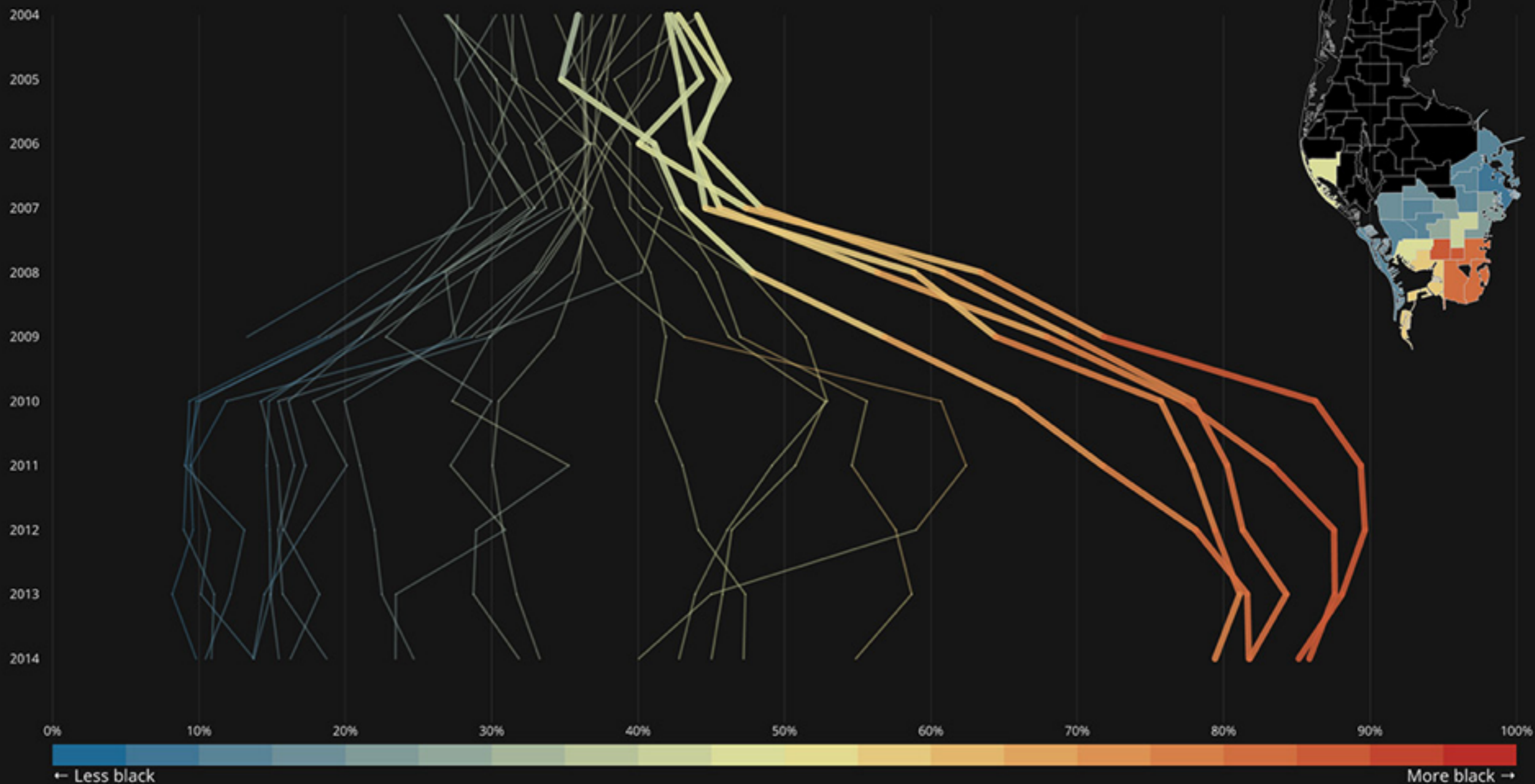
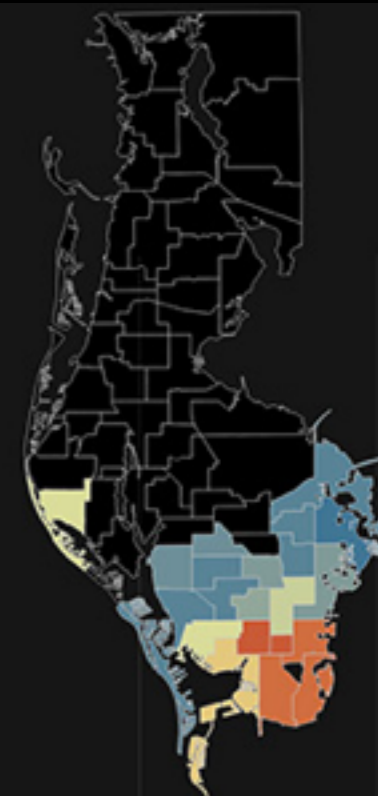
^ TAP TO HIDE THESE FILTERS ^

SHOOTINGS BY POLICE PER MONTH IN 2015



<https://www.washingtonpost.com/graphics/national/police-shootings/>

Today, **Campbell Park, Fairmount Park, Lakewood, Maximo** and **Melrose** are the **most segregated** schools in Pinellas.



<http://www.tampabay.com/projects/2015/investigations/pinellas-failure-factories/chart-failing-black-students/>



Browse studies database ▾

Skills

Experts

Syllab

Find studies, reports, data and more:

ADS, PUBLIC OPINION, PUBLIC HEALTH

How “scientific” graphs and formulas can increase the persuasiveness of advertising media

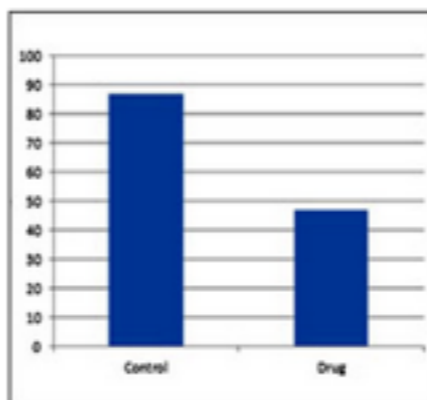
Last updated: December 3, 2014

Research Findings

Feedback

Share

Tweet



“New and improved!” is the oldest line in the advertising book, but it’s a book that has gotten plenty crowded in recent years. Once restricted to blazingly obvious banner ads, online advertisers now [track users’ behavior](#) and slip promotions into search results, Twitter feeds, and Facebook pages. Traditional ads have been joined by “native advertising,” which is designed to look like editorial content, and its ability to deceive consumers has [received pointed attention](#) from the Federal Trade Commission.

Whether ads are on broadcast media, in print, or online, their effectiveness has been the subject of substantial academic research. A 2013 study published in *Political Communication* found that for political advertising, most persuasion effects are [short-lived](#), particularly with state and local elections. A 2011 study from the University of Toronto and MIT found that increasing online ad visibility could improve viewer interest, but [could also backfire](#). “Contextually targeted” ads were found to increase a viewer’s interest more than highly visible ones, but tended to be less memorable.

These are not minor questions given the immense amount of money spent on advertising — a projected [\\$182 billion](#) in the United States alone in 2015. A fast-growing segment is direct-to-consumer advertising by pharmaceutical companies. According to a 2014 University of Pennsylvania study, pharmaceutical companies spent [\\$3 billion](#) on consumer advertising in 2012 — more than 20 times what they spent on clinical trials. Such ads often feature claims about the drugs’ effectiveness in an attempt to influence consumer decisions, often about subjects about which they had little understanding.

FULL TEXT OF



Blin
Triv
For
Per
Bell
Effi

RELATED POS



Tru
inst
acre



Am
abo
prop



Pub
“bir
flaw



Dur
adv
effe



Neg
and
cam



Cou
effe
poli

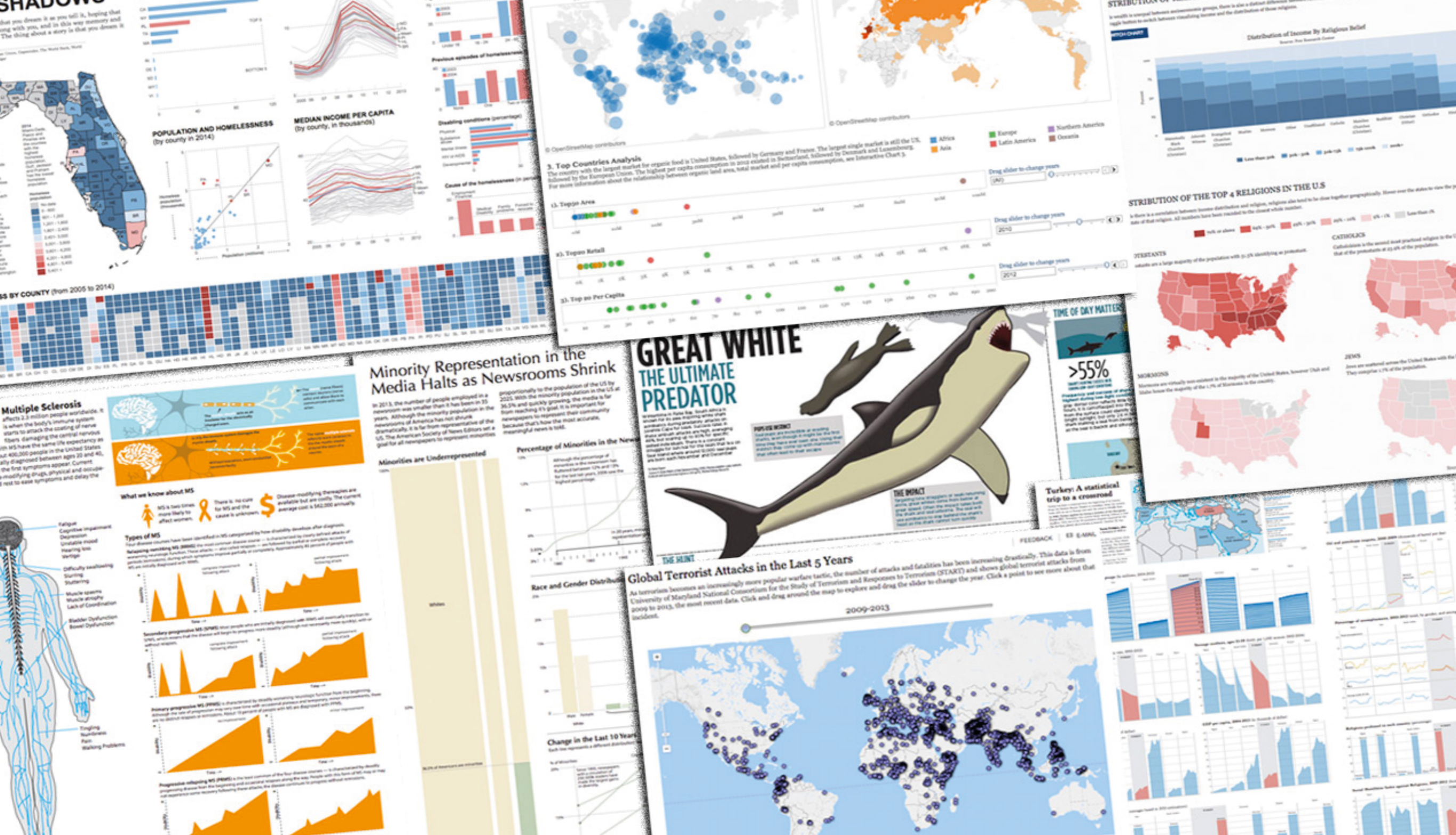


201
of C
Lea

OTHER DATA

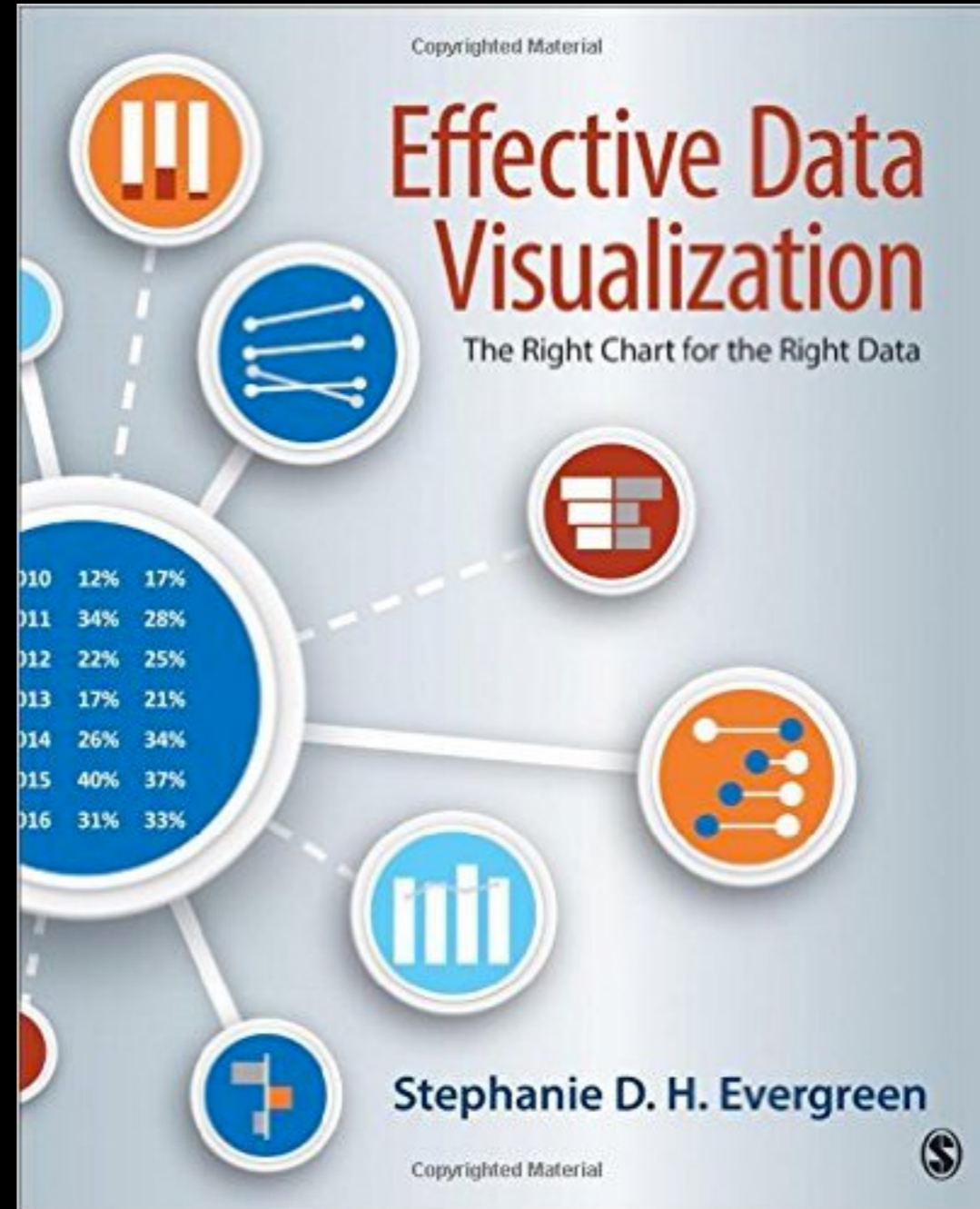
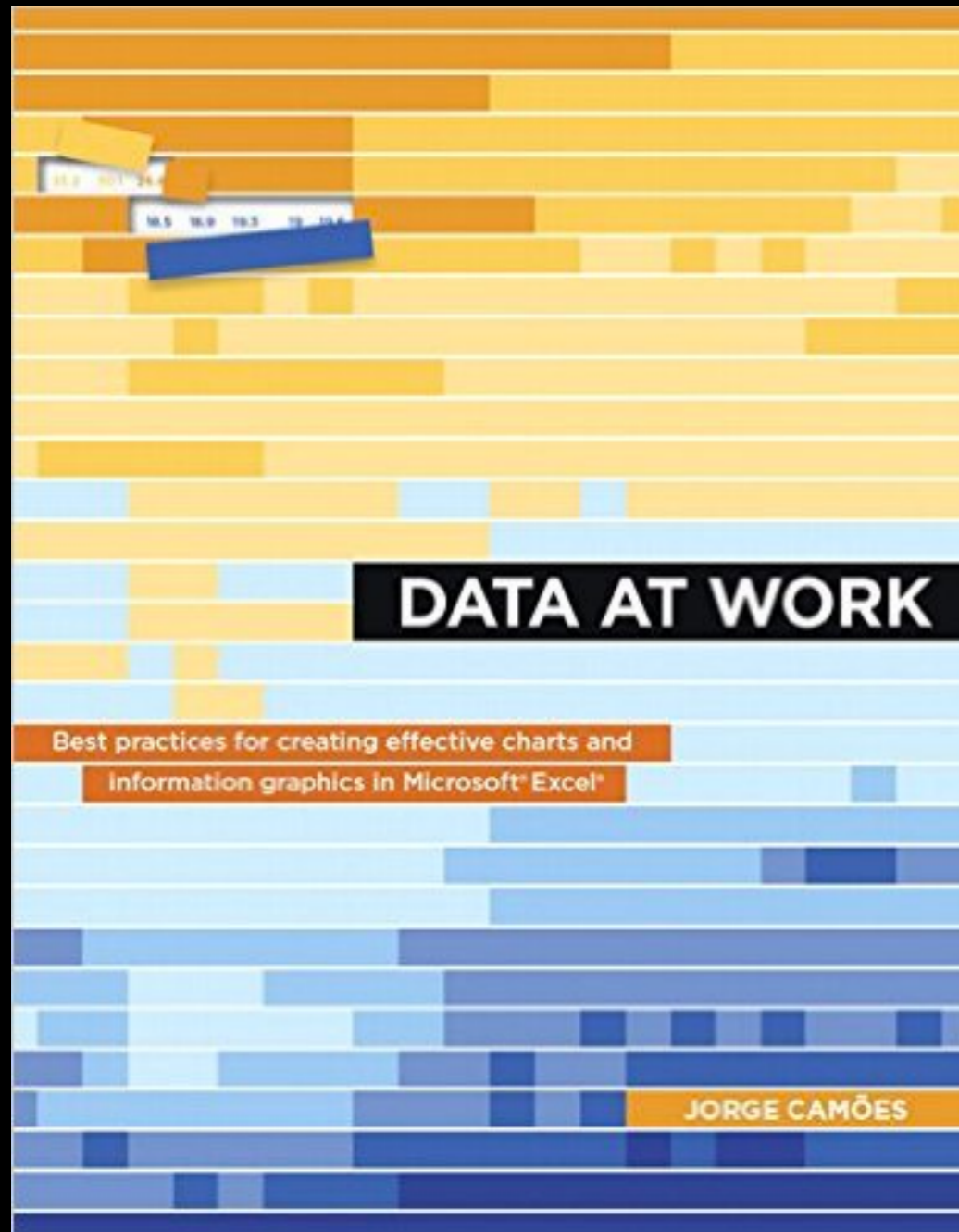
Not only informative, but also persuasive

<http://www.thefunctionalart.com/2016/01/research-on-persuasive-visualization.html>



TECHNOLOGIES

Excel can take you a long way





The R Project for Statistical Computing

Getting Started:

- R is a free software environment for statistical computing and graphics. It compiles and runs on a wide variety of UNIX platforms, Windows and MacOS. To [download R](#), please choose your preferred [CRAN mirror](#).
- If you have questions about R like how to download and install the software, or what the license terms are, please read our [answers to frequently asked questions](#) before you send an email.

News :

- **R version 3.1.2** (Pumpkin Helmet) has been released on 2014-10-31.
- [The R Journal Volume 6/1](#) is available.
- [useR! 2014](#), took place at the University of California, Los Angeles, USA June 30 - July 3, 2014.
- **R version 3.0.3** (Warm Puppy) has been released on 2014-03-06.
- [useR! 2015](#), will take place at the University of Aalborg, Denmark, June 30 - July 3, 2015.

This server is hosted by the [Institute for Statistics and Mathematics](#) of [WU](#) ([Wirtschaftsuniversität Wien](#)).

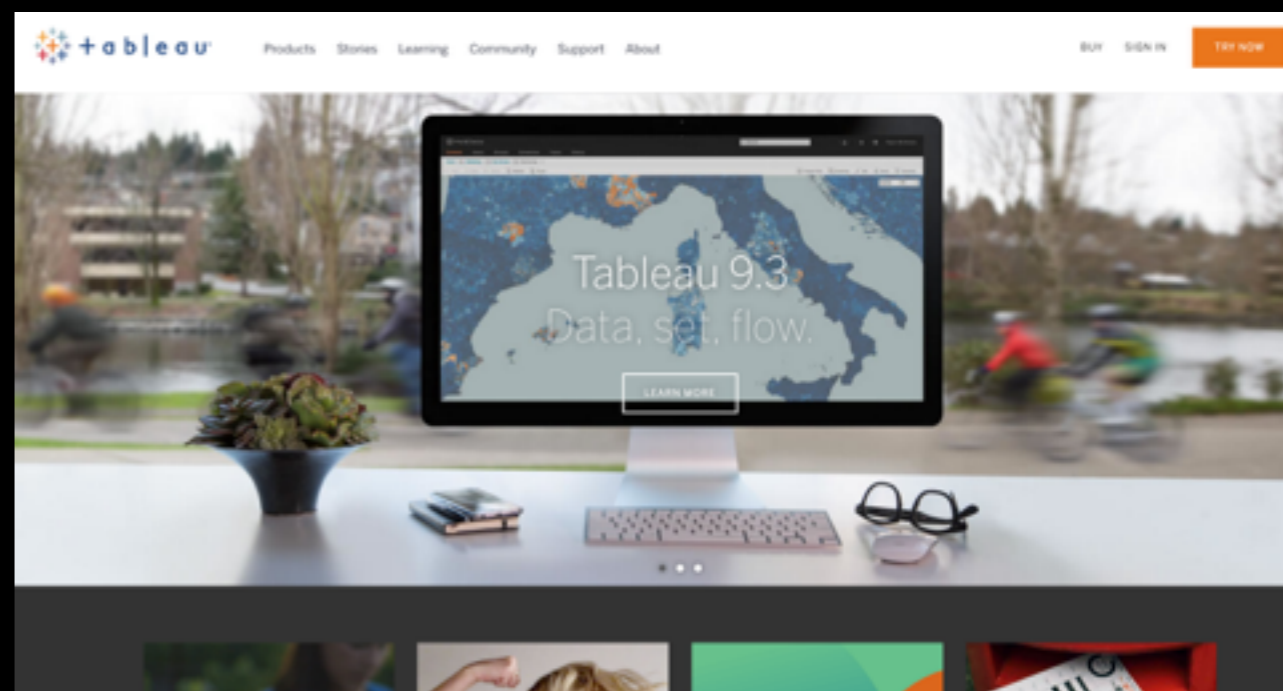


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Tableau 9.3

Data, set, flow.

[LEARN MORE](#)

ggplot2

ggplot2 is a plotting system for R, based on the grammar of graphics, which tries to take the tedium out of the fiddly details that make plotting a hassle (like drawing legends) as well as providing

Documentation

ggplot2 documentation is now available at docs.ggplot2.org.

Mailing list

You are welcome to ask ggplot2 questions on R-help, but if you'd like to participate in a mailing list, please subscribe.

Your email address:

You must be a member to post messages, but anyone can read the archived discussions.



The R Project for Statistical Computing

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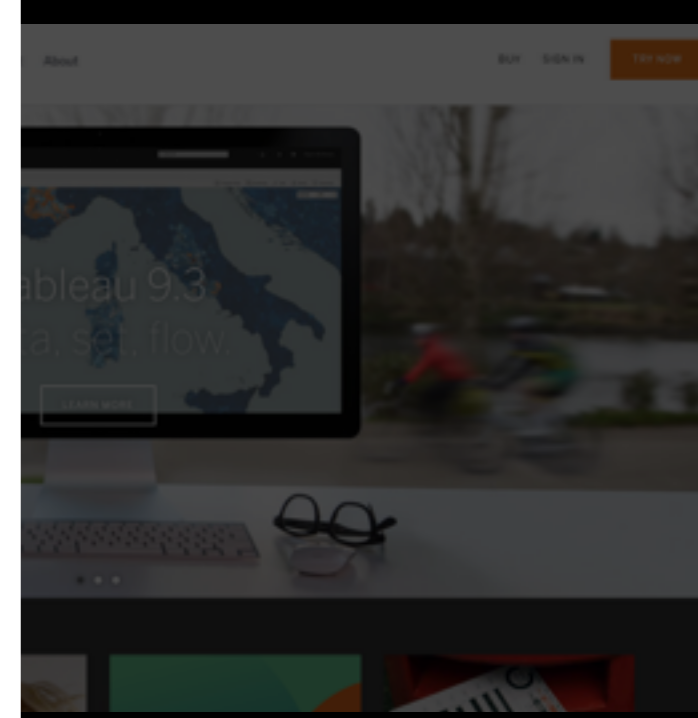
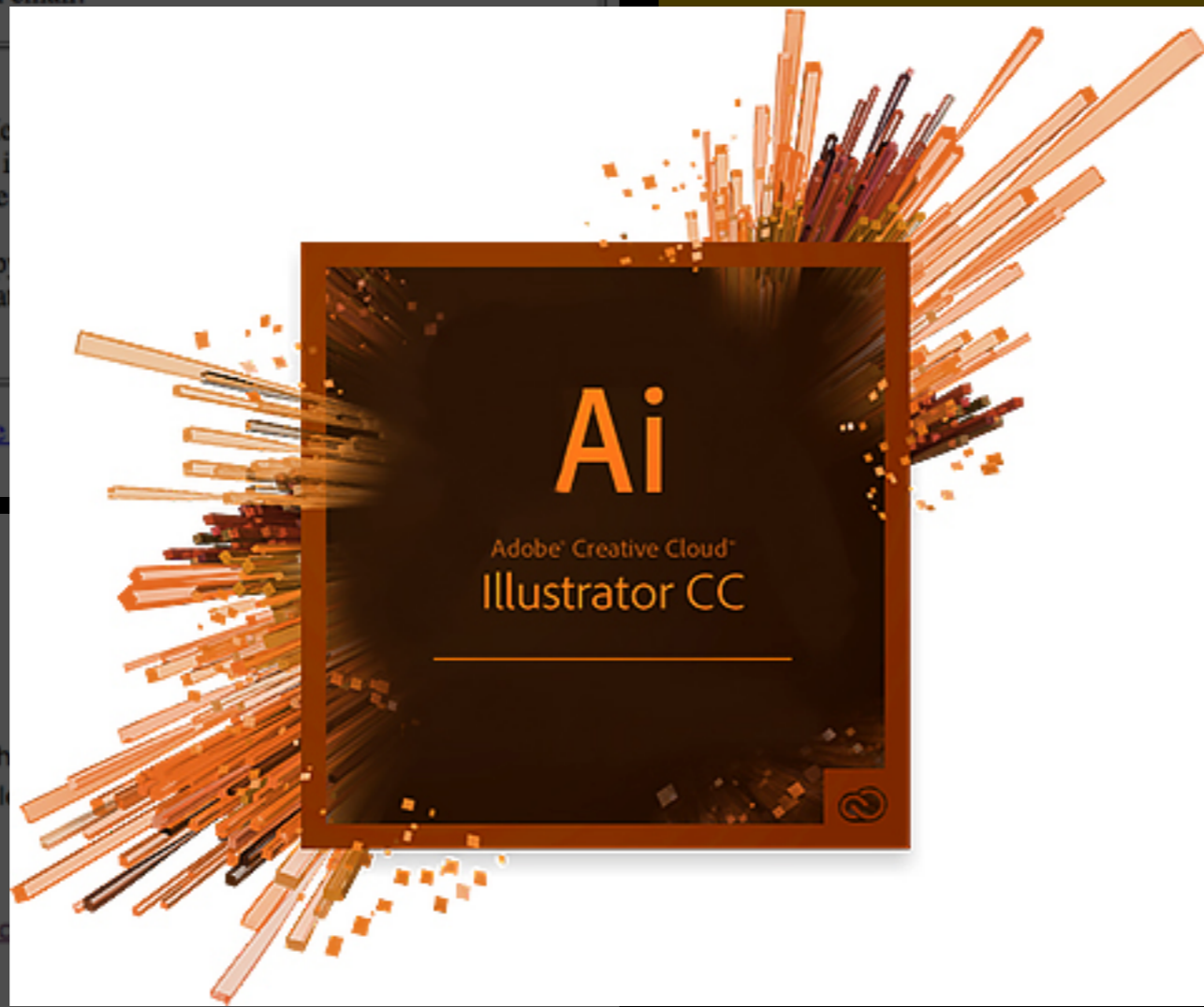
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- [The R Journal Volume 6/1](#)
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This server is hosted by the [Institute \(Wirtschaftsuniversität Wien\)](#).

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ggplot2

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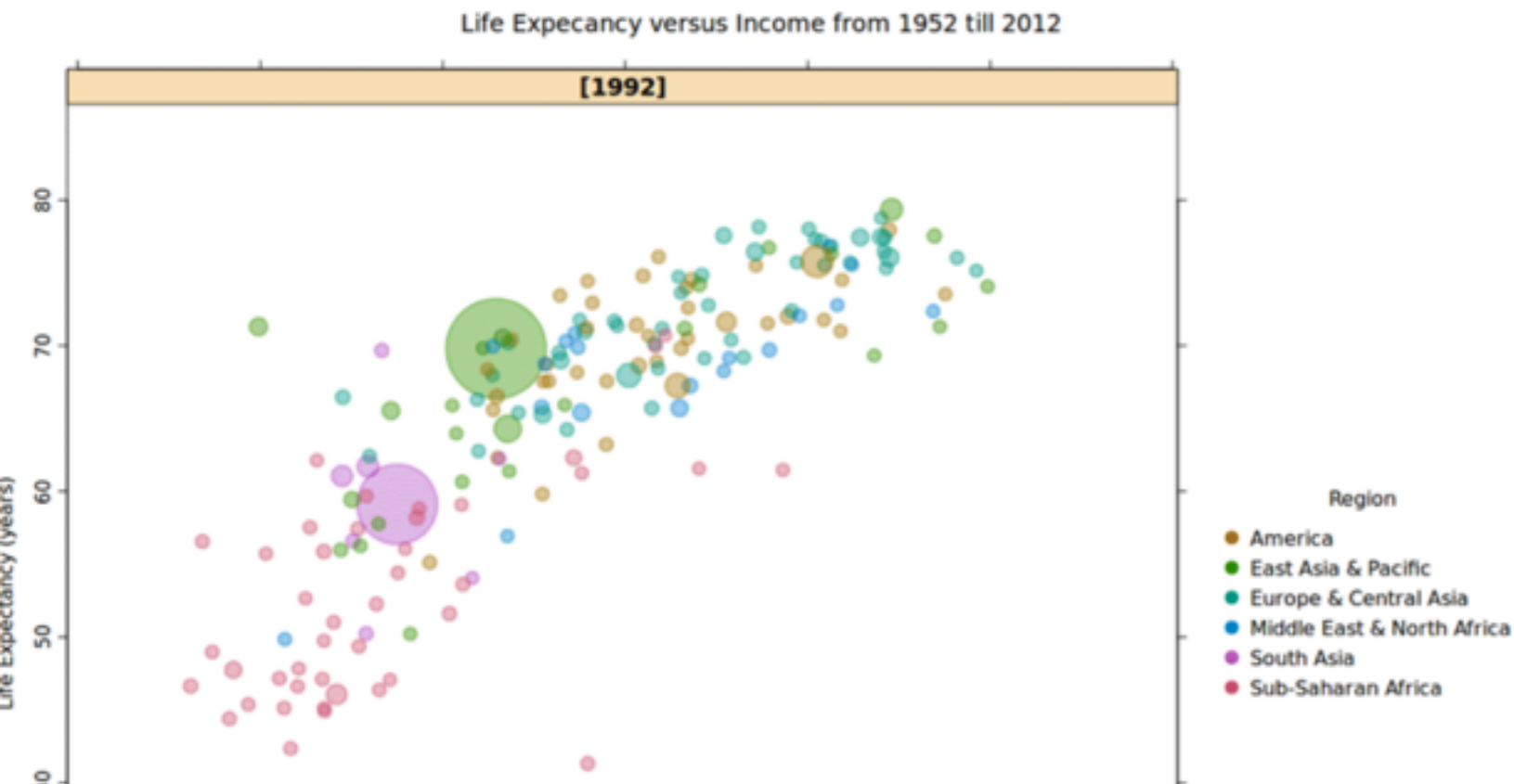
Mailing list

You are welcome to ask ggplot2 questions on R-help, but if you'd like to participate in a mailing list

Your email address:

You must be a member to post messages, but anyone can read the archived discussions.

Easily **explore data** and **discover trends**
without learning complex software



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Release Date: **12 August 2015**

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<https://www.stat.auckland.ac.nz/~wild/iNZight/index.php>

Introduction

yeroon.net/ggplot2 is a web interface for Hadley Wickham's R package *ggplot2*. It is used as a tool for rapid prototyping, exploratory graphical analysis and education of statistics and R. The interface is written completely in javascript, therefore there is no need to install anything on the client side: a standard browser will do. All major browsers are supported but a recent and standards-compliant browser is highly recommended. Best performance is achieved by using Google Chrome.

Mirrors

Currently these public mirrors are available:

- rweb.stat.ucla.edu (Up) (US mirror by UCLA dept. of Statistics)
- labs.dataspora.com (Up) (US mirror by Michael Driscoll)
- app.rapache.net (Up) (US mirror by Jeffrey Horner)

More mirrors are needed to keep this application online. If you are able to supply or sponsor a dedicated or virtual server, please contact the author.

Use case videos



Short introduction

- *Uploading datafiles*
- *Importing data from Google Documents*
- *Univariate and Bivariate plots*
- *Converting a variable to factor*
- *Using the Syntax panel*

[video](#) | [mtcars.txt](#) | [sleepstudy.csv](#) | [diamonds.csv](#)

<http://www.stat.ucla.edu/~jeroen/ggplot2/>

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WHAT
Easy to use

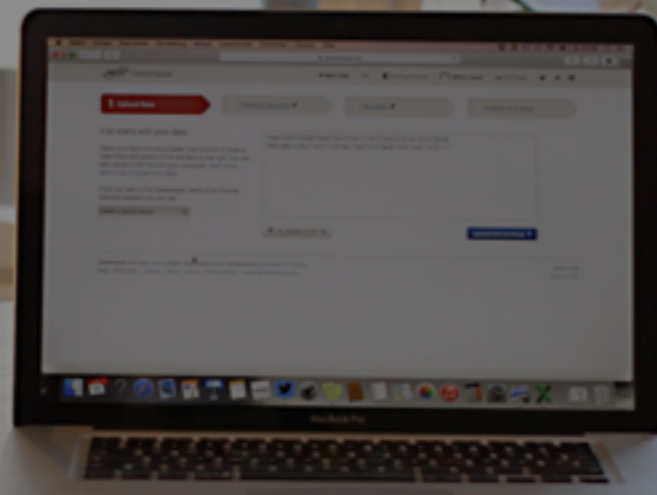
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VIEW DEMO

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Shiny

by RStudio

A web application framework for R

Turn your analyses into interactive web applications

No HTML, CSS, or JavaScript knowledge required

TUTORIAL | ARTICLES | GALLERY | REFERENCE | DEPLOY | HELP



CHALLENGE:

Becoming software-driven

Some core principles

Some core principles

Good graphics...

1. They are based on good data

Some core principles

Good graphics...

1. They are based on good data
2. They attract readers' attention

Some core principles

Good graphics...

1. They are based on good data
2. They attract readers' attention
3. They don't frustrate readers

Some core principles

Good graphics...

1. They are based on good data
2. They attract readers' attention
3. They don't frustrate readers
4. They show the right amount of data

Some core principles

Good graphics...

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4. They show the right amount of data

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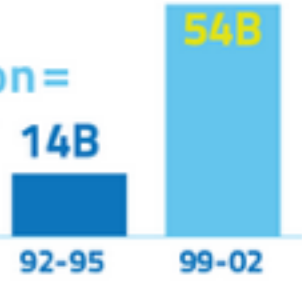
THE BEST ENTERTAINMENT IS FOUND ON CABLE



CHECK THE NUMBERS

Get the Facts About Broadband
Investment and Innovation

Less Regulation =
More Industry
Investment

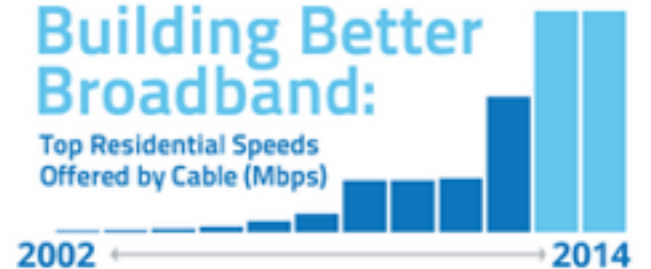


Total U.S. Broadband Industry
Investment since 1999

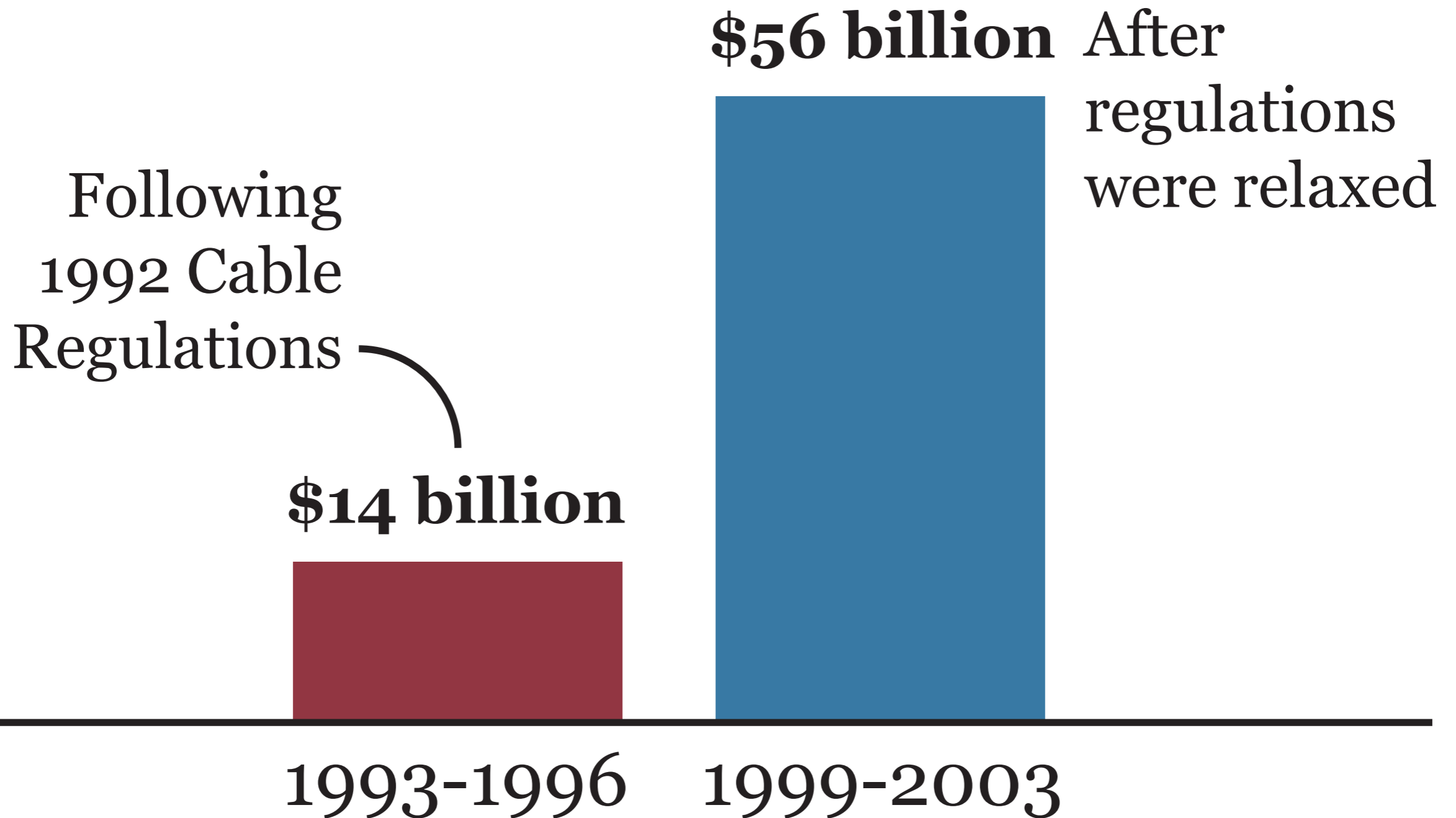


Building Better
Broadband:

Top Residential Speeds
Offered by Cable (Mbps)

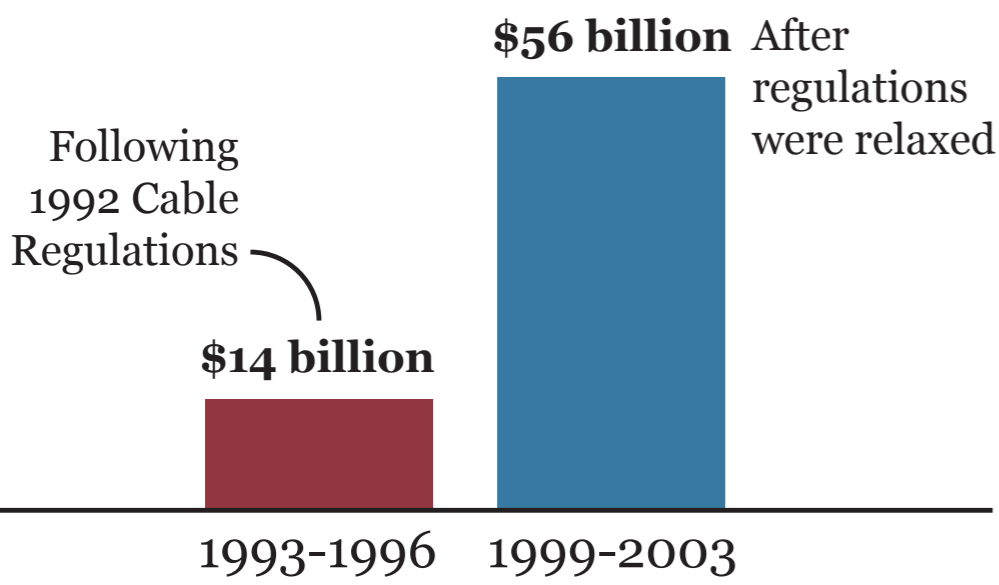


Less regulation = More Industry Investment



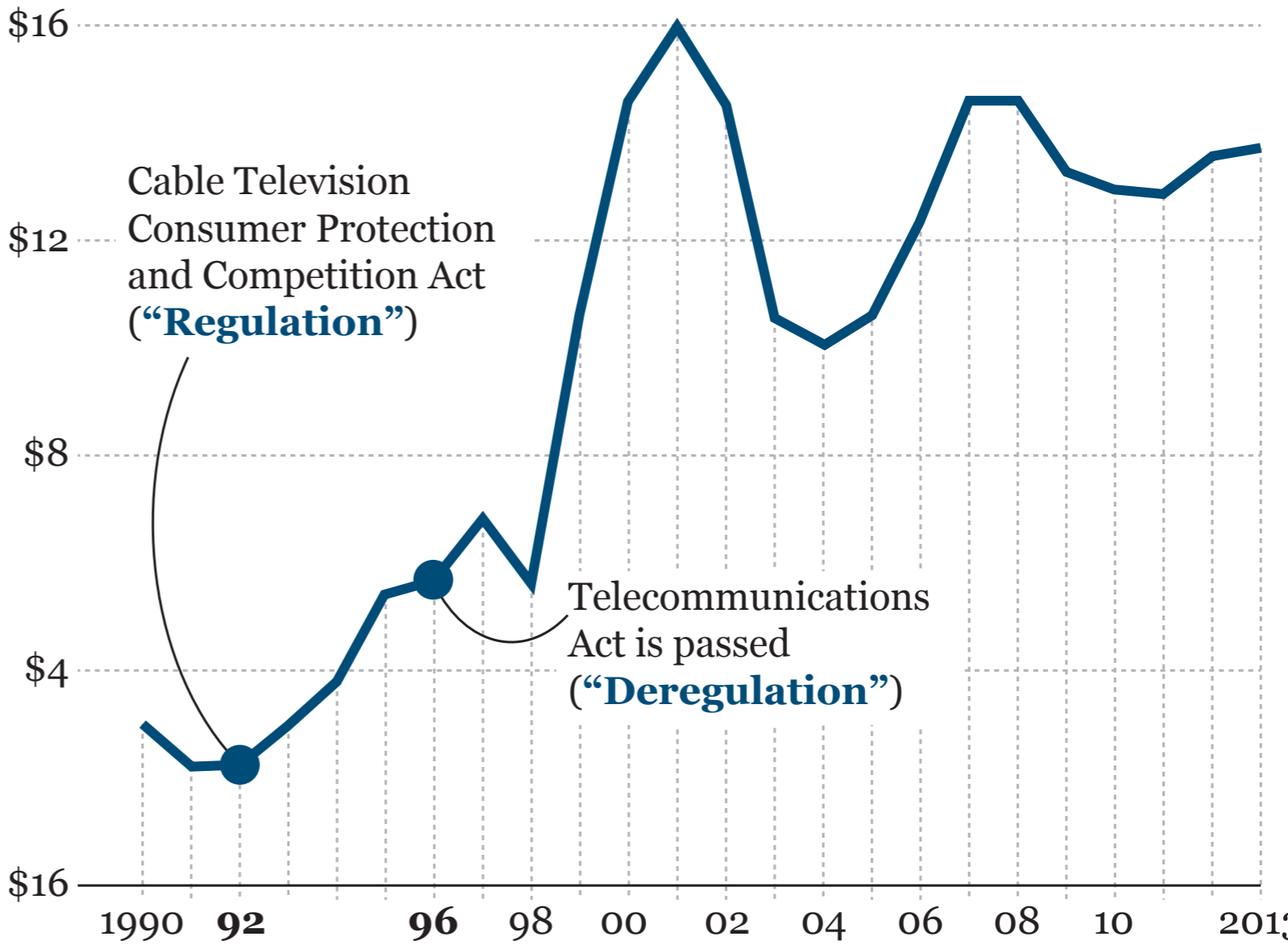
Based on a chart by the National Cable & Telecommunications Association

**Less regulation =
More Industry Investment**



Cable Industry Infrastructure Expenditures

In billions

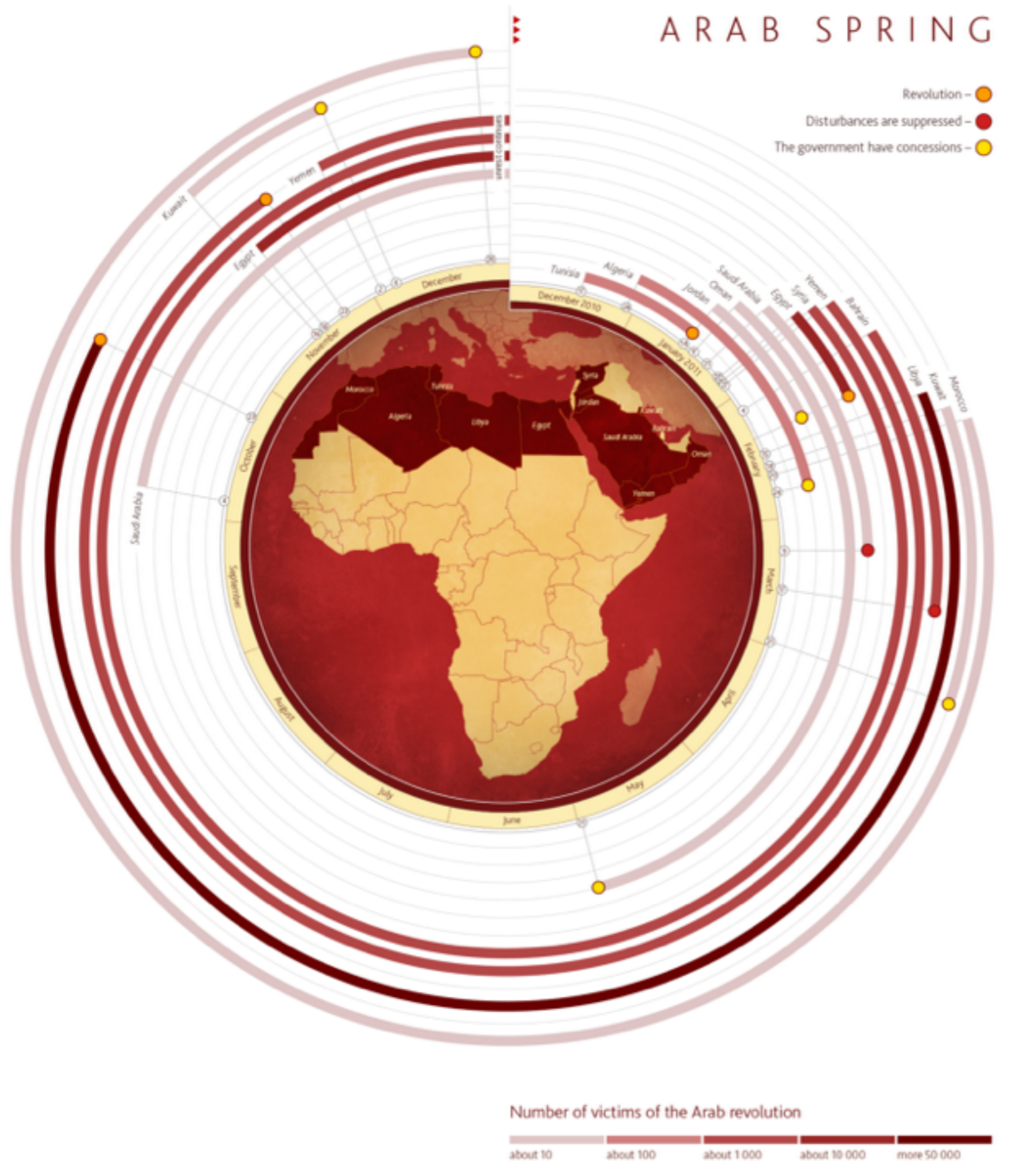


Some core principles

Good graphics...

1. They are based on good data
2. They attract readers' attention
3. They don't frustrate readers
4. They show the right amount of data

ARAB SPRING



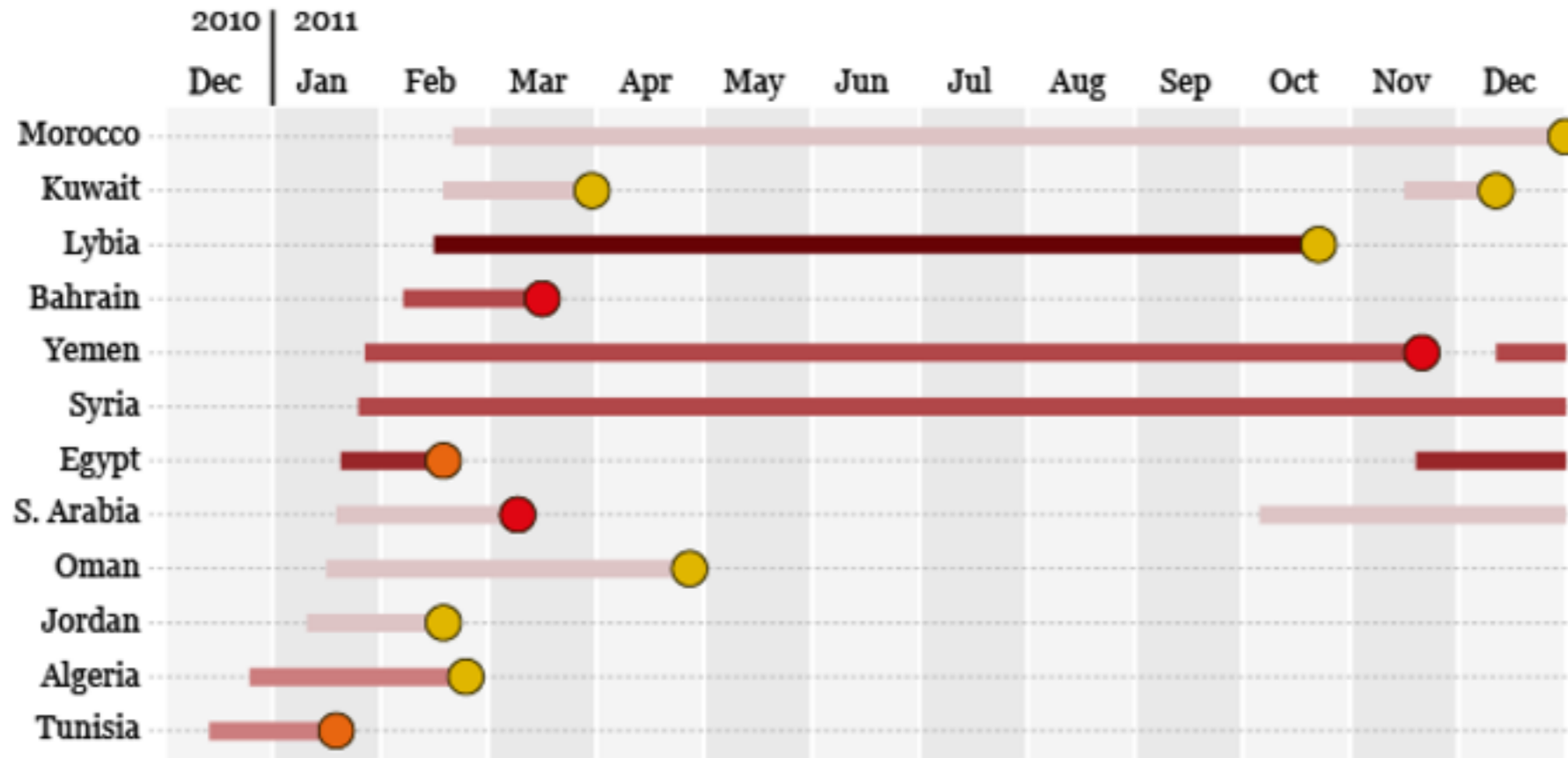
Graphic by
Kir Khachaturov

ARAB SPRING

Victims



● Government makes concessions
 ● Revolution
 ● Protests are suppressed



<http://www.thefunctionalart.com/2015/02/redesigning-circular-timeline.html>

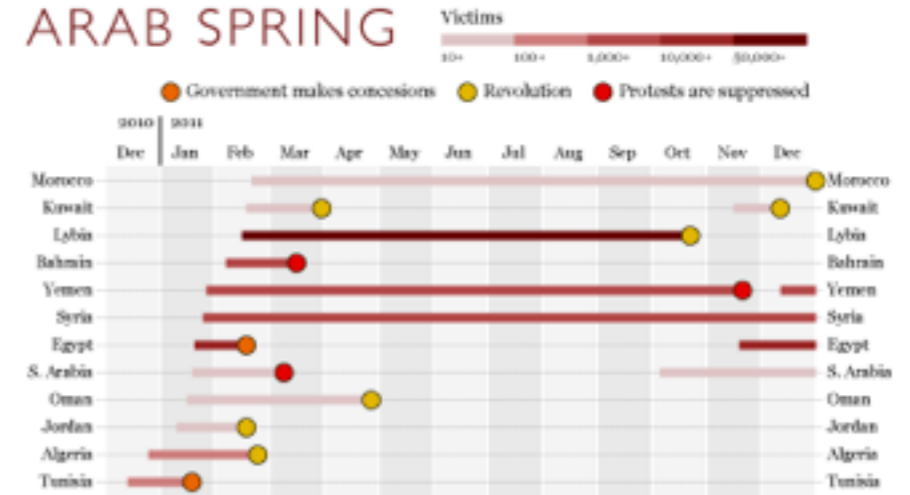
ORIGINAL

ARAB SPRING

NEW VERSION



ARAB SPRING



CHOOSING GRAPHIC FORMS

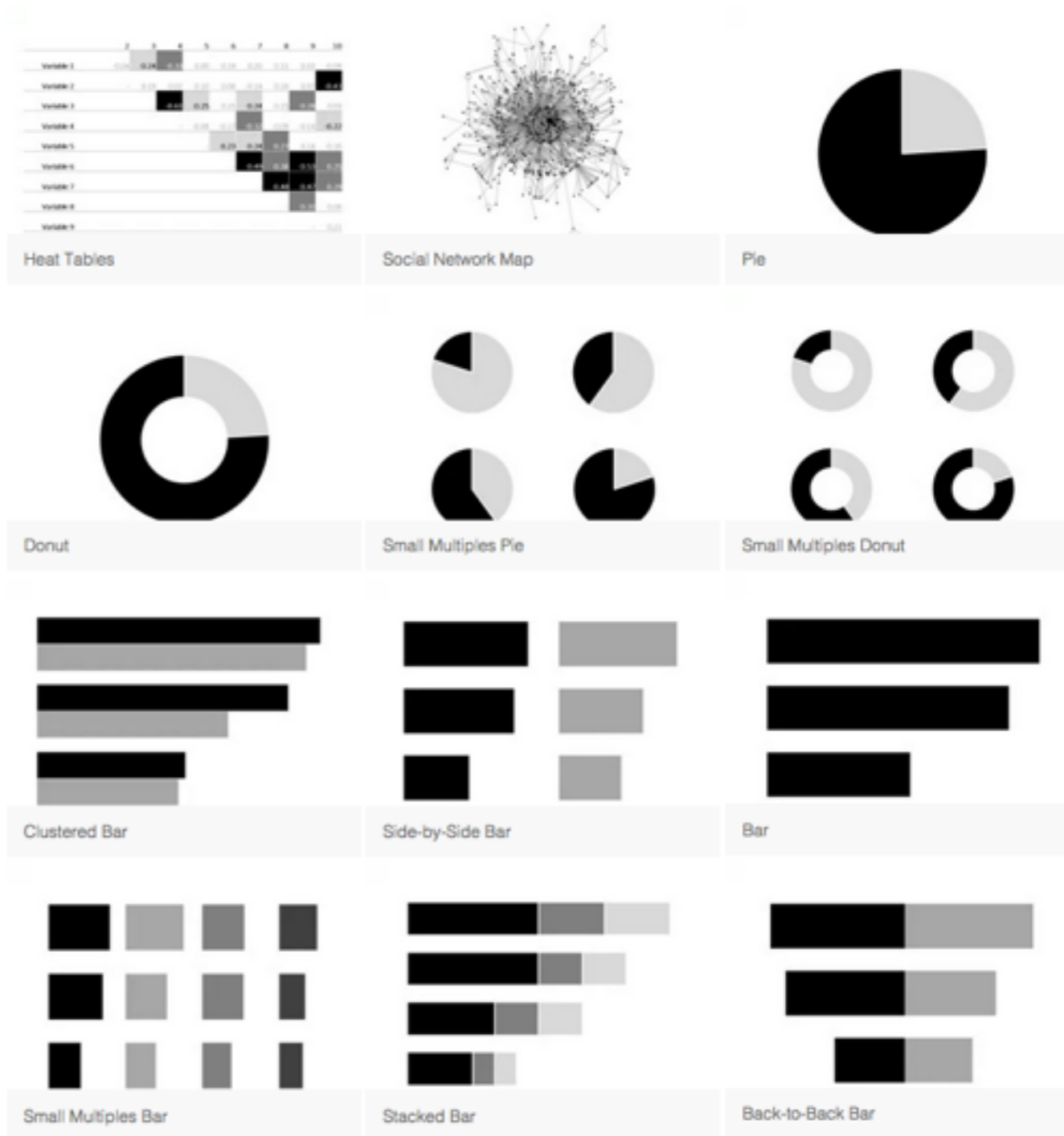
Search by Function

View by List



EMERY'S ESSENTIALS Chart Choosing Tool

ALL / SMALL MULTIPLES / COMPARING 2 OR MORE CATEGORIES / RANGES OR DISPERSION / PART TO WHOLE / DO-ABLE IN EXCEL / GEOGRAPHIC MAPS / RELATIONSHIPS / COLLAGES / QUALITATIVE / EXPLORATORY / CORRELATION / 1 POINT IN TIME / 2 POINTS IN TIME / 3+ POINTS IN TIME



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

<http://annkemery.com/essentials/>

What graphic forms are more appropriate to represent your data?

1. Think about the audience and the publication
2. Think of the questions your graphic should help readers answer
3. Can you understand it without reading every single figure?

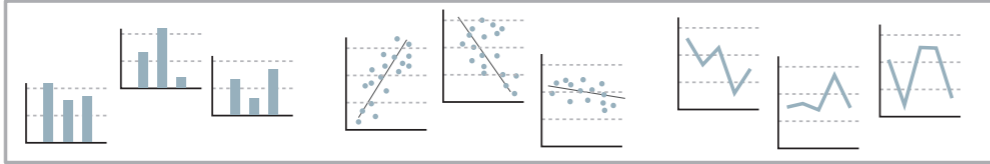
Based on Cleveland and Robert McGill (1984)

Enable accurate estimates

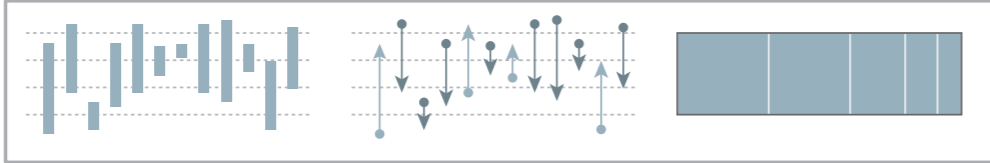
Position along a common scale



Position along identical, nonaligned scales



Length



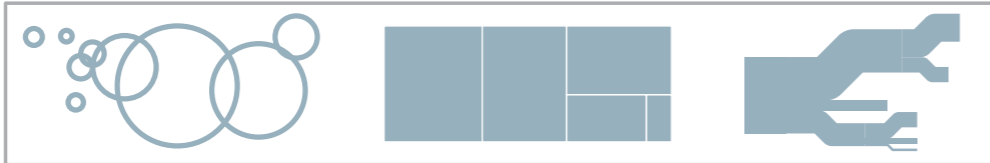
Direction/slope



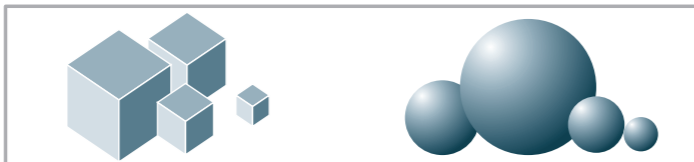
Angle



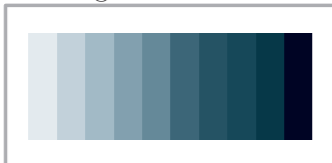
Area



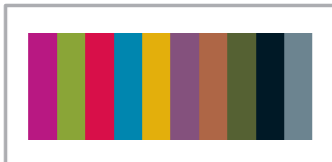
Volume



Shading and saturation

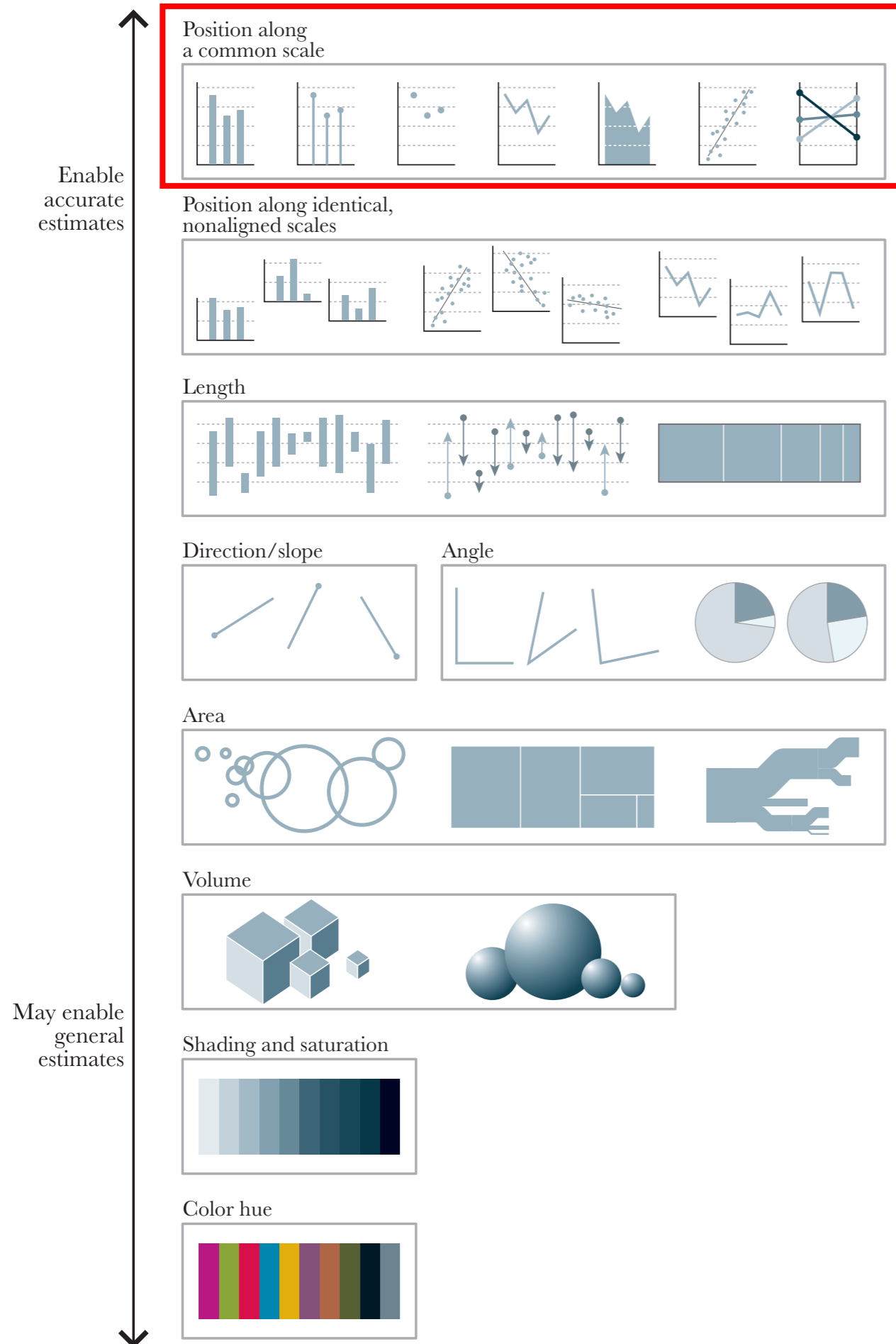


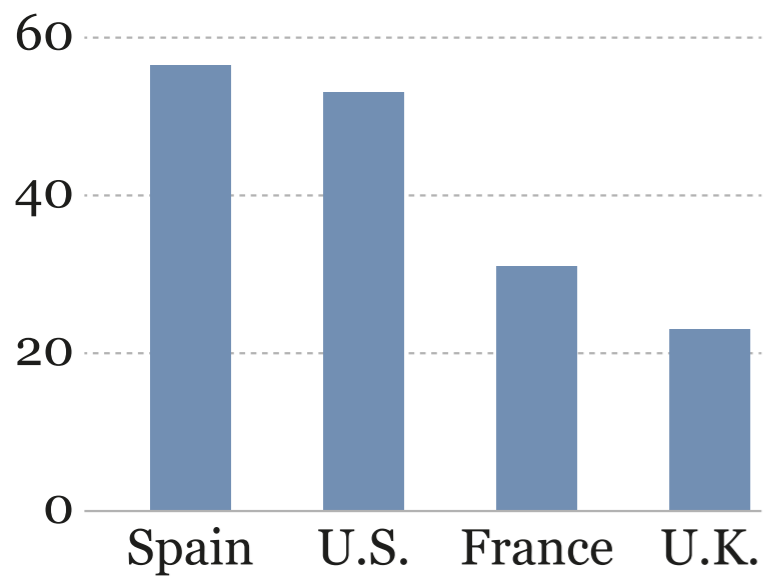
Color hue



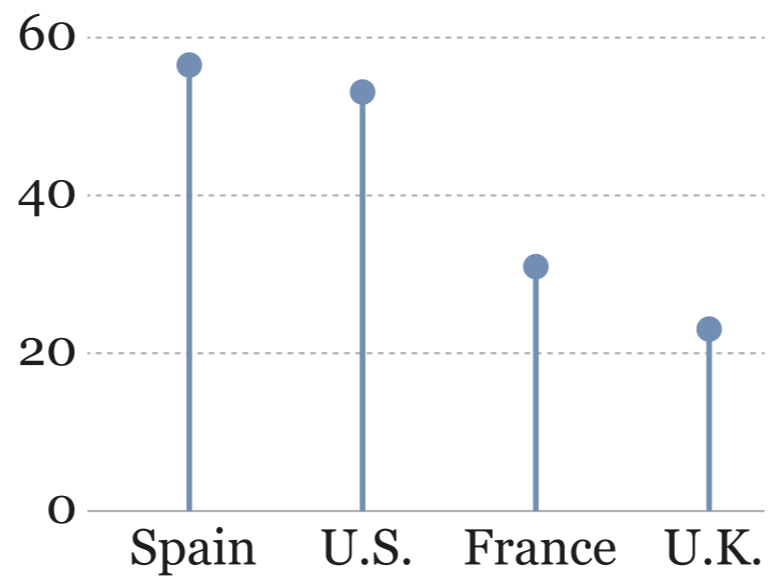
May enable general estimates

Based on Cleveland and Robert McGill (1984)

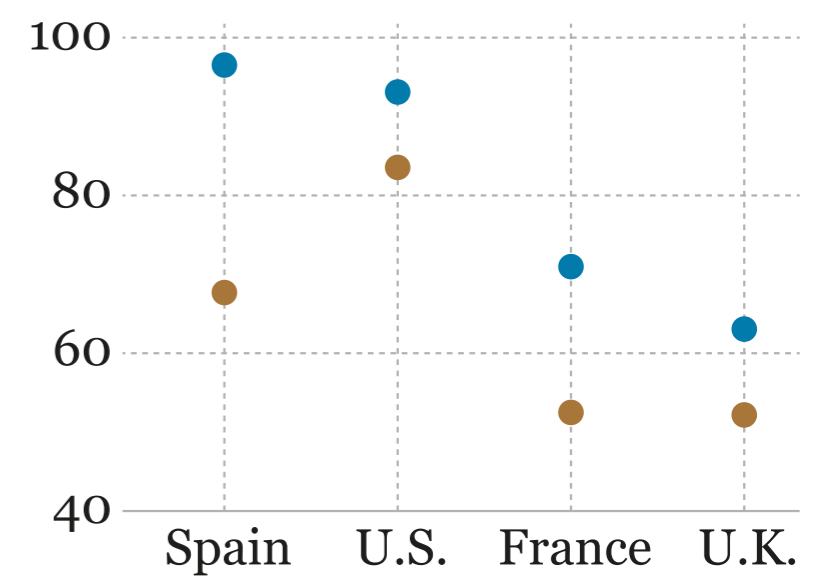




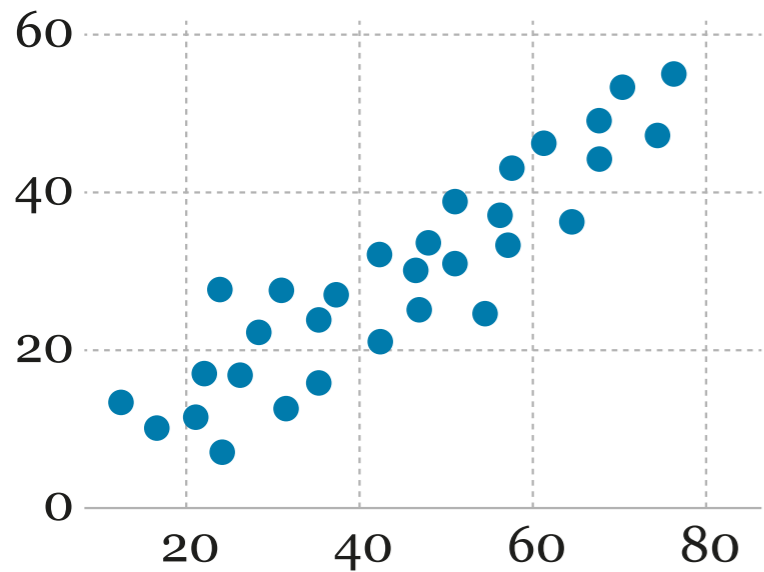
BAR CHART



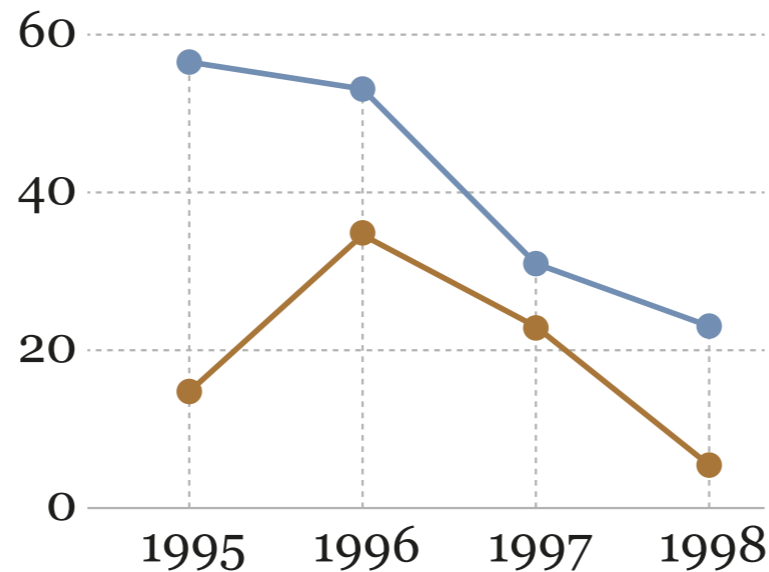
LOLLIPOP CHART



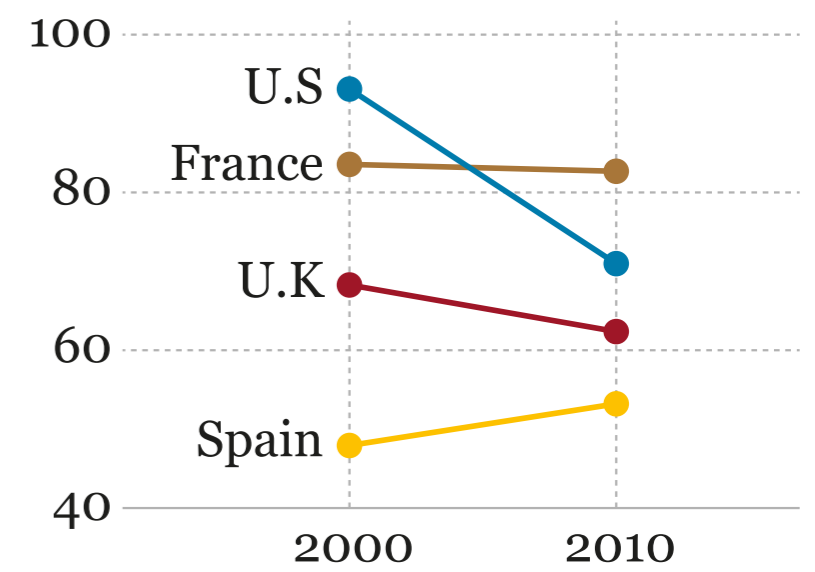
**DOT CHART
(or dot plot)**



**SCATTER CHART
(or scatter plot)**



**LINE CHART
(or time series chart)**



SLOPE CHART

Great for accurate judgments:
Comparisons, relationships, etc.

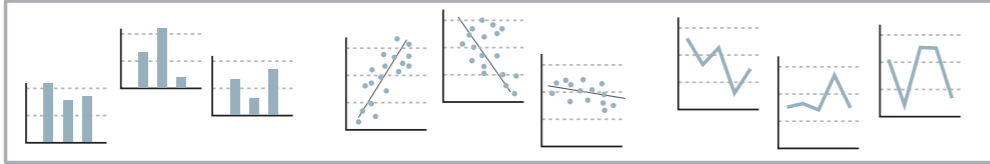
Based on Cleveland and Robert McGill (1984)

Enable accurate estimates

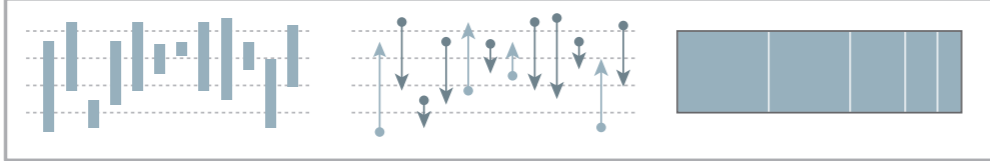
Position along a common scale



Position along identical, nonaligned scales



Length



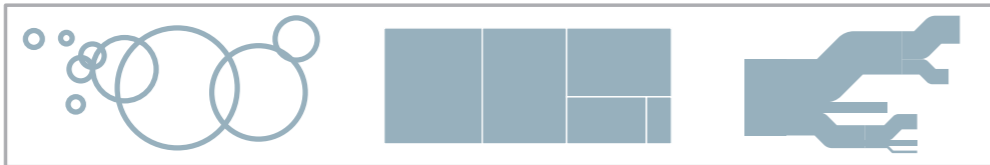
Direction/slope



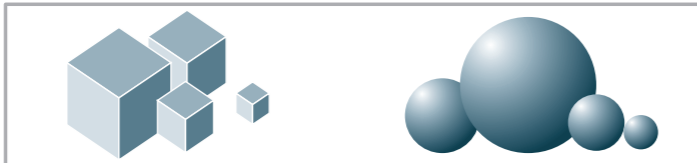
Angle



Area

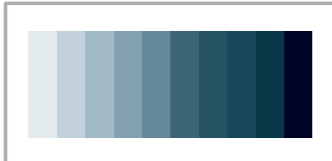


Volume

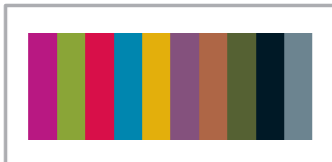


May enable general estimates

Shading and saturation



Color hue



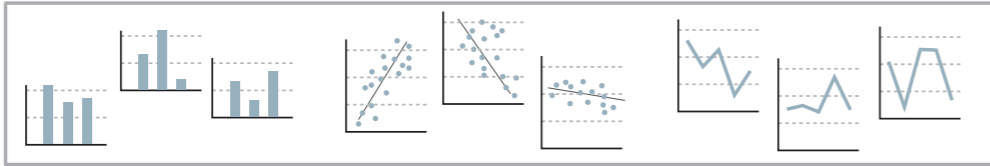
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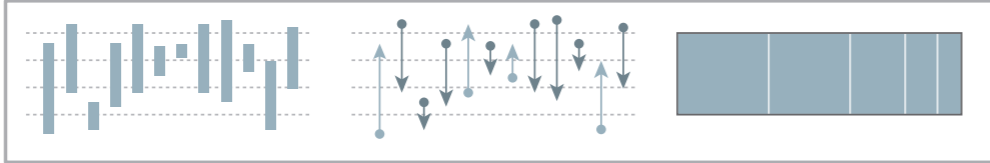
Position along a common scale



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Length



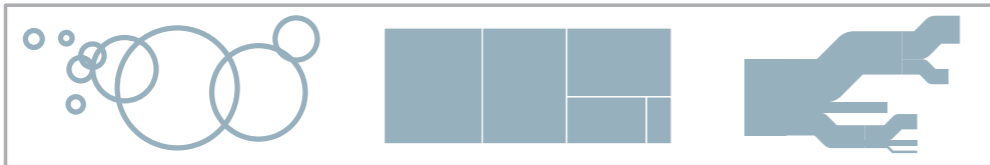
Direction/slope



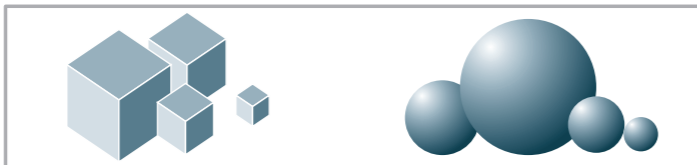
Angle



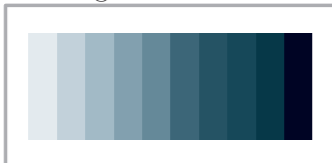
Area



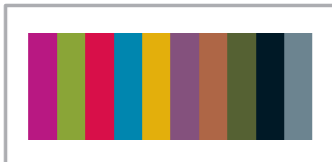
Volume



Shading and saturation



Color hue



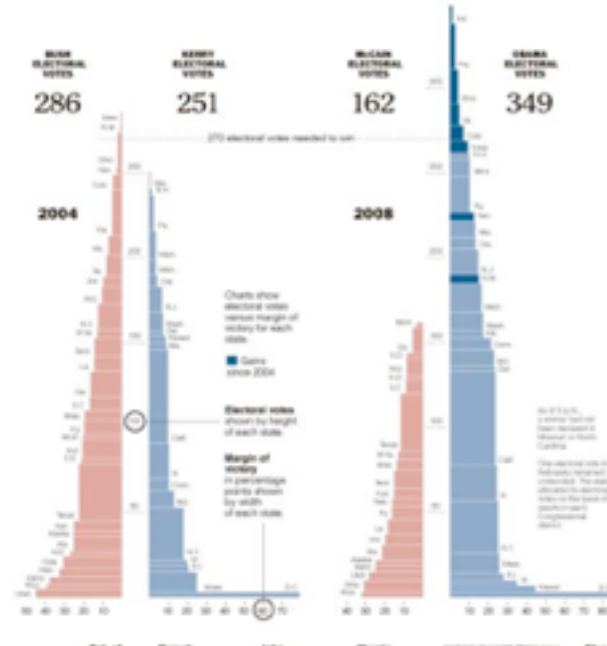
May enable general estimates

In a Decisive Victory, Obama Reshapes the Electoral Map

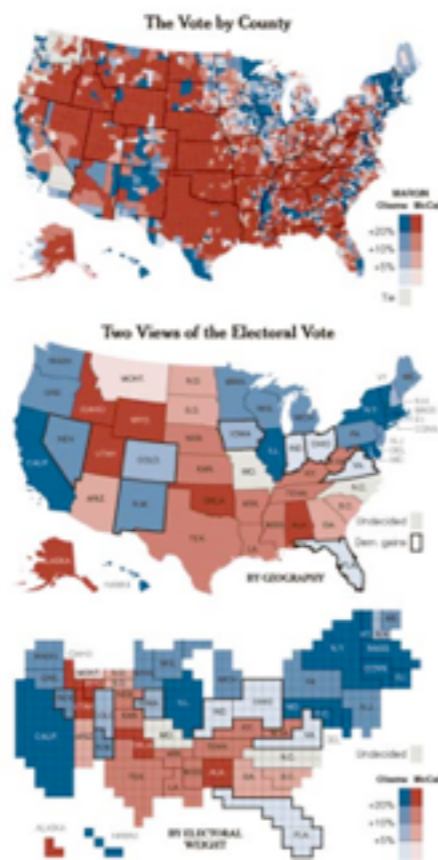
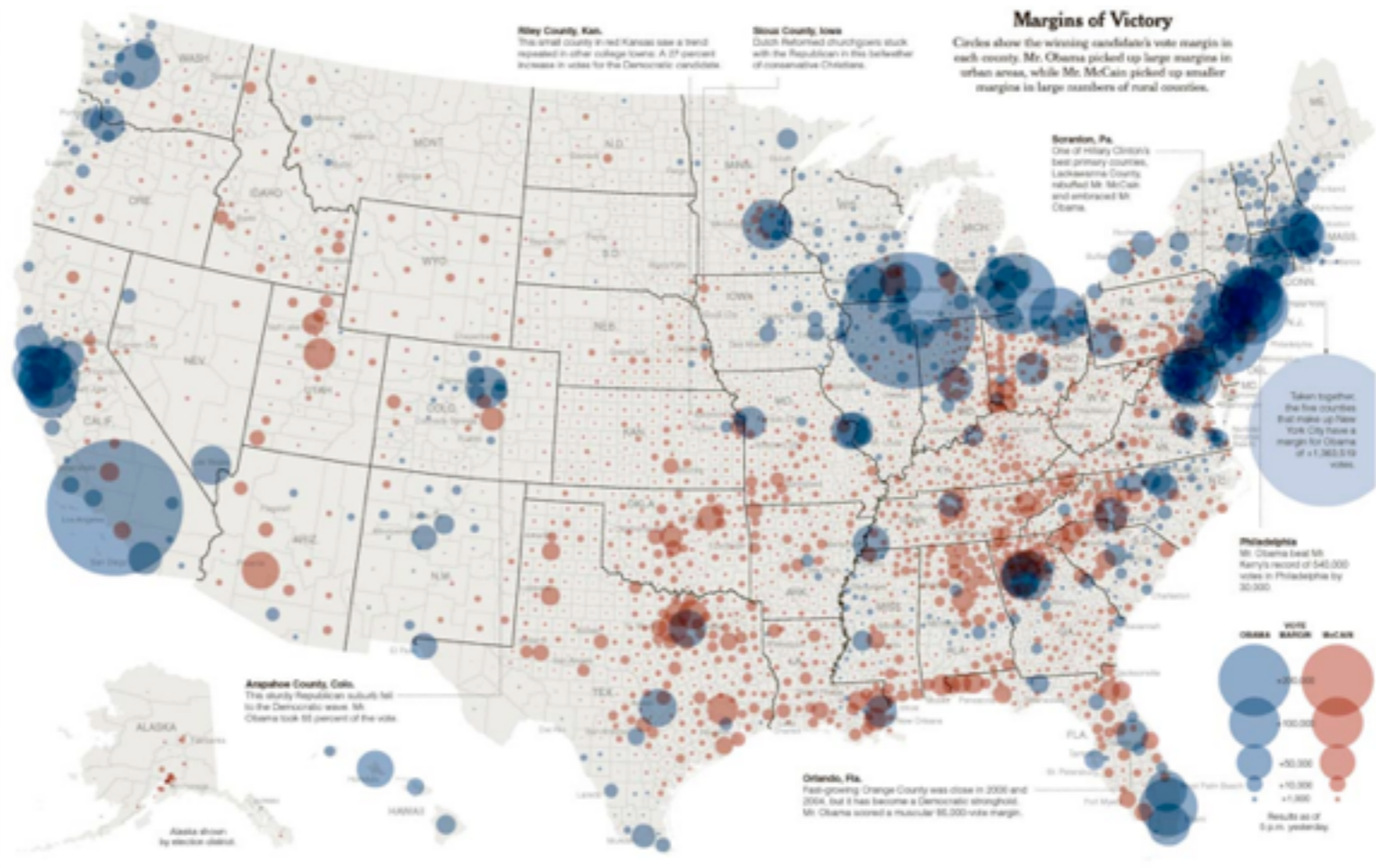
Barack Obama's historic win, with at least 349 electoral votes to John McCain's 162, can be attributed to his victories in several high-population states, like Florida, Virginia and Ohio, that George W. Bush won handily in 2004. The struggling economy, especially in more

industrial states, and high numbers of new voters helped flip key areas from red to blue. Even where Mr. McCain beat Mr. Obama, he won by slimmer margins, as much of the electorate — across age, race and income lines — swung toward the Democratic Party.

By Erin Aigner, Joe Berges, Braden Copeland, Matthew Ericson, Hannah Fairfield, Fred Foxen, Hayden Park and Archie Tan



State	Obama %	McCain %	Obama Elect. Votes	McCain Elect. Votes	Change
States won by Obama					
Alaska	100%	0%	3	0	+3
Alabama	35%	65%	9	9	0
Arizona	39%	61%	6	6	0
Arkansas	35%	65%	6	6	0
California	69%	31%	55	0	+55
Colorado	73%	27%	9	0	+9
Connecticut	100%	0%	3	0	+3
Delaware	100%	0%	3	0	+3
Florida	53%	47%	27	0	+27
Georgia	30%	70%	15	15	0
Hawaii	100%	0%	3	0	+3
Idaho	33%	67%	6	6	0
Illinois	60%	40%	13	0	+13
Indiana	35%	65%	6	6	0
Iowa	67%	33%	7	0	+7
Kansas	35%	65%	6	6	0
Kentucky	35%	65%	6	6	0
Louisiana	35%	65%	6	6	0
Maine	100%	0%	3	0	+3
Maryland	100%	0%	10	0	+10
Massachusetts	100%	0%	4	0	+4
Michigan	52%	48%	16	0	+16
Minnesota	60%	40%	10	0	+10
Mississippi	35%	65%	6	6	0
Missouri	35%	65%	7	7	0
Montana	33%	67%	3	3	0
Nebraska	33%	67%	5	5	0
Nevada	33%	67%	3	3	0
New Hampshire	100%	0%	3	0	+3
New Jersey	100%	0%	14	0	+14
New Mexico	33%	67%	5	5	0
New York	100%	0%	29	0	+29
North Carolina	35%	65%	15	15	0
North Dakota	33%	67%	3	3	0
Ohio	52%	48%	21	0	+21
Oklahoma	35%	65%	6	6	0
Oregon	60%	40%	7	0	+7
Rhode Island	100%	0%	4	0	+4
South Carolina	35%	65%	6	6	0
South Dakota	33%	67%	3	3	0
Tennessee	35%	65%	6	6	0
Texas	35%	65%	34	34	0
Vermont	100%	0%	3	0	+3
Virginia	53%	47%	13	0	+13
Washington	60%	40%	9	0	+9
West Virginia	35%	65%	5	5	0
Wisconsin	58%	42%	10	0	+10
Wyoming	33%	67%	3	3	0
No winner called					
Missouri	35%	65%	7	7	0
North Carolina	35%	65%	15	15	0
TOTAL	50%	50%	349	162	+187



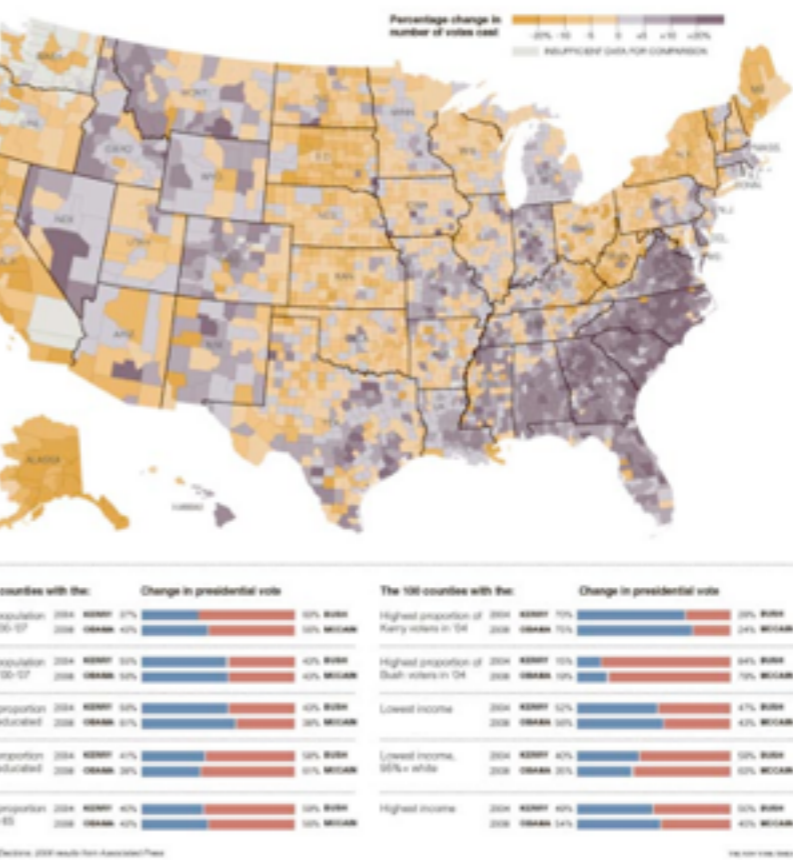
New Voters, New Power Bases

Mr. Obama's campaign theme of change created a groundswell of support in areas of the country hit by the weakened economy. Rising unemployment and housing foreclosures in Rust Belt states, as well as Florida and Nevada, may have led voters to support Mr. Obama.

A powerful get-out-the-vote effort paid off for the Obama campaign in certain crucial states, like Florida, Colorado and Nevada. The number of people who voted in Florida rose by 9.2 percent from 2004. Many of those voters went to the polls for the first time — and those voters chose Mr. Obama nearly 70 percent of the time.

Vote figures were also high in states won by Mr. McCain, like South Carolina, Georgia and Alabama.

Turnout may have been a defining factor in Indiana, a battleground state that had 5.3 percent more voters than in 2004. It ensured a narrow victory, and its 11 electoral votes, to Mr. Obama.

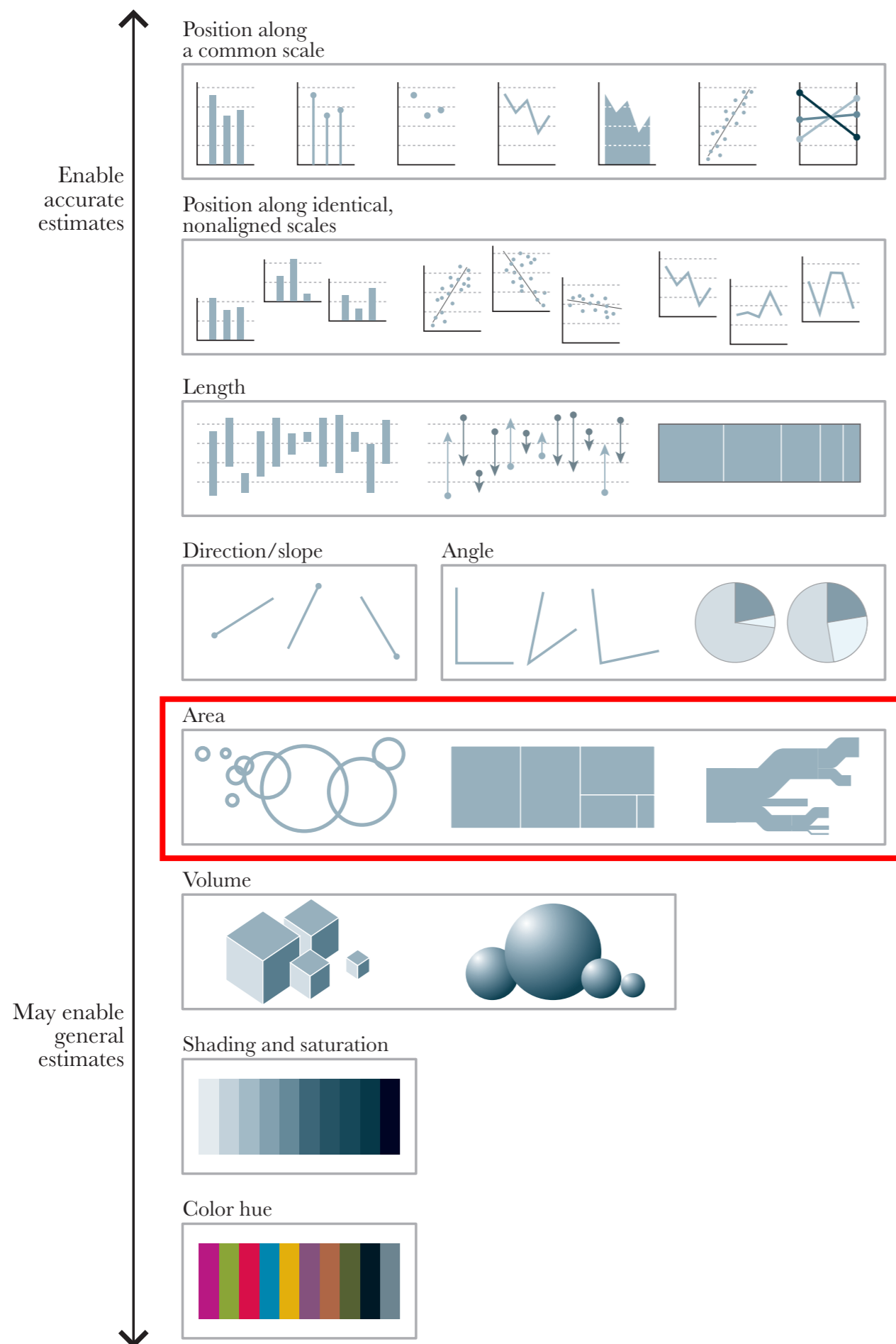


Shifting Demographics

The electorate moved toward the Democratic Party across nearly every demographic category. Many shifts were a few percentage points, but several categories had much higher jumps. One exception to the trend: low-income white counties moved solidly toward the Republican side.

Category	2004 Obama %	2008 Obama %	Change
Fastest population growth, 10-17	33%	41%	+8%
Fastest population decline, 10-17	33%	41%	+8%
Highest proportion college-educated	33%	41%	+8%
Lowest proportion college-educated	33%	41%	+8%
Highest proportion over age 65	33%	41%	+8%
Highest proportion under age 18	33%	41%	+8%
Highest proportion of heavy voters in 04	33%	41%	+8%
Highest proportion of heavy voters in 08	33%	41%	+8%
Lowest income	33%	41%	+8%
Lowest income, 55%+ white	33%	41%	+8%
Highest income	33%	41%	+8%

Using graphic forms erroneously

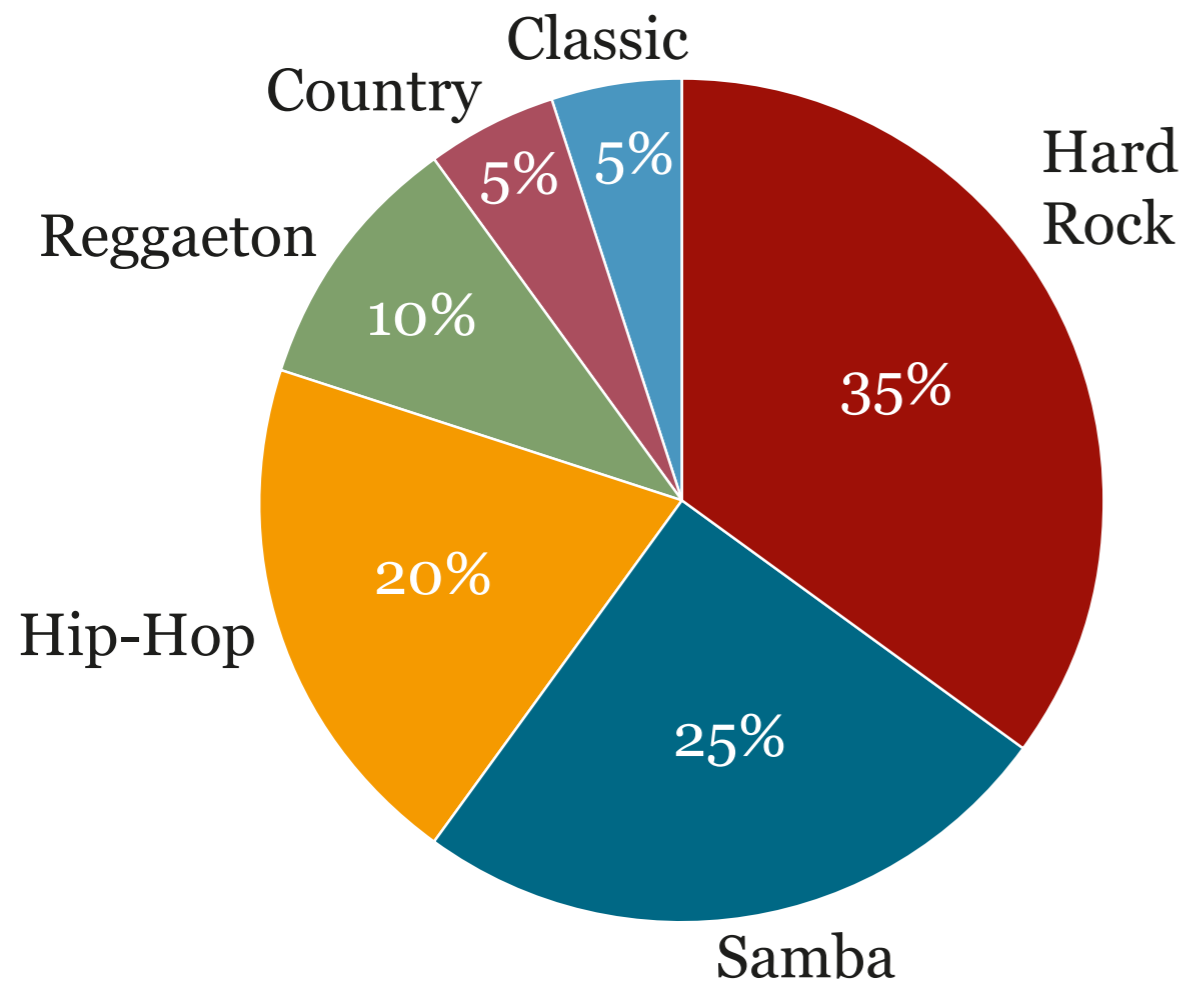


How Music Preferences Have Changed in Two Decades

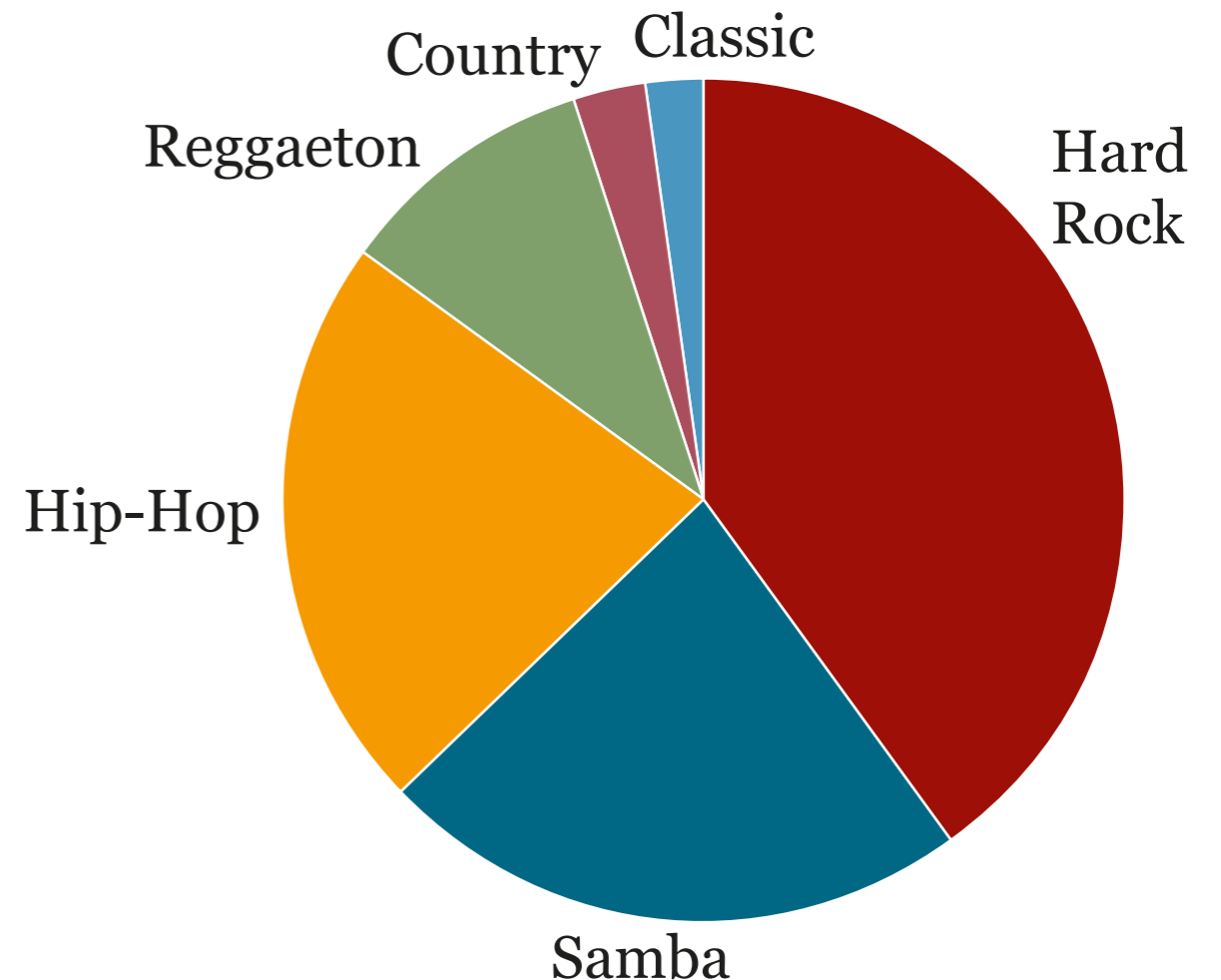
Music styles preferred by University of Miami students. Survey based on interviews with 1,000 students.

SOURCE: WishfulThinkingData Inc.

1994



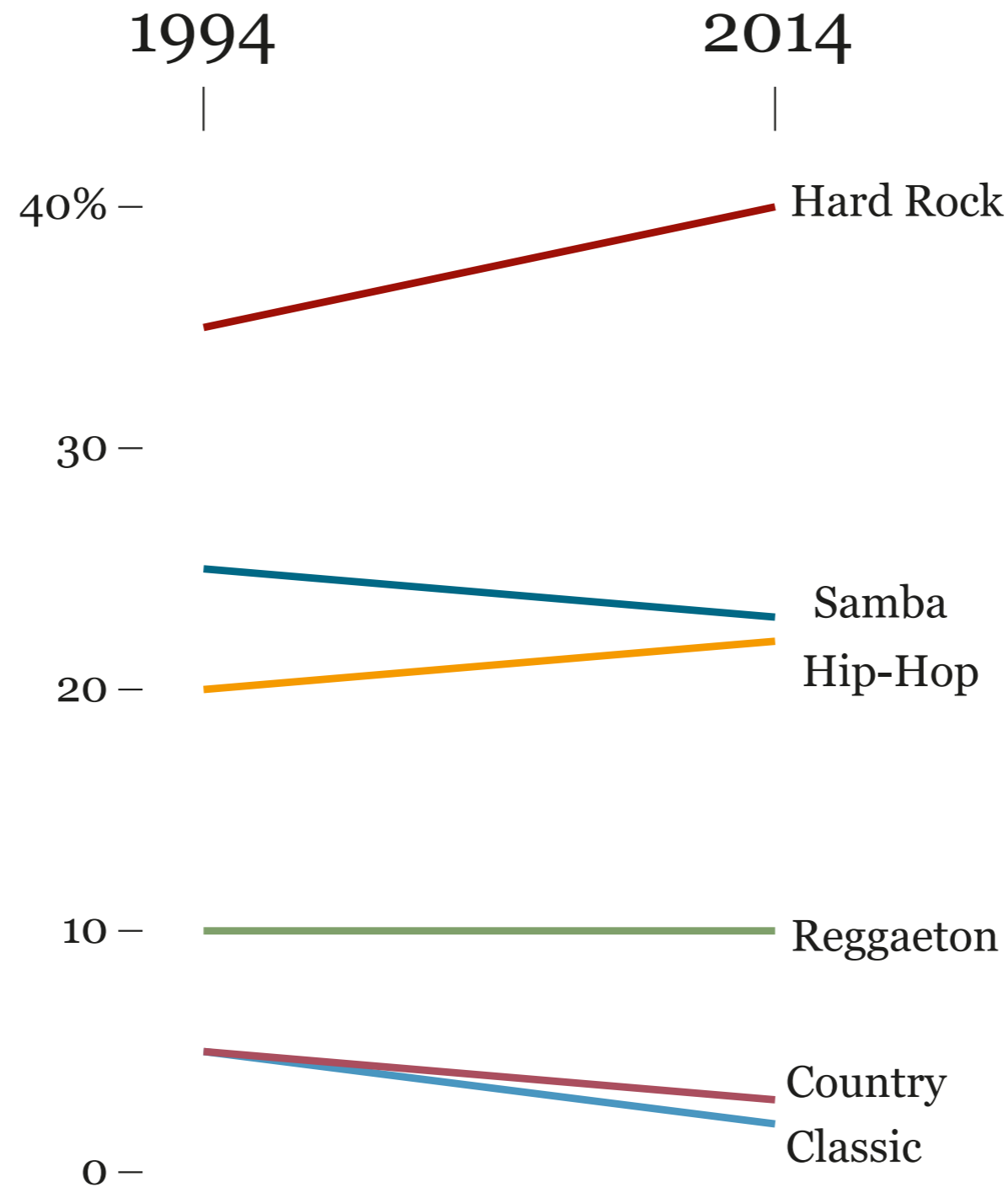
2014



How Music Preferences Have Changed in Two Decades

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ENGAGING VISUALIZATION

DIAGRAM
NEWS IN PERSPECTIVE

Brazil's Demographic Opportunity

How Brazil can take advantage of a future with fewer children per couple.

Alberto Cairo, Francine Lima, Marco Vergotti

PRELIMINARY DATA FROM THE 2010 CENSUS create an interesting picture of the changes that the Brazilian population has gone through in the past ten years. Brazil's population grew, on average, 10% between 2000 and 2010, but the fertility rate is below 2.1 children per woman, the minimum to keep a population from shrinking. According to César Marques, a demographer from the University of Campinas, the main challenge Brazil will face in the future is how to maintain a healthy Social Security system if the number of older and retired people will likely be much larger than it is today. Read on to learn about all the variables at play in this story.

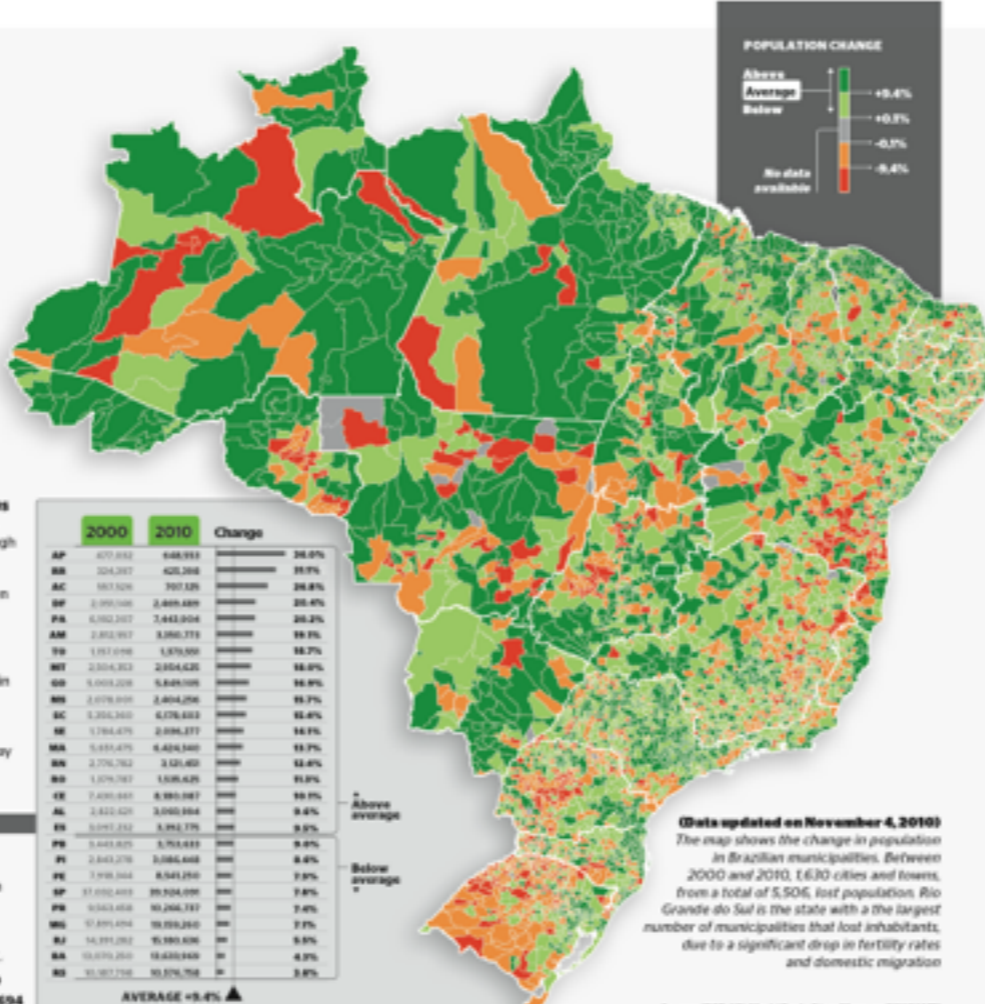
1 BRAZIL'S POPULATION IS BIGGER

The 2010 Census has revealed a 9.4% population increase between 2000 and 2010. The differences between states, as you can see on the chart on the right, are noticeable. Most rich states, such as São Paulo and Rio, didn't grow as fast as the ones in the north east.



	2000	2010	Change
AP	477,354	488,953	24.0%
BA	324,287	428,268	32.1%
AC	983,529	707,128	-26.8%
DF	2,093,049	2,495,489	20.4%
PA	6,002,207	7,441,004	20.2%
AM	2,832,957	3,060,771	19.1%
TO	1,157,019	1,570,599	18.7%
MT	2,004,323	2,404,628	18.6%
GO	5,003,229	5,449,098	16.9%
MS	2,078,009	2,404,256	16.7%
SC	3,264,249	3,776,683	16.4%
SE	1,764,479	2,096,277	16.1%
MA	3,431,479	4,024,549	18.7%
RN	2,776,762	3,120,460	12.6%
RR	1,074,787	1,098,639	0.1%
CE	2,400,649	2,893,987	19.1%
AL	2,422,429	2,690,364	9.4%
PI	2,091,232	2,394,776	9.3%
PE	3,443,677	3,763,437	9.3%
PR	2,443,278	2,684,468	9.0%
RS	7,198,344	8,543,250	7.0%
SP	17,000,409	19,204,099	7.8%
MG	9,043,458	10,296,737	7.8%
ES	3,100,494	3,339,230	7.7%
RJ	14,391,282	15,995,438	5.9%
DF	10,076,200	12,420,948	4.9%
RO	10,387,708	10,376,768	0.0%

AVERAGE +9.4%

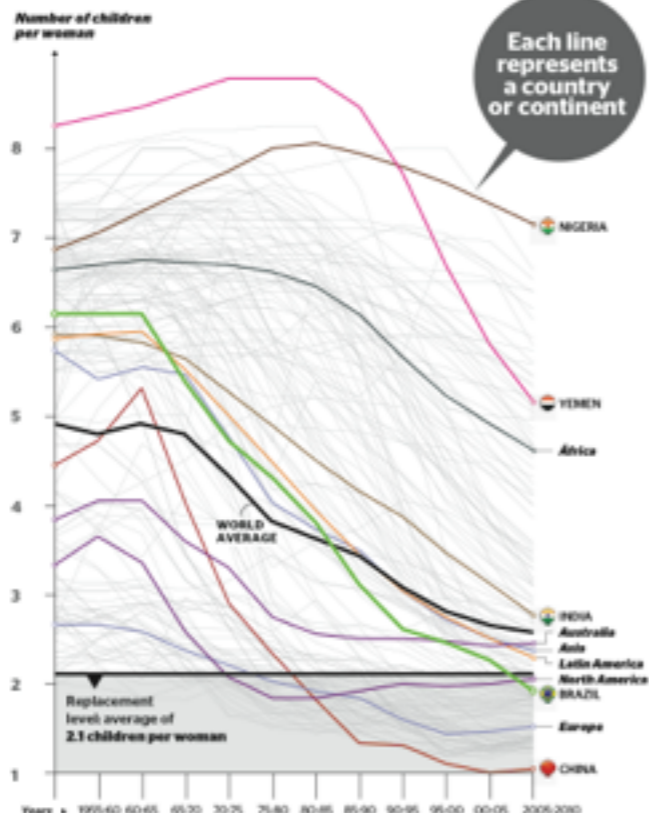


(Data updated on November 4, 2010)
The map shows the change in population in Brazilian municipalities, between 2000 and 2010, 1,630 cities and towns, from a total of 5,504, lost population. Rio Grande do Sul is the state with a the largest number of municipalities that lost inhabitants, due to a significant drop in fertility rates and domestic migration.

Sources: IBGE, UN, World Bank, César Marques (UNICAMP)

2 —BUT THE FERTILITY RATE IS MUCH LOWER THAN EXPECTED

A study in 2004 estimated that in 2010, the fertility rate would be 2.4 children per woman, on average. But new data collected by the IBGE prove that the fertility rate is already 1.9, below the threshold called "replacement rate". When the fertility rate drops below this number, the population of a country will eventually start to shrink and grow older.



3 AS A CONSEQUENCE, POPULATION WILL STOP GROWING—

Forecasts made in 2004 anticipated that Brazil's population would stop growing in 2040. But the most recent data from the IBGE suggests that this could happen much earlier, in 2030.



4 —AND IT WILL BECOME OLDER

Comparing the current population pyramid with the one predicted for 2050



How Brazil can transform the population challenge into an opportunity

- As the population ages, the proportion of people of working age increases. The country will therefore have more people producing wealth (if the labor market can absorb them) and fewer children to consume investments. It is a window of opportunity, because in some cases the number of people of working age to fall back when older people are leaving the market.
- The population under 15 years of age is falling today. A smaller number of student in public schools will facilitate the quality of teaching, if the amount invested in education stays the same.
- Educational policy focused on low-income youth favors the formation of more skilled workforce and greater social mobility.
- In the future, Brazil will reach the stage of Europe and Japan, which struggle to support their elders. This is why it's so important to prepare a more balanced retirement system, which will include retirement at a later age.

Build a narrative; integrate words and visuals

DIAGRAM

NEWS IN PERSPECTIVE

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How Brazil can take advantage of a future with fewer children per couple.

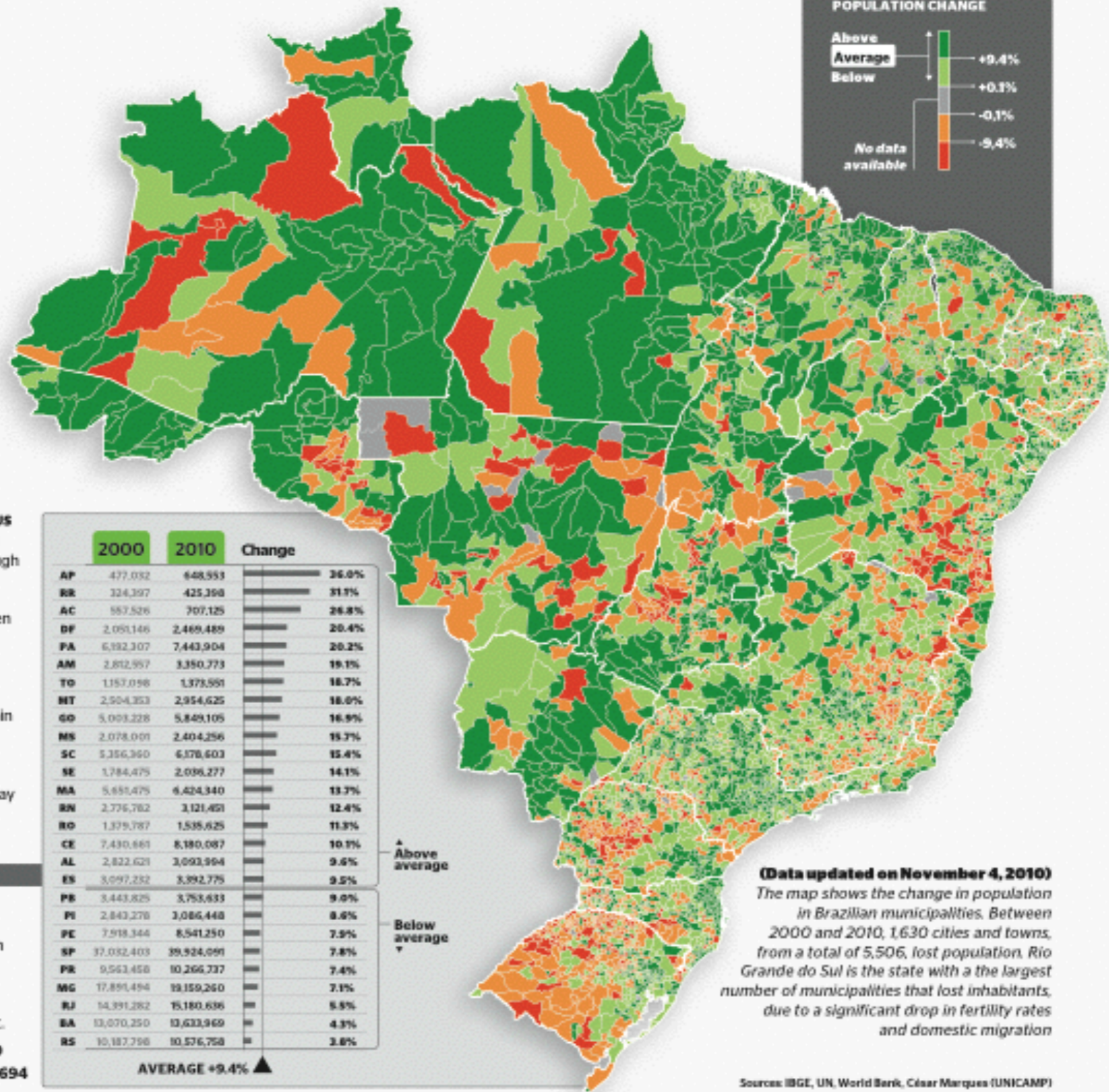
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2000 **169,799,170**
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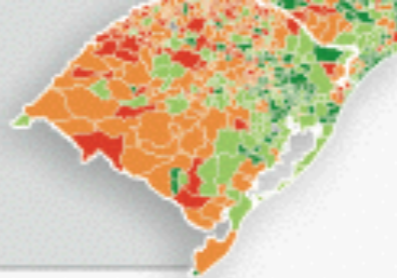
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PE	7,918,344	8,541,250	7.9%
SP	37,032,403	39,924,091	7.8%
PR	9,563,458	10,266,737	7.4%
MG	17,891,494	19,159,260	7.1%
RJ	14,391,282	15,180,636	5.5%
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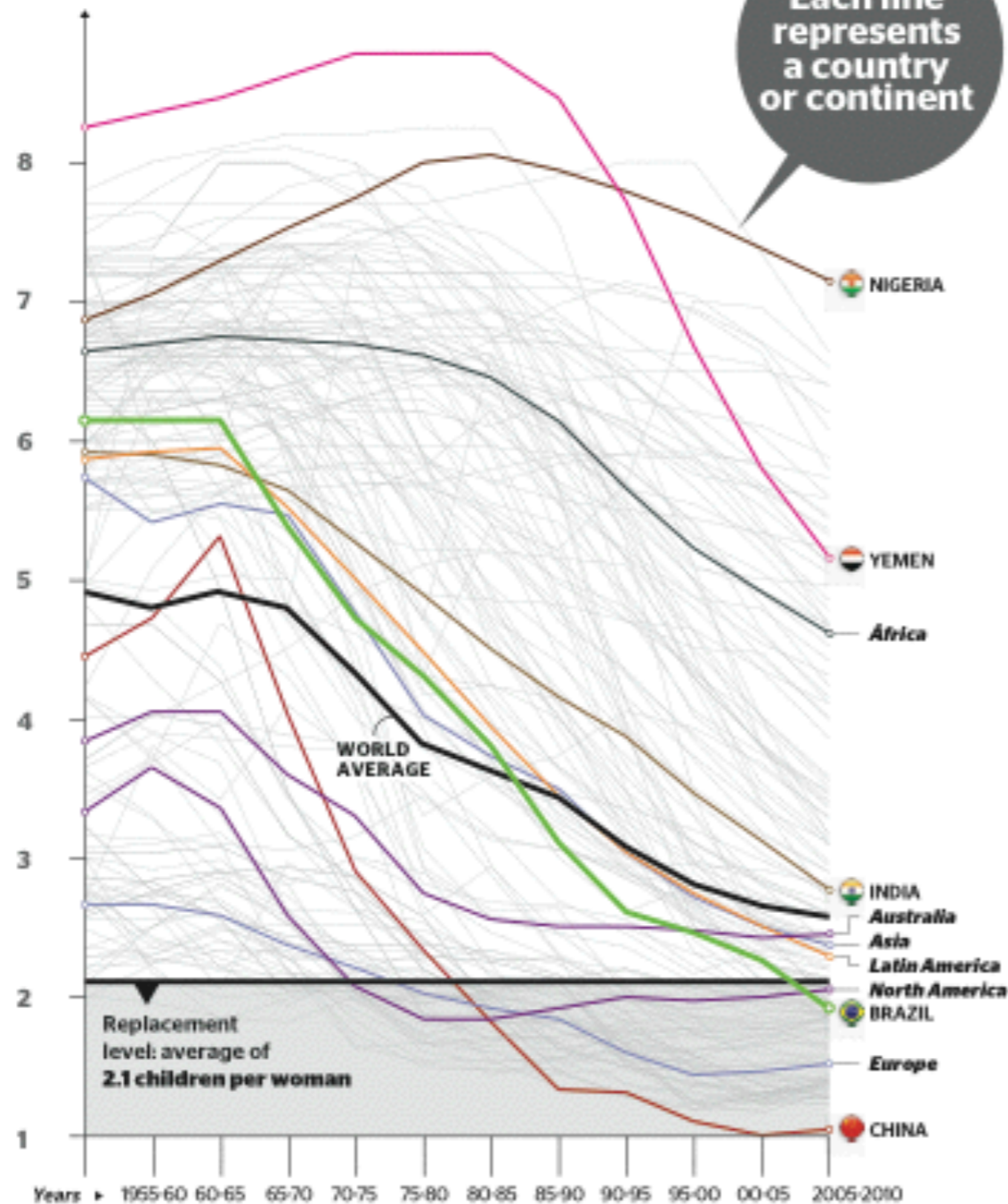
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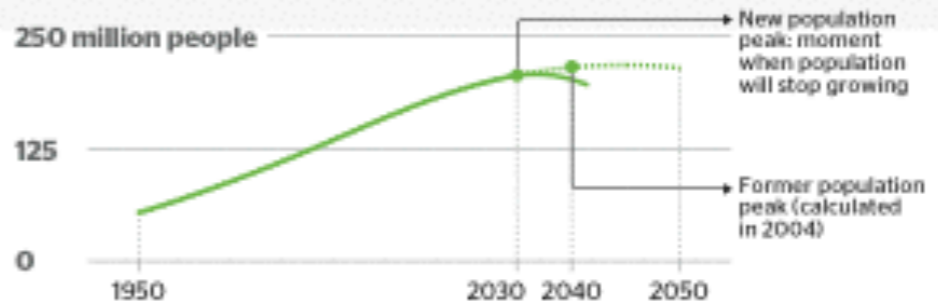
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Number of children per woman



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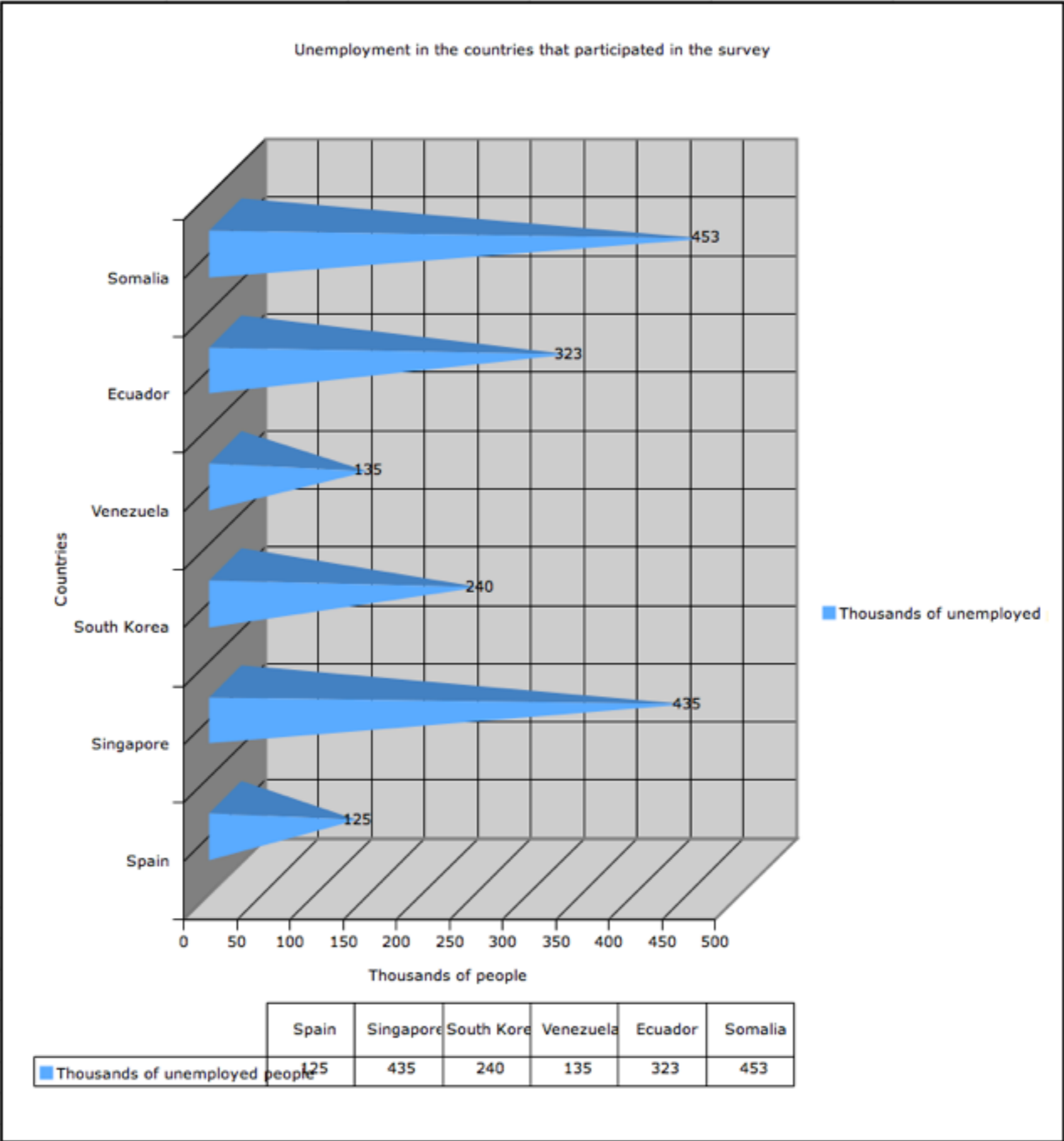
2005
Forecast for 2050



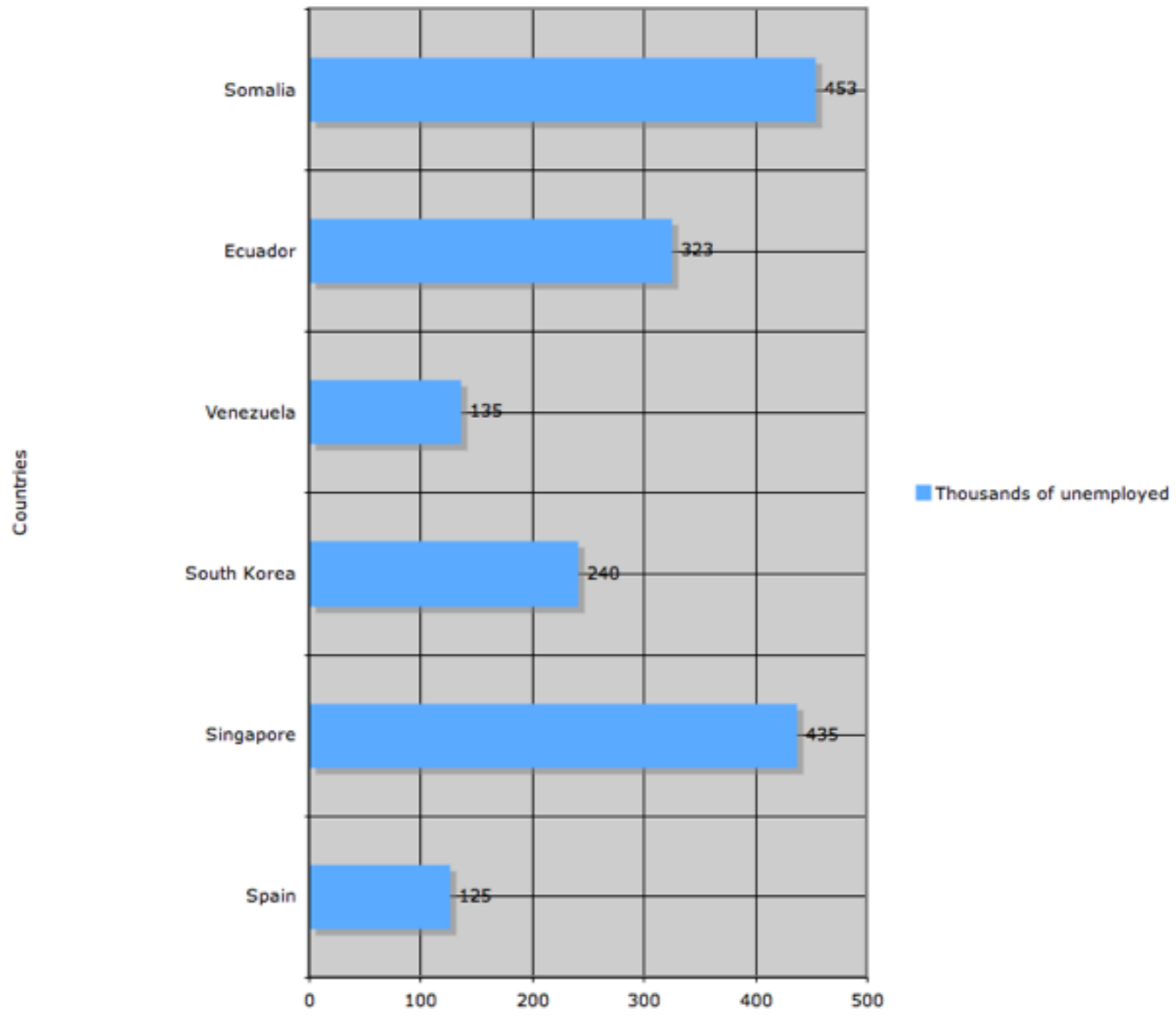
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Pay attention at visual design

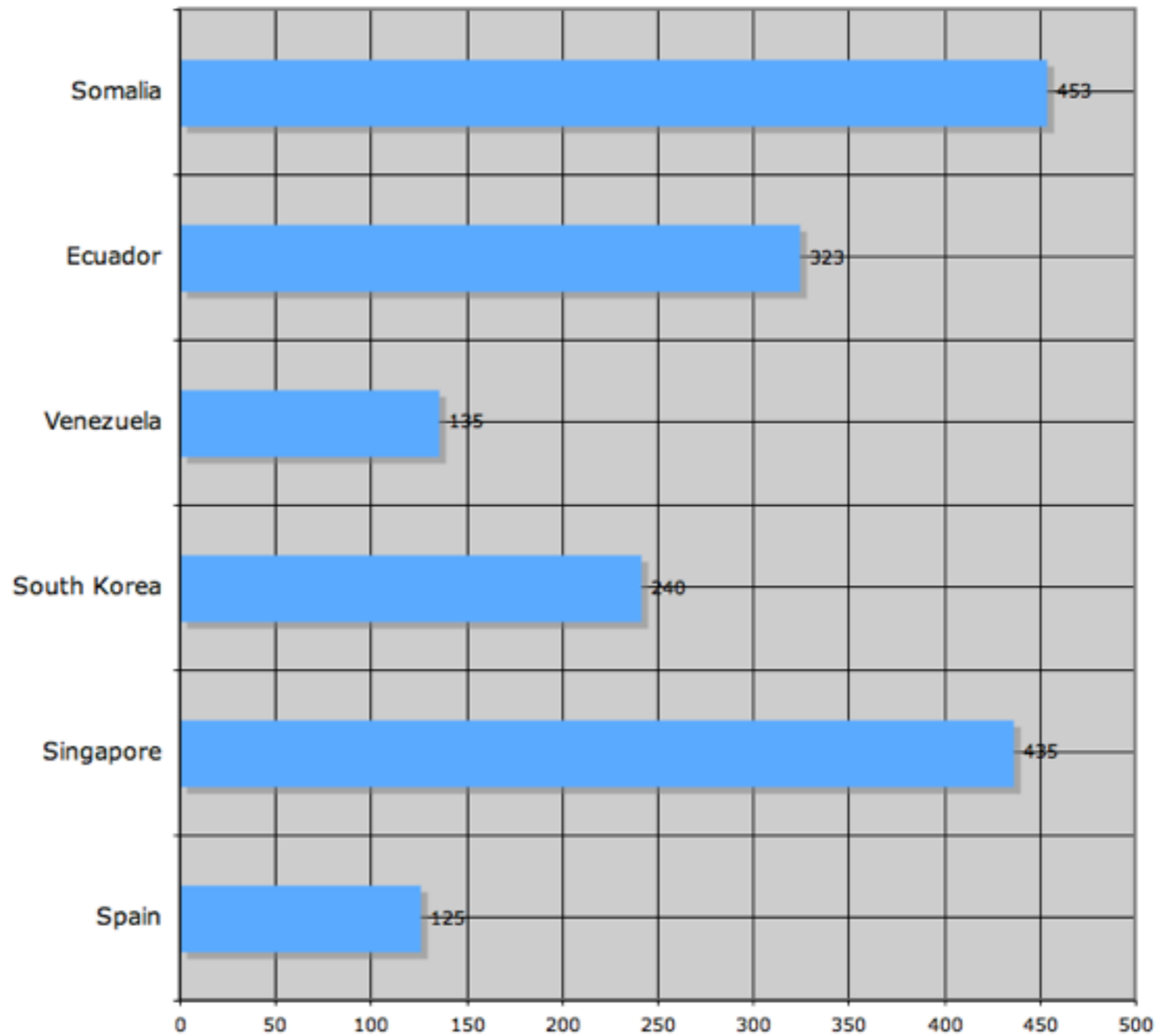


Unemployment in the countries that participated in the survey



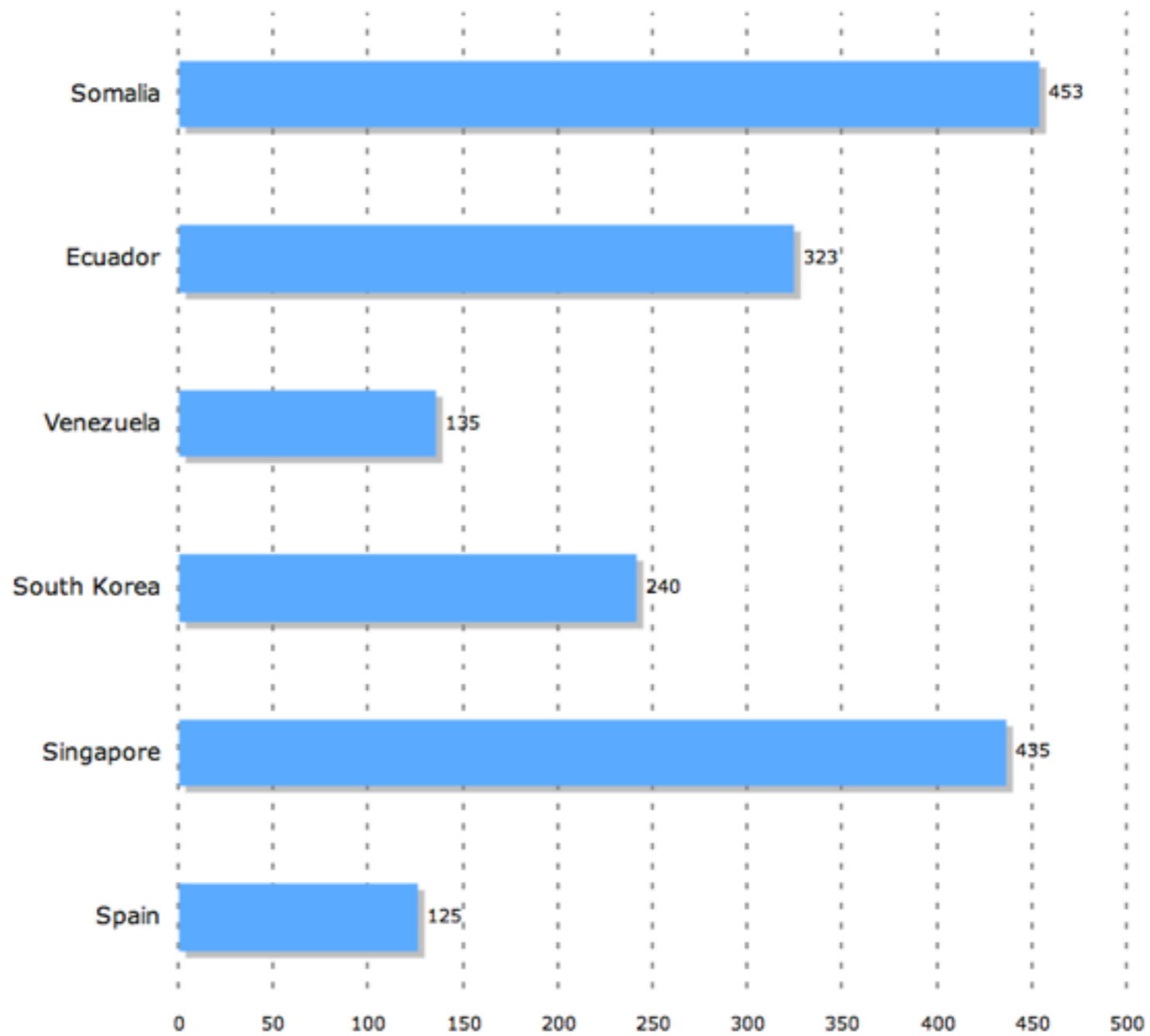
	Spain	Singapore	South Korea	Venezuela	Ecuador	Somalia
Thousands of unemployed people	125	435	240	135	323	453

Unemployment in the countries that participated in the survey (*thousands of people*)



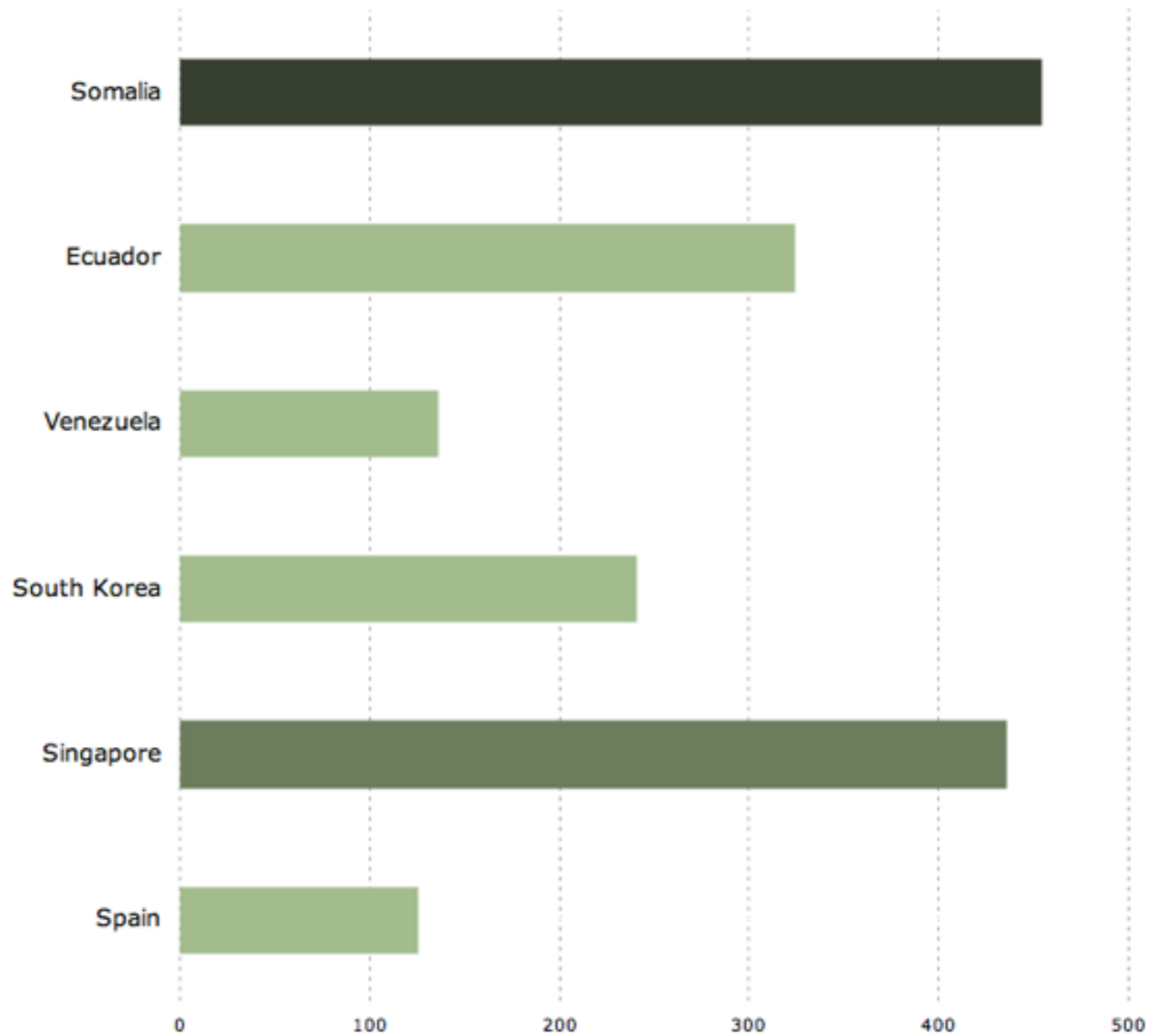
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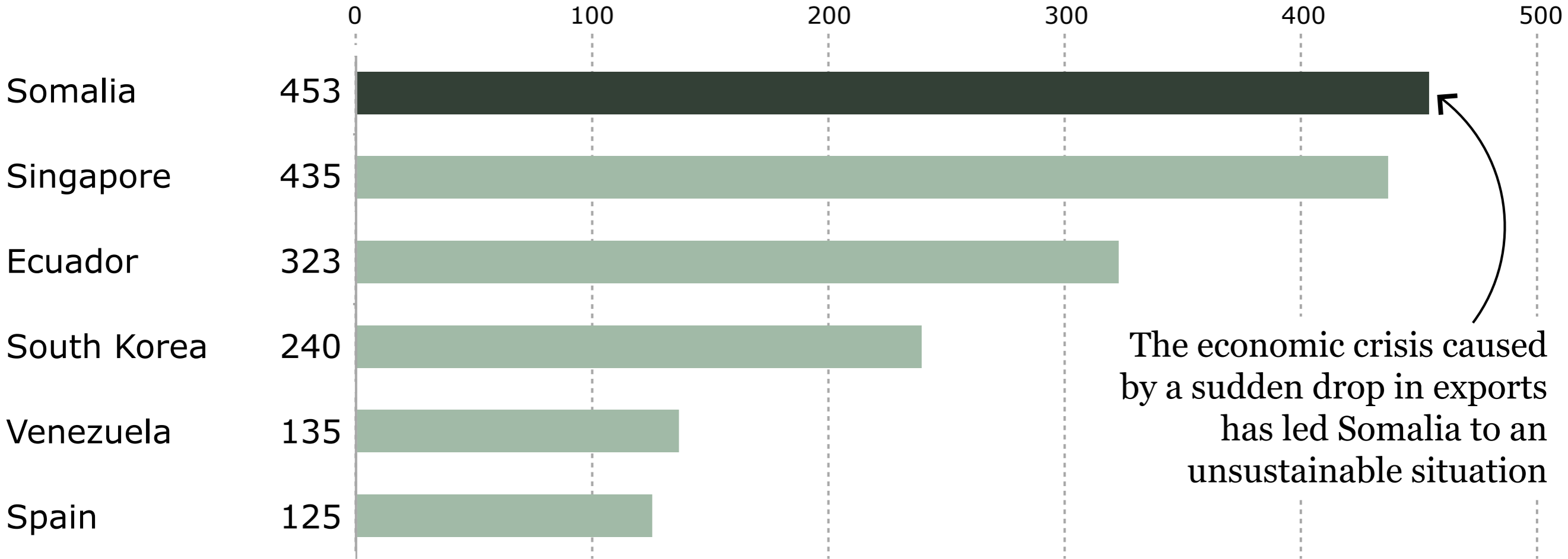
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	Spain	Singapore	South Korea	Venezuela	Ecuador	Somalia
Thousands of unemployed people	125	435	240	135	323	453

Somalia leads the countries that participated in the survey

Thousands of unemployed people



Source: CompletelyFakeData Inc.

Graphic by ACME

Pay attention at visual design

Multi-scale Modeling and Assessment of Malaria Risk in Northern South America

UNIVERSITY OF MIAMI
ABESS CENTER
for ECOSYSTEM
SCIENCE & POLICY



Alimi, T. O.¹; Fuller, D. O.^{1,2} and Beier, J.C.^{1,3}

¹ Abess Center for Ecosystem Science and Policy; ² Department of Geography and Regional Studies; ³ Department of Epidemiology and Public Health, University of Miami

1. Introduction

The public health problem posed by malaria has made it a top priority for control efforts and the general consensus globally, is that its elimination is crucial for continued international development. Consequently, there is ongoing research in different regions including South America (SA) to better understand the disease dynamics with the intent that findings may establish scientific framework that would support the development of new intervention strategies for malaria elimination in areas with seasonal malaria. One of such investigations is undertaken by the International Centers of Excellence in Malaria Research (ICEMR) under a National Institutes of Health (NIH) grant.

While only about 3% of the global malaria burden is borne by SA¹, undertaking malaria research in the region is currently important because an estimated 23million people are still at risk² and approximately about 80% of clinical cases are found in Northern South America (NSA)³. A key factor limiting effective control is lack of data and uneven implementation of control measures, including use of bed-nets, sprays, early diagnosis, and treatment. As part of the ICEMR investigation, this project seeks to model the spatial patterns of malaria risk in NSA through vector distribution and land-use changes. Furthermore, I intend to investigate the perceptions of malaria risk in order to identify barriers to adoption and how they can be circumvented.

2. Significance

Spatial distribution of malaria risk is still perceived as broadly categorized by the WHO's traditional risk maps which are highly generalized, of low resolution and have broad categories with uncertain boundaries (see da Nunes-Silva et al. 2012). There is need for up- to-date high resolution risk maps which can aid malaria control efforts. Secondly, modeling distribution of principal malaria vectors and land use changes which may explain the observed distribution and risk are useful tools which would guide future management strategies. Finally, understanding the perceptions of at risk populations may help address barriers to adoption of interventions and influence policies. Overall, findings will empower NMCPs to achieve effective control and move them closer to elimination.

3. Specific Aims

- > Specific Aim 1: Model the spatial patterns of malaria risk through vector distribution and land use changes
 - Hypothesis 1.1: GIS-based Multi-Criteria Evaluation (MCE) model can accurately predict spatial extent of malaria risk areas. **Objective:** Generate risk maps that represent risk of malaria transmission.
 - Hypothesis 1.2: The Maximum Entropy (Maxent) model can accurately depict actual and predict potential distribution of three *Anopheles* species. **Objective:** Model observed and potential spread of *An. albimanus*, *An. darlingi*, and *An. nuneztovari*.
 - Hypothesis 1.3: Land- use changes can explain the variations in predicted malaria risk. **Objective:** Characterize land use land cover (LULC) and investigate changes in areas of risk.
 - > Specific Aim 2: Investigate the perceptions of malaria risk in order to identify barriers to adoption and how they can be circumvented.
 - Hypothesis 2.1: Knowledge of perception of malaria risk can aid design of malaria control strategies. **Objective:** Obtain and analyze data on subjective perceptions of risk.
 - Hypothesis 2.2: Identification of barriers to adoption of malaria control interventions provide means of tackling them. **Objective:** Analyze data addressing perceived barriers and policy implications
- *Only ongoing work on Hypothesis 1.1 in presented here

4. Materials and Methods

> **Study Area:** is NSA comprising of ten countries- Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Panama, Peru, Suriname and Venezuela. These countries account for approximately 90% of clinical cases in the region hence, the choice as study area (Fig. 1).



Figure 1: Map of study area

> **Research Approach:** Due to the complexity of malaria problem, I'm employing an interdisciplinary approach to address the problem (Fig. 2).



Figure 2: Interdisciplinary approach

> **Materials:** Raster data layers of environmental, climatic and anthropogenic parameters from satellite imageries, weather monitoring stations, global land cover and population data were collected from Worldclim, Digital Charts of the World, Globcover and Landsat. Vector data was collected from field sampling by our collaborators and the Walter Reed Biosystematics Unit. Sociological data would be collected through questionnaires to be administered in one of the study area. Other data will be collected as needed.

> **Procedure:** To test hypothesis 1.1, raster data of parameters that influence mosquito distribution (rivers, wetlands, urban areas, roads, population and elevation) were combined using a Multi-Criteria Evaluation in Idrisi GIS package. This produced a map of potential exposure to malaria vectors which is used as a proxy for risk of malaria transmission. All the data layers were gridded at 1km spatial resolution. A set of distance layers had been created for discrete factors using standard GIS operations. All factors were subsequently standardized into a continuous common numeric range on a byte 0-255 probability scale using a fuzzy function based on knowledge of mosquito interaction with the factor. Weights were generated for each factor based on the importance of the factor to malaria transmission by expert opinions and then assigned using Analytical Hierarchy Process. The risk maps produced were validated statistically using data on *An. darlingi* distribution and malaria case data from some parts of the study area. See preliminary results (Fig. 3,4,5)

5. Preliminary Results

> Areas of high to moderate risk corresponded with locations of some of the anophelines collected.

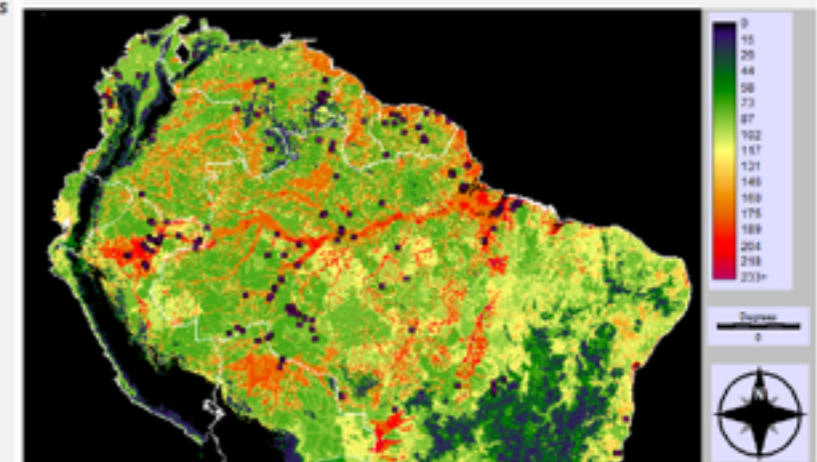


Figure 3: Potential risk of exposure to malaria vectors across NSA (0 indicate little or no risk while 233 indicate high risk)

> Risk scores for mosquito occurrence points were significantly higher than those generated randomly (Fig. 4).

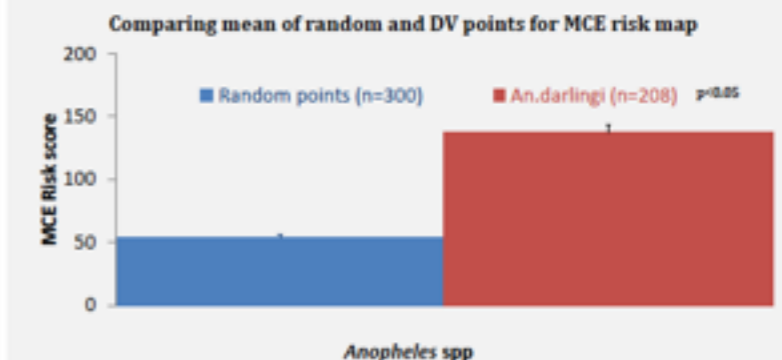


Figure 4: Plot showing the MCE risk values for randomly sampled points and for occurrence points of a DV, *An. darlingi*

6. Conclusion

Findings from preliminary results suggest that the MCE approach is a viable method to modeling spatial risk. The high resolution risk map produced aligned well with sampled vector points and may therefore be used to plan control of malaria vectors. Further analysis is planned to generate and validate risk maps with actual measures of malaria transmission, results of which could be used to plan containment of future outbreaks.

References

1. WHO. (2007). MALARIA ELIMINATION: A field manual for low and moderate endemic countries.
2. PAHO (2012). PAHO Honors 2012 Malaria Champions of the Americas. Available: http://www.paho.org/ha/index.php?option=com_content&view=article&id=7429&Itemid=29629
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Pay attention at visual design

Multi-scale Modeling and Assessment of Malaria Risk in Northern South America

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SCIENCE & POLICY



1 Introduction

Malaria as a public health problem has become a priority for control efforts worldwide. The global consensus is that its elimination is crucial for continual development. Ongoing research projects in different regions, including South America (SA), try to improve our understanding of the disease dynamics. Their goal is to establish a new framework that would lead to new intervention strategies for malaria elimination in areas where the disease is seasonal. One of such investigations is undertaken by the International Centers of Excellence in Malaria Research (ICEMR) under a National Institutes of Health grant.

While only about 3% of the global malaria burden is borne by SA, undertaking malaria research in the region is currently important because an estimated 23 million people are still at risk and approximately about 80% of clinical cases are found in **Northern South America (NSA)**. A key factor limiting effective control is lack of data and uneven implementation of control measures, including use of bednets, sprays, early diagnosis, and treatment. As part of the ICEMR investigation, this project seeks to model the spatial patterns of malaria risk in NSA through vector distribution and land-use changes. Furthermore, I intend to investigate the perceptions of malaria risk in order to identify barriers to adoption and how they can be circumvented.

2 Significance

Spatial distribution of malaria risk is still perceived as broadly categorized by the WHO's traditional risk maps which are highly generalized, of low resolution and have broad categories with uncertain boundaries (see da Nunes-Silva et al. 2012). There is need for up-to-date high resolution risk maps which can aid malaria control efforts. Secondly, modeling distribution of principal malaria vectors and land use changes which may explain the observed distribution and risk are useful tools which would guide future management strategies. Finally, understanding the perceptions of at risk populations may help address barriers to adoption of interventions and influence policies. Overall, findings will empower NMCPs to achieve effective control and move them closer to elimination.

3 Aims

Specific Aim 1: Model the spatial patterns of malaria risk through vector distribution and land use changes

- **Hypothesis 1.1:** GIS-based Multi-Criteria Evaluation (MCE) model can accurately predict spatial extent of malaria risk areas. **Objective:** Generate risk maps that represent risk of malaria transmission
- **Hypothesis 1.2:** The Maximum Entropy (Maxent) model can accurately depict actual and predict potential distribution of three Anopheles species. **Objective:** Model observed and potential spread of *An. albimanus*, *An. darlingi*, and *An. nuneztovari*.
- **Hypothesis 1.3:** Land-use changes can explain the variations in predicted malaria risk. **Objective:** Characterize land use land cover (LULC) and investigate changes in areas of risk

Specific Aim 2: Investigate the perceptions of malaria risk in order to identify barriers to adoption and how they can be circumvented.

- **Hypothesis 2.1:** Knowledge of perception of malaria risk can aid design of malaria control strategies. **Objective:** Obtain and analyze data on subjective perceptions of risk.
- **Hypothesis 2.2:** Identification of barriers to adoption of malaria control interventions provide means of tackling them. **Objective:** Analyze data addressing perceived barriers and policy implications

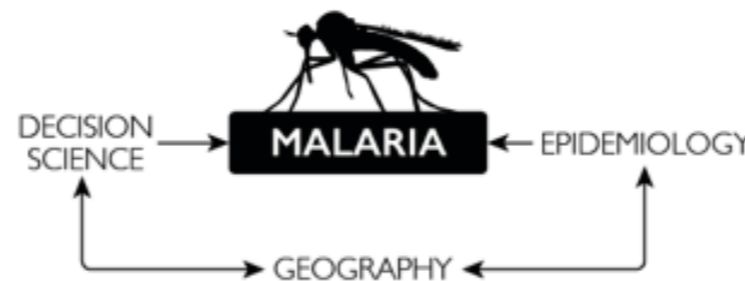
*Only ongoing work on Hypothesis 1.1 in presented here

4 Materials and methods

NSA comprising of ten countries - Bolivia, Brazil, Colombia, Ecuador, French Guiana, Guyana, Panama, Peru, Suriname and Venezuela. These countries account for approximately 90% of clinical cases in the region



Research approach: Due to the complexity of malaria problem, I'm employing an interdisciplinary approach to address the problem.

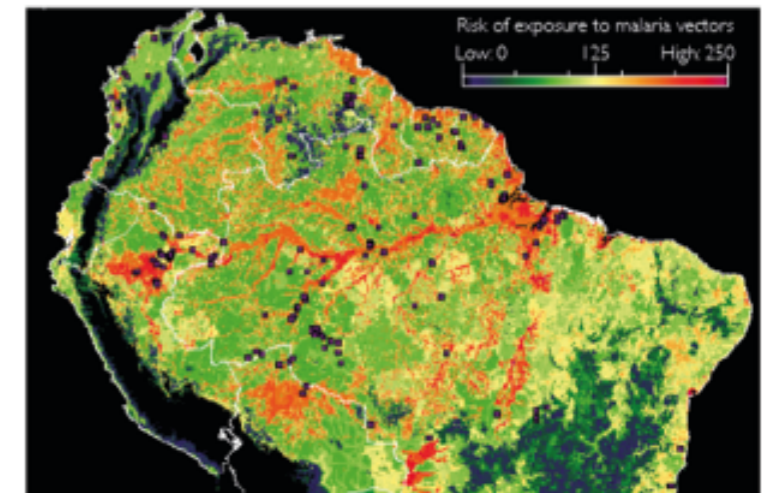


Materials: Raster data layers of environmental, climatic and anthropogenic parameters from satellite imageries, weather monitoring stations, global land cover and population data were collected from Worldclim, Digital Charts of the World, Globcover and Landsat. Vector data was collected from field sampling by our collaborators and the Walter Reed Biosystematics Unit. Sociological data would be collected through questionnaires to be administered in one of the study area. Other data will be collected as needed.

Procedure: To test hypothesis 1.1, raster data of parameters that influence mosquito distribution (rivers, wetlands, urban areas, roads, population and elevation) were combined using a Multi-Criteria Evaluation in Idrisi GIS package. This produced a map of potential exposure to malaria vectors which is used as a proxy for risk of malaria transmission. All the data layers were gridded at 1km spatial resolution. A set of distance layers had been created for discrete factors using standard GIS operations. All factors were subsequently standardized into a continuous common numeric range on a byte 0-255 probability scale using a fuzzy function based on knowledge of mosquito interaction with the factor. Weights were generated for each factor based on the importance of the factor to malaria transmission by expert opinions and then assigned using Analytical Hierarchy Process. The risk maps produced were validated statistically using data on *An. darlingi* distribution and malaria case data from some parts of the study area. See preliminary results

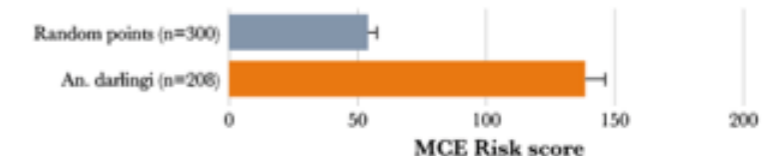
5 Preliminary results

Areas of high to moderate risk corresponded with locations of some of the anophelines collected.



Risk scores for mosquito occurrence points were significantly higher than those generated randomly.

Comparing mean of random and DV points for MCE risk map - $p < 0.05$



6 Conclusion

Findings from preliminary results suggest that the MCE approach is a viable method to modeling spatial risk. The high resolution risk map produced aligned well with sampled vector points and may therefore be used to plan control of malaria vectors. Further analysis is planned to generate and validate risk maps with actual measures of malaria transmission, results of which could be used to plan containment of future outbreaks.

References

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If possible, make it customizable

HealthCare.gov Explorer

See the rates for health plans available through HealthCare.gov, the federal insurance exchange. Many consumers will also be eligible for federal subsidies to help buy coverage through the exchanges, and may pay lower rates. Plans are labeled Catastrophic, Bronze, Silver, Gold or Platinum depending on the level of coverage.

Interactive by: Martin Burch, Madeline Farbman, Jonathan Keegan, Adam Suharja, Christopher Weaver, Kurt Wilberding/The Wall Street Journal.
Write to the editors at WSJGraphicsEditors@WSJ.com.



How Health-Insurance Subsidies Are Calculated

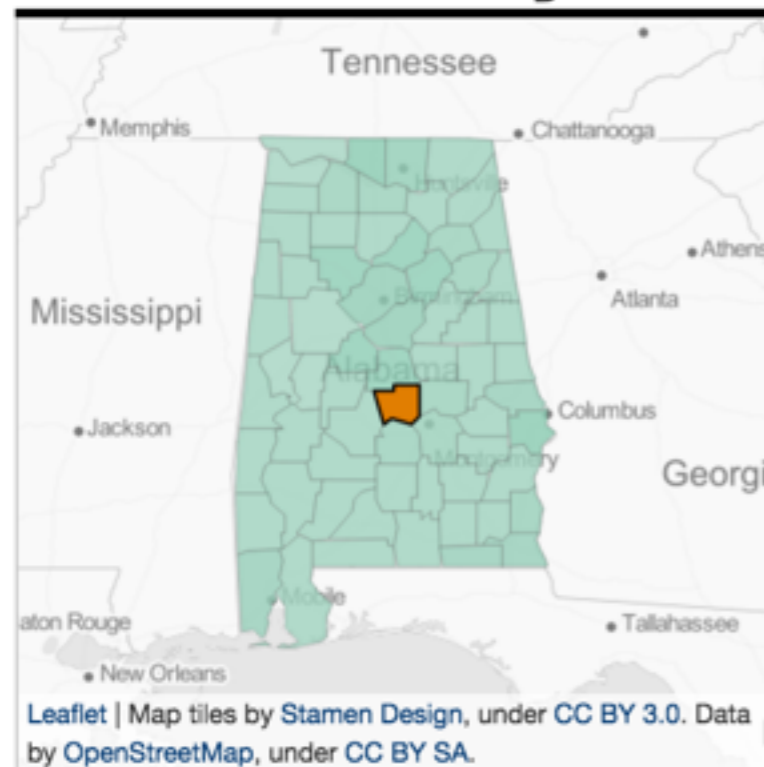


AGE: 30 | PLAN TYPE: Silver | STATE: Alabama | COUNTY: Autauga | OR ADDRESS: | SEARCH | GEO LOCATE

Range of prices for lowest-cost Silver plans on HealthCare.gov



Alabama: Autauga



Results

CALCULATE SUBSIDY ►

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\$215 monthly premium

Silver PLAN DETAILS »

AGE 30
AUTAUGA, ALA.

BLUE CROSS AND BLUE SHIELD OF ALABAMA
Blue Value Silver

DEDUCTIBLE	\$2,400
OUT-OF-POCKET MAX	\$6,350
COST OF DOCTOR'S VISIT	\$40

About Silver plans »

\$228 monthly premium

Silver PLAN DETAILS »

AGE 30
AUTAUGA, ALA.

BLUE CROSS AND BLUE SHIELD OF ALABAMA

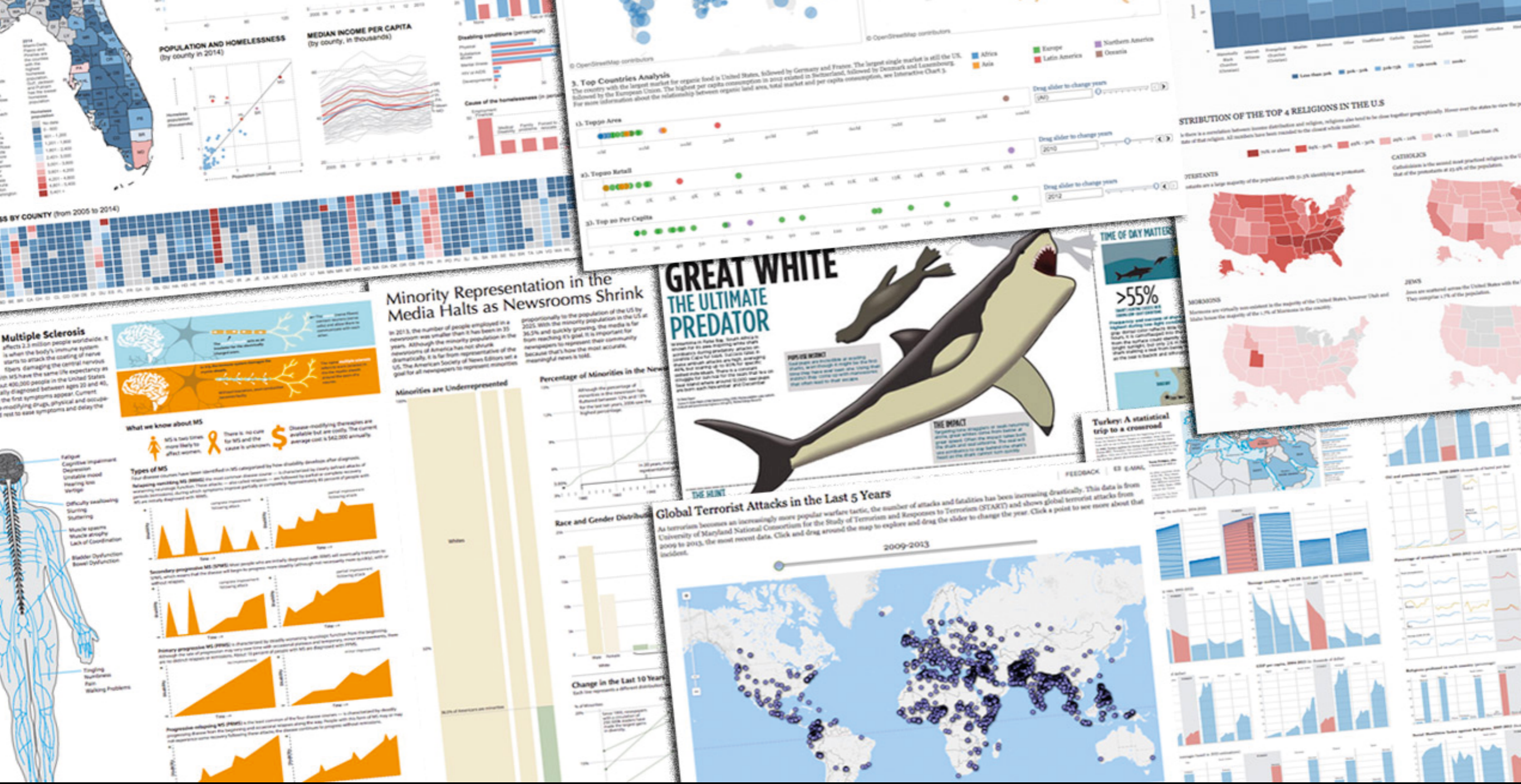
Your plans

Click pins to compare and share plans

Which states can I explore?

Health-insurance premiums and plan details are available for the 36 states served by HealthCare.gov, the federally run marketplace. Data for 14 states and the District of Columbia, which are running their own marketplaces, are not available at

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