



# Motivation and pre-requisites

Jeffrey Leek  
Johns Hopkins Bloomberg School of Public Health

# About this course

- This course covers the basic ideas behind getting data ready for analysis
  - Finding and extracting raw data
  - Tidy data principles and how to make data tidy
  - Practical implementation through a range of R packages
- What this course depends on
  - The Data Scientist's Toolbox
  - R Programming
- What would be useful
  - Exploratory analysis
  - Reporting Data and Reproducible Research

# What you wish data looked like

solutions-jun3.csv

New Open Save Print Import Copy Paste Format Undo Redo AutoSum Sort A-Z Sort Z-A Gallery Toolbox Zoom Help

Verdana 10 B I U %

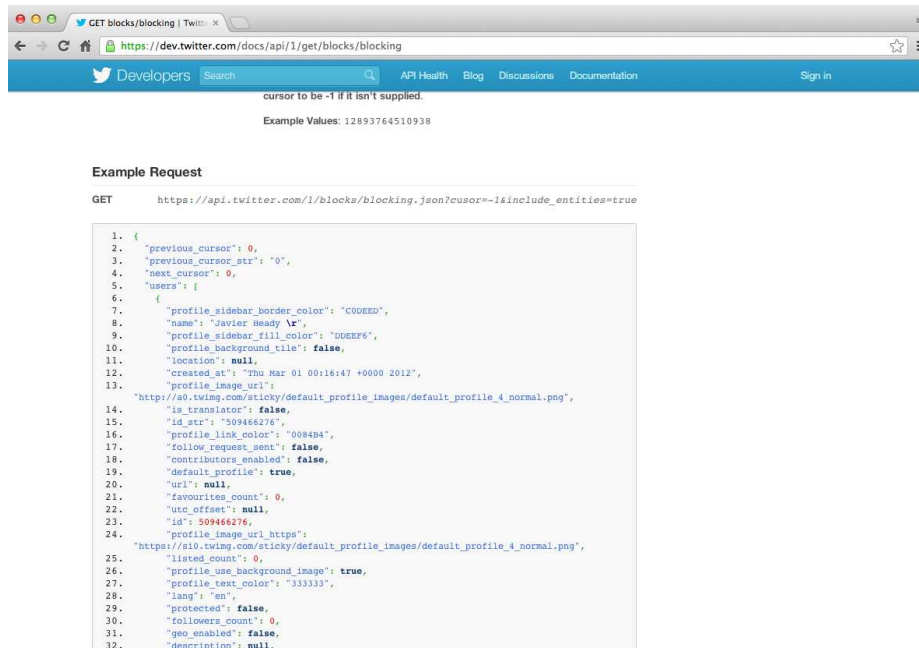
	A	B	C	D	E	F	G	H	I	J	K	L	M	N	O	P
	id	problem_id	subject_id	start	stop	time_left	answer									
1	1	498	17	1307119989	1307120016	2369	A									
2	2	150	15	1307119991	1307120009	2376	D									
3	3	313	16	1307119994	1307120009	2376	E									
4	4	12	13	1307119995	1307120019	2366	B									
5	5	273	14	1307119996	1307120028	2357	A									
6	6	101	19	1307119996	1307120021	2364	B									
7	7	105	18	1307119998	1307120048	2337	B									
8	8	162	12	1307120004	1307120042	2343	C									
9	9	70	15	1307120011	1307120038	2347	C									
10	10	300	16	1307120012	1307120092	2293	B									
11	11	494	17	1307120017	1307120075	2310	D									
12	12	357	13	1307120021	1307120118	2267	A									
13	13	522	19	1307120025	1307120152	2233	D									
14	14	232	14	1307120030	1307120158	2227	C									
15	15	344	15	1307120041	1307120117	2268	B									
16	16	160	17	1307120079	1307120249	2136	D									
17	17	516	16	1307120094	1307120159	2226	B									
18	18	472	12	1307120119	1307120170	2215	A									
19	19	43	15	1307120122	1307120140	2245	C									
20	20	353	13	1307120144	1307120199	2186	C									
21	21	218	15	1307120152	1307120272	2113	E									
22	22	69	16	1307120163	1307120188	2197	D									
23	23	562	16	1307120190	1307120301	2084	D									
24	24	121	19	1307120253	1307120294	2091	E									
25	25	297	15	1307120277	1307120342	2043	B									
26	26	495	13	1307120281	1307120353	2032	E									
27	27	94	14	1307120288	1307120343	2042	E									
28	28	22	18	1307120310	1307120365	2020	C									
29	29	64	19	1307120310	1307120385	2000	B									
30	30	502	16	1307120323	1307120336	2049	B									
31	31	44	16	1307120339	1307120352	2033	A									
32	32	315	14	1307120348	1307120362	2023	B									
33	33	385	15	1307120352	1307120553	1832	E									
34	34	550	13	1307120356	1307120444	1941	B									
35	35	92	14	1307120368	1307120397	1988	B									
36	36	395	16	1307120377	1307120426	1959	D									
37	37	267	17	1307120382	1307120515	1870	E									
38	38	257	14	1307120401	1307120427	1958	C									
39	39	312	19	1307120407	1307120548	1837	D									
40	40	321	18	1307120431	1307120449	1936	A									
41	41	220	16	1307120437	1307120510	1875	A									
42																

# What does data really look like?

```
@HWI-EAS121:4:100:1783:550#0/1
CGTTACGAGATCGGAAGAGCGGTTTCAGCAGGAATGCCGAGACGGATCTCGTATGCGGTCGCTGCGTGACAAGACAGGGG
+HWI-EAS121:4:100:1783:550#0/1
aaaaa`b_aa`aa`YaX]aZ`aZM`Z]YRa]YSG[ [ZREQLHESDHNDHNDHMEEDDMPENITKFLFEEDDDHEJQMEDDD
@HWI-EAS121:4:100:1783:1611#0/1
GGGTGGGCATTTCCACTCGCAGTATGGGTTGCCGCACGACAGGCAGCGGTGAGCCTGCGCTTTGGCCTGGCCTTCGGAAA
+HWI-EAS121:4:100:1783:1611#0/1
a^^\`_`_`_`_`^a``a`^a`_][a_]`]\`a`_____`_`^`^]X]_]XTV\_]\]NX_XVX]_]_TTTGT[VTHPN]VFDZ
@HWI-EAS121:4:100:1783:322#0/1
CGTTTATGTTTTGAATATGTCTTATCTTAACGGTTATATTTTAGATGTTGGTCTTATTCTAACGGTCATATATTTTCTA
+HWI-EAS121:4:100:1783:322#0/1
abaa`^aaaaabbaababbbbbbb`bbbb`bbbbbbbbbb`bbbaV`_a``a``]\`aT]a__V\]]_]`a`]a_abbav__
@HWI-EAS121:4:100:1783:1394#0/1
GGGTCTTTATTGGTCTGGTGATCCCCATATTCTCCGGTTGTGTGGTTTAAACCGATCATCGCGCATTACTTCCCGGCTGC
+HWI-EAS121:4:100:1783:1394#0/1
````[aa\b`^`^][aabb][`_a`_abb`a```bbbbbbababaaaab_VZa`^____bab_X`[a\HV[_]_[^_X\T_VQQ
@HWI-EAS121:4:100:1783:207#0/1
CCCTGGGAGATCGGAAGAGCGGTTTCAGCAGGAATGCCGAGACCGATCTCGTATGCGGTCCTCTGCTTGAAAAAAAAAAAAACA
+HWI-EAS121:4:100:1783:207#0/1
abba`Xa\`^\\`aa]ba__bba[a_O_a`aa`aa`a]^V]X_a`YS\R\_H[_]\ZTDUZZUSOPX]]POP\GS\WSHHD
@HWI-EAS121:4:100:1783:455#0/1
GGGTAATTACAGGCACAATGTAATGGCTGCACAAAAAATACATCTTTCATGTTCCATTGCACCATTGACAAATACATATT
+HWI-EAS121:4:100:1783:455#0/1
abb`babbabababbbbbbbbbbbbbbbba`b`b`abbbabbbabbbbbbbaabbbbbb`bb`ab`O`bab`Q`bbabaa`a`
```

[http://brianknaus.com/software/srtoolbox/s\\_4\\_1\\_sequence80.txt](http://brianknaus.com/software/srtoolbox/s_4_1_sequence80.txt)

# What does data really look like?



The screenshot shows a web browser window displaying the Twitter API documentation for the `GET blocks/blocking` endpoint. The browser's address bar shows the URL `https://dev.twitter.com/docs/api/1/get/blocks/blocking`. The page header includes the Twitter Developers logo, a search bar, and navigation links for API Health, Blog, Discussions, Documentation, and Sign in. Below the header, a note states "cursor to be -1 if it isn't supplied." and provides "Example Values: 12893764510938".

**Example Request**

```
GET https://api.twitter.com/1/blocks/blocking.json?cursor=-1&include_entities=true
```

```
1. {
2.   "previous_cursor": 0,
3.   "previous_cursor_str": "0",
4.   "next_cursor": 0,
5.   "users": [
6.     {
7.       "profile_sidebar_border_color": "COBEEED",
8.       "name": "Javier Heady \u00d7",
9.       "profile_sidebar_fill_color": "DDEEFF",
10.      "profile_background_tile": false,
11.      "location": null,
12.      "created_at": "Thu Mar 01 00:16:47 +0000 2012",
13.      "profile_image_url":
14.        "https://s0.twimg.com/profile_images/default_profile_images/default_profile_4_normal.png",
15.      "is_translator": false,
16.      "id_str": "509466276",
17.      "profile_link_color": "0084B4",
18.      "follow_request_sent": false,
19.      "contributors_enabled": false,
20.      "default_profile": true,
21.      "url": null,
22.      "favourites_count": 0,
23.      "utc_offset": null,
24.      "id": "509466276",
25.      "profile_image_url_https":
26.        "https://s10.twimg.com/profile_images/default_profile_images/default_profile_4_normal.png",
27.      "listed_count": 0,
28.      "profile_use_background_image": true,
29.      "profile_text_color": "333333",
30.      "lang": "en",
31.      "protected": false,
32.      "followers_count": 0,
33.      "geo_enabled": false,
34.      "description": null,
```

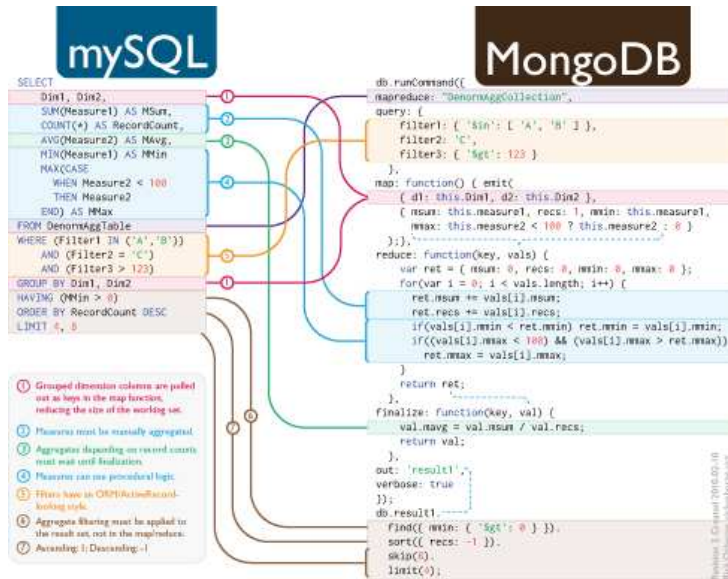
<https://dev.twitter.com/docs/api/1/get/blocks/blocking>

# What does data really look like?

ALLERGIES		MEDICATION HISTORY	
Last Updated: 01 Dec 2011 @ 0851		Last Updated: 11 Apr 2011 @ 1737	
Allergy Name:	TRIMETHOPRIM	Medication:	AMLODIPINE BESYLATE 10MG TAB
Location:	DAYT29	Instructions:	TAKE ONE TABLET BY MOUTH TAKE ONE-HALF TABLET FOR GRAPEFRUIT JUICE--
Date Entered:	09 Mar 2011	Status:	Active
Reaction:		Refills Remaining:	3
Allergy Type:	DRUG	Last Filled On:	20 Aug 2010
Drug Class:	ANTI-INFECTIVES, OTHER	Initially Ordered On:	13 Aug 2010
Observed/Historical:	HISTORICAL	Quantity:	45
Comments:	The reaction to this allergy was MILD (NO SQUELAE)	Days Supply:	90
		Pharmacy:	DAYTON
		Prescription Number:	2718953
Allergy Name:	TRAMADOL	Medication:	IBUPROFEN 600MG TAB
Location:	DAYT29	Instructions:	TAKE ONE TABLET BY MOUTH FOUR TIMES A DAY WITH FOOD
Date Entered:	09 Mar 2011	Status:	Active
Reaction:	URINARY RETENTION	Refills Remaining:	3
Allergy Type:	DRUG	Last Filled On:	20 Aug 2010
Drug Class:	NON-OPIOID ANALGESICS	Initially Ordered On:	01 Jul 2010
Observed/Historical:	HISTORICAL	Quantity:	300
Comments:	gradually worsening difficulty emptying bladder		

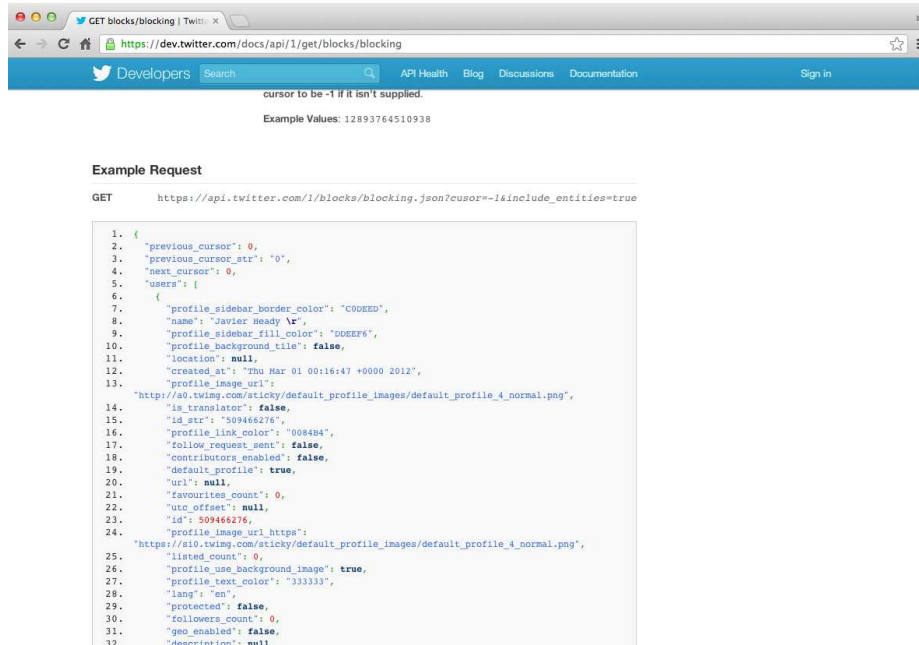
<http://blue-button.github.com/challenge/>

# Where is data?



<http://rickosborne.org/blog/2010/02/infographic-migrating-from-sql-to-mapreduce-with-mongodb/>

# Where is data?



The screenshot shows a web browser window with the URL `https://dev.twitter.com/docs/api/1/get/blocks/blocking`. The page is titled "GET blocks/blocking | Twitter" and includes a search bar and navigation links like "API Health", "Blog", "Discussions", and "Documentation". Below the header, there is a note: "cursor to be -1 if it isn't supplied." and "Example Values: 12893764510938".

**Example Request**

```
GET https://api.twitter.com/1/blocks/blocking.json?cursor=-1&include_entities=true
```

```
1. {
2.   "previous_cursor": 0,
3.   "previous_cursor_str": "0",
4.   "next_cursor": 0,
5.   "users": [
6.     {
7.       "profile_sidebar_border_color": "COBEEED",
8.       "name": "Javier Heady \u00d7",
9.       "profile_sidebar_fill_color": "DDEEFF",
10.      "profile_background_tile": false,
11.      "location": null,
12.      "created_at": "Thu Mar 01 00:16:47 +0000 2012",
13.      "profile_image_url":
14.        "http://s0.twimg.com/sticky/default_profile_images/default_profile_4_normal.png",
15.      "is_translator": false,
16.      "id_str": "509466276",
17.      "profile_link_color": "0084B4",
18.      "follow_request_sent": false,
19.      "contributors_enabled": false,
20.      "default_profile": true,
21.      "url": null,
22.      "favourites_count": 0,
23.      "utc_offset": null,
24.      "id": "509466276",
25.      "profile_image_url_https":
26.        "https://s10.twimg.com/sticky/default_profile_images/default_profile_4_normal.png",
27.      "listed_count": 0,
28.      "profile_use_background_image": true,
29.      "profile_text_color": "333333",
30.      "lang": "en",
31.      "protected": false,
32.      "followers_count": 0,
33.      "geo_enabled": false,
34.      "description": null,
```

<https://dev.twitter.com/docs/api/1/get/blocks/blocking>



# Where is data?



<https://data.baltimorecity.gov/>

# The goal of this course

Raw data -> Processing script -> tidy data -> data analysis -> data communication