DATA COLLECTION

WESLEY WILLETT

VISUAL ANALYTICS

24 SEPT 2014

WHERE DOES DATA COME FROM?

We tend to think of data as a thing...

in a database...

somewhere...

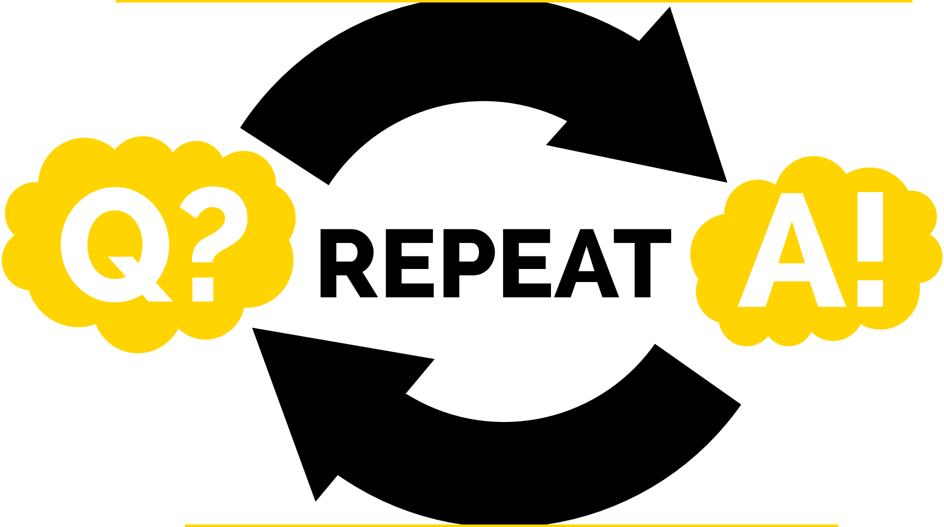
WHY DO YOU NEED DATA?

(HINT: Usually, because you have a question you need to answer!)

DATA ➡ ANSWERS

ANALYSIS IS A CYCLE

GATHERING DATA,
APPLYING STATISTICAL TOOLS,
AND CONSTRUCTING GRAPHICS
TO ADDRESS QUESTIONS



INSPECT "ANSWERS" AND
ASSESS NEW QUESTIONS

(SOMETIMES YOU'LL ALREADY START WITH DATA...)

"EXPLORATORY DATA ANALYSIS"

JOHN TUKEY

We'll revisit this later in the course...

(...BUT OFTEN YOU START WITH A QUESTION AND NEED TO COLLECT DATA TO FIT IT)

CHOOSING A QUESTION

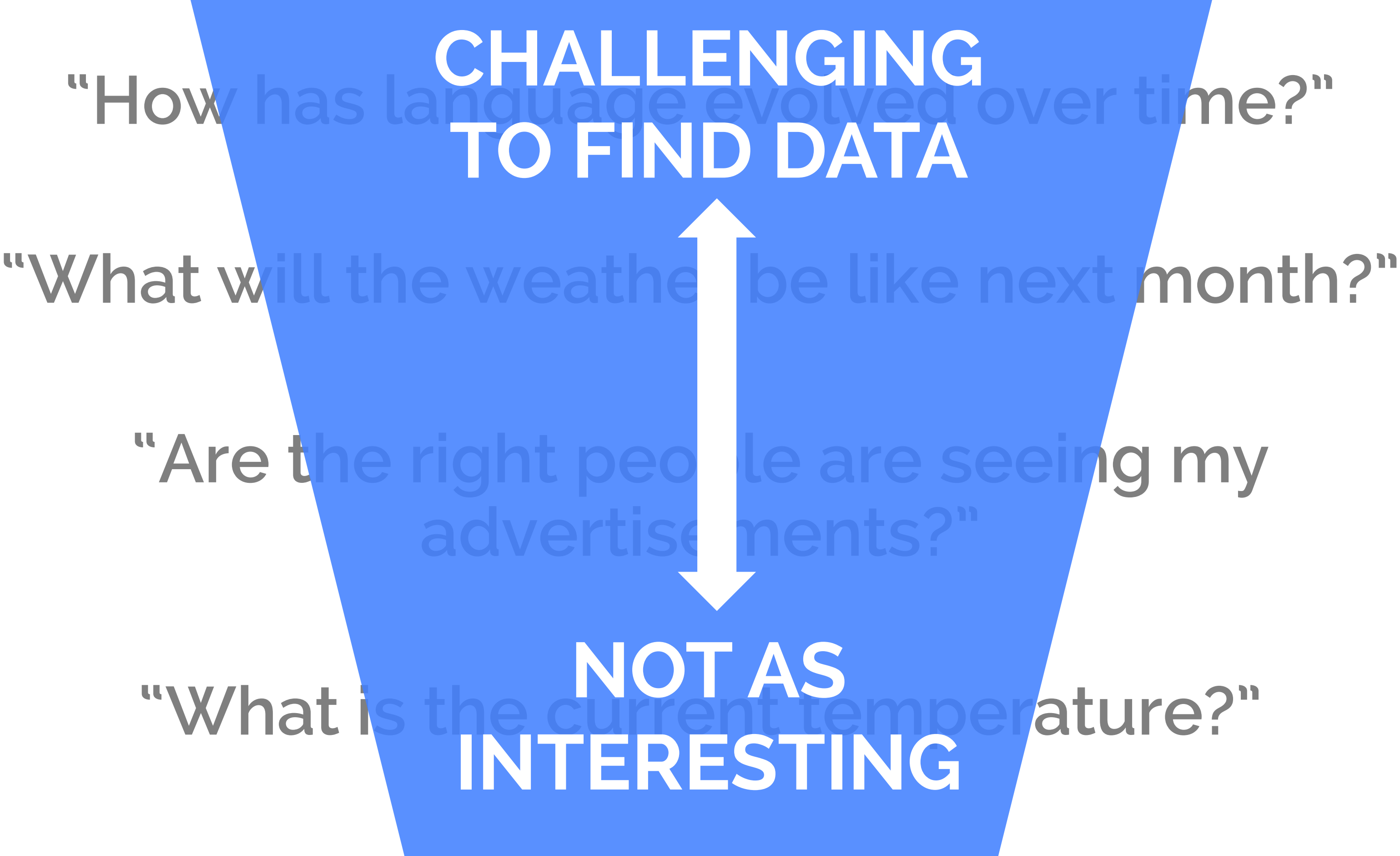
“How has language evolved over time?”

“What will the weather be like next month?”

“Are the right people are seeing my advertisements?”

“What is the current temperature?”

A PROBLEM OF SCALE



CHALLENGING TO FIND DATA

"How has language evolved over time?"

"What will the weather be like next month?"

"Are the right people are seeing my advertisements?"

"What is the current temperature?"

NOT AS INTERESTING

HOW TO OBTAIN DATA?

COLLECT IT

- OBSERVATION
- SURVEYS
- LOGGING
- SENSORS
- CROWDSOURCING

FIND OR EXTRACT IT

- OPEN CORPUSES
- DATA RETAILERS
- APIS
- SCRAPING THE WEB

GENERATE IT

- SIMULATIONS

ALL OF THESE HAVE

PROS/CONS

THIS LIST IS NOT EXHAUSTIVE

This lecture is intended to expose you to just a few useful data sources and collection methods.

COLLECTING DATA

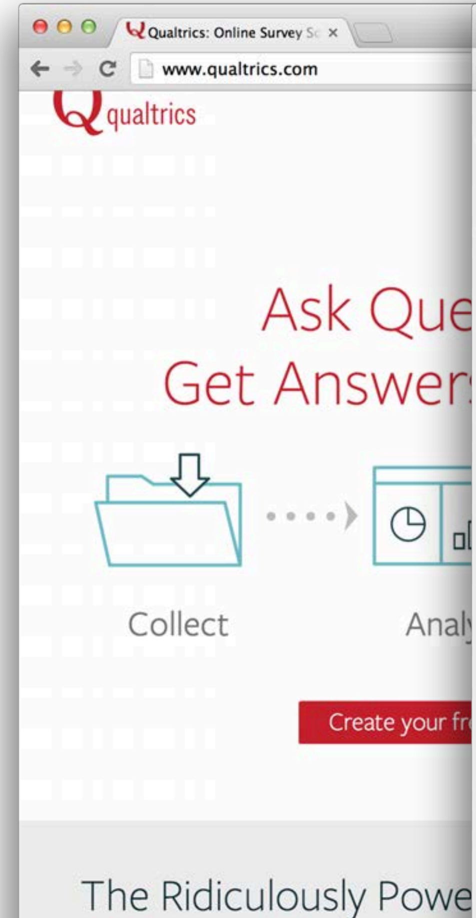
Choosing the best way to capture information you need.

SURVEYS

Paper surveys / In person interviews

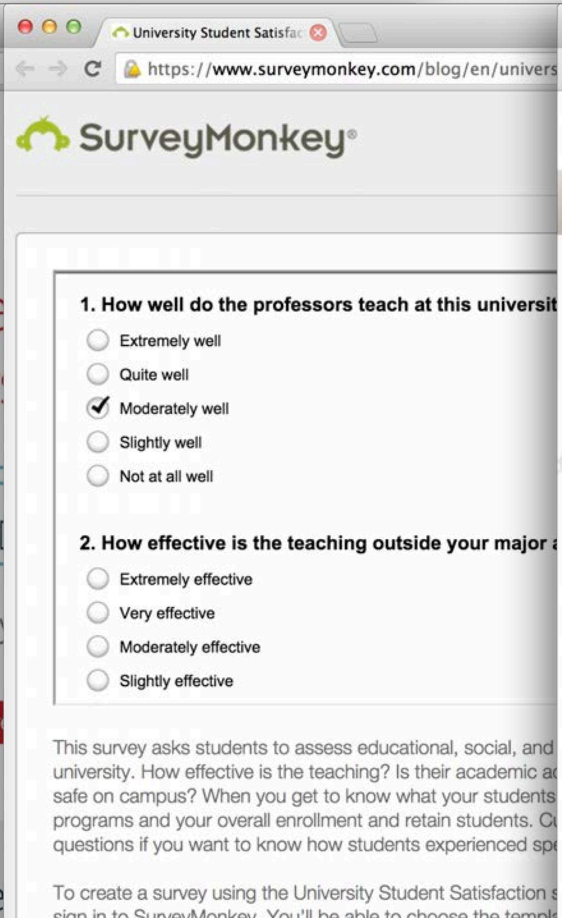
STILL ONE OF THE BEST WAYS TO GET DETAILED DATA OR DATA ABOUT SENSITIVE SUBJECTS

SURVEYS ONLINE



Ask Que
Get Answer

The Ridiculously Powe


University Student Satisfac
https://www.surveymonkey.com/blog/en/univers
SurveyMonkey

1. How well do the professors teach at this universit

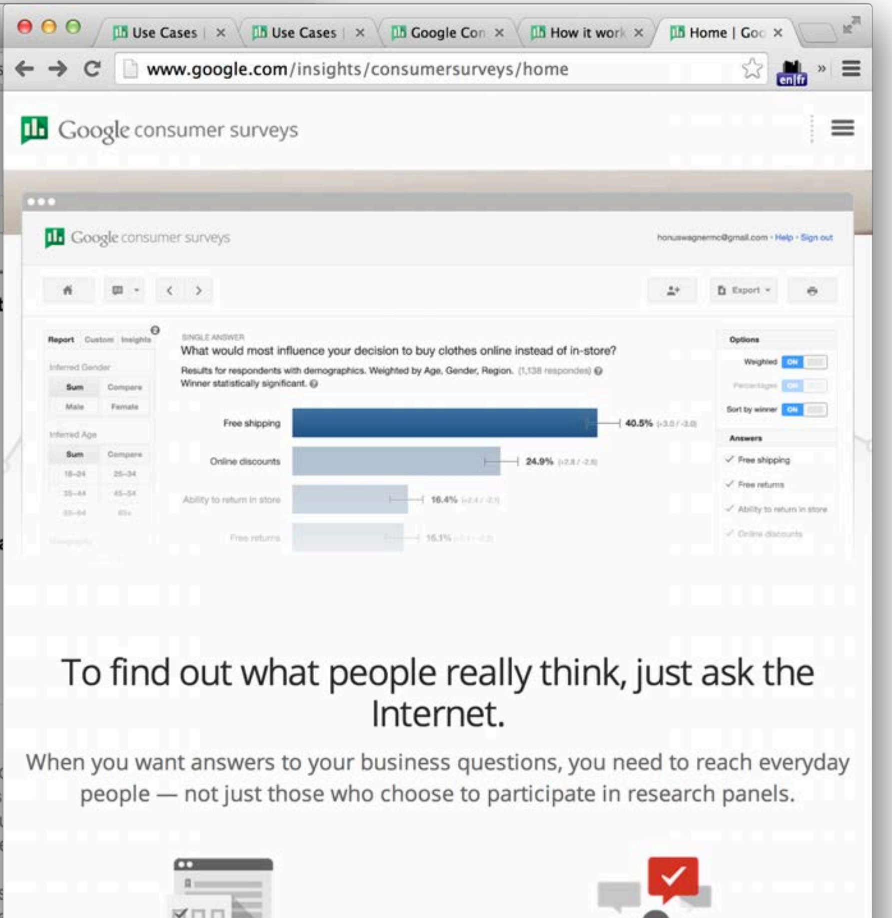
○ Extremely well
○ Quite well
☑ Moderately well
○ Slightly well
○ Not at all well

2. How effective is the teaching outside your major a

○ Extremely effective
○ Very effective
○ Moderately effective
○ Slightly effective

This survey asks students to assess educational, social, and
university. How effective is the teaching? Is their academic ad
safe on campus? When you get to know what your students
programs and your overall enrollment and retain students. Cu
questions if you want to know how students experienced spe

To create a survey using the University Student Satisfaction s
sign in to SurveyMonkey. You'll be able to choose the templa



SINGLE ANSWER

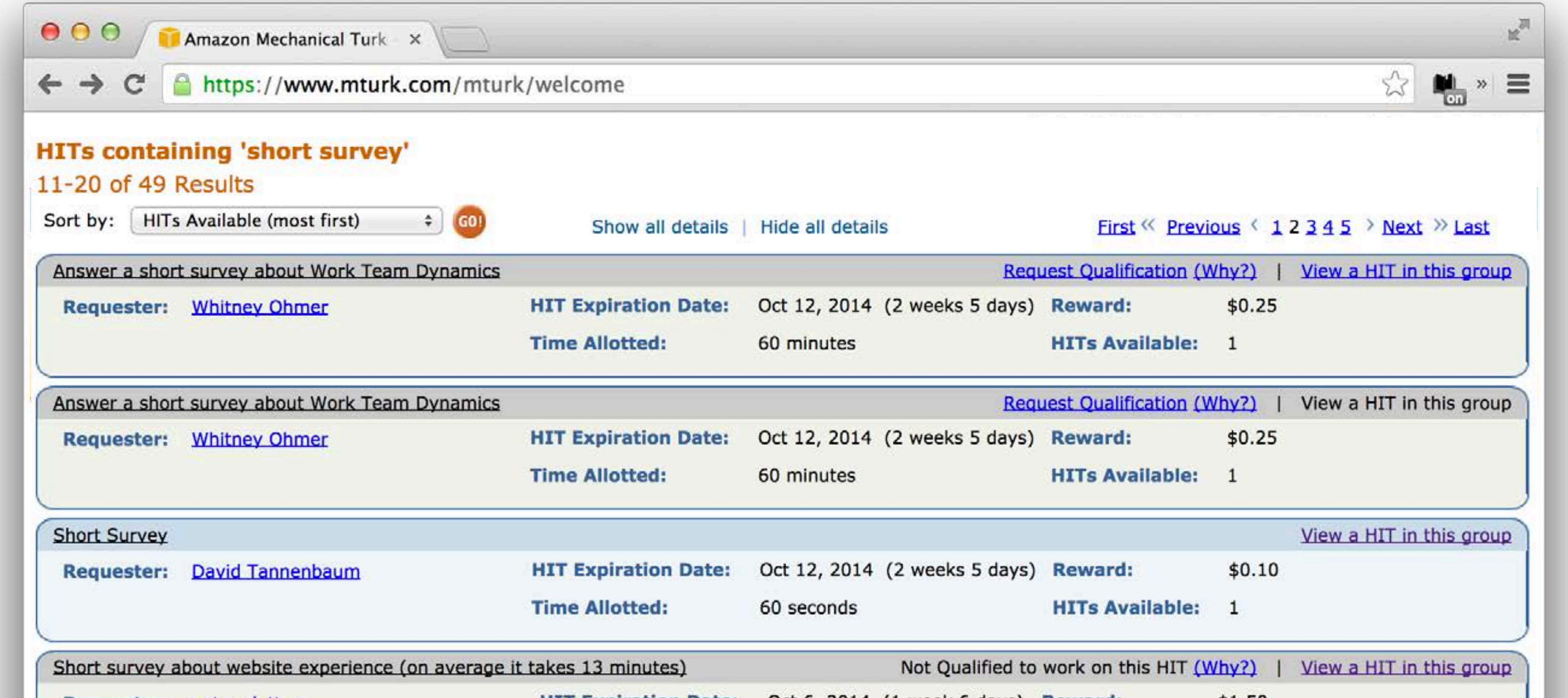
What would most influence your decision to buy clothes online instead of in-store?

Results for respondents with demographics. Weighted by Age, Gender, Region. (1,138 responses)
Winner statistically significant.

To find out what people really think, just ask the Internet.

When you want answers to your business questions, you need to reach everyday people — not just those who choose to participate in research panels.

CROWDSOURCING DATA COLLECTION



Amazon Mechanical Turk
https://www.mturk.com/mturk/welcome

HITs containing 'short survey'

11-20 of 49 Results

Sort by: HITs Available (most first)
GO!
Show all details | Hide all details
First « Previous ‹ 1 2 3 4 5 › Next » Last

Answer a short survey about Work Team Dynamics — Request Qualification (Why?) | View a HIT in this group

Requester:	Whitney Ohmer	**HIT Expiration Date:**	Oct 12, 2014 (2 weeks 5 days)	**Reward:**	$0.25
		Time Allotted:	60 minutes	**HITs Available:**	1

Answer a short survey about Work Team Dynamics — Request Qualification (Why?) | View a HIT in this group

Requester:	Whitney Ohmer	**HIT Expiration Date:**	Oct 12, 2014 (2 weeks 5 days)	**Reward:**	$0.25
		Time Allotted:	60 minutes	**HITs Available:**	1

Short Survey — View a HIT in this group

Requester:	David Tannenbaum	**HIT Expiration Date:**	Oct 12, 2014 (2 weeks 5 days)	**Reward:**	$0.10
		Time Allotted:	60 seconds	**HITs Available:**	1

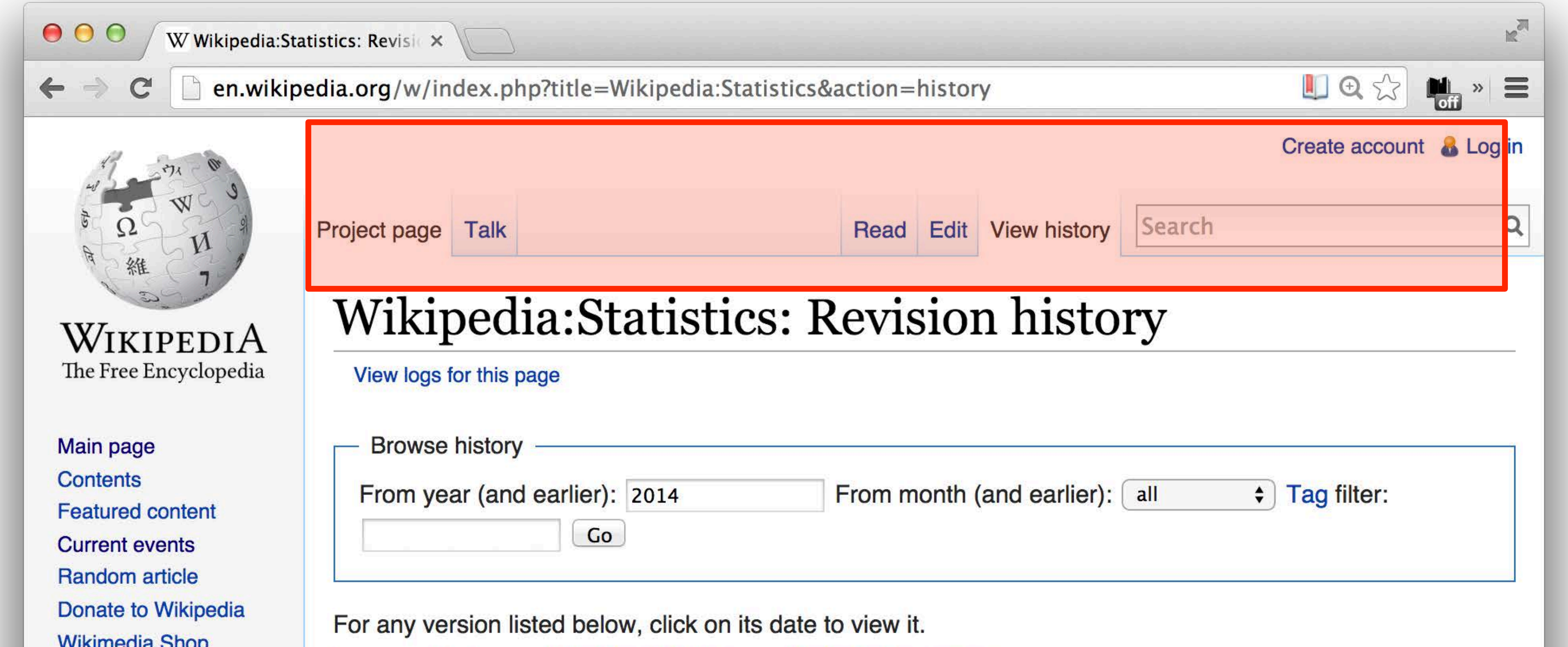
Short survey about website experience (on average it takes 13 minutes) — Not Qualified to work on this HIT (Why?) | View a HIT in this group

WEB LOGGING

Tracking Visits, Click-Throughs, and Traffic Patterns and other measures of User Activity.

- Google Analytics
- Open Web Analytics
- and many others…

EDITS & ACCESSS LOGS ON WIKIPEDIA



Wikipedia:Statistics: Revisi

en.wikipedia.org/w/index.php?title=Wikipedia:Statistics&action=history

Wikipedia:Statistics: Revision history

View logs for this page

Browse history

From year (and earlier): 2014 From month (and earlier): all Tag filter: Go

For any version listed below, click on its date to view it.

SENSORS

- Weather stations
- Personal activity trackers
- Cameras
- Mobile phones

HOW TO OBTAIN DATA?

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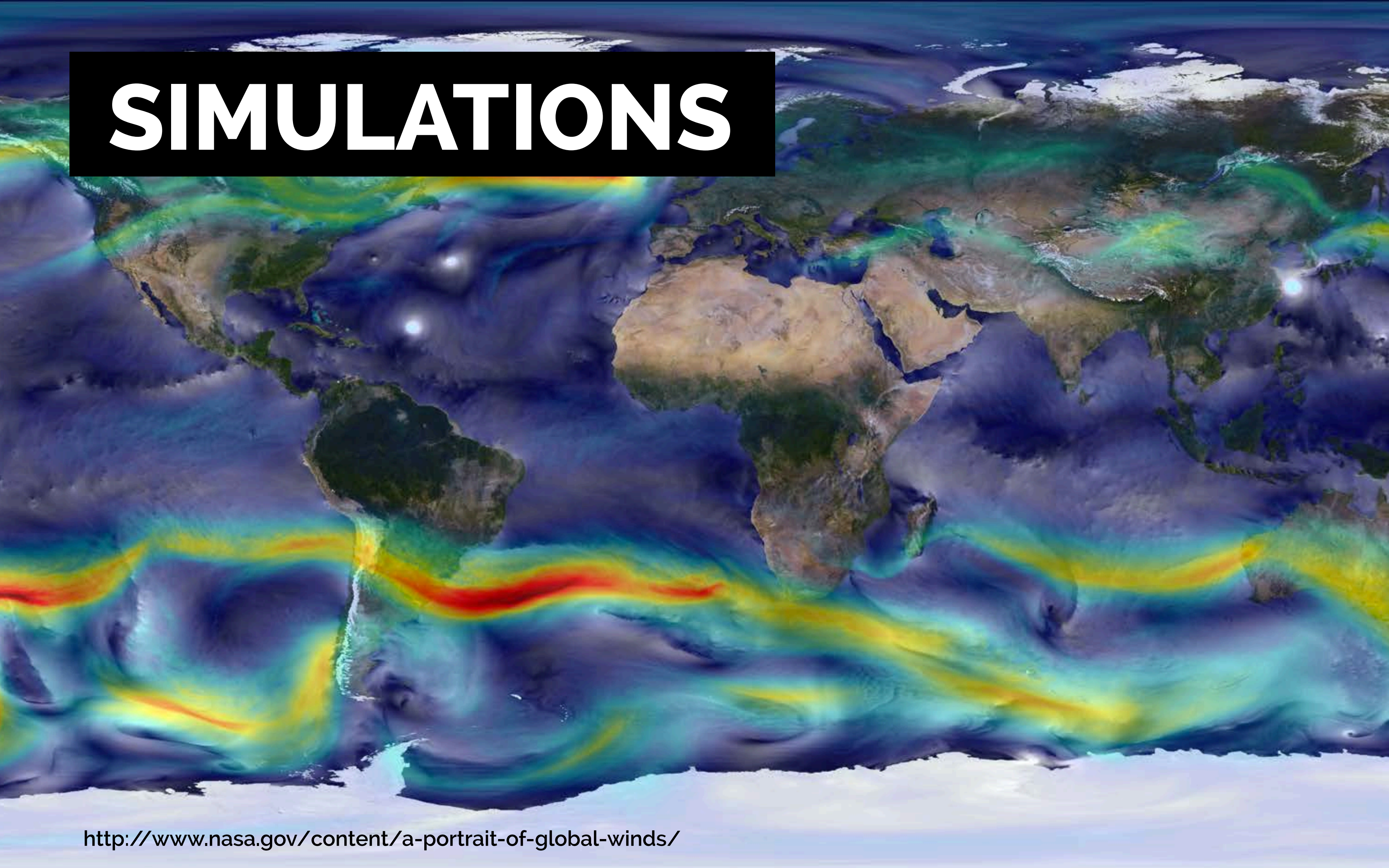
- APIS
- SCRAPING THE WEB

GENERATE IT

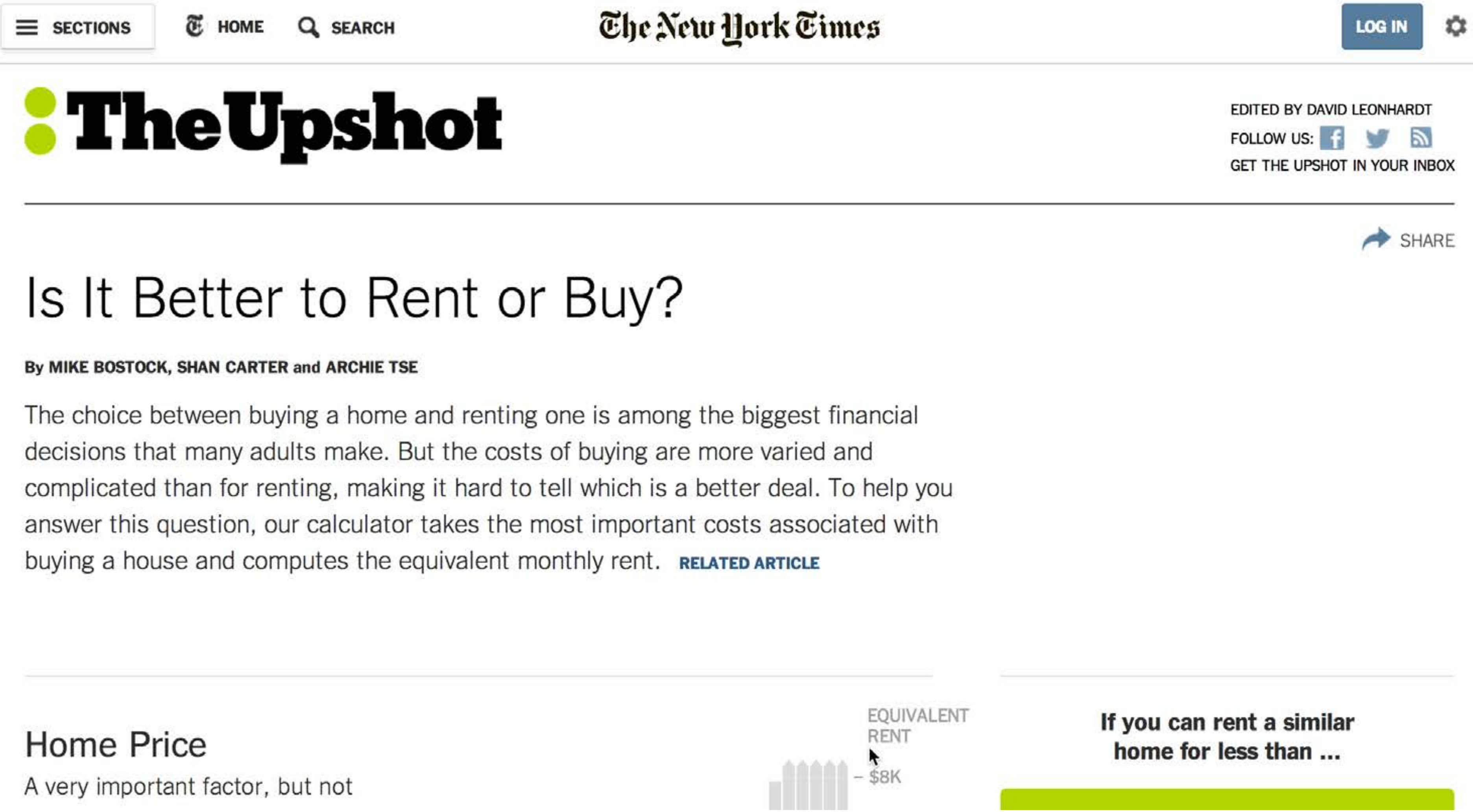
- SIMULATIONS

GENERATING DATA

SIMULATIONS



http://www.nasa.gov/content/a-portrait-of-global-winds/



TheUpshot

Is It Better to Rent or Buy?

By MIKE BOSTOCK, SHAN CARTER and ARCHIE TSE

The choice between buying a home and renting one is among the biggest financial decisions that many adults make. But the costs of buying are more varied and complicated than for renting, making it hard to tell which is a better deal. To help you answer this question, our calculator takes the most important costs associated with buying a house and computes the equivalent monthly rent. RELATED ARTICLE

Home Price

A very important factor, but not

If you can rent a similar home for less than ...

HOW TO OBTAIN DATA?

COLLECT IT

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FIND OR EXTRACT IT

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- APIS
- SCRAPING THE WEB

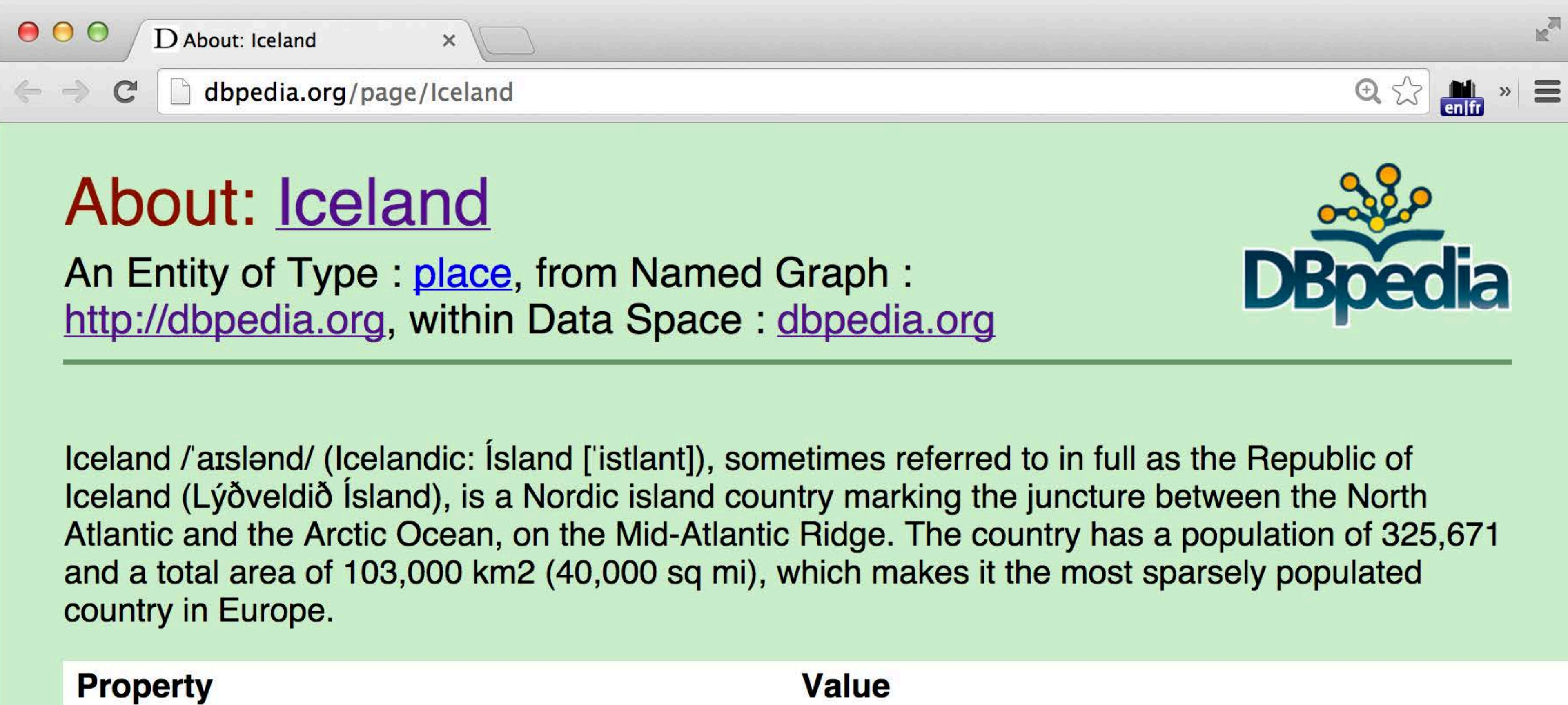
GENERATE IT

- SIMULATIONS

FINDING AND EXTRACTING EXISTING DATA

LARGE OPEN CORPUSES

DBPEDIA



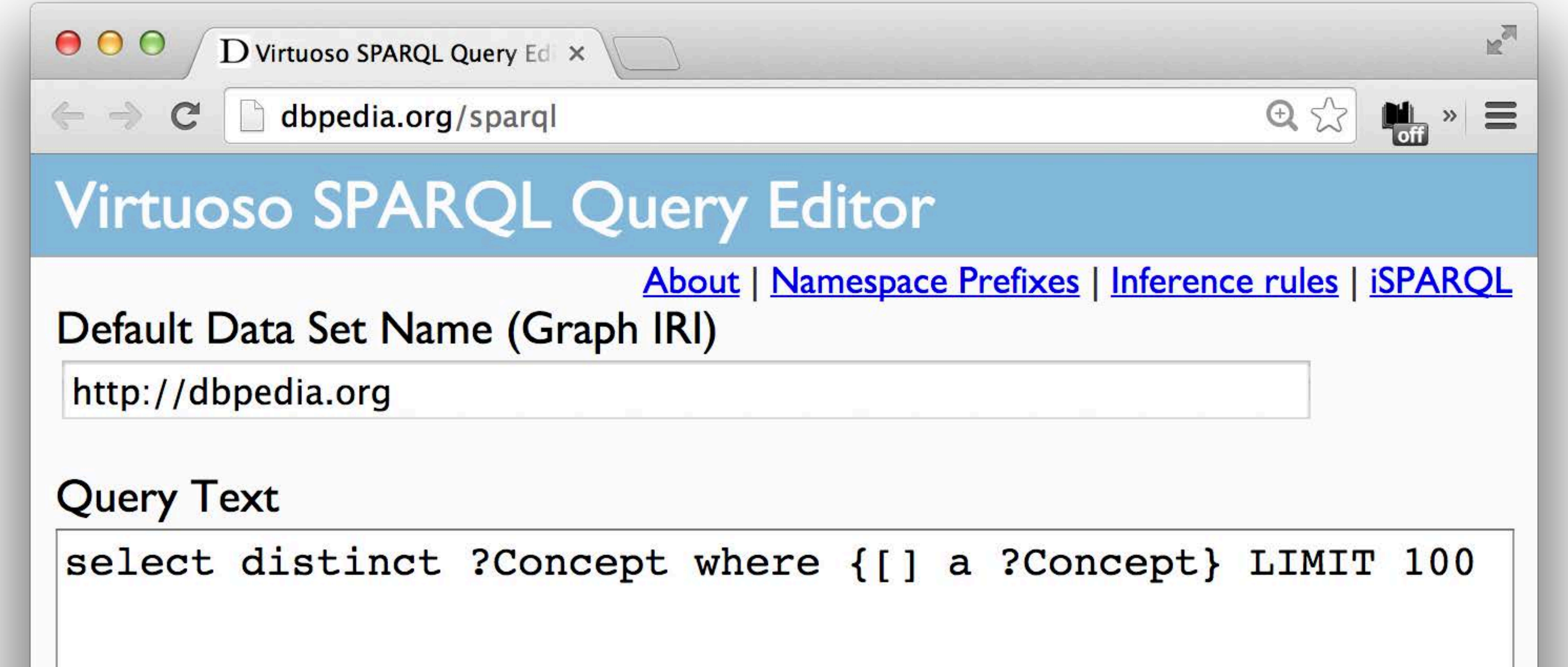
About: Iceland

An Entity of Type : place, from Named Graph : http://dbpedia.org, within Data Space : dbpedia.org

Iceland /ˈaɪslənd/ (Icelandic: Ísland [ˈistlant]), sometimes referred to in full as the Republic of Iceland (Lýðveldið Ísland), is a Nordic island country marking the juncture between the North Atlantic and the Arctic Ocean, on the Mid-Atlantic Ridge. The country has a population of 325,671 and a total area of 103,000 km2 (40,000 sq mi), which makes it the most sparsely populated country in Europe.

Property	Value

QUERYING DBPEDIA



Virtuoso SPARQL Query Editor

About | Namespace Prefixes | Inference rules | iSPARQL

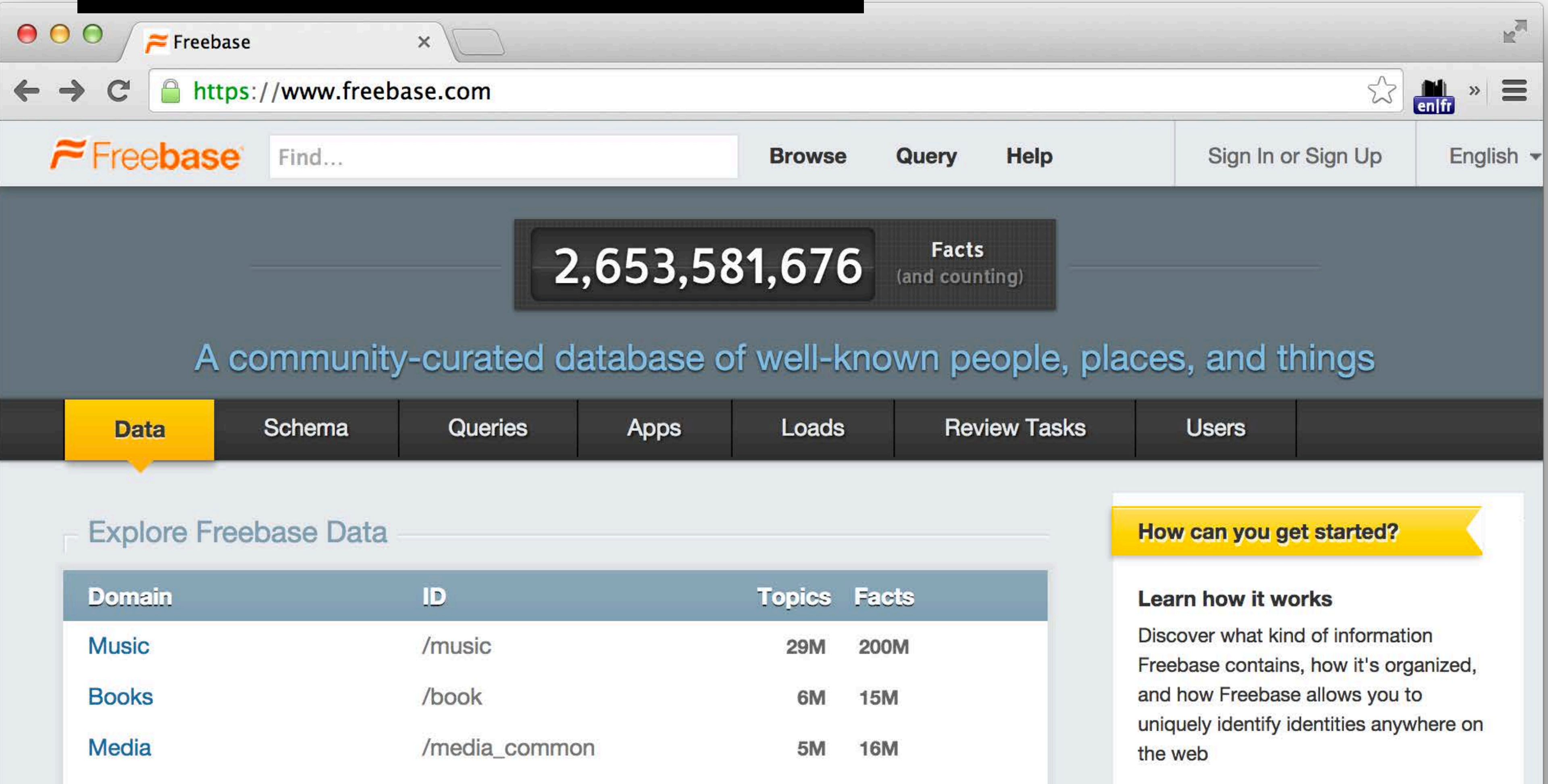
Default Data Set Name (Graph IRI)

http://dbpedia.org

Query Text

```
select distinct ?Concept where {[] a ?Concept} LIMIT 100
```

FREEBASE



2,653,581,676 Facts (and counting)

A community-curated database of well-known people, places, and things

Explore Freebase Data

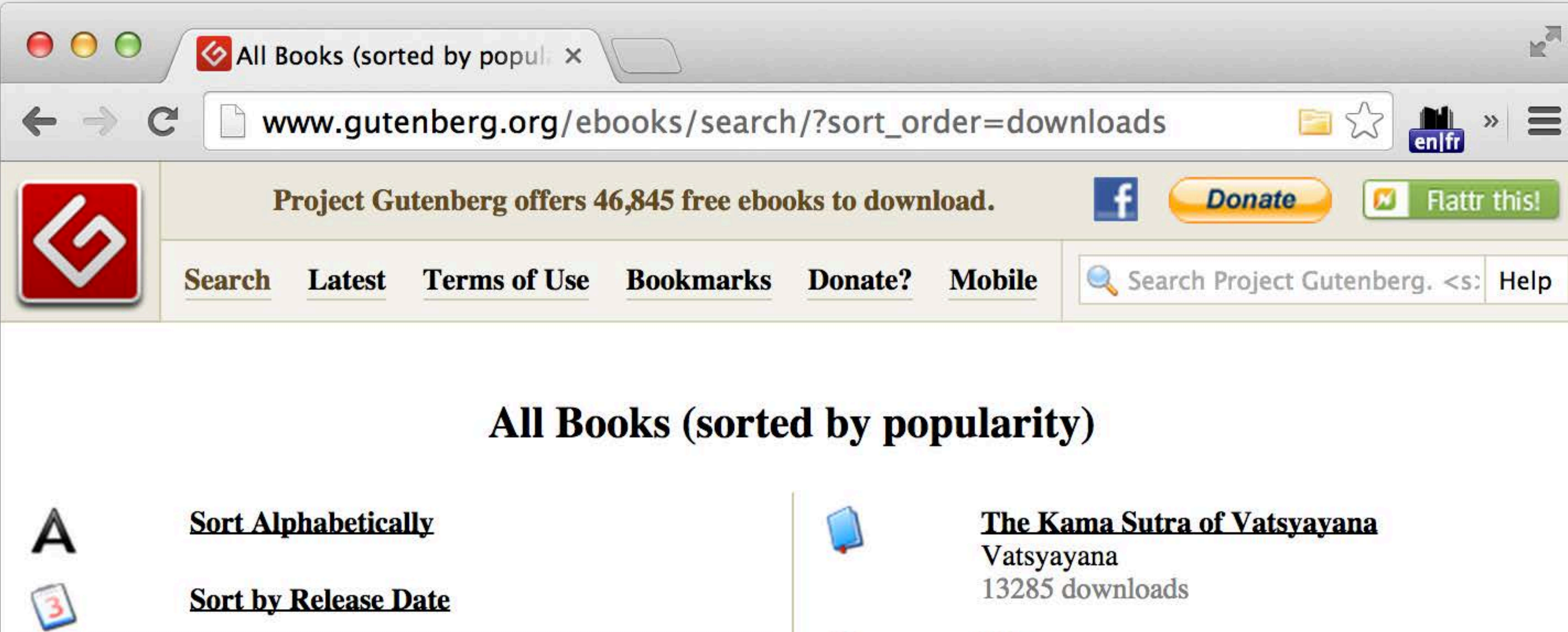
Domain	ID	Topics	Facts
Music	/music	29M	200M
Books	/book	6M	15M
Media	/media_common	5M	16M

How can you get started?

Learn how it works

Discover what kind of information Freebase contains, how it's organized, and how Freebase allows you to uniquely identify identities anywhere on the web

PROJECT GUTENBERG

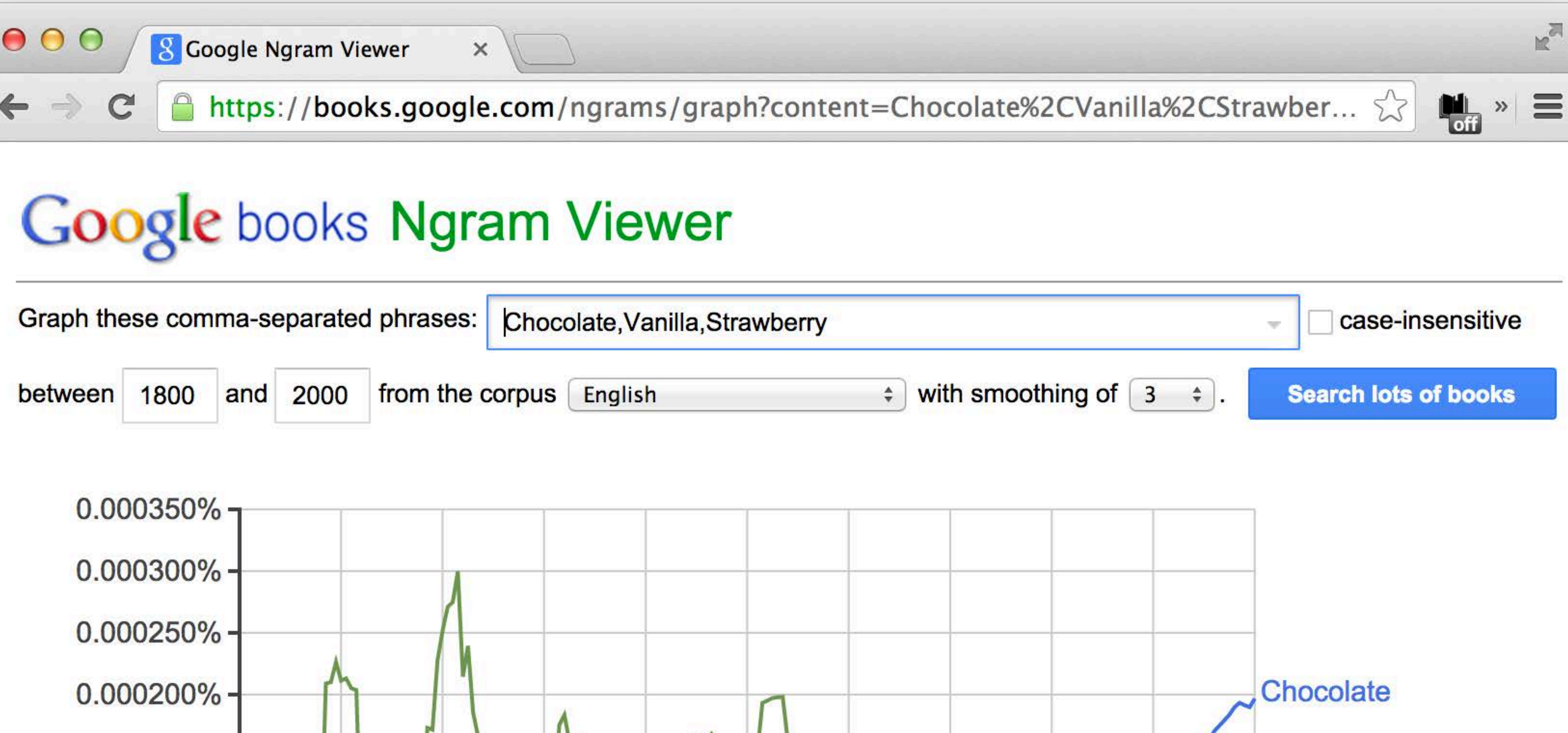


Project Gutenberg offers 46,845 free ebooks to download.

All Books (sorted by popularity)

The Kama Sutra of Vatsyayana
Vatsyayana
13285 downloads

GOOGLE N-GRAMS



Google Ngram Viewer

https://books.google.com/ngrams/graph?content=Chocolate%2CVanilla%2CStrawber...

Google books Ngram Viewer

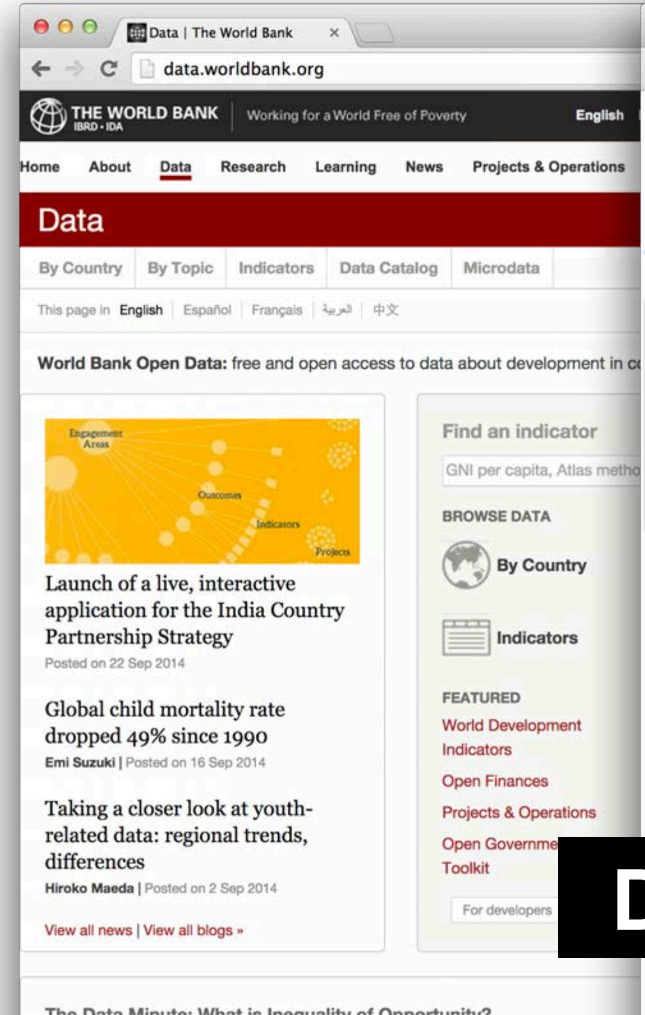
Graph these comma-separated phrases: Chocolate,Vanilla,Strawberry □ case-insensitive

between 1800 and 2000 from the corpus English with smoothing of 3.

FINDING AND EXTRACTING EXISTING DATA

GOVERNMENT AND INTERNATIONAL DATA INITIATIVES

DATA.WORLDBANK.ORG



Data | The World Bank

data.worldbank.org

THE WORLD BANK IBRD · IDA Working for a World Free of Poverty English

Home About Data Research Learning News Projects & Operations

Data

By Country | By Topic | Indicators | Data Catalog | Microdata

This page in: English | Español | Français | العربية | 中文

World Bank Open Data: free and open access to data about development in co

Launch of a live, interactive application for the India Country Partnership Strategy

Posted on 22 Sep 2014

Global child mortality rate dropped 49% since 1990

Emi Suzuki | Posted on 16 Sep 2014

Taking a closer look at youth-related data: regional trends, differences

Hiroko Maeda | Posted on 2 Sep 2014

View all news | View all blogs »

The Data Minute: What is Inequality of Opportunity?

Find an indicator

GNI per capita, Atlas metho

BROWSE DATA

By Country

Indicators

FEATURED

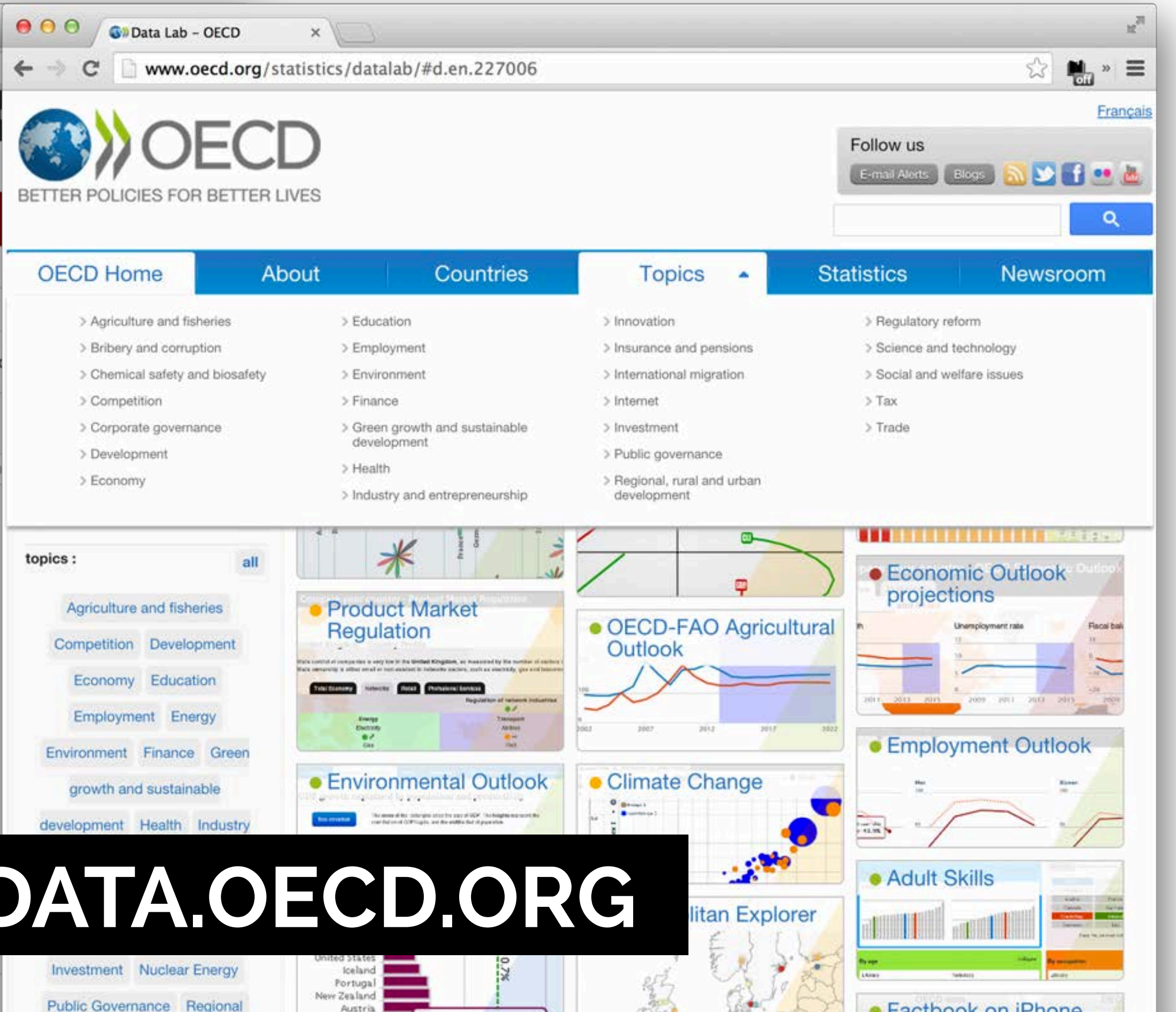
World Development Indicators

Open Finances

Projects & Operations

Open Governme Toolkit

For developers



Data Lab – OECD

www.oecd.org/statistics/datalab/#d.en.227006

Français

OECD BETTER POLICIES FOR BETTER LIVES

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- Agriculture and fisheries
- Bribery and corruption
- Chemical safety and biosafety
- Competition
- Corporate governance
- Development
- Economy
- Education
- Employment
- Environment
- Finance
- Green growth and sustainable development
- Health
- Industry and entrepreneurship
- Innovation
- Insurance and pensions
- International migration
- Internet
- Investment
- Public governance
- Regional, rural and urban development
- Regulatory reform
- Science and technology
- Social and welfare issues
- Tax
- Trade

topics : all

Agriculture and fisheries | Competition | Development | Economy | Education | Employment | Energy | Environment | Finance | Green growth and sustainable development | Health | Industry | Investment | Nuclear Energy | Public Governance | Regional

Product Market Regulation

OECD-FAO Agricultural Outlook

Economic Outlook projections

Employment Outlook

Environmental Outlook

Climate Change

Adult Skills

litan Explorer

Factbook on iPhone

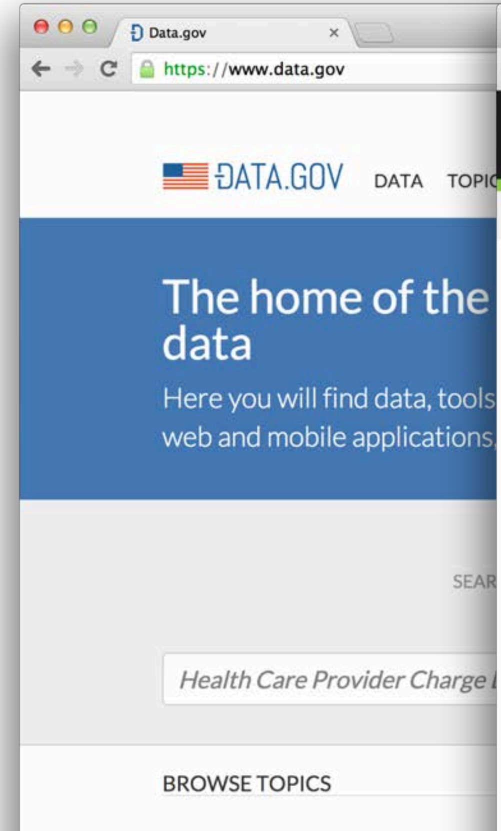
DATA.OECD.ORG

GOVERNMENT INITIATIVES

WWW.DATA.GOV (US)

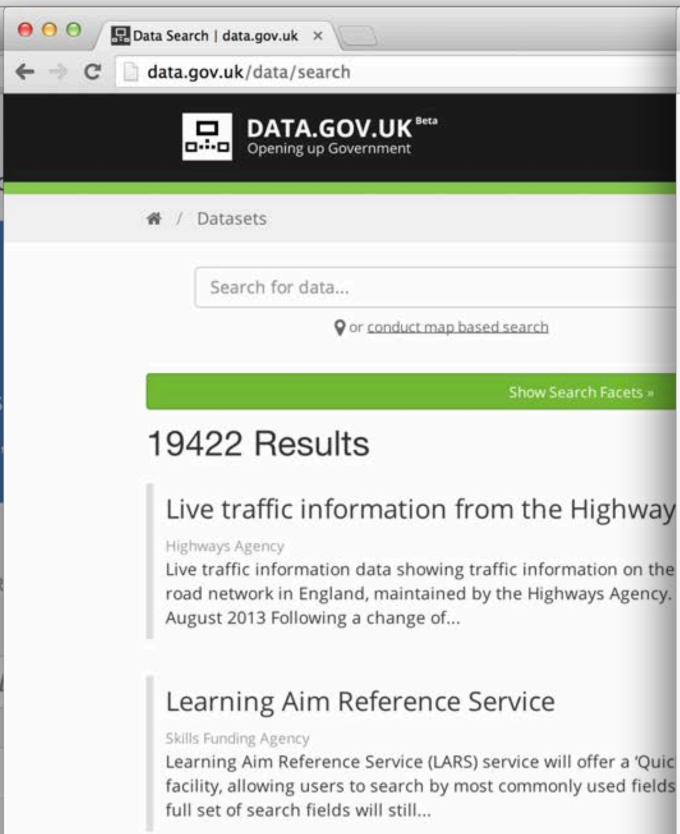
DATA.GOV.UK

DATA.GOV.BE



The home of the data

Here you will find data, tools web and mobile applications.



19422 Results

Live traffic information from the Highway

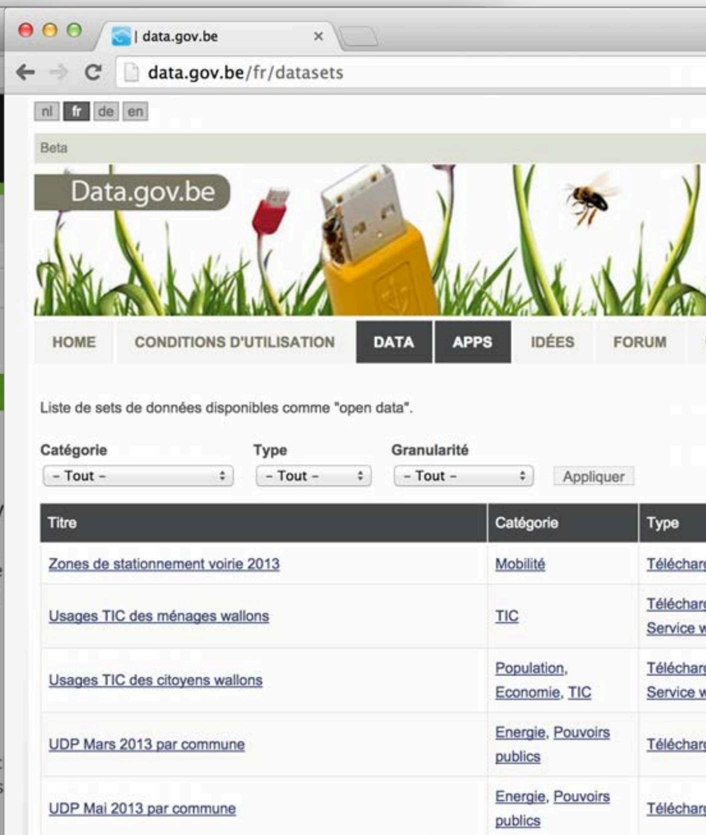
Highways Agency

Live traffic information data showing traffic information on the road network in England, maintained by the Highways Agency. August 2013 Following a change of...

Learning Aim Reference Service

Skills Funding Agency

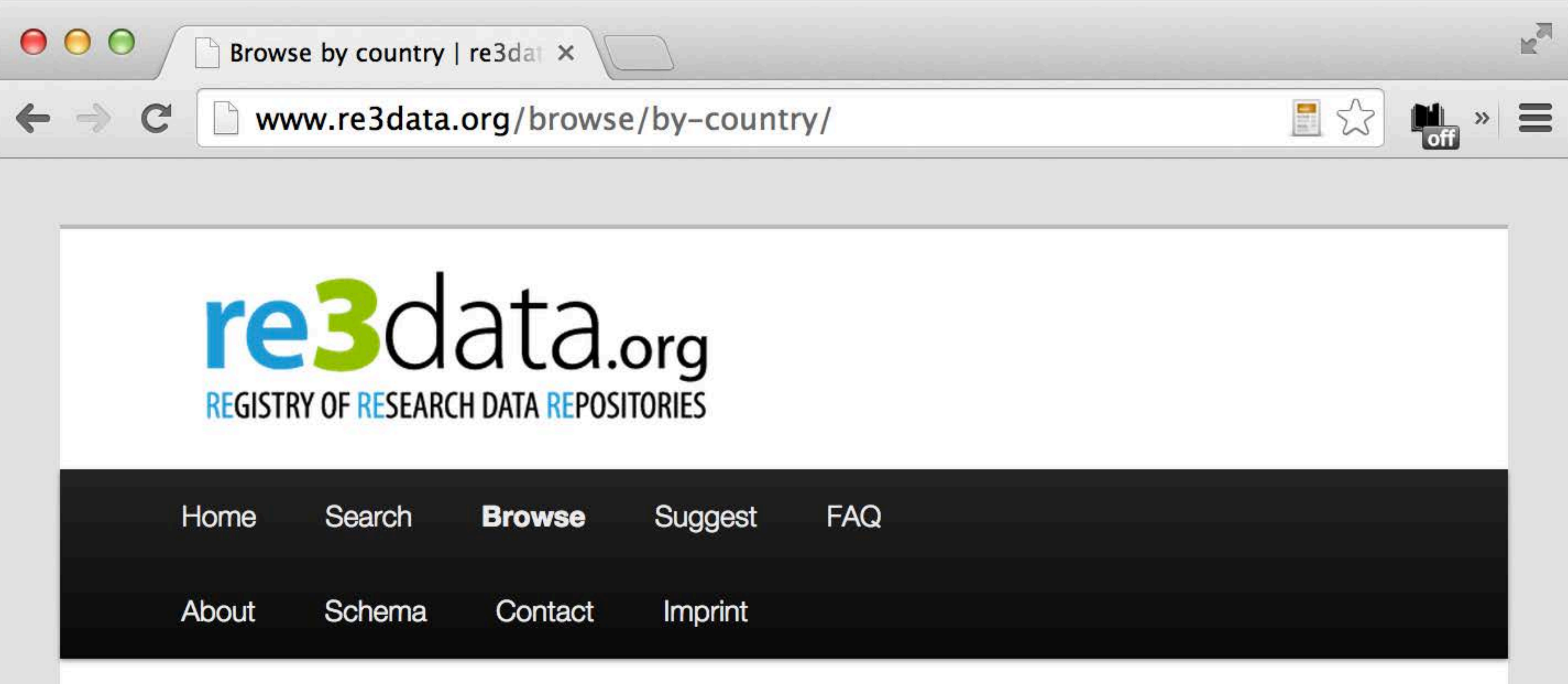
Learning Aim Reference Service (LARS) service will offer a 'Quic facility, allowing users to search by most commonly used fields full set of search fields will still...



Liste de sets de données disponibles comme "open data".

Titre	Catégorie	Type
Zones de stationnement voirie 2013	Mobilité	Téléchar
Usages TIC des ménages wallons	TIC	Téléchar Service w
Usages TIC des citoyens wallons	Population, Economie, TIC	Téléchar Service w
UDP Mars 2013 par commune	Energie, Pouvoirs publics	Téléchar
UDP Mai 2013 par commune	Energie, Pouvoirs publics	Téléchar

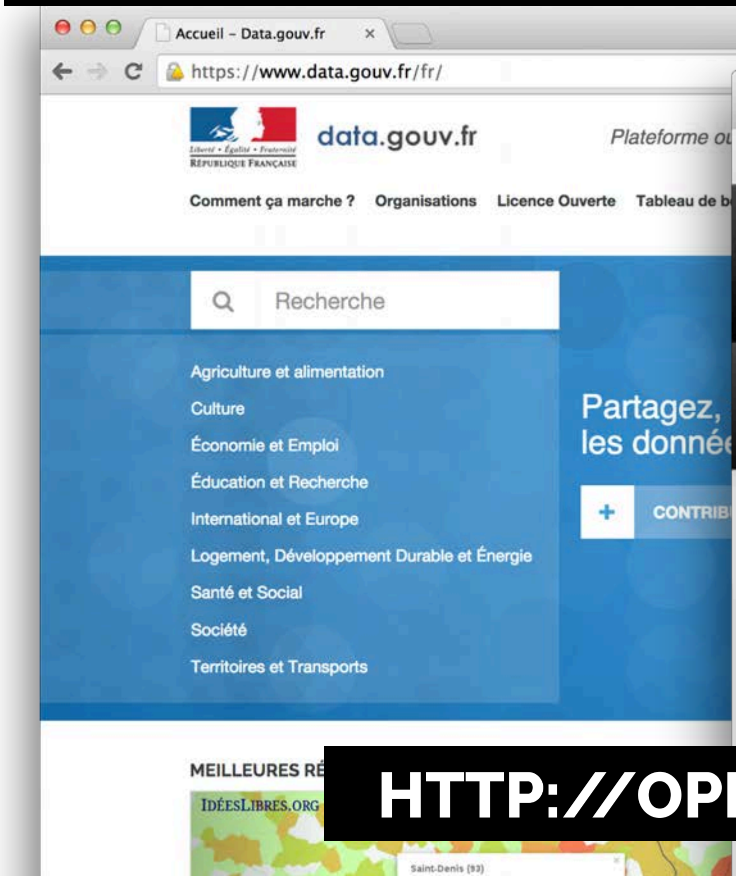
NEW DATA INITIATIVES JUST TO TRACK ALL THE DATA INITIATIVES

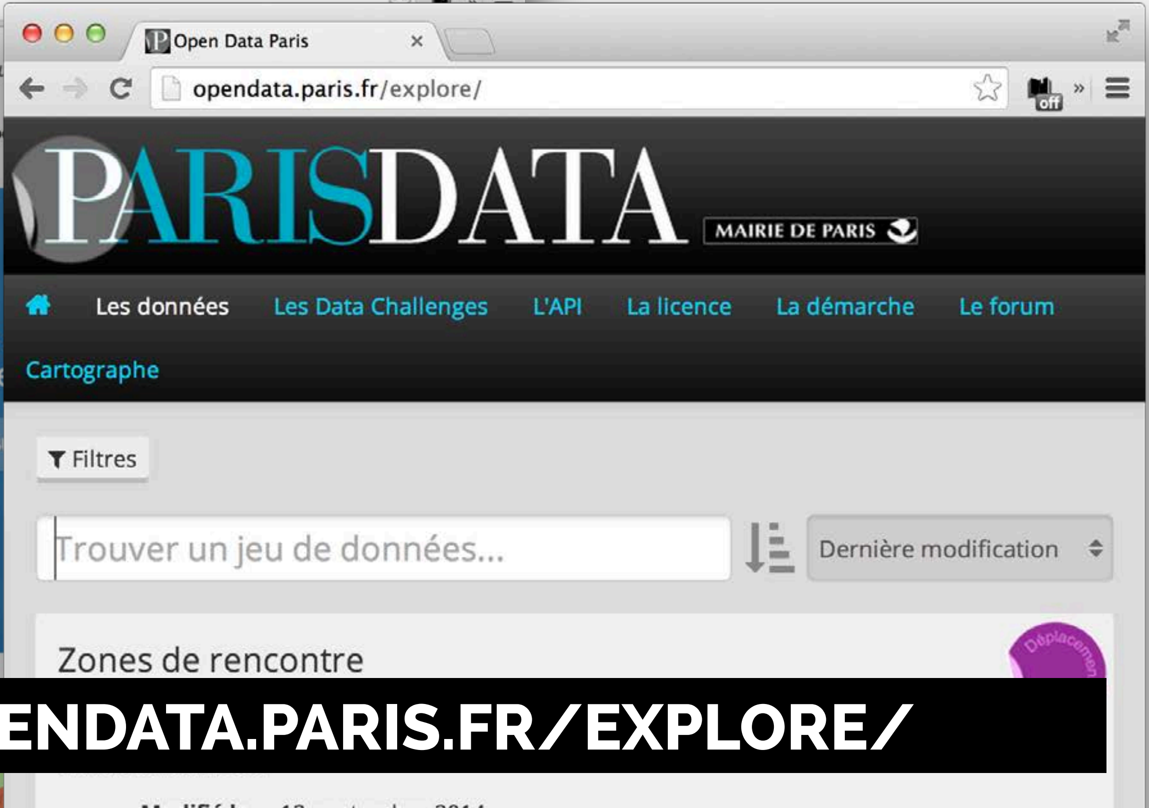


Browse by country | re3dat
www.re3data.org/browse/by-country/
off
re3data.org
REGISTRY OF RESEARCH DATA REPOSITORIES
Home
Search
Browse
Suggest
FAQ
About
Schema
Contact
Imprint

INITIATIVES IN FRANCE

HTTP://DATA.GOUV.FR





HTTP://OPENDATA.PARIS.FR/EXPLORE/

FINDING AND EXTRACTING EXISTING DATA

OTHER PUBLIC DATA REPOSITORIES

MORE REPOSITORIES

VISUALIZING.ORG

http://visualizing.org/data/browse

AMAZON PUBLIC DATA HOSTING

http://aws.amazon.com/publicdatasets/

GOOGLE PUBLIC DATA

http://www.google.com/publicdata/directory

FINDING AND EXTRACTING EXISTING DATA

DATA RETAILERS

DATA RETAILERS

AZURE DATA MARKET

https://datamarket.azure.com/browse/data

FACTUAL

http://www.factual.com/

AND AGAIN, THERE ARE MANY, MANY MORE…

FINDING AND EXTRACTING EXISTING DATA

APIS

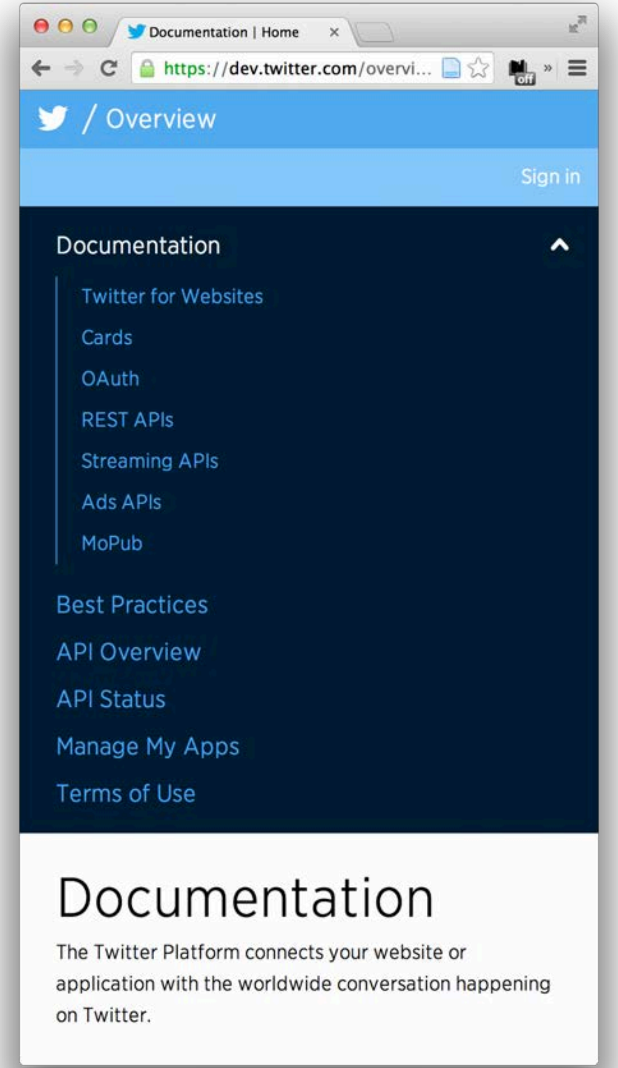
TWITTER

Streaming APIs (live data by users and by topics)

The "Firehose" (all of live twitter)

Complete Archives via "Gnip" and eventually the US Library of Congress

HTTPS://DEV.TWITTER.COM



Documentation

- Twitter for Websites
- Cards
- OAuth
- REST APIs
- Streaming APIs
- Ads APIs
- MoPub

Best Practices

API Overview

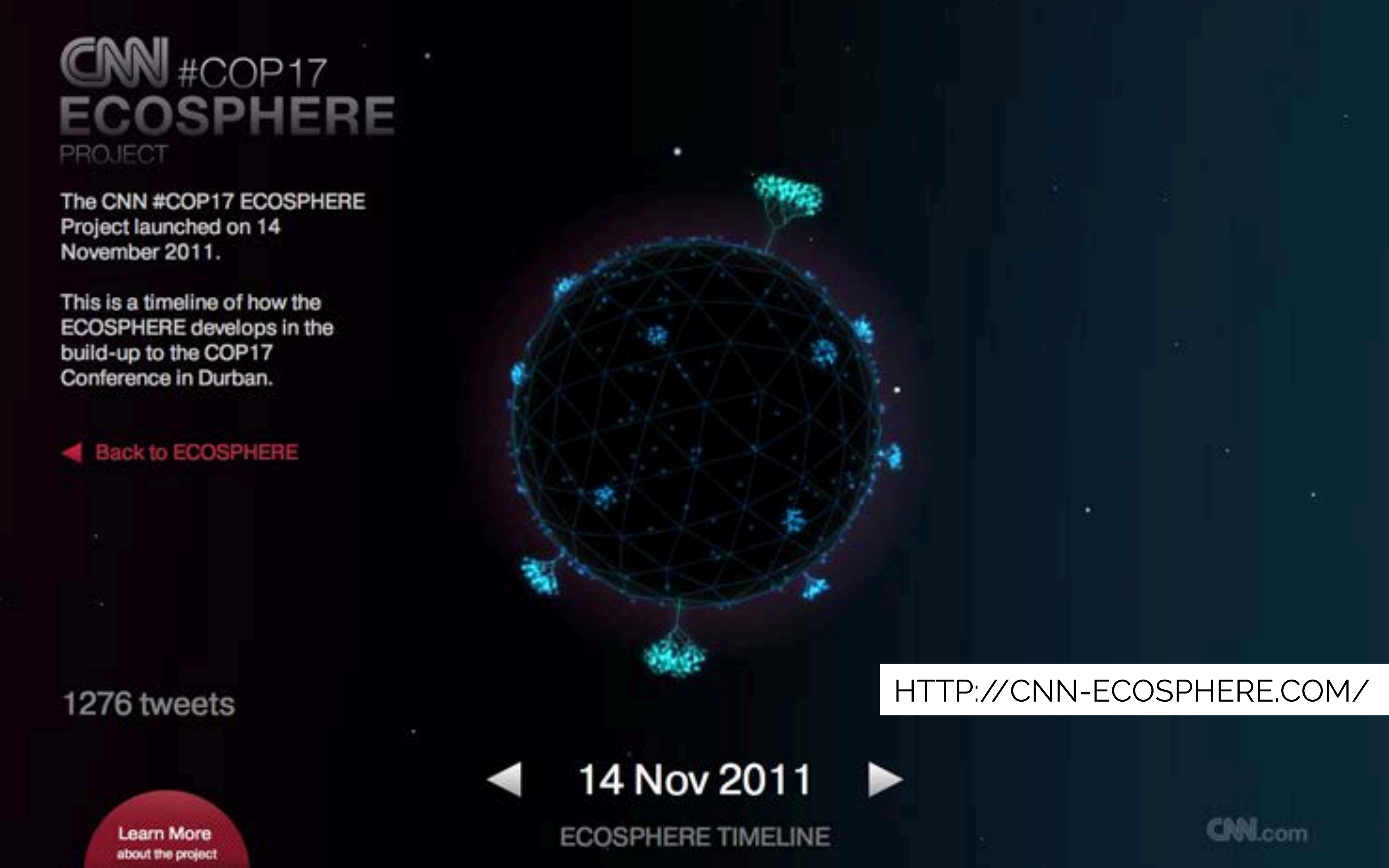
API Status

Manage My Apps

Terms of Use

Documentation

The Twitter Platform connects your website or application with the worldwide conversation happening on Twitter.

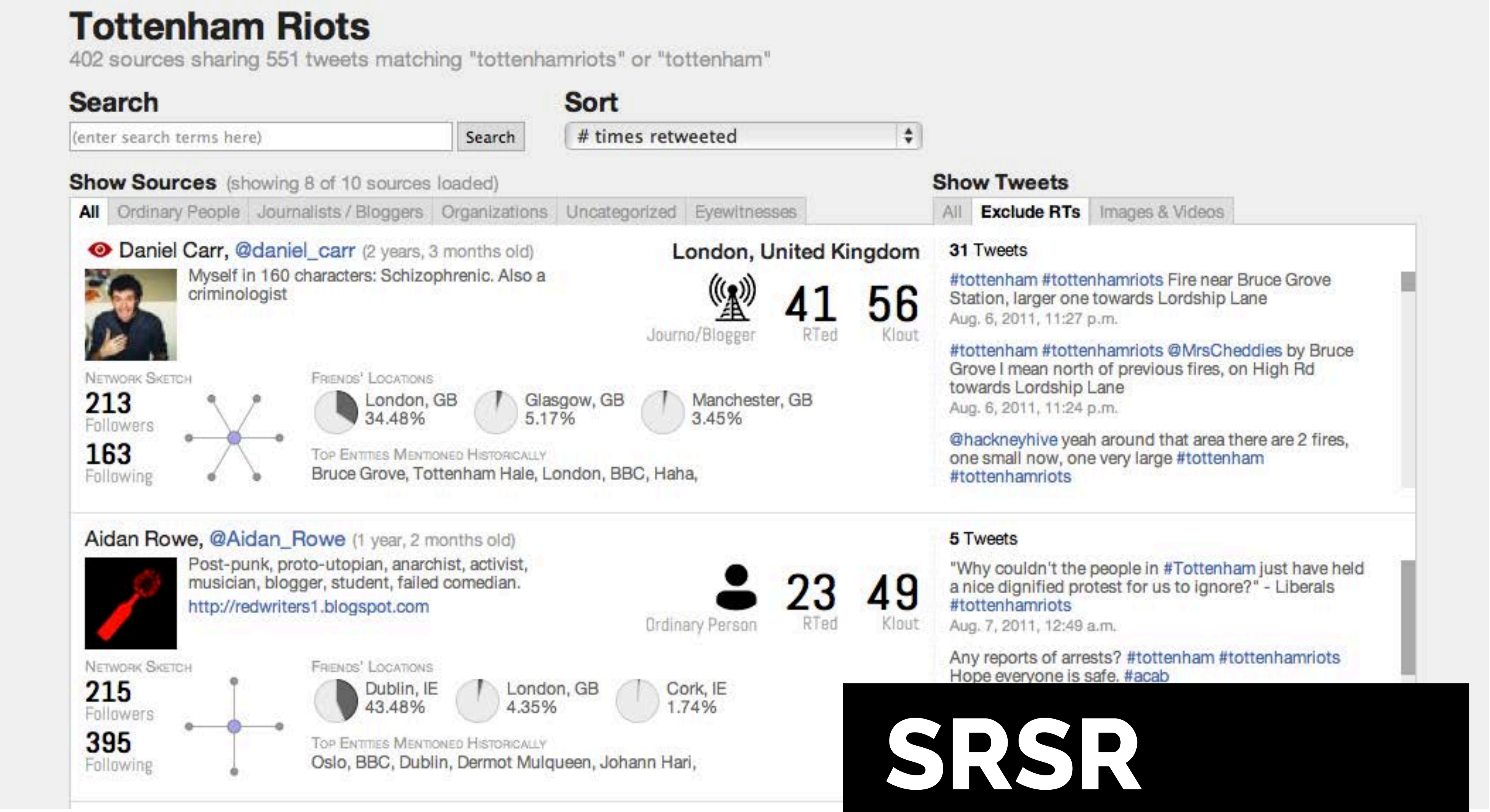


CNN #COP17 ECOSPHERE PROJECT

The CNN #COP17 ECOSPHERE Project launched on 14 November 2011.

This is a timeline of how the ECOSPHERE develops in the build-up to the COP17 Conference in Durban.

HTTP://CNN-ECOSPHERE.COM/



Tottenham Riots

402 sources sharing 551 tweets matching "tottenhamriots" or "tottenham"

Search

(enter search terms here) | Search

Sort

times retweeted

Show Sources (showing 8 of 10 sources loaded)

All | Ordinary People | Journalists / Bloggers | Organizations | Uncategorized | Eyewitnesses

Show Tweets

All | **Exclude RTs** | Images & Videos

Daniel Carr, @daniel_carr (2 years, 3 months old)

Myself in 160 characters: Schizophrenic. Also a criminologist

London, United Kingdom

Journo/Blogger | 41 RTed | 56 Klout

NETWORK SKETCH

213 Followers

163 Following

FRIENDS' LOCATIONS

London, GB 34.48% | Glasgow, GB 5.17% | Manchester, GB 3.45%

TOP ENTITIES MENTIONED HISTORICALLY

Bruce Grove, Tottenham Hale, London, BBC, Haha,

31 Tweets

#tottenham #tottenhamriots Fire near Bruce Grove Station, larger one towards Lordship Lane

Aug. 6, 2011, 11:27 p.m.

#tottenham #tottenhamriots @MrsCheddies by Bruce Grove I mean north of previous fires, on High Rd towards Lordship Lane

Aug. 6, 2011, 11:24 p.m.

@hackneyhive yeah around that area there are 2 fires, one small now, one very large #tottenham #tottenhamriots

Aidan Rowe, @Aidan_Rowe (1 year, 2 months old)

Post-punk, proto-utopian, anarchist, activist, musician, blogger, student, failed comedian.

http://redwriters1.blogspot.com

Ordinary Person | 23 RTed | 49 Klout

NETWORK SKETCH

215 Followers

395 Following

FRIENDS' LOCATIONS

Dublin, IE 43.48% | London, GB 4.35% | Cork, IE 1.74%

TOP ENTITIES MENTIONED HISTORICALLY

Oslo, BBC, Dublin, Dermot Mulqueen, Johann Hari,

5 Tweets

"Why couldn't the people in #Tottenham just have held a nice dignified protest for us to ignore?" - Liberals #tottenhamriots

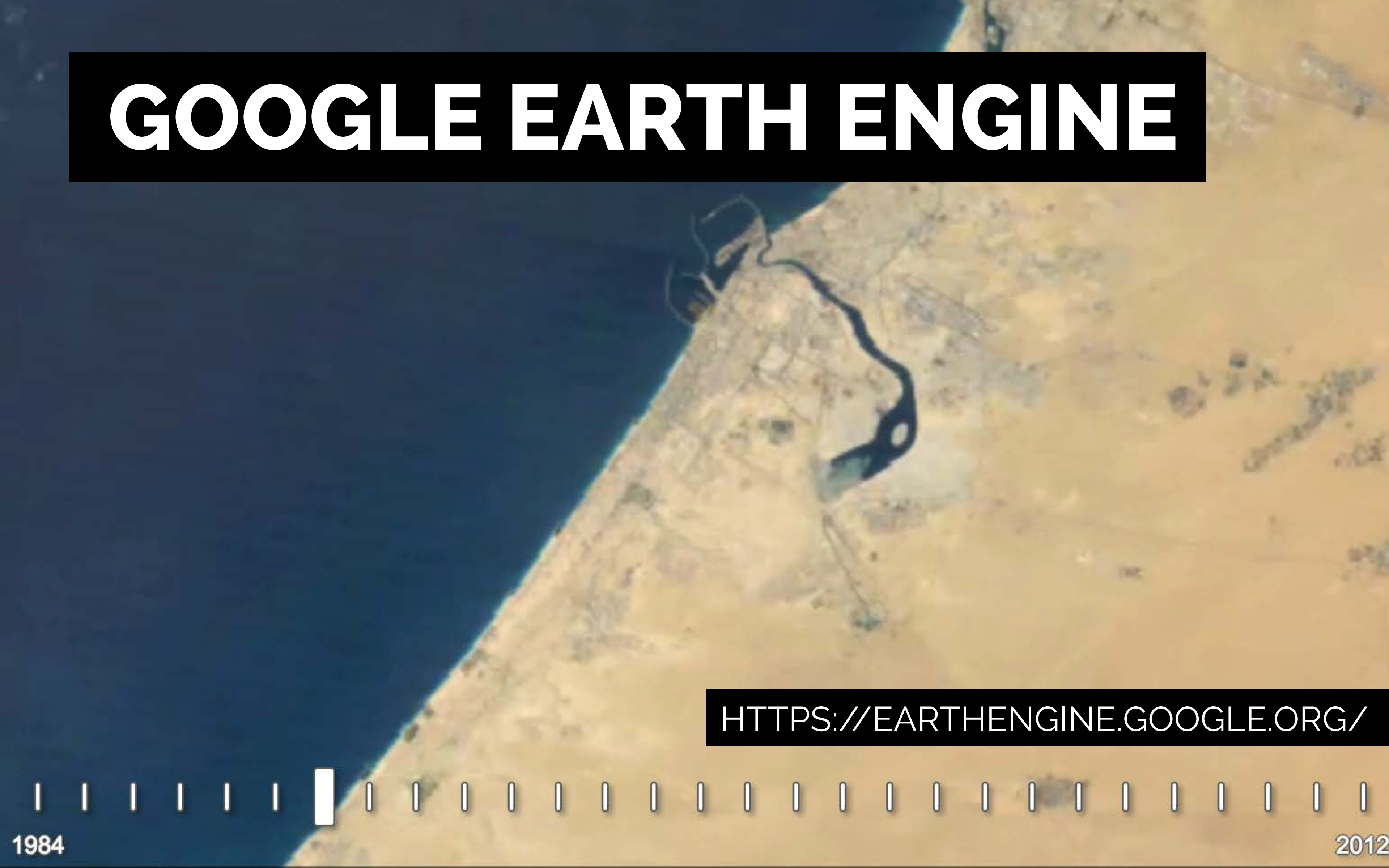
Aug. 7, 2011, 12:49 a.m.

Any reports of arrests? #tottenham #tottenhamriots Hope everyone is safe. #acab

SRSR

[DIAKOPOULOS ET AL. 2012]

GOOGLE EARTH ENGINE



HTTPS://EARTHENGINE.GOOGLE.ORG/

MORE APIS

(APPLICATION PROGRAMMING INTERFACES)

NEW YORK TIMES APIS

http://developer.nytimes.com/

(Archival news articles from 1851, books, movies, geographical, and political data)

ECHONEST APIS

http://developer.echonest.com/

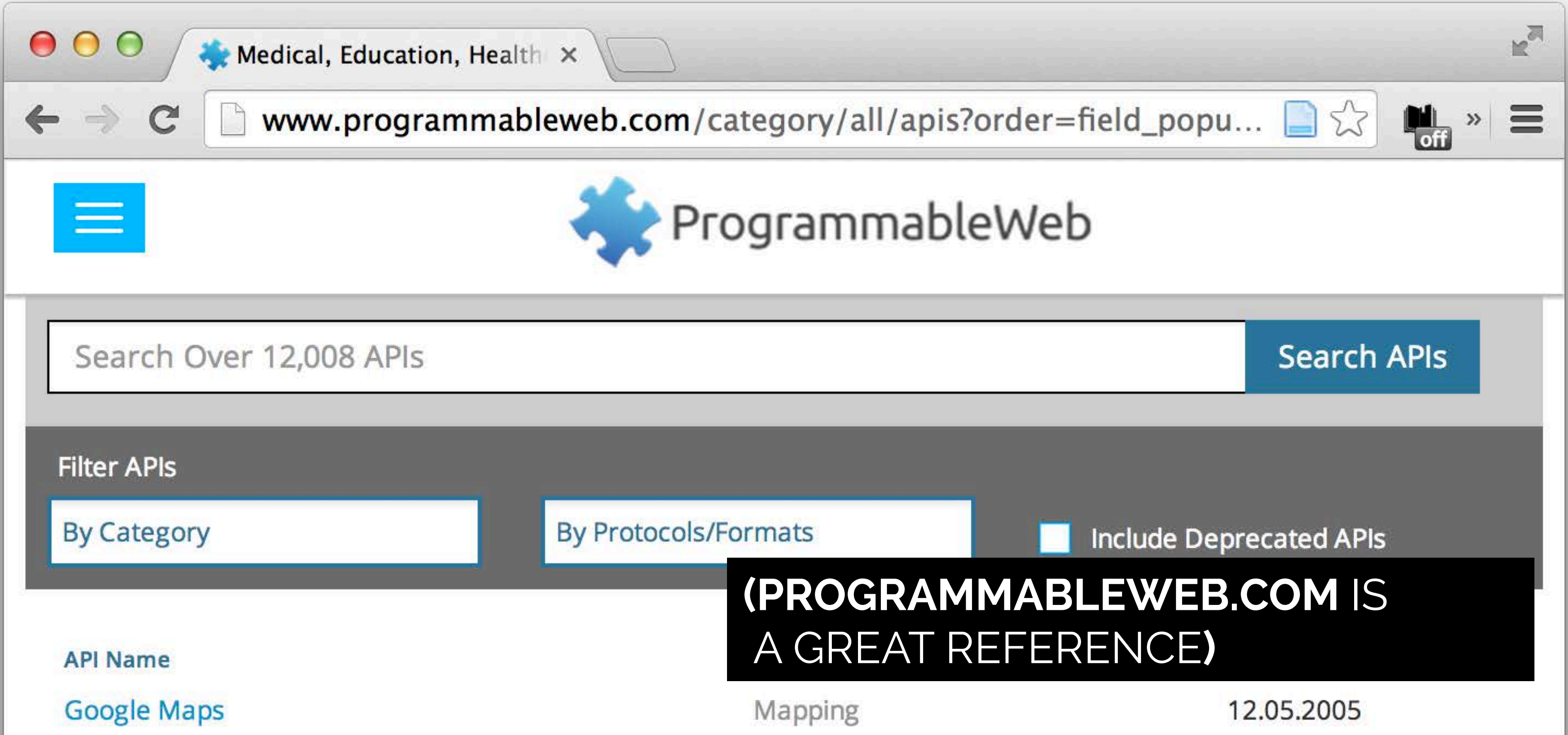
(Incredibly detailed Song, Album, Artist data for millions of musicians)

OPEN STREET MAP

http://wiki.openstreetmap.org/wiki/API

(Detailed location and map data for the whole world)

AND THE LIST GOES ON!



Medical, Education, Health
www.programmableweb.com/category/all/apis?order=field_popu...
off
ProgrammableWeb

Search Over 12,008 APIs

Search APIs

Filter APIs

By Category

By Protocols/Formats

□ Include Deprecated APIs

API Name

Google Maps Mapping 12.05.2005

(PROGRAMMABLEWEB.COM IS A GREAT REFERENCE**)**

FINDING AND EXTRACTING EXISTING DATA

SCRAPING THE WEB

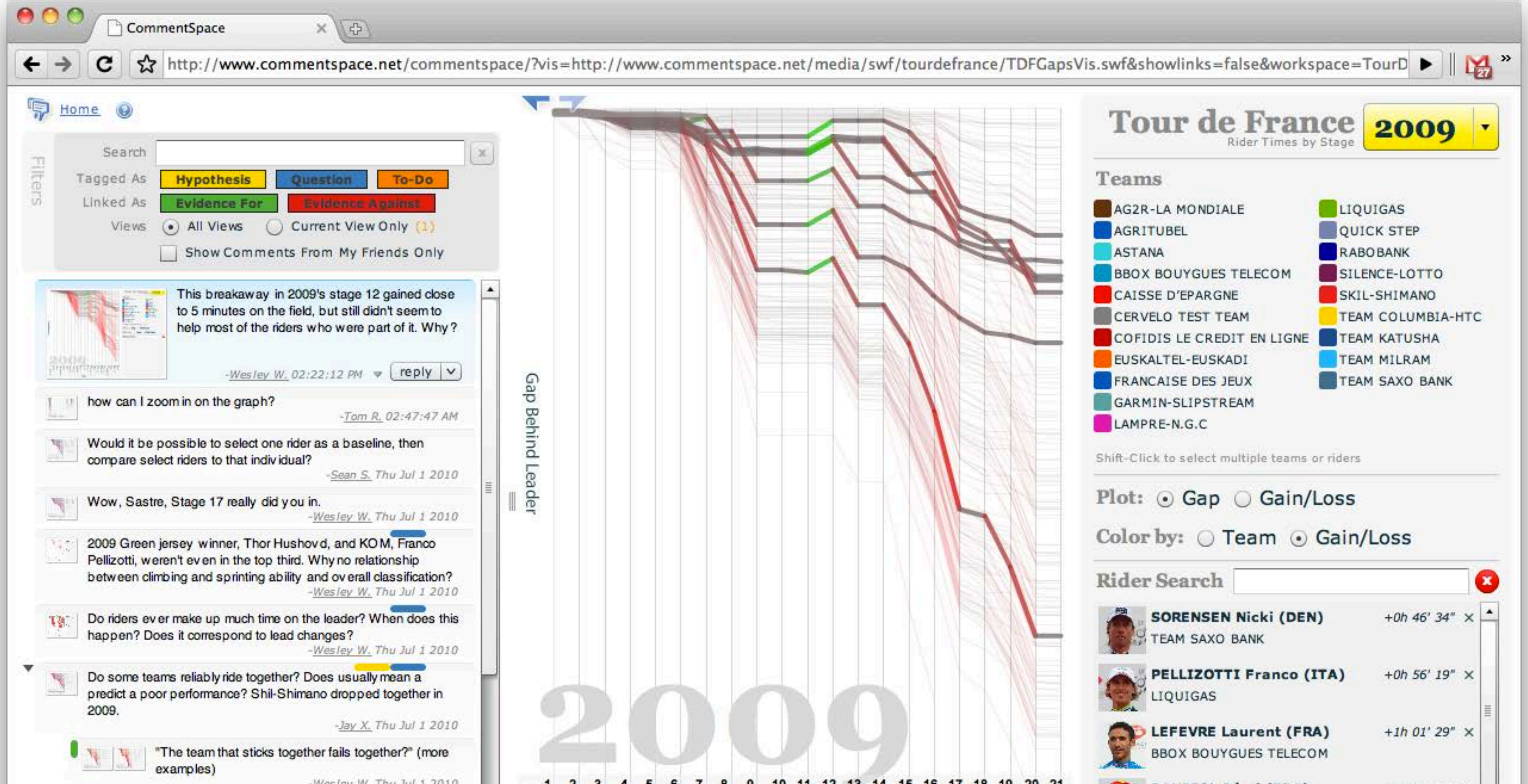
WHY SCRAPE?

<u>No API exists</u> for the data you want
(can't access the right data, wrong format, etc.)

<u>Simplicity</u> – Usually don't need to authenticate, no rate-limiting, etc.

Want to capture **<u>context of pages</u>** or relationship between them.

FOR EXAMPLE...



Search

Tagged As: Hypothesis, Question, To-Do

Linked As: Evidence For, Evidence Against

Views: ● All Views ○ Current View Only (1)

□ Show Comments From My Friends Only

This breakaway in 2009's stage 12 gained close to 5 minutes on the field, but still didn't seem to help most of the riders who were part of it. Why?
-Wesley W. 02:22:12 PM

how can I zoom in on the graph?
-Tom R. 02:47:47 AM

Would it be possible to select one rider as a baseline, then compare select riders to that individual?
-Sean S. Thu Jul 1 2010

Wow, Sastre, Stage 17 really did you in.
-Wesley W. Thu Jul 1 2010

2009 Green jersey winner, Thor Hushovd, and KOM, Franco Pellizotti, weren't even in the top third. Why no relationship between climbing and sprinting ability and overall classification?
-Wesley W. Thu Jul 1 2010

Do riders ever make up much time on the leader? When does this happen? Does it correspond to lead changes?
-Wesley W. Thu Jul 1 2010

Do some teams reliably ride together? Does usually mean a predict a poor performance? Shil-Shimano dropped together in 2009.
-Jay X. Thu Jul 1 2010

"The team that sticks together fails together?" (more examples)
-Wesley W. Thu Jul 1 2010

Tour de France 2009
Rider Times by Stage

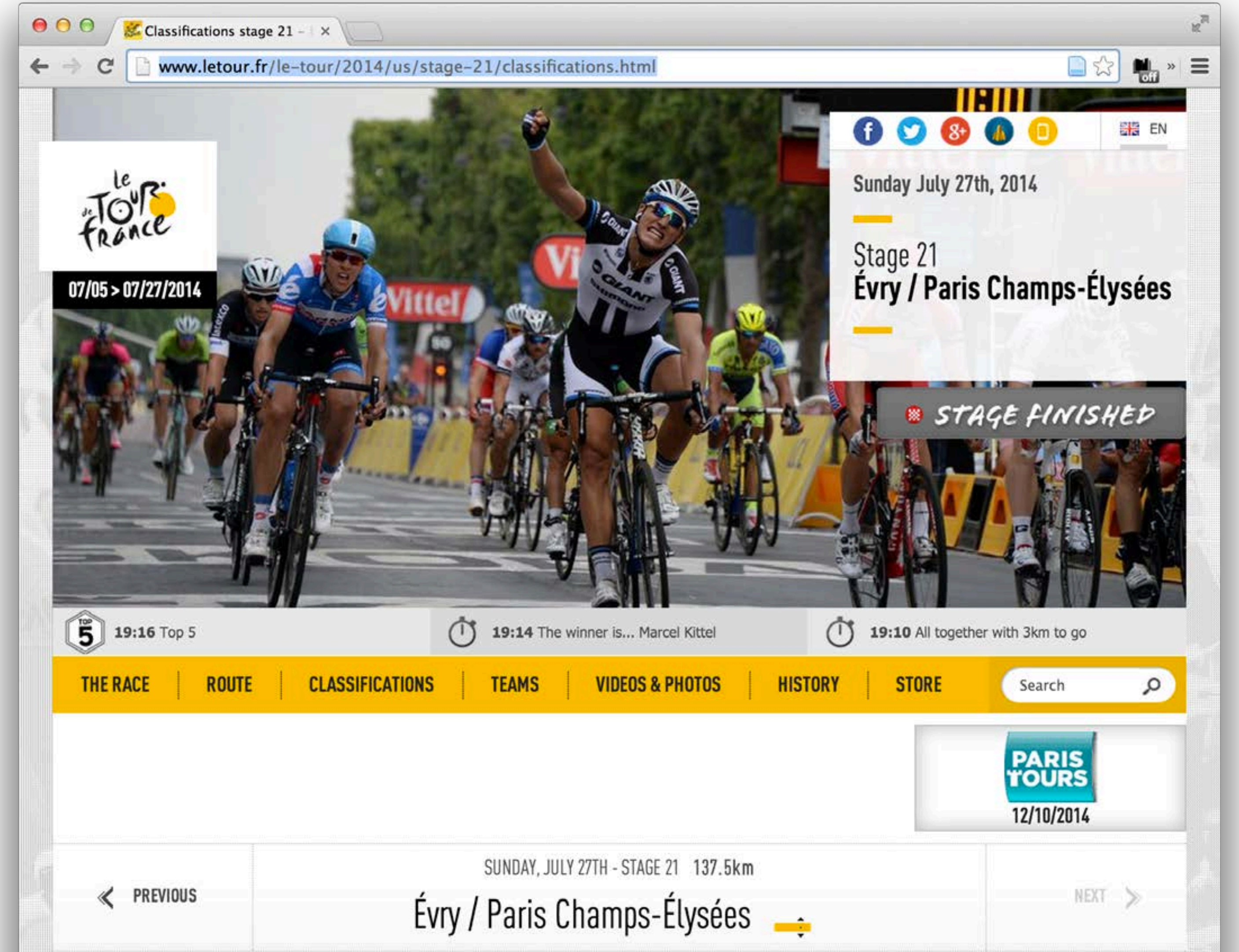
Shift-Click to select multiple teams or riders

Plot: ● Gap ○ Gain/Loss

Color by: ○ Team ● Gain/Loss

Rider Search

SORENSEN Nicki (DEN)	TEAM SAXO BANK	+0h 46' 34"
PELLIZOTTI Franco (ITA)	LIQUIGAS	+0h 56' 19"
LEFEVRE Laurent (FRA)	BBOX BOUYGUES TELECOM	+1h 01' 29"



Classifications stage 21 -

www.letour.fr/le-tour/2014/us/stage-21/classifications.html

EN

le Tour de France

07/05 > 07/27/2014

Sunday July 27th, 2014

Stage 21
Évry / Paris Champs-Élysées

STAGE FINISHED

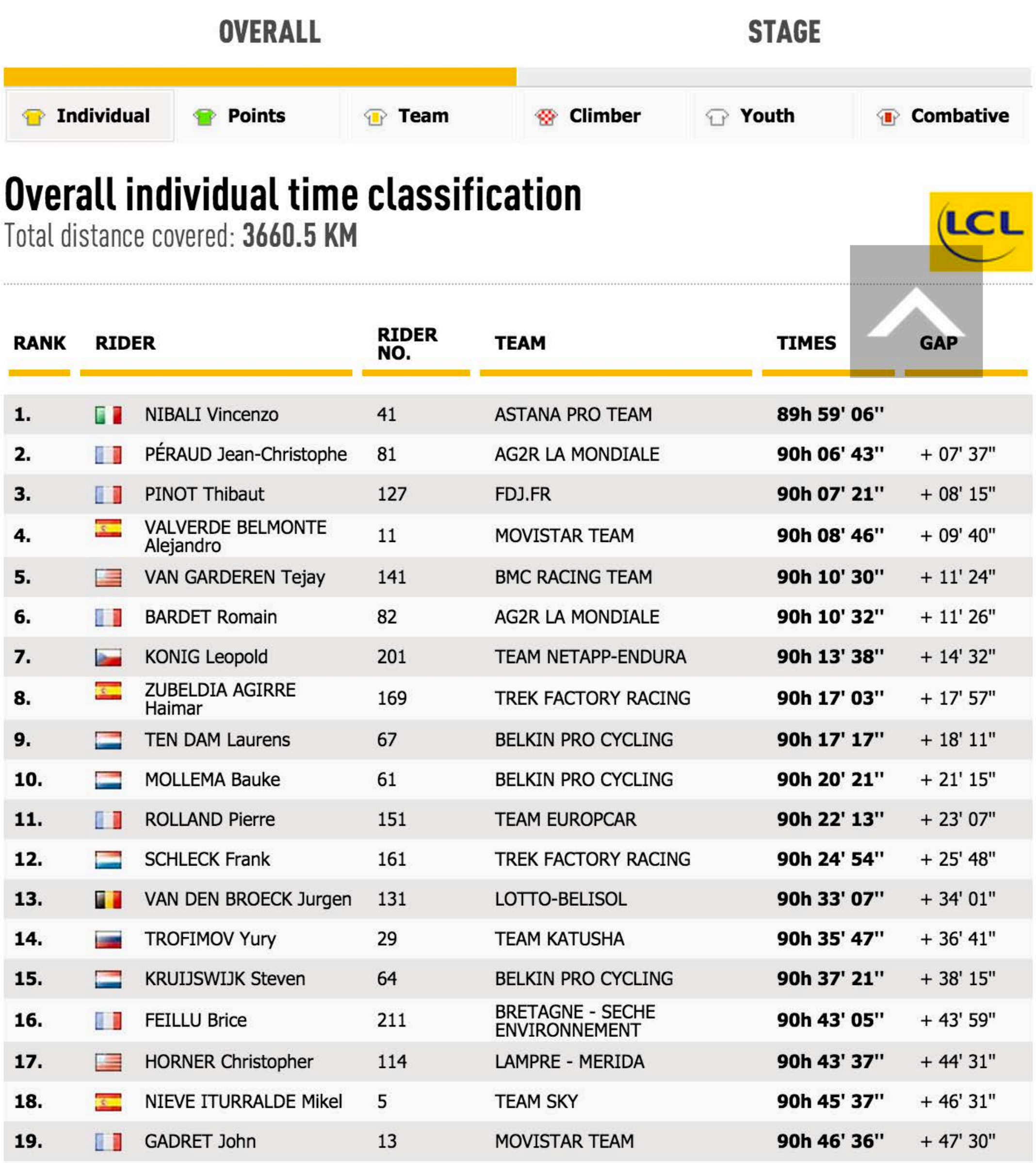
19:16 Top 5

19:14 The winner is... Marcel Kittel

19:10 All together with 3km to go

SUNDAY, JULY 27TH - STAGE 21 137.5km

Évry / Paris Champs-Élysées



OVERALL STAGE

Individual Points Team Climber Youth Combative

Overall individual time classification

Total distance covered: **3660.5 KM**

RANK	RIDER	RIDER NO.	TEAM	TIMES	GAP
1.	NIBALI Vincenzo	41	ASTANA PRO TEAM	**89h 59' 06''**	
2.	PÉRAUD Jean-Christophe	81	AG2R LA MONDIALE	**90h 06' 43''**	+ 07' 37''
3.	PINOT Thibaut	127	FDJ.FR	**90h 07' 21''**	+ 08' 15''
4.	VALVERDE BELMONTE Alejandro	11	MOVISTAR TEAM	**90h 08' 46''**	+ 09' 40''
5.	VAN GARDEREN Tejay	141	BMC RACING TEAM	**90h 10' 30''**	+ 11' 24''
6.	BARDET Romain	82	AG2R LA MONDIALE	**90h 10' 32''**	+ 11' 26''
7.	KONIG Leopold	201	TEAM NETAPP-ENDURA	**90h 13' 38''**	+ 14' 32''
8.	ZUBELDIA AGIRRE Haimar	169	TREK FACTORY RACING	**90h 17' 03''**	+ 17' 57''
9.	TEN DAM Laurens	67	BELKIN PRO CYCLING	**90h 17' 17''**	+ 18' 11''
10.	MOLLEMA Bauke	61	BELKIN PRO CYCLING	**90h 20' 21''**	+ 21' 15''
11.	ROLLAND Pierre	151	TEAM EUROPCAR	**90h 22' 13''**	+ 23' 07''
12.	SCHLECK Frank	161	TREK FACTORY RACING	**90h 24' 54''**	+ 25' 48''
13.	VAN DEN BROECK Jurgen	131	LOTTO-BELISOL	**90h 33' 07''**	+ 34' 01''
14.	TROFIMOV Yury	29	TEAM KATUSHA	**90h 35' 47''**	+ 36' 41''
15.	KRUIJSWIJK Steven	64	BELKIN PRO CYCLING	**90h 37' 21''**	+ 38' 15''
16.	FEILLU Brice	211	BRETAGNE - SECHE ENVIRONNEMENT	**90h 43' 05''**	+ 43' 59''
17.	HORNER Christopher	114	LAMPRE - MERIDA	**90h 43' 37''**	+ 44' 31''
18.	NIEVE ITURRALDE Mikel	5	TEAM SKY	**90h 45' 37''**	+ 46' 31''
19.	GADRET John	13	MOVISTAR TEAM	**90h 46' 36''**	+ 47' 30''

SOMETIMES YOU DON'T NEED A SCRAPER!

A few tips and tricks...

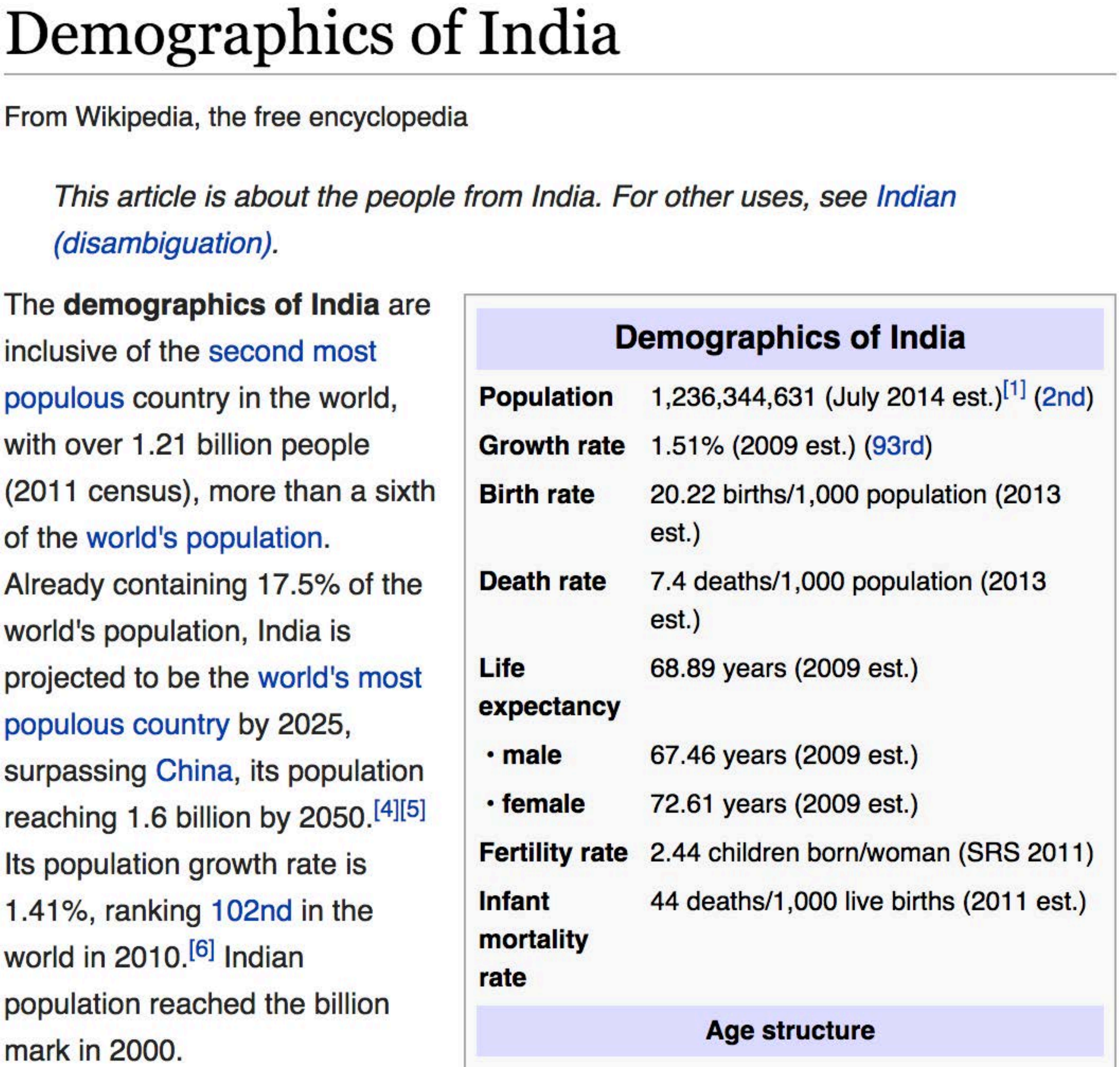
PULLING DATA TABLES FROM THE WEB

Google

≡ Sheets

IMPORTHTML

Imports data from a table or list within an HTML page.



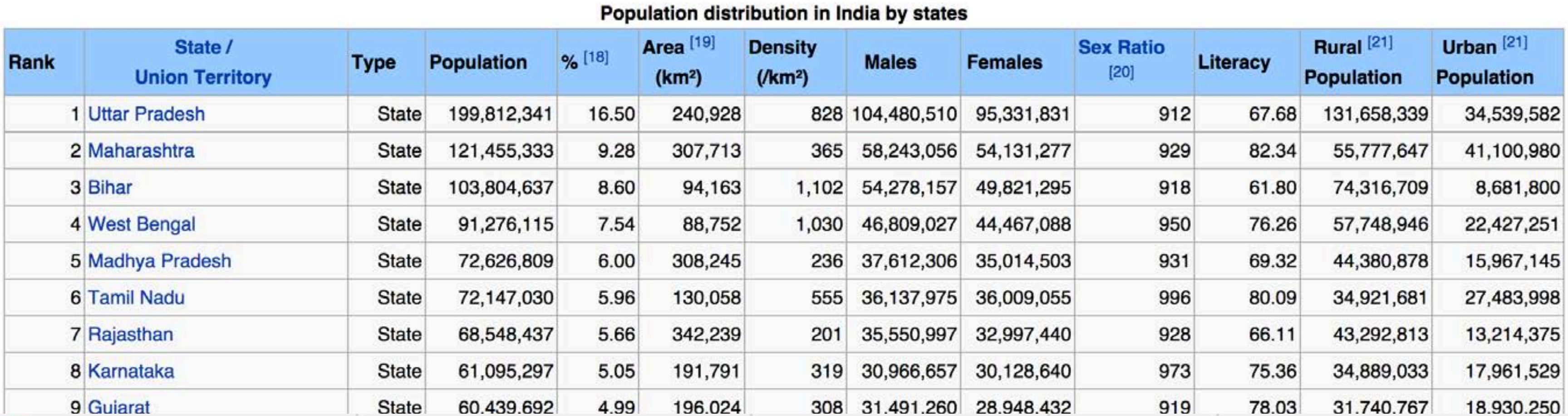
Demographics of India

From Wikipedia, the free encyclopedia

This article is about the people from India. For other uses, see Indian (disambiguation).

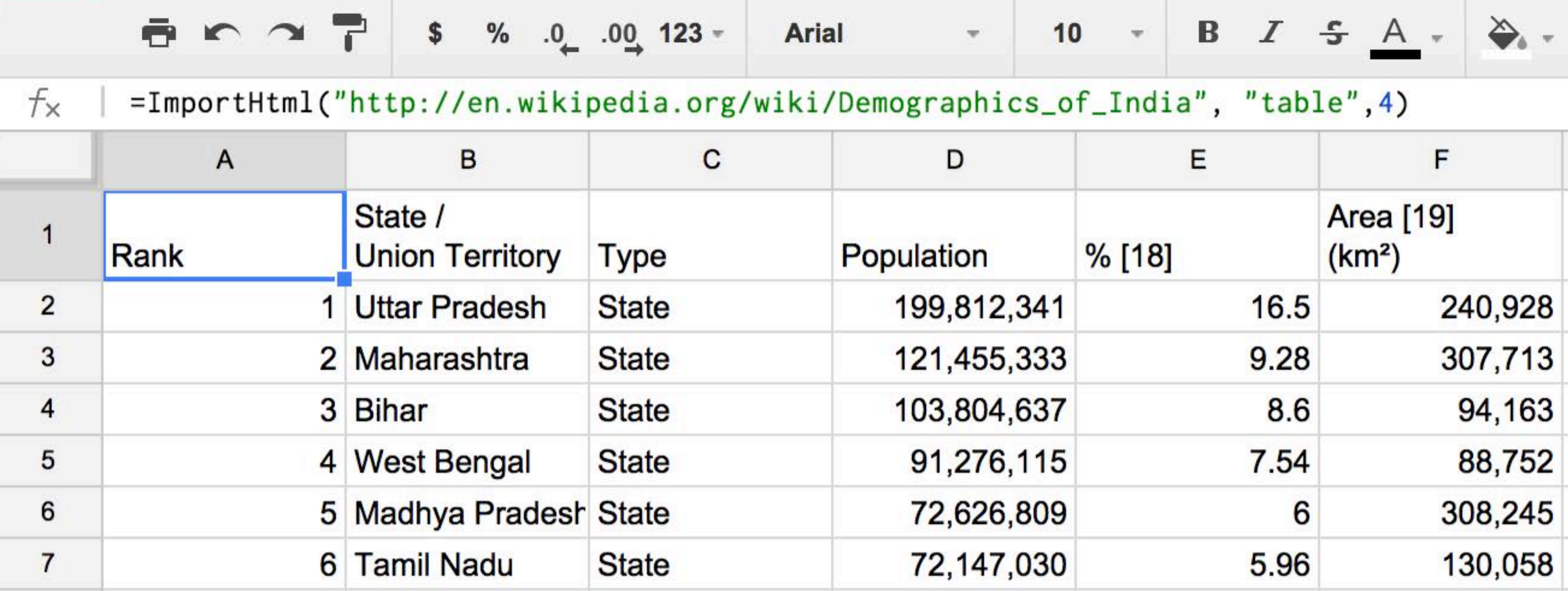
Demographics of India	
Population	1,236,344,631 (July 2014 est.)[1] (2nd)
Growth rate	1.51% (2009 est.) (93rd)
Birth rate	20.22 births/1,000 population (2013 est.)
Death rate	7.4 deaths/1,000 population (2013 est.)
Life expectancy	68.89 years (2009 est.)
· male	67.46 years (2009 est.)
· female	72.61 years (2009 est.)
Fertility rate	2.44 children born/woman (SRS 2011)
Infant mortality rate	44 deaths/1,000 live births (2011 est.)
Age structure	

The **demographics of India** are inclusive of the second most populous country in the world, with over 1.21 billion people (2011 census), more than a sixth of the world's population. Already containing 17.5% of the world's population, India is projected to be the world's most populous country by 2025, surpassing China, its population reaching 1.6 billion by 2050.[4][5] Its population growth rate is 1.41%, ranking 102nd in the world in 2010.[6] Indian population reached the billion mark in 2000.



Population distribution in India by states

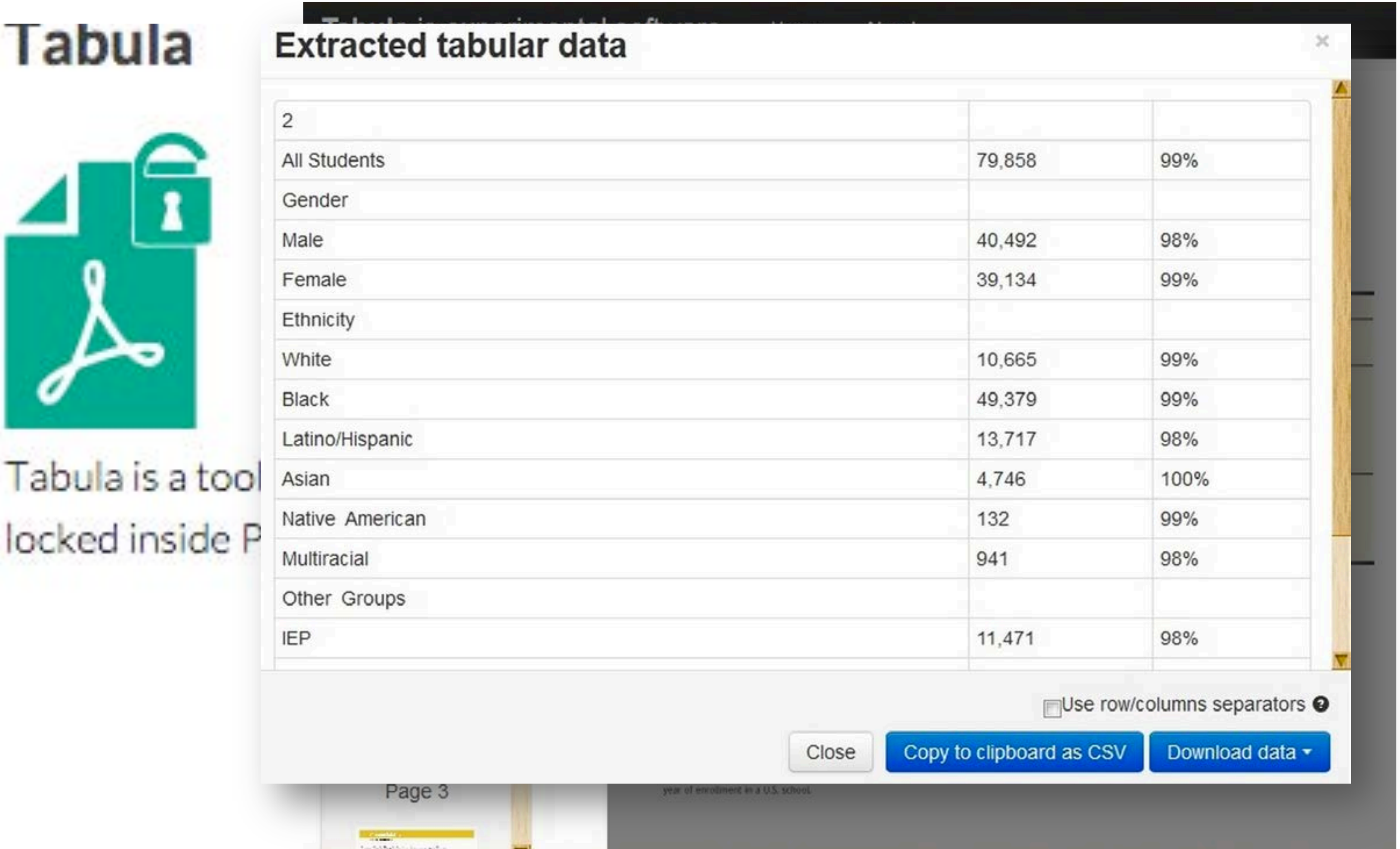
Rank	State / Union Territory	Type	Population	% [18]	Area [19] (km²)	Density (/km²)	Males	Females	Sex Ratio [20]	Literacy	Rural [21] Population	Urban [21] Population
1	Uttar Pradesh	State	199,812,341	16.50	240,928	828	104,480,510	95,331,831	912	67.68	131,658,339	34,539,582
2	Maharashtra	State	121,455,333	9.28	307,713	365	58,243,056	54,131,277	929	82.34	55,777,647	41,100,980
3	Bihar	State	103,804,637	8.60	94,163	1,102	54,278,157	49,821,295	918	61.80	74,316,709	8,681,800
4	West Bengal	State	91,276,115	7.54	88,752	1,030	46,809,027	44,467,088	950	76.26	57,748,946	22,427,251
5	Madhya Pradesh	State	72,626,809	6.00	308,245	236	37,612,306	35,014,503	931	69.32	44,380,878	15,967,145
6	Tamil Nadu	State	72,147,030	5.96	130,058	555	36,137,975	36,009,055	996	80.09	34,921,681	27,483,998
7	Rajasthan	State	68,548,437	5.66	342,239	201	35,550,997	32,997,440	928	66.11	43,292,813	13,214,375
8	Karnataka	State	61,095,297	5.05	191,791	319	30,966,657	30,128,640	973	75.36	34,889,033	17,961,529
9	Gujarat	State	60,439,692	4.99	196,024	308	31,491,260	28,948,432	919	78.03	31,740,767	18,930,250



=ImportHtml("http://en.wikipedia.org/wiki/Demographics_of_India", "table",4)

	A	B	C	D	E	F
1	Rank	State / Union Territory	Type	Population	% [18]	Area [19] (km²)
2	1	Uttar Pradesh	State	199,812,341	16.5	240,928
3	2	Maharashtra	State	121,455,333	9.28	307,713
4	3	Bihar	State	103,804,637	8.6	94,163
5	4	West Bengal	State	91,276,115	7.54	88,752
6	5	Madhya Pradesh	State	72,626,809	6	308,245
7	6	Tamil Nadu	State	72,147,030	5.96	130,058

PARSING PDFS



Tabula

Tabula is a tool

locked inside P

Extracted tabular data

2		
All Students	79,858	99%
Gender		
Male	40,492	98%
Female	39,134	99%
Ethnicity		
White	10,665	99%
Black	49,379	99%
Latino/Hispanic	13,717	98%
Asian	4,746	100%
Native American	132	99%
Multiracial	941	98%
Other Groups		
IEP	11,471	98%

□ Use row/columns separators

BUILDING A WEB SCRAPER

FETCHING DATA + PARSING DATA

YOU SHOULD **SEPARATE** THESE PROCESSES **WHENEVER POSSIBLE!**

FETCHING DATA

DON'T DO EVERYTHING AT ONCE

Download complete pages and save them locally **before** you process them.

DEALING WITH PAGINATION

If results or records are spread across multiple pages, you may need to parse the page to find the link to the next page.

PARSING DATA

SERIOUSLY, DON'T DO EVERYTHING AT ONCE!

Processing data from local files means
you don't have to get it right the first time.

USE YOUR BROWSER'S DEVELOPER TOOLS

All modern web browsers have built-in tools
that let you inspect web pages.

BE CAREFUL - YOU CAN GET YOURSELF BLOCKED

Many sites will try to slow or block heavy access (both to prevent scraping and DoS attacks)

To get around this…You can introduce delays in your scraper or scrape from multiple locations.

A FEW MORE NOTES ABOUT DATA MANAGEMENT

FORMATS AND BEST-PRACTICES

DATA FORMATS

STRUCTURED vs. UNSTRUCTURED

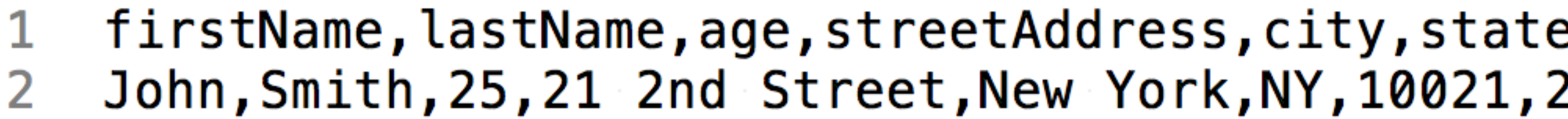
STRUCTURED DATA is more like what you'd find in a traditional **spreadsheet** or **database**.

UNSTRUCTURED DATA can include **raw text**, **streaming data**, even **images** or **video**.

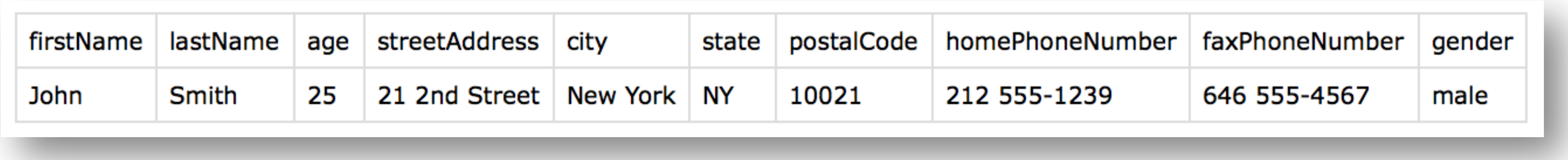
SEMI-STRUCTURED DATA is more organized, but doesn't follow a fixed schema (e.g. DBPEDIA data)

CSV

(Comma-Separated Value)



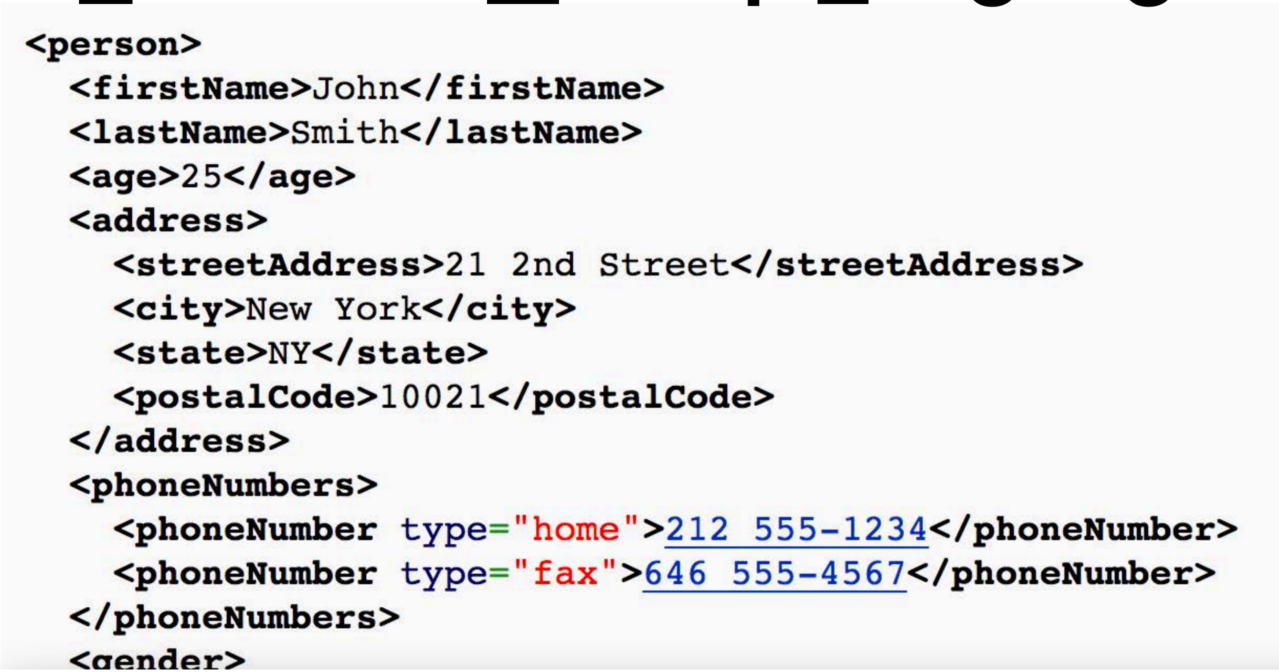
```
firstName,lastName,age,streetAddress,city,state
John,Smith,25,21 2nd Street,New York,NY,10021,2
```



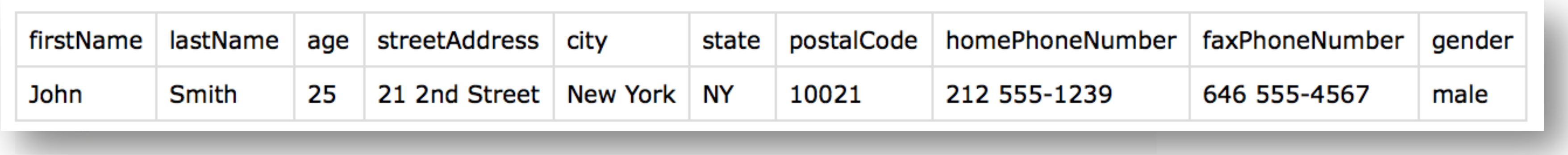
firstName	lastName	age	streetAddress	city	state	postalCode	homePhoneNumber	faxPhoneNumber	gender
John	Smith	25	21 2nd Street	New York	NY	10021	212 555-1239	646 555-4567	male

XML

(eXtensible Markup Language)



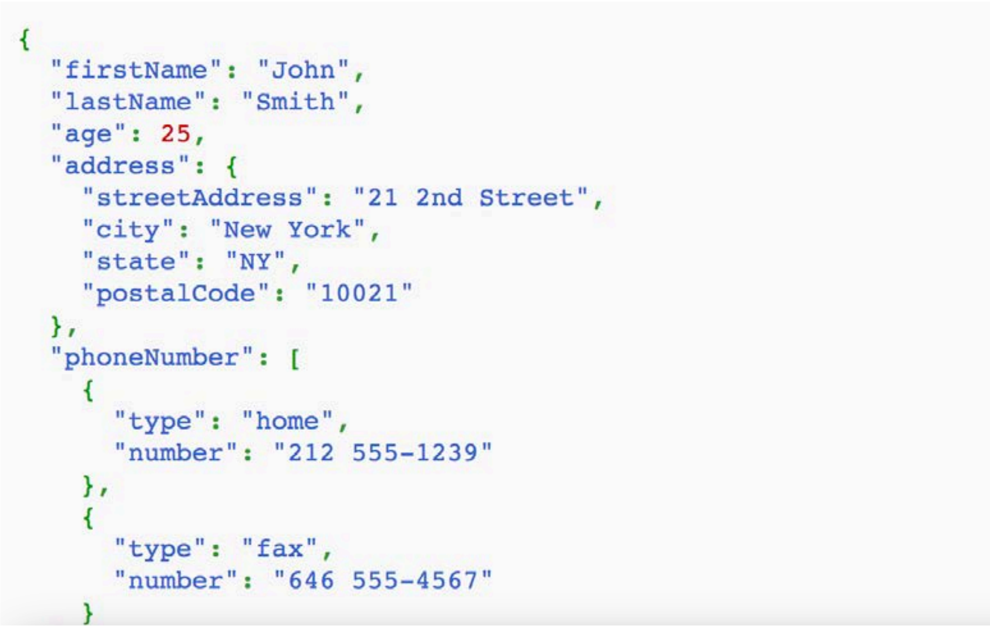
```
<person>
  <firstName>John</firstName>
  <lastName>Smith</lastName>
  <age>25</age>
  <address>
    <streetAddress>21 2nd Street</streetAddress>
    <city>New York</city>
    <state>NY</state>
    <postalCode>10021</postalCode>
  </address>
  <phoneNumbers>
    <phoneNumber type="home">212 555-1234</phoneNumber>
    <phoneNumber type="fax">646 555-4567</phoneNumber>
  </phoneNumbers>
  <gender>
```



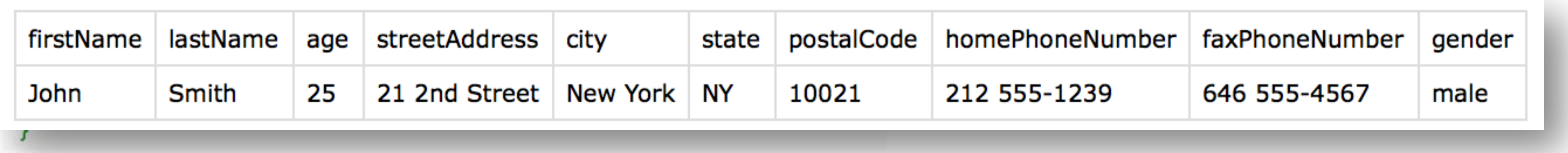
firstName	lastName	age	streetAddress	city	state	postalCode	homePhoneNumber	faxPhoneNumber	gender
John	Smith	25	21 2nd Street	New York	NY	10021	212 555-1239	646 555-4567	male

JSON

(JavaScript Object Notation)



```
{
  "firstName": "John",
  "lastName": "Smith",
  "age": 25,
  "address": {
    "streetAddress": "21 2nd Street",
    "city": "New York",
    "state": "NY",
    "postalCode": "10021"
  },
  "phoneNumber": [
    {
      "type": "home",
      "number": "212 555-1239"
    },
    {
      "type": "fax",
      "number": "646 555-4567"
    }
```

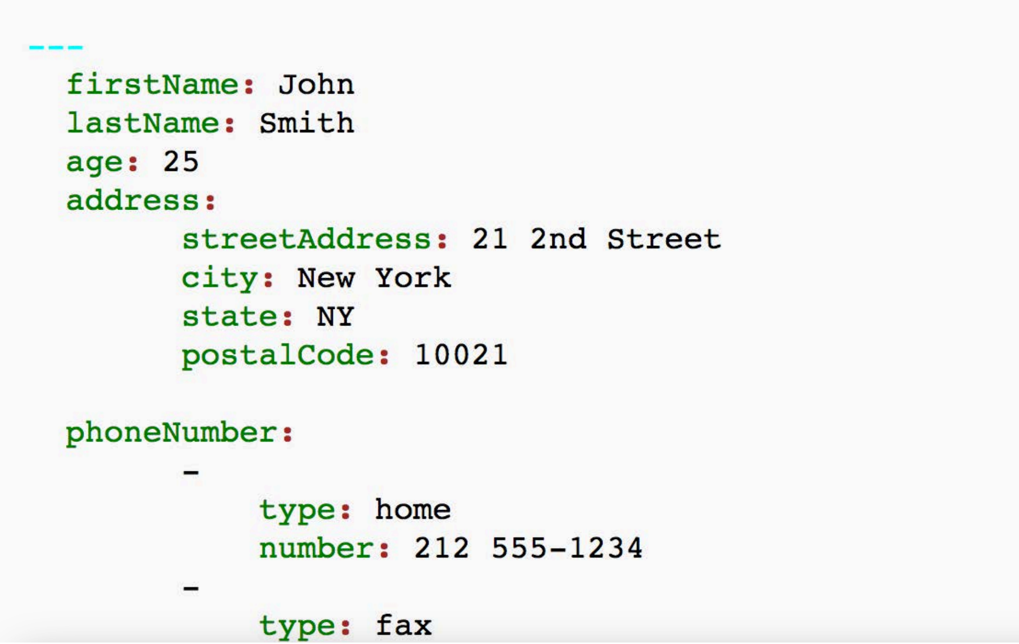


firstName	lastName	age	streetAddress	city	state	postalCode	homePhoneNumber	faxPhoneNumber	gender
John	Smith	25	21 2nd Street	New York	NY	10021	212 555-1239	646 555-4567	male

```
}
```

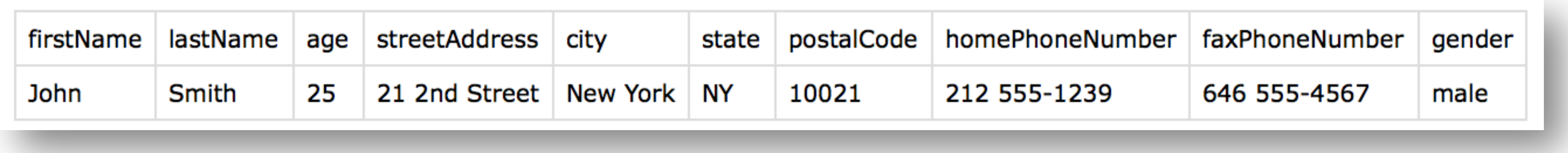
YAML

(YAML Ain't Markup Language)



```
---
  firstName: John
  lastName: Smith
  age: 25
  address:
        streetAddress: 21 2nd Street
        city: New York
        state: NY
        postalCode: 10021

  phoneNumber:
        -
            type: home
            number: 212 555-1234
        -
            type: fax
```



firstName	lastName	age	streetAddress	city	state	postalCode	homePhoneNumber	faxPhoneNumber	gender
John	Smith	25	21 2nd Street	New York	NY	10021	212 555-1239	646 555-4567	male

HANDLING DATA

STORING DATA

- Always keep backups
- Password protect or encrypt any data with personal or sensitive information

PROVENANCE

- Keep track of where/when data was collected
- Record any data processing steps so you (or others) can repeat them if necessary

IP, COPYRIGHT, AND (RE)SHARING DATA

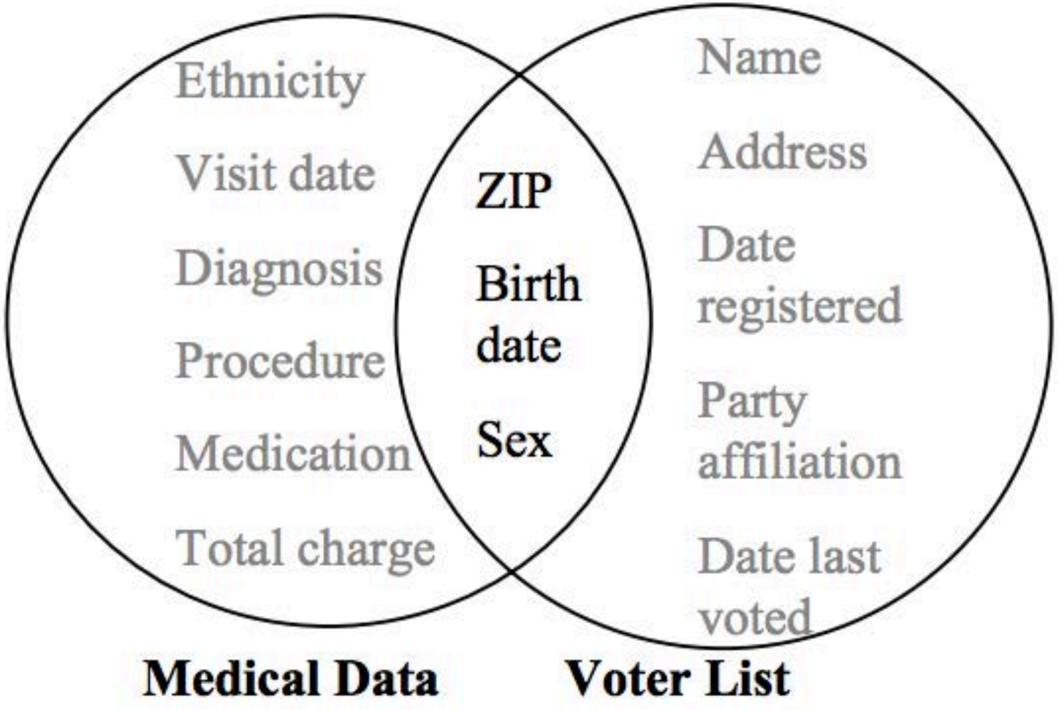
- Be sure you know who **owns** the data.
- Think early on about whether or not you'll need to **publish** or **(re)share** data.
- Be careful you **aren't violating copyright**, especially when scraping.

PRIVACY AND ANONYMIZING DATA

- Any information that could be used to **identify individuals** is sensitive!
- There may be **legal reprecussions** for releasing it.
- In some cases you might need to **anonymize** data before sharing.

JUST REMOVING NAMES IS OFTEN NOT ENOUGH!

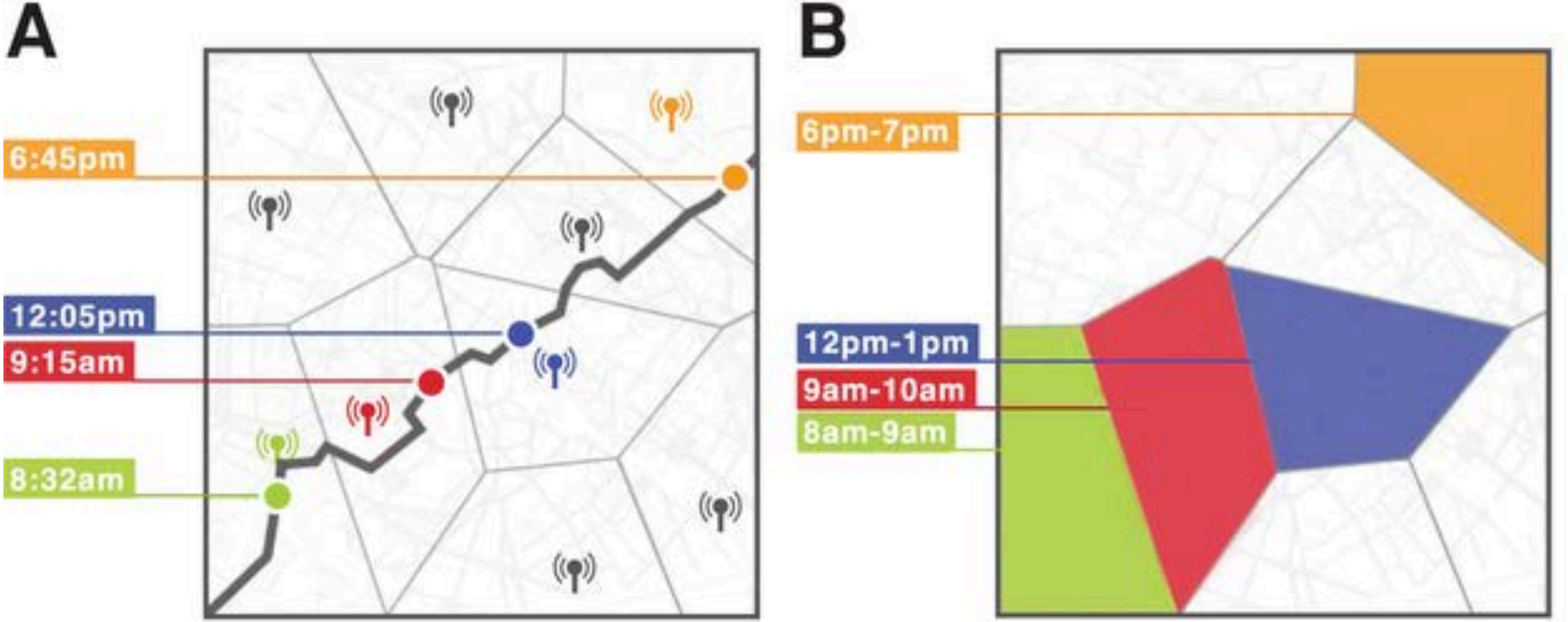
OTHER INFORMATION CAN STILL BE UNIQUE



[L. Sweeney. 2002]

k-ANONYMITY: A MODEL FOR PROTECTING PRIVACY

LOCATION DATA IS ESPECIALLY SENSITIVE



[de Montjoye et al. 2013]

Unique in the Crowd: The privacy bounds of human mobility

REGULATIONS (ACADEMIA AND RESEARCH)

Institutional Review and Ethics Boards may need to approve experiments or data collection **before it happens.**

Studies involving people may need **informed consent.**

REGULATIONS (INDUSTRY)

Some governments have placed limits on **how long** user data can be kept.

Some kinds of tracking (e.g., cookies) may now require **opt-in** or **notifications**. (However this varies by country).

IN SUMMARY: THERE ARE LOTS OF TOOLS AT YOUR DISPOSAL!

COLLECT IT

- OBSERVATION
- SURVEYS
- LOGGING
- SENSORS
- CROWDSOURCING

FIND OR EXTRACT IT

- OPEN CORPUSES
- DATA RETAILERS
- APIS
- SCRAPING THE WEB

GENERATE IT

– SIMULATIONS

(...AND WE'LL BE HAPPY TO DISCUSS OR SUGGEST MORE)

NEXT UP

THIS AFTERNOON

TUTORIAL 1 – BUILDING A WEB SCRAPER

NEXT WEEK

DATA CLEANING & STATISTICS

BEFORE NEXT WEEK'S CLASS

INSTALL BOTH:

OpenRefine (formerly Google Refine)
http://openrefine.org/

R

http://www.r-project.org/