

End Users Publishing Structured Data to the Web

An Observational Study of What, Why and How

Ted Benson & David Karger
MIT CSAIL



Massachusetts
Institute of
Technology



How you, toolbuilder,
can give people
better data publishing tools

Conclusions First..

- Analyzed 2000 visualizations & Interviewed 12 authors
- Generalized conclusions about how to better support authors
- This talk: Data, Programming Model, Publishing

Problem

The sophistication of
sites people
browse > sites people
can create



1-16 of 21,068,104 results for "cell phone"

Choose a Department to sort ▾

Show results for

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Product Description

... Information. This Samsung cell phone offers an easy, user-friendly ...

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SHOW ANIMALS WITH:
[Reset All](#)
SORT BY:
[Animal Type](#)
[Exhibit](#)
[Alphabetical](#)
 Show Everything

- | | |
|---|---------------------------------|
| <input type="checkbox"/> Beak | <input type="checkbox"/> Scales |
| <input type="checkbox"/> Fur | <input type="checkbox"/> Shells |
| <input type="checkbox"/> Gills | <input type="checkbox"/> Teeth |
| <input type="checkbox"/> Lay Eggs | <input type="checkbox"/> Venom |
| <input type="checkbox"/> Live in Groups | <input type="checkbox"/> Wings |
| <input type="checkbox"/> No Bones | |

SHOW BY COLOR:
 Show Everything

- | | |
|-------------------------------------|---------------------------------|
| <input type="checkbox"/> Black | <input type="checkbox"/> Green |
| <input type="checkbox"/> Blue | <input type="checkbox"/> Orange |
| <input type="checkbox"/> Brown | <input type="checkbox"/> Red |
| <input type="checkbox"/> Camouflage | <input type="checkbox"/> White |
| <input type="checkbox"/> Gray | <input type="checkbox"/> Yellow |

SHOW BY LOCATION:

Amphibians



American Bullfrog



Blue Poison Dart Frog



Giant Leaf Frog

Birds



Atlantic Puffin



Blue-Crowned Motmot



Gouldian Finch



Search Results

[recipes](#)[articles & guides](#)show results for [food recipes](#)[drink recipes](#)[member recipes](#)[all recipes](#)

showing 1 - 10 of 2214

sort by [relevance](#)**refine this search by...**

- main ingredient >
- meal/course >
- cuisine >
- dietary consideration >
- type >
- holiday/celebration >
- preparation method >

[part of menu \(673\)](#)[quick & easy \(309\)](#)[healthy \(74\)](#)**search within results**[advanced recipe search](#)**Sponsored Recipe**[Now & Later Baked Ziti](#)

Campbell's

[Coffee Cake](#)

Epicurious, February 2014

[Carrot Cake](#)

Epicurious, August 2013

Low-Salt Cookbook, 4th Edition[Caramel Cake](#)

Epicurious, April 2013

The Lee Bros. Charleston Kitchen[Porter Cake](#)

Epicurious, March 2013

Rachel's Irish Family Food

But end-user web authors
are primarily limited to
blogs and text pages



Problem

The sophistication of
sites people
browse > sites people
can create

Claim

Users are held back
by lack of tooling

as much as (more than?)

lack of sophistication



What do users need from
their data publishing tools?

data authoring

programming model

publishing

Approach
mixed-method
ethnographic study
of the community who uses the
Exhibit Framework

Exhibit

- Toolkit for lightweight structured data publishing
- Introduced in 2007
[Huynh, Karger, Miller. WWW]
- A few thousand web pages made with this tool

data authoring

programming model

publishing

quick walk through of
Exhibit



1-16 of 21,068,104 results for "cell phone"

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Show results for

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[+ See All 36 Departments](#)

Refine by

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[Free Shipping by Amazon](#)
Unlocked Cell Phone Type
 Slider

 Basic Phone

 Bar

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 Touchscreen

 Flip

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 Nokia

 Apple

 LG

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Free Shipping by Amazon

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<list of items>

Show results for

Cell Phones & Accessories >

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Cell Phones

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All ▾

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<spreadsheet>

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<search>

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Show results for

{facet}

Refine by

Eligible for Free Shipping

Free Shipping by Amazon

{facet}

{facet}

<list of items>

<list of items>

<map>

<timeline>

<bar chart>

<scatterplot>

<list of items> <search>

<map>

<facet>

<timeline>

<calendar>

<bar chart>

<scatterplot>

<list of items> <search>
<map> <facet>
<timeline> <calendar>
<bar chart>
<scatterplot> **Exhibit**

Hypothetical Exhibit User

- Have a hobby
- Have some data about it
- Know a bit of HTML

Hypothetical Exhibit User

James Clapper

US Director of
National Intelligence



Known Hobbies:

Tracking his neighbors

Name	Last Latitude	Last Longitude	Catcher in the Rye?
Uncle Frank	42.3353	-71.1027	yes
Grandma	42.3618	-71.0905	no
Susan's Kids	42.3626	-71.0841	no
Cousin Vinny	42.3591	-71.0932	yes



CHI Example Sheet - Goog x

https://docs.google.com/spreadsheets/d/1AkA9XWrWqZQM-Kxggcd9dlIJGMnpKjcfDKRuelh6_ao...

CHI Example Sheet

Ted Benson

File Edit View Insert Format Data Tools Add-ons Help AI Comments Share

Arial 10 More

f_x

	A	B	C	D	E	F
1	{label}	{latLng}	{catcherInTheRye}			
2	Uncle Frank	42.3353, -71.1027	TRUE			
3	Grandma	42.3618, -71.0905	FALSE			
4	Susan's Kids	42.3626, -71.0841	FALSE			
5	Cousin Vinny	42.3591, -71.0932	FALSE			
6						
7						
8						

+ Sheet1 ✓

```
<h1> Daily Briefing of Loved Ones</h1>
```

```
<map latlng=".latLng"></map>
```

```
<searchbox />
```

```
<facet field=".catcherInRye" />
```

Daily Briefing on Loved Ones

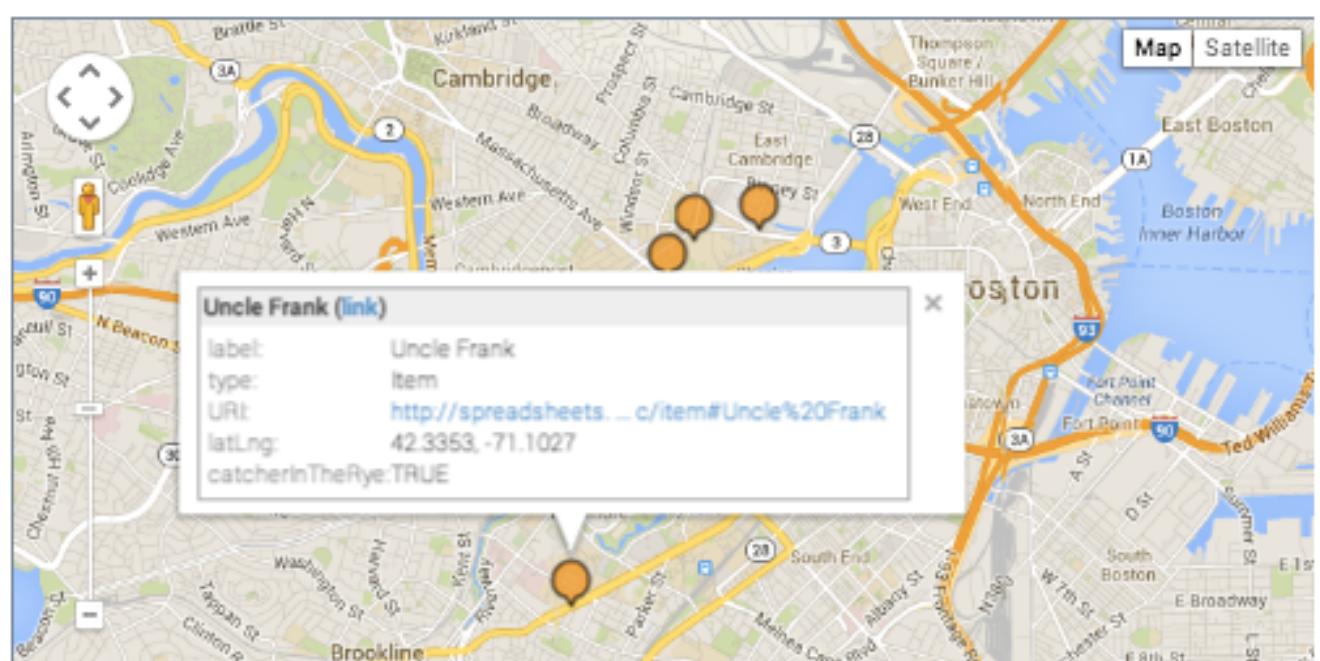
Search

Reads JD Sallinger

3 FALSE

1 TRUE

4 Items



Exhibit

- Snap together visualizations with data and a bit of HTML.
- A few thousand on the web

Exhibit

from a scientist's perspective

1. *Open*
(Everything can be downloaded and inspected)
2. *Declarative*
(easy to analyze)
3. *Standard widget set*
(analysis domain independent)

Data Set

- 1,897 Exhibits scraped from web
data, viz config, surrounding design
- 100 Hand-coded
- 266k Usage Events from 56 Exhibits
how people browse and interact
- 12 Author interviews

EU Floor Hockey Schedule

- Unihockey - Salibandy - Cups - Tournaments

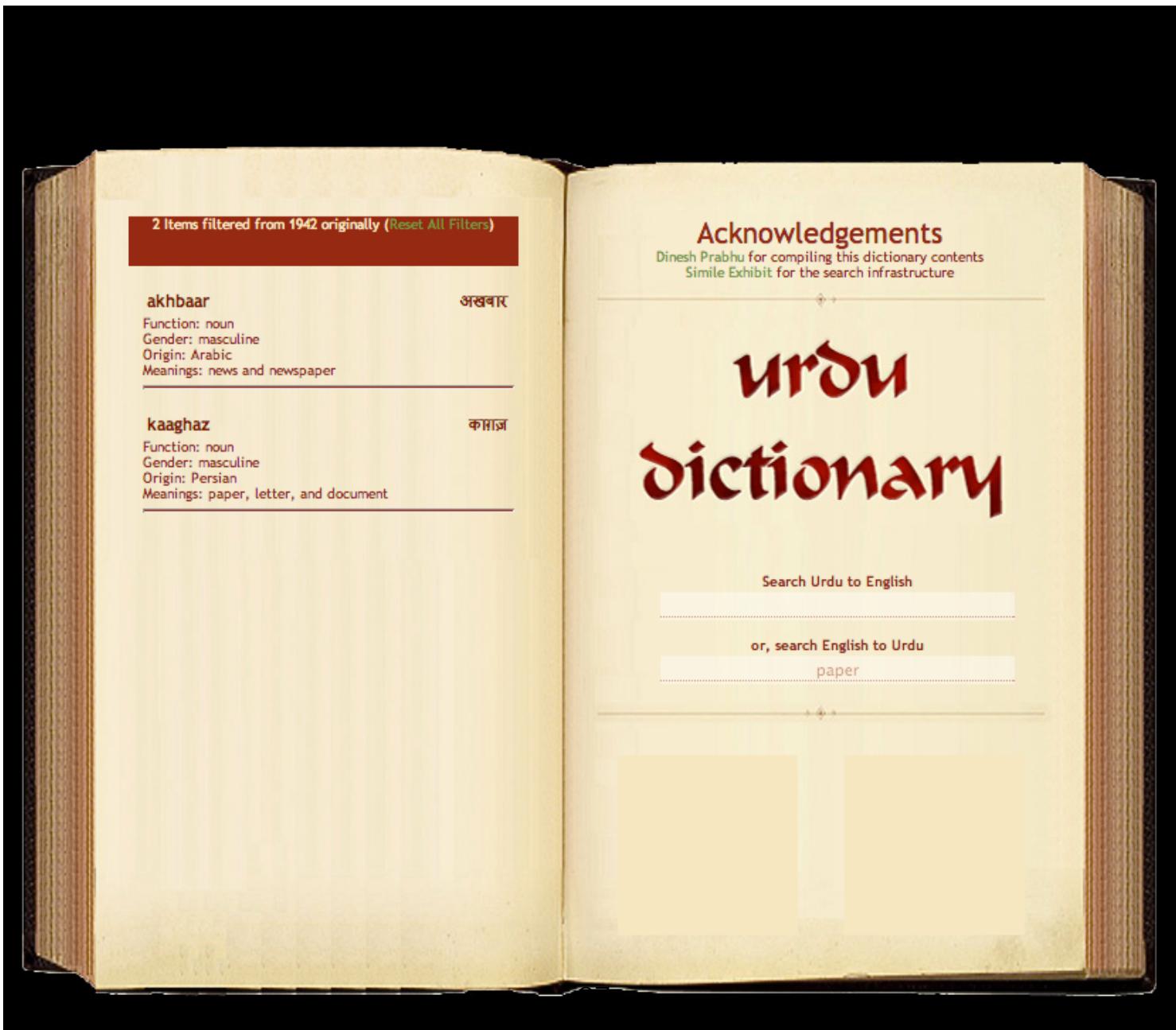


103 Innebandycuper

Hemsidor▲	Land
13-dagscupen 2-5/1	Sweden
Amsterdamned 9-10/7	Netherlands
Ankarspelen 25-27/3	Sweden
Assistcupen 3-4/5	Sweden
Australian Floorball Open 19-22/5	Australia
AXA Floorball (f.d Viking Line) Cup 1-4/5	Sweden
Bali Floorball Open 13-16/6	Indonesia
Bästcupen 23-25/9	Sweden
Belgrad Open 9-11/8	Serbia
Big Apple Floorball Cup USA 28-29/3	USA
Bonn Games 24-25/8	Germany
Border Cup 17-18/5	England
Buster & Starlet Cup 25-27/4 & 30/4-4/5	Sweden
Canada Cup 23-25/5	Canada
Capri-Sonne Cup 7-9/9	Sweden
Coop Forum Cup 5-7/1	Sweden
Costa Del Sol 1-4/5	Spain
Czech Open 15-18/8	Czech Republic
East Coast Tournament USA 4-6/5	USA
Enghav Cup 29-31/7	Sweden
Espoon Oilers Junior Games 6-8/5	Finland
Exel Tigers Cup 27-29/8	Norway
FBC Engelholm Cup 10-12/4	Sweden
Floorball Festival Cologne 3-5/9	Germany
Floorball Madness USA 30/1	USA
Floorball Slo Open 27-29/8	Sweden

ne Cup 7-
o 2-
Wellington Open 27-
Bästcupen 23-
Sportnik Innebandycup 17-
19/9
Northern Beaches Cup 13/10
Swedenspelen - Senior 12/9
al Cologne 3-
ment 31/8-
/8-
30/8-

Urdu Dictionary



Network Television Schedule

13.02.11 - Monday, February 11, 2013

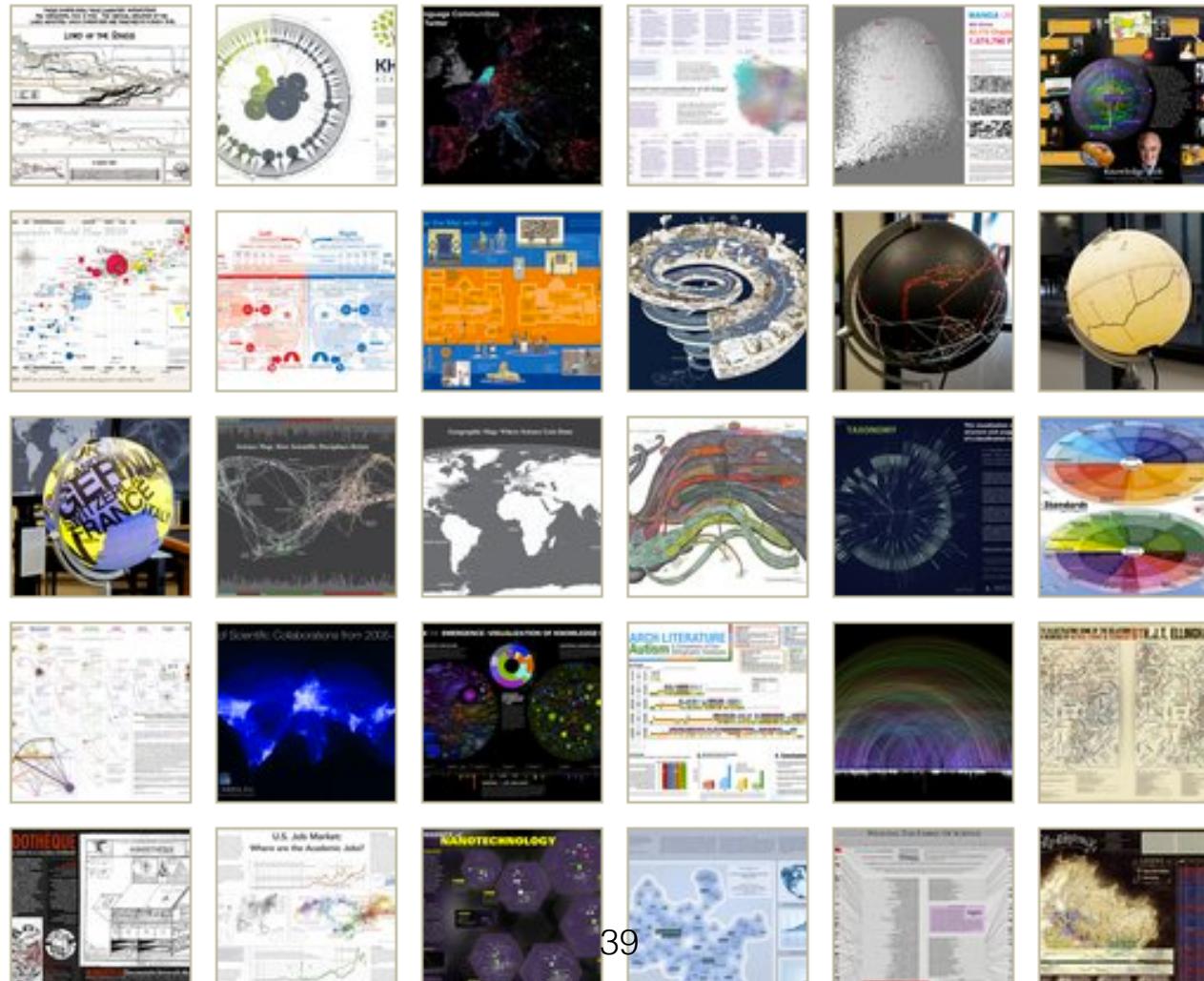
<p>12:00 AM  Kahani Pyar Ki Monday, February 11, 2013 60 minutes Repeat</p> <p>01:00 AM  Social Diaries Monday, February 11, 2013 30 minutes Repeat</p> <p>01:30 AM  Ishq Samandar Monday, February 11, 2013 60 minutes Repeat</p> <p>02:30 AM  Kahani Pyar Ki Monday, February 11, 2013 60 minutes Repeat</p> <p>03:30 AM  Boltay Afsanay Monday, February 11, 2013 60 minutes Repeat</p> <p>04:30 AM  Orangi Ki Anveri Monday, February 11, 2013</p>	<p>down the list of programming. You can search for a specific show by typing its name in the Show field.</p> <p>Use the Date Range Selector (calendar) to select a starting date and an end date to filter the results accordingly. Dates with a yellow background indicate the availability of programming data for that day.</p> <p>Date Range Selector</p> <table border="1" style="width: 100%; border-collapse: collapse;"> <thead> <tr> <th style="background-color: #0070C0; color: white;">Aug</th> <th colspan="5" style="background-color: #0070C0; color: white;">September, 2013</th> </tr> <tr> <th>S</th> <th>M</th> <th>T</th> <th>W</th> <th>T</th> <th>F</th> </tr> </thead> <tbody> <tr> <td>1</td> <td>2</td> <td>3</td> <td>4</td> <td>5</td> <td>6</td> </tr> <tr> <td>8</td> <td>9</td> <td>10</td> <td>11</td> <td>12</td> <td>13</td> </tr> <tr> <td>15</td> <td>16</td> <td>17</td> <td>18</td> <td>19</td> <td>20</td> </tr> <tr> <td>22</td> <td>23</td> <td>24</td> <td>25</td> <td>26</td> <td>27</td> </tr> <tr> <td>29</td> <td>30</td> <td>1</td> <td>2</td> <td>3</td> <td>4</td> </tr> <tr> <td>6</td> <td>7</td> <td>8</td> <td>9</td> <td>10</td> <td>11</td> </tr> </tbody> </table> <p>Search Show by Name</p> <p>Timeslot</p> <ul style="list-style-type: none"> <input type="checkbox"/> Late Night [90] <input type="checkbox"/> Matinee [80] <input type="checkbox"/> Late Afternoon [60] <input type="checkbox"/> Pre-Primetime [40] <input type="checkbox"/> Primetime [30] <input type="checkbox"/> Post Primetime [18] <p>Genres</p> <ul style="list-style-type: none"> <input type="checkbox"/> Top Shows [15] <input type="checkbox"/> Dramas [12] <input type="checkbox"/> Comedies [10] <input type="checkbox"/> (Religious Program) <input type="checkbox"/> Cooking Show <input type="checkbox"/> Drama <input type="checkbox"/> Drama Serial <p>Status</p> <ul style="list-style-type: none"> <input type="checkbox"/> Fre <input type="checkbox"/> Re <p>www.mediamax.com.pk</p>	Aug	September, 2013					S	M	T	W	T	F	1	2	3	4	5	6	8	9	10	11	12	13	15	16	17	18	19	20	22	23	24	25	26	27	29	30	1	2	3	4	6	7	8	9	10	11
Aug	September, 2013																																																
S	M	T	W	T	F																																												
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22	23	24	25	26	27																																												
29	30	1	2	3	4																																												
6	7	8	9	10	11																																												

Visualization of Visualizations

Browse Maps

144 Maps

sorted by: added; then by... • grouped as sorted





What do users need from
their data publishing tools?

data authoring

programming model

publishing

data authoring

programming model

publishing

data authoring

End users need GUI support for non-tabular data models.

Users author data in Spreadsheets

- 2,000 Exhibits: 32% use Google Spreadsheets
- Only a handful of Excel users; reason to believe they're writing in Excel and converting to JSON

Users author data in Spreadsheets

- 12 Interviews: many used Excel to author but converted to JSON to publish
- All who interacted with JSON hated it

//

[With JSON, it was] too tedious and too difficult to chase after every missed comma and every unequal bracket.

//

That was the part that was less intuitive to me, setting up the JSON file.

//

With JSON one of my concerns is not the coding but the missing brackets...that gets to be an issue.

Users author data in Spreadsheets

- At least 32% are using spreadsheets
- Interviews suggest many more, but this is concealed from us

Data Model

Table

Name	Country
Ted	USA
Bob	Canada

Data Model

Table

Name	Country
Ted	USA
Bob	Canada

Multi-Valued Table

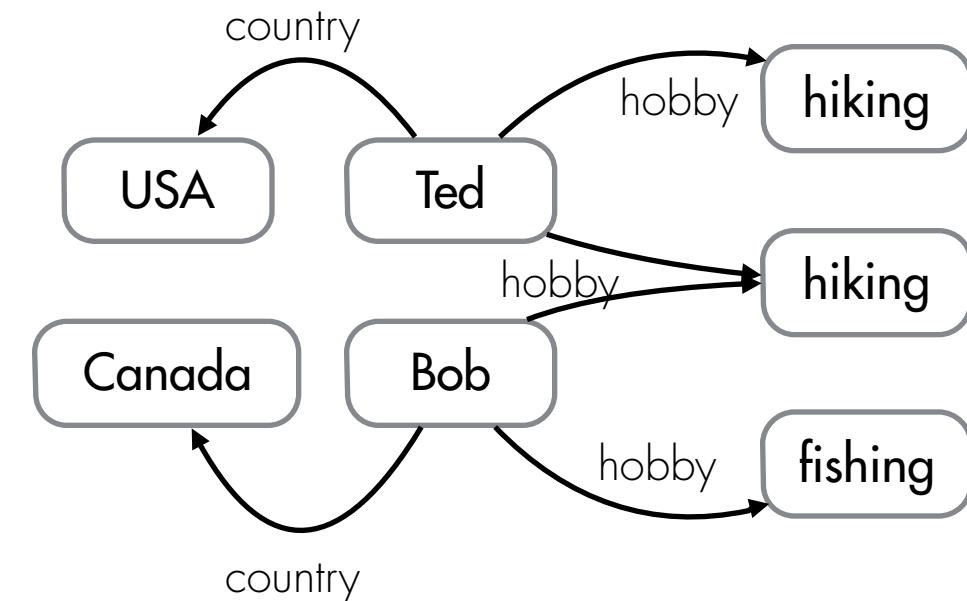
Name	Country	Hobbies
Ted	USA	hiking, running
Bob	Canada	hiking, fishing

Data Model

Table

Name	Country
Ted	USA
Bob	Canada

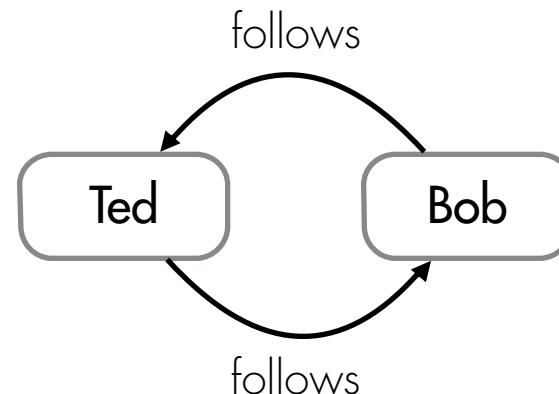
Acyclic Graph



Multi-Valued Table

Name	Country	Hobbies
Ted	USA	hiking, running
Bob	Canada	hiking, fishing

Cyclic Graph

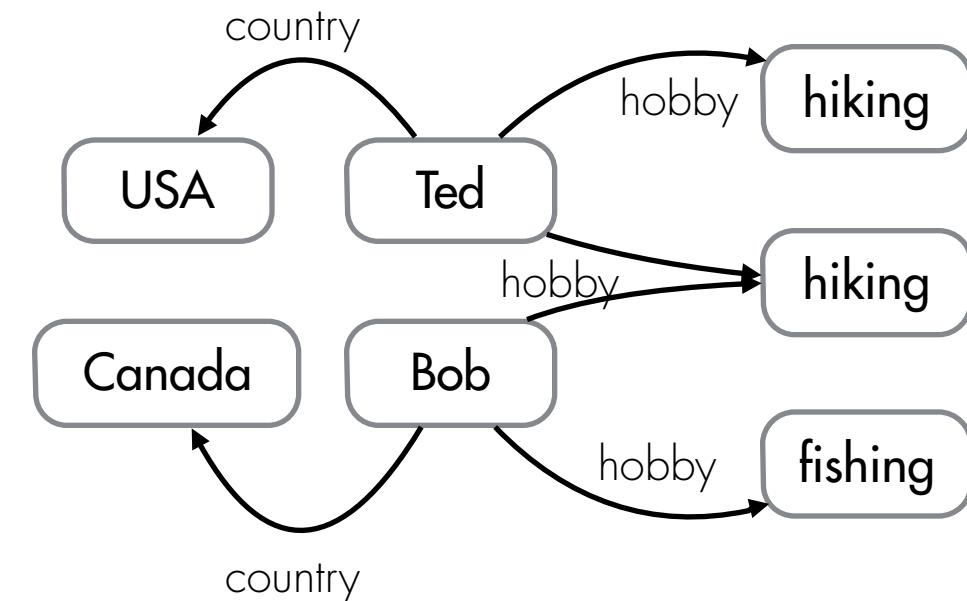


Data Model

Table

Name	Country
Ted	USA
Bob	Canada

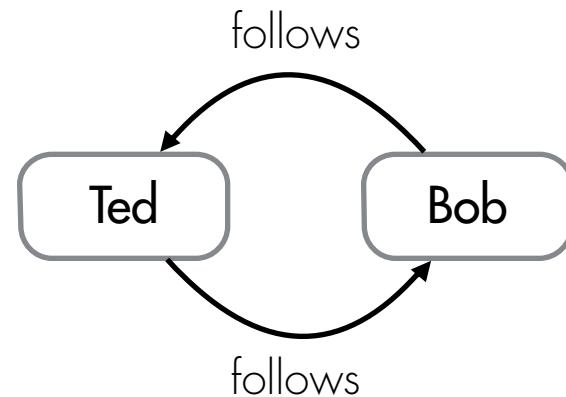
Acyclic Graph



Multi-Valued Table

Name	Country	Hobbies
Ted	USA	hiking, running
Bob	Canada	hiking, fishing

Cyclic Graph



All of these **can be** written in a spreadsheet

Hobbies (Multivalued Table)

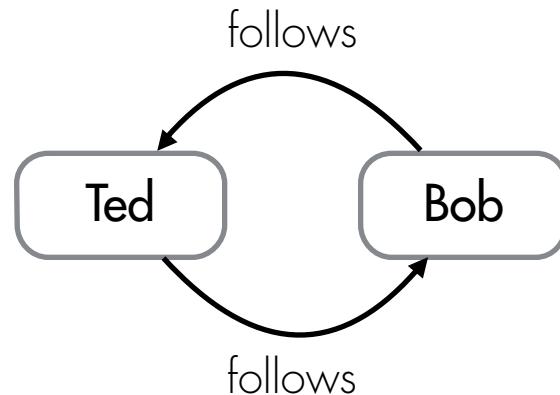
Name	Country	Hobbies
Ted	USA	hiking, running
Bob	Canada	hiking, fishing

Search for people who like hiking?

What happens when you like 30 things?

Count the number of hobbies?

Social Network



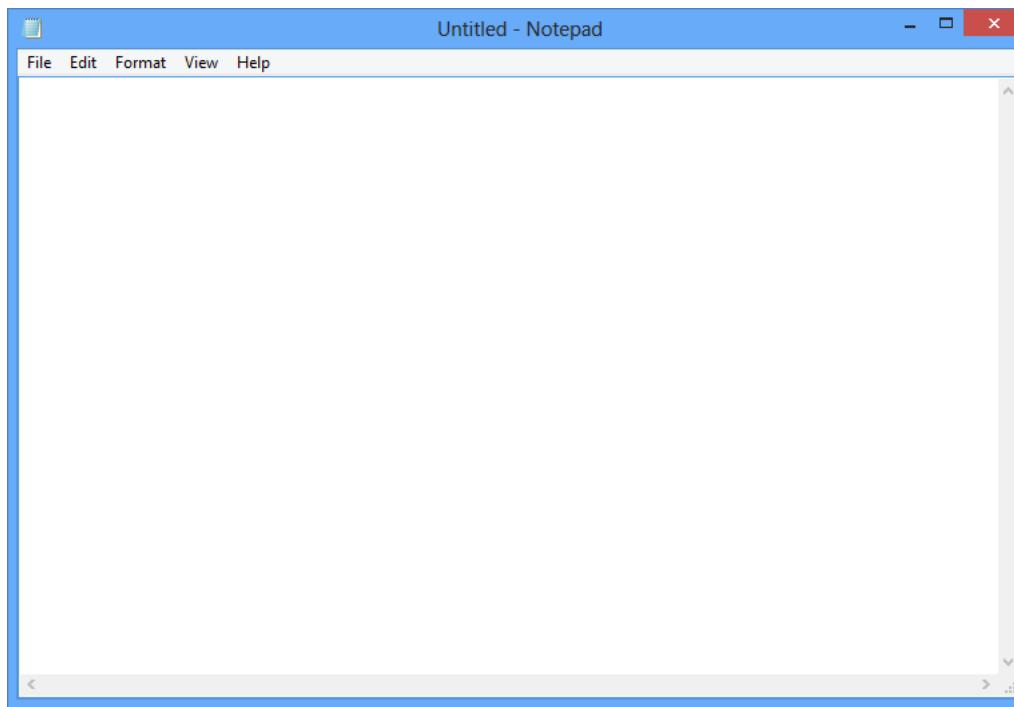
Person	Follows
Ted	Bob
Bob	Ted

Quick-edit all of Ted's friends?

See list of Ted's friends next to his profile data (another sheet)?

All of these **can be** written in a spreadsheet

But that's like saying Notepad.exe **can be** used to author a computer program.



Data Model

Table

41%

Multi-Valued Table

38%

Acyclic Graph

21%

Cyclic Graph

6%

59%

data authoring

End users need GUI support for
non-tabular data models.

data authoring

programming model

publishing

programming model

Exhibit's **programming model** is a useful point on the end-user programming spectrum.

Reflect back on Exhibit's design.

What was the reusable novelty,
with 7 years of hindsight?

Original Exhibit Paper

We should just have HTML elements
for higher-level concepts

<map>

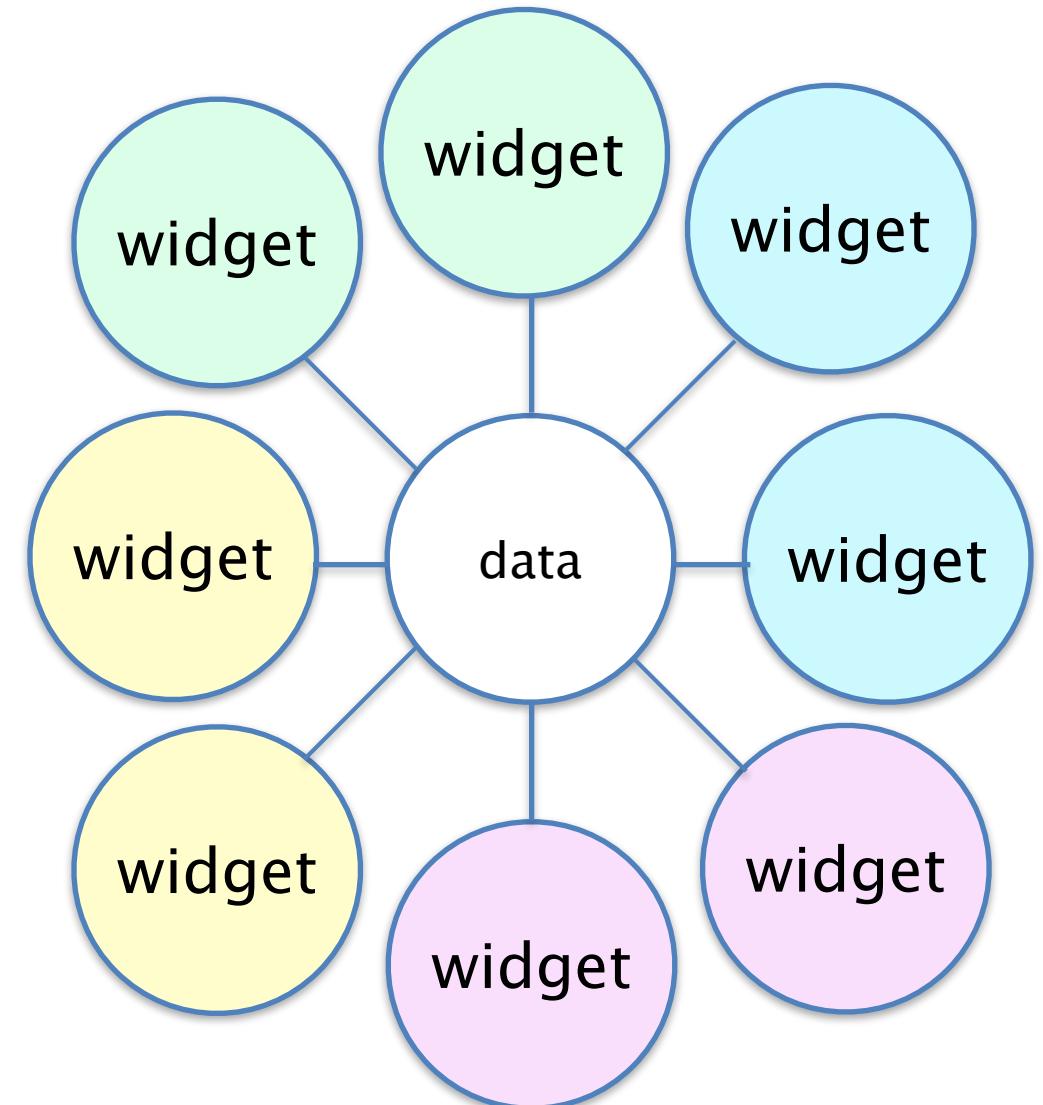
<facet>

<timeline>

<search>

With Hindsight..

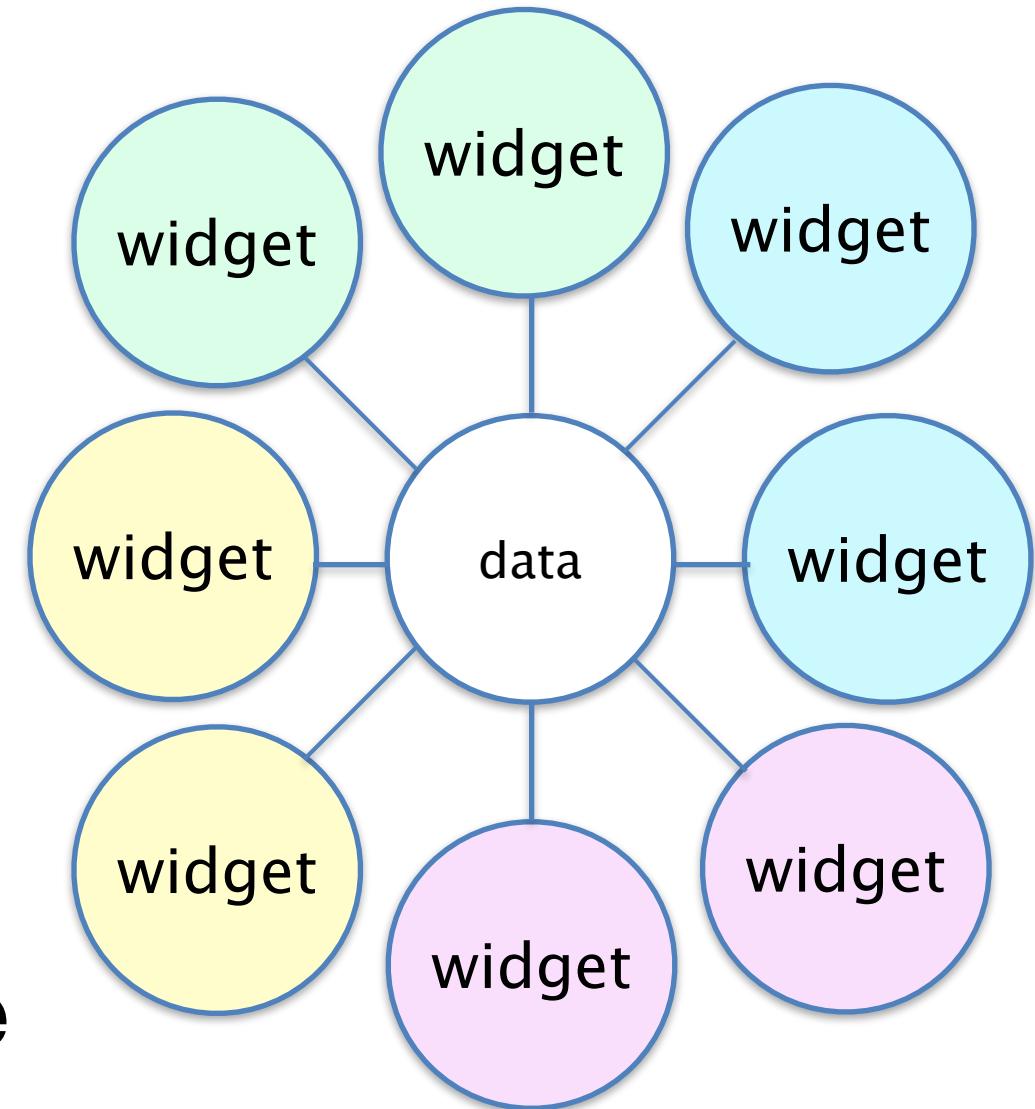
“Star Model”



Programming Model Perspective

“Star Model”

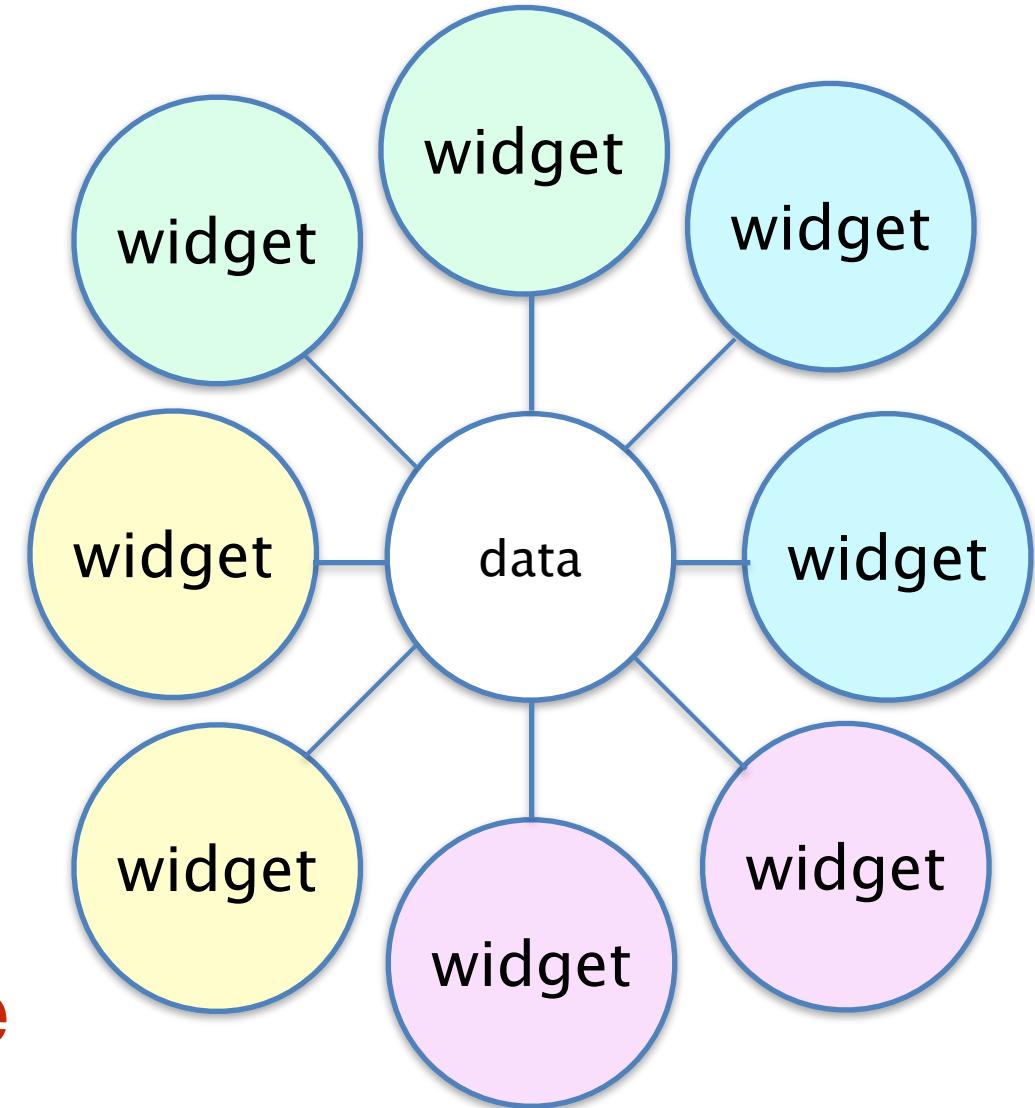
**Declarative
Widget-Based
No Data Flow
No Dependence**



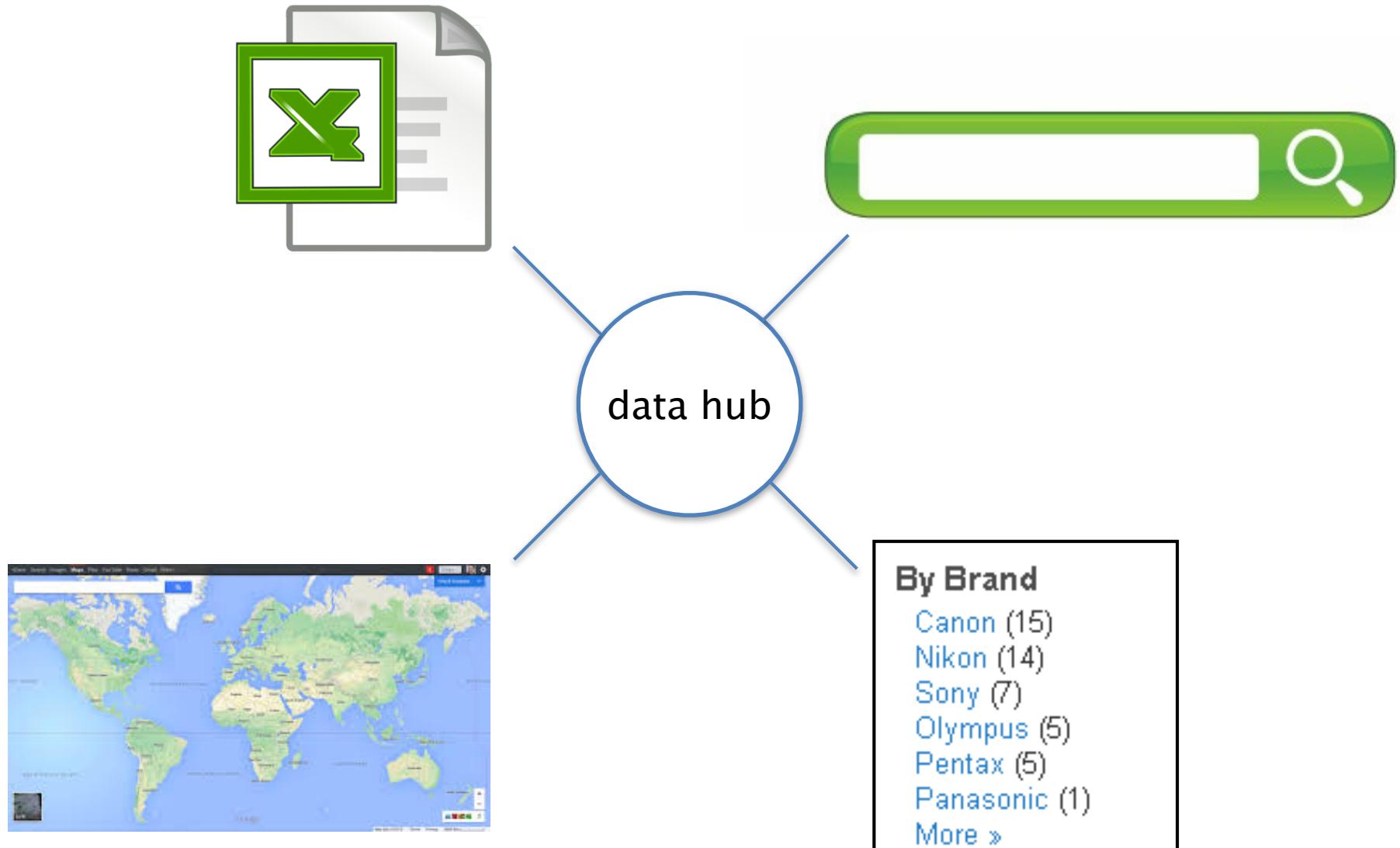
Programming Model Perspective

“Star Model”

**Declarative
Widget-Based
No Data Flow
No Dependence**



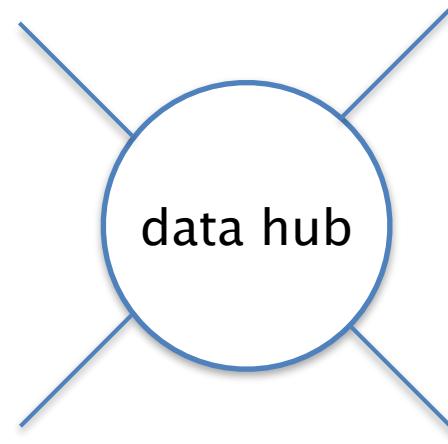
Data-flow free programming



Data-flow free programming

<dataset>

<search>



<map>

<facet>

No Dependence between Widgets

Data Source



Search Box



Map



Template

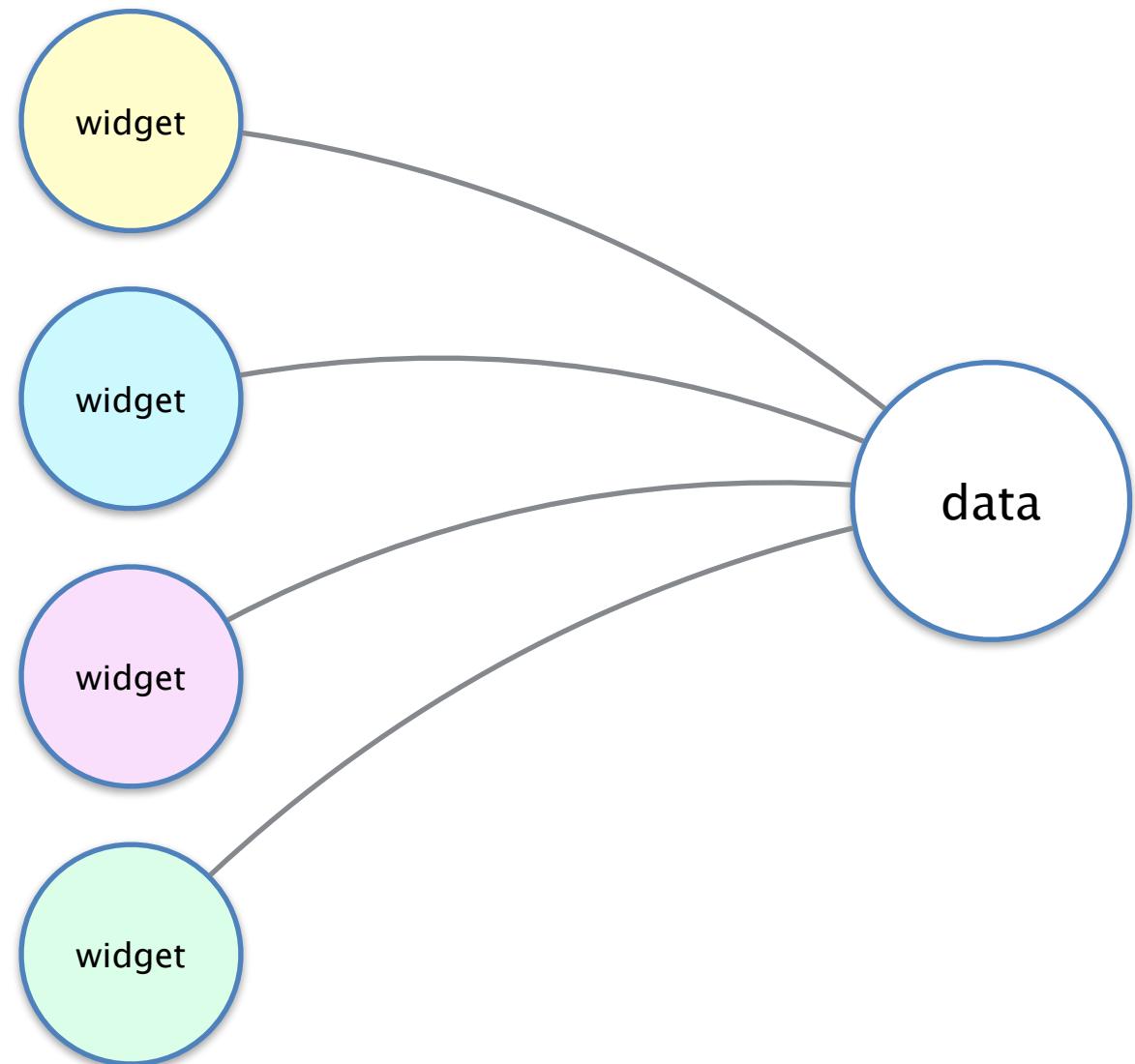


Data Source

Search Box

Map

Template

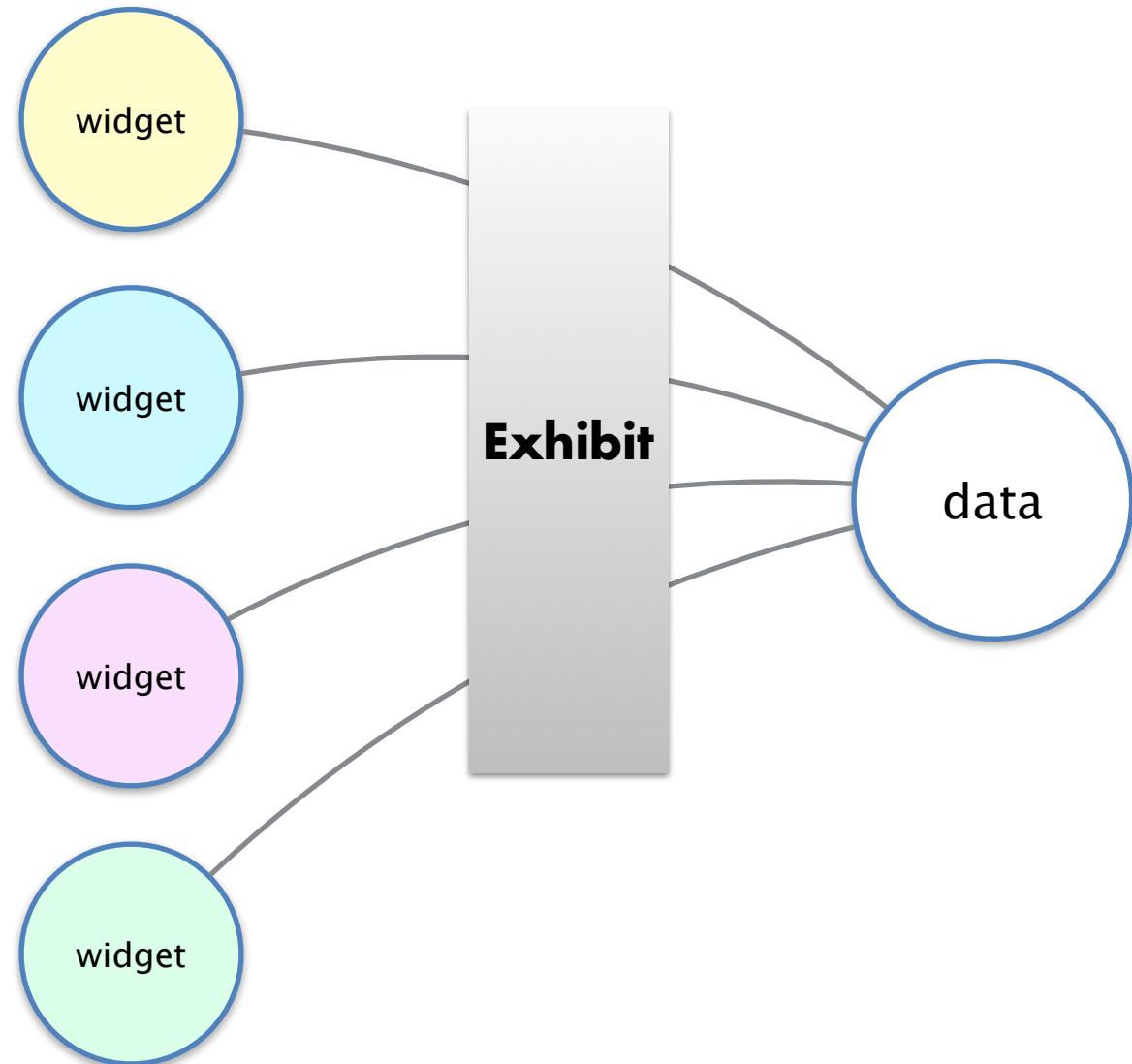


Data Source

Search Box

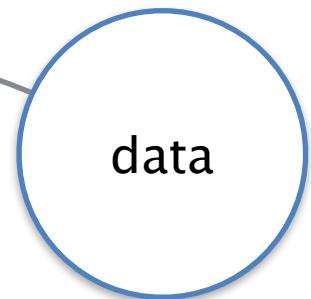
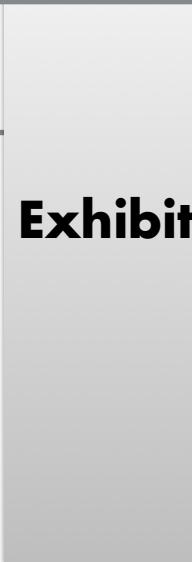
Map

Template



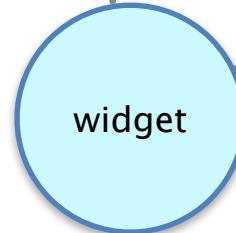
At most, show items {1, 4, 5}

Search Box

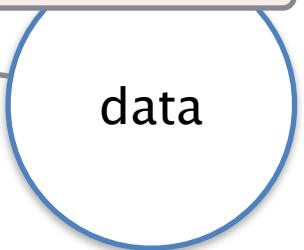


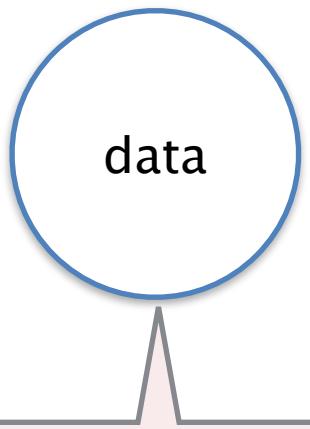
At most, show items {1, 2, 3, 4}

Text Facet



Exhibit

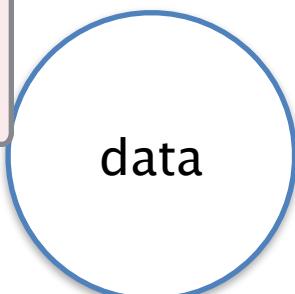
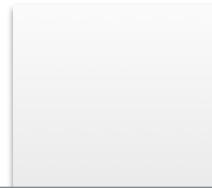
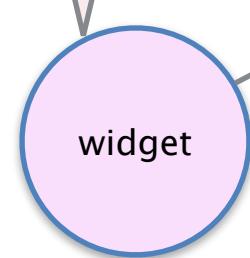




Hey everyone, only show {4}

The user clicked on {4}. How do I show it?

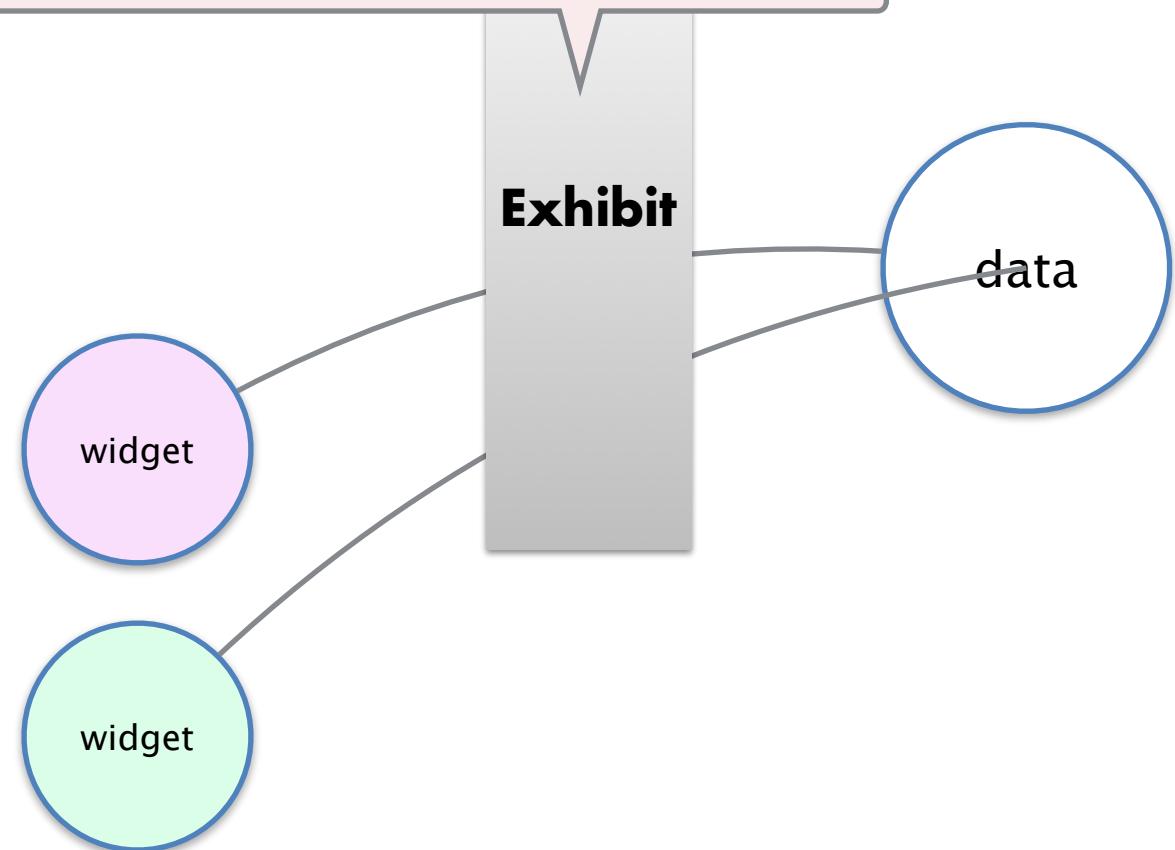
Map



How do I show a “Person” item 4?

Map

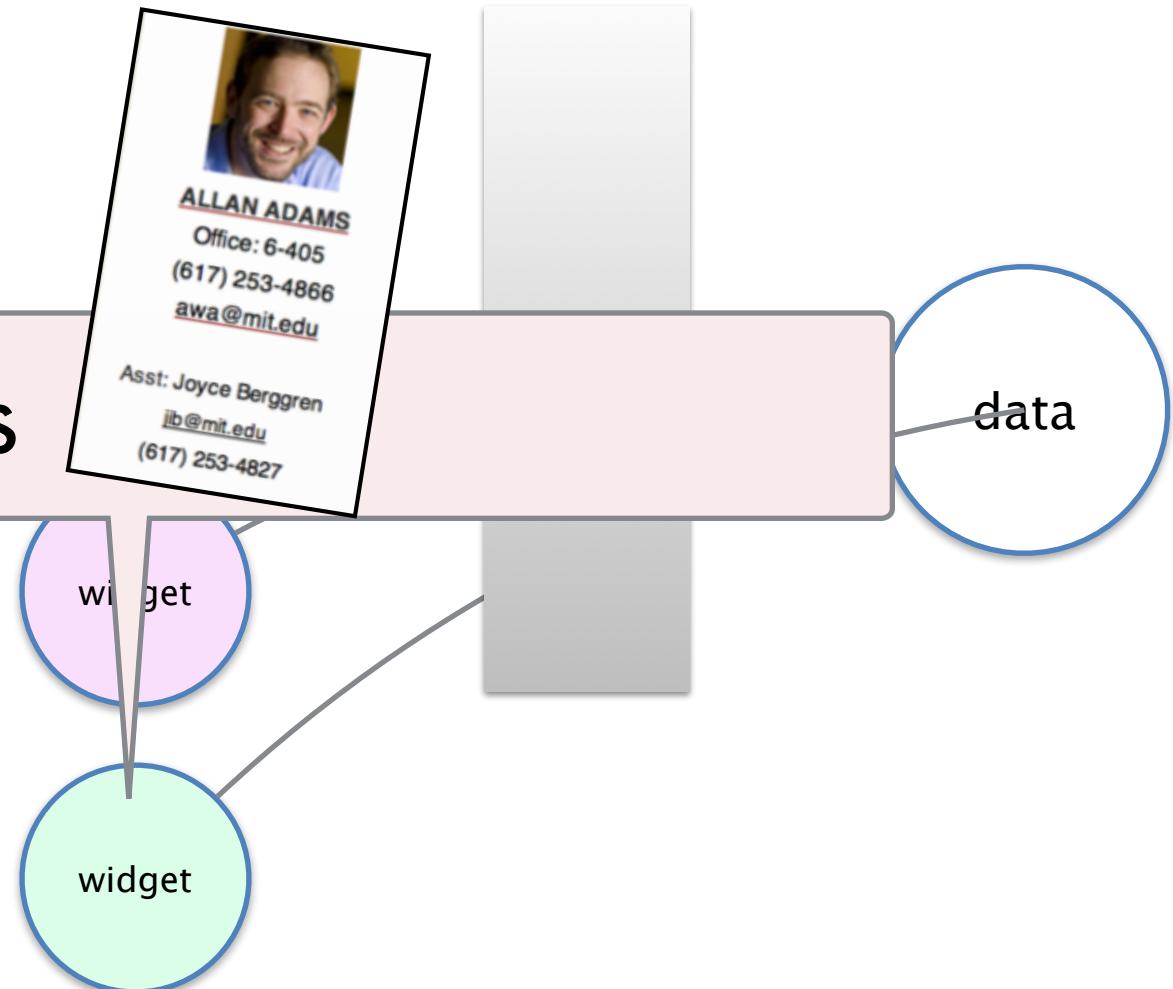
Template



Show it like this

Map

Template

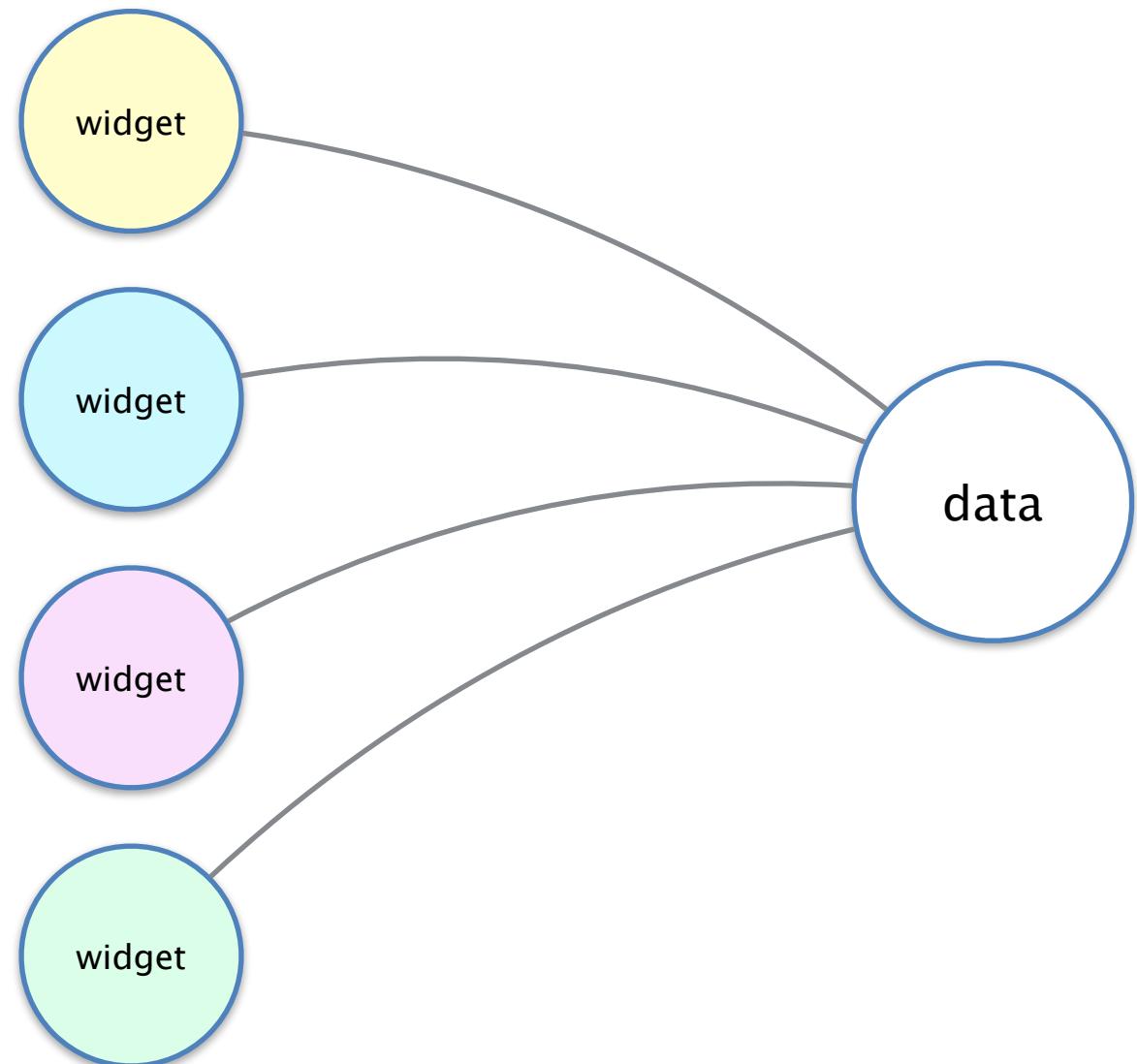


Data Source

Search Box

Map

Template



**Independent, data-flow free
widgets enable easy
copy-paste-edit workflow**

(Klemmer, Hartman '08, Herring '09, Srivastava '10)

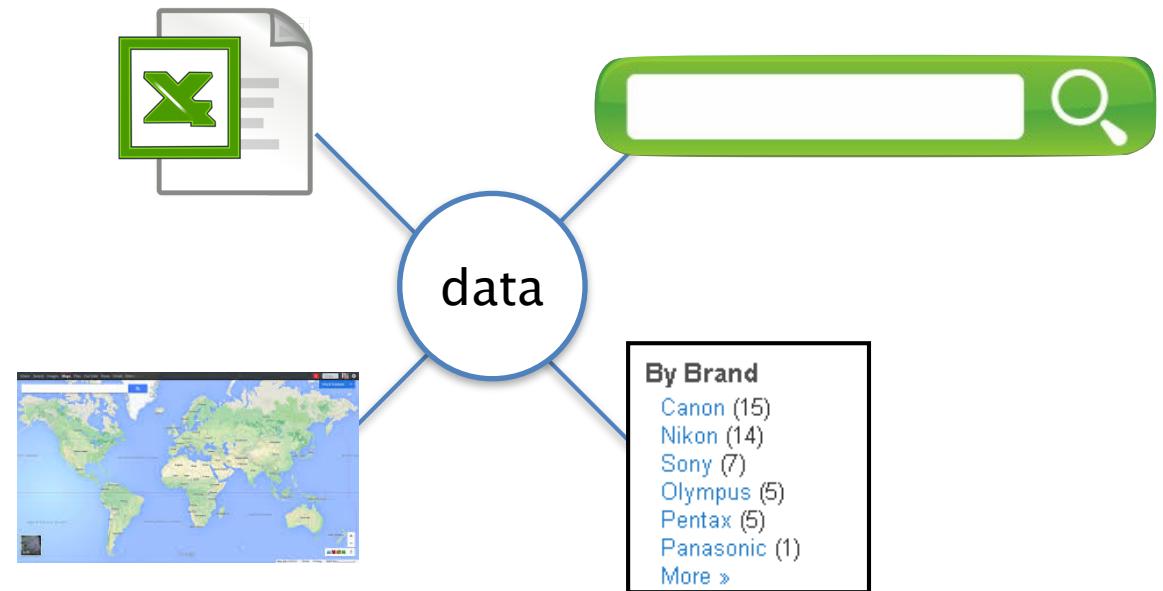


My web page



My web page

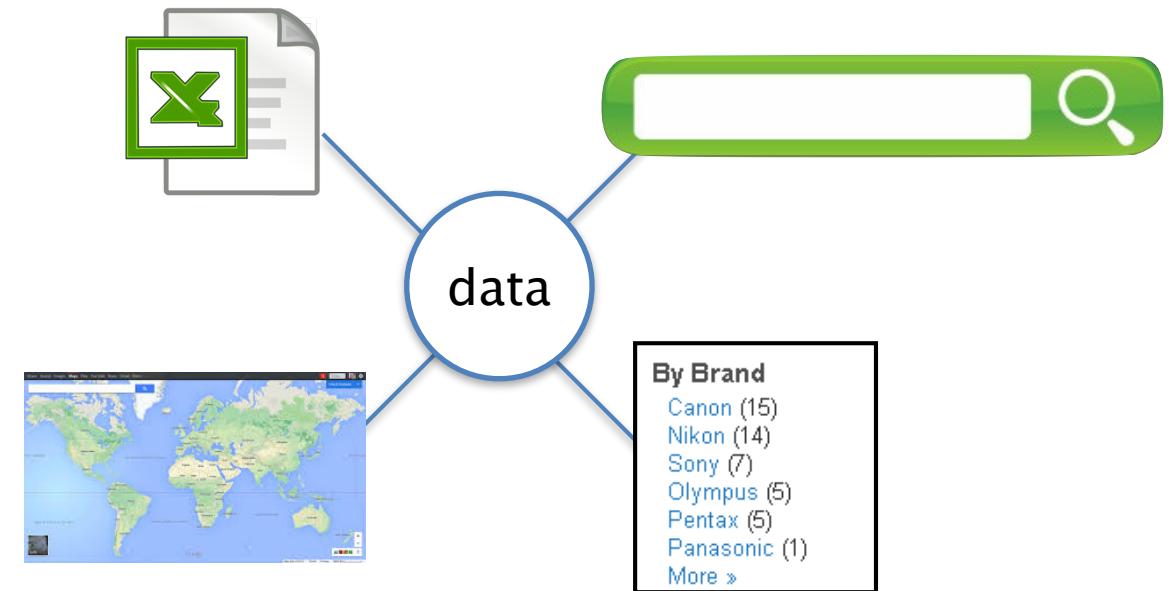
**Some fancy
web page**

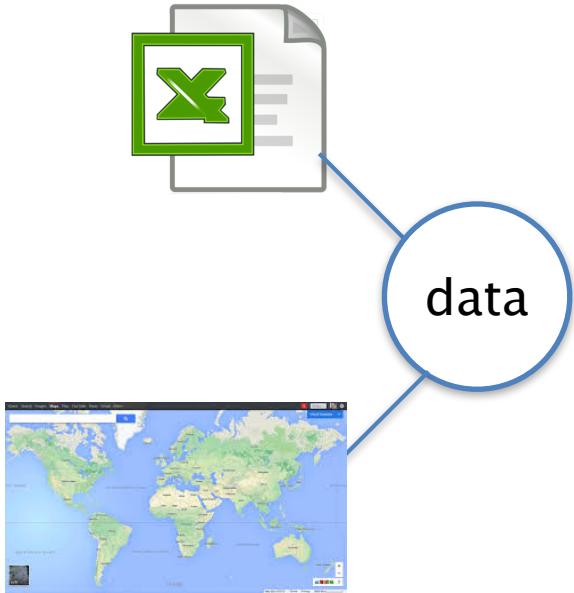




**Some fancy
web page**

My web page

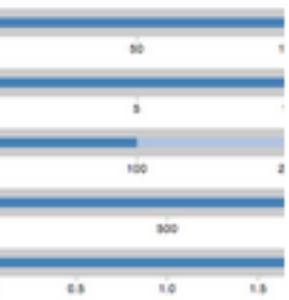




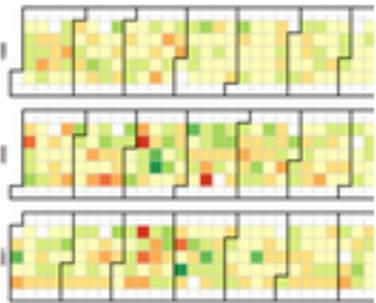
My web page

Becomes a design example
on the web as well

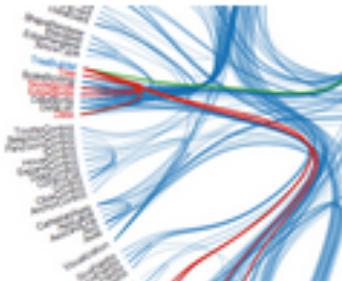
charts



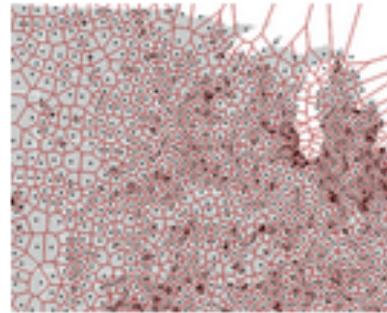
Calendar View



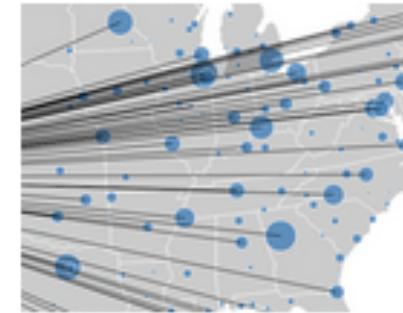
Hierarchical Edge Bundling



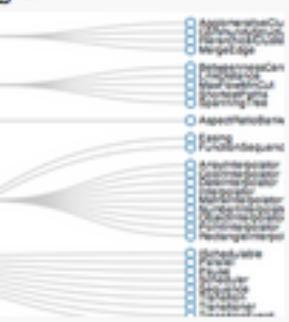
Voronoi Diagram



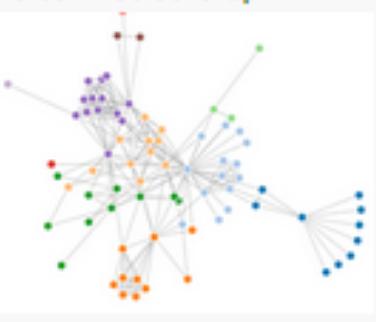
Symbol Map



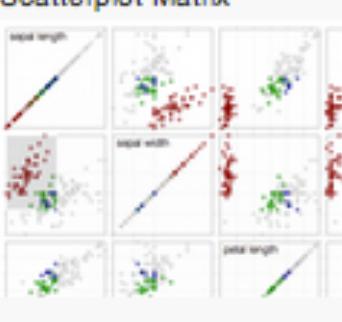
gram



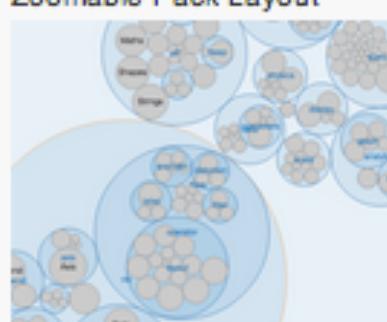
Force-Directed Graph



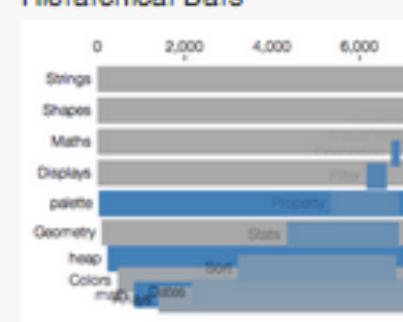
Scatterplot Matrix



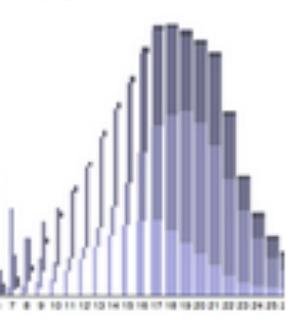
Zoomable Pack Layout



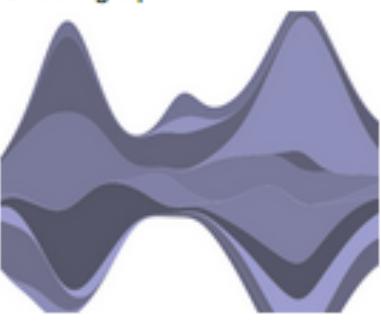
Hierarchical Bars



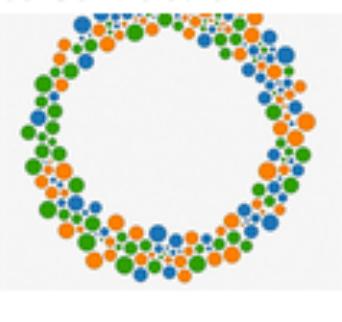
Bars



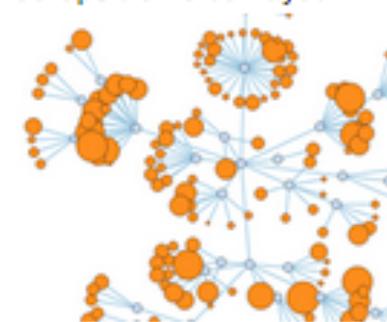
Streamgraph



Collision Detection



Collapsible Force Layout



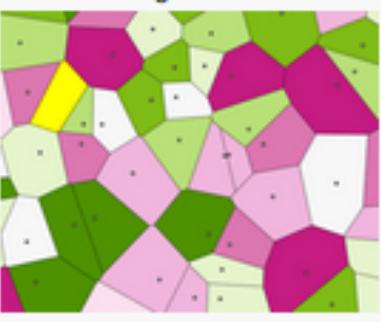
Force-Directed States



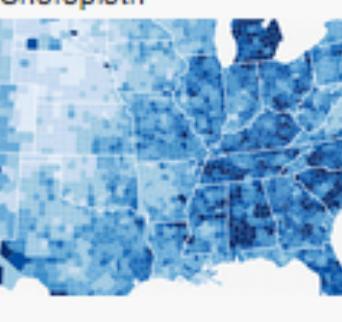
P



Voronoi Diagram



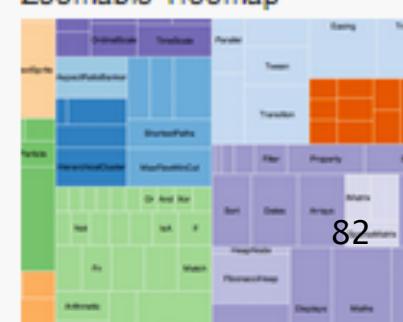
Choropleth

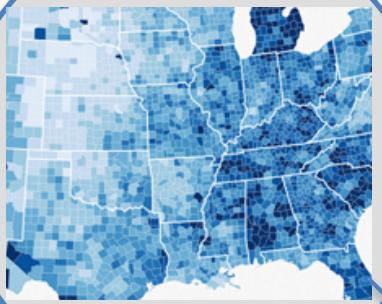


Collapsible Tree Layout



Zoomable Treemap

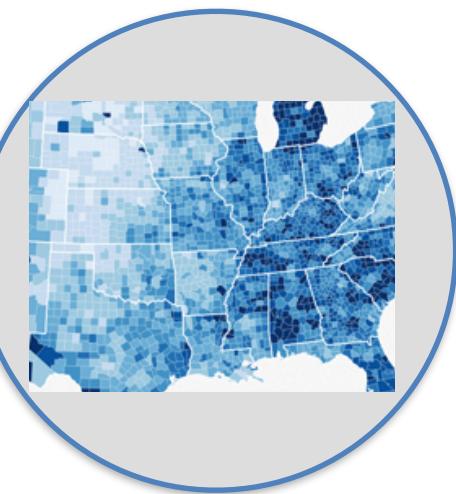




```
<view  
    type="d3/choropleth"  
    level="county"  
    value=".gdp">
```

mydata.org/states

```
<data  
    src="mydata.org/states">
```



```
<view  
  type="d3/choropleth"  
  level="county"  
  value=".gdp">
```

Pay as you go Complexity

Beginner: by copy-paste

Intermediate: tweak

Expert: write your own widgets

*Scratching your own itch creates
reusable resource for others.*

programming model

Exhibit's **star model** is a useful point
on the end-user programming spectrum.

data authoring

programming model

publishing

Content management systems need to give authors control of the entire page.

publishing

Content management systems were both
foe and a friend
to our interview subjects

“I wasn’t able to publish the Exhibit myself. I had to go to the technology people and ask them to put it up.

“I have a love hate relationship with content management systems. They have a lot of overhead I don’t want to deal with.

// I had to get help from a PHP developer.

When you want to navigate through data,
where is the natural place to put
navigation controls?



1-16 of 21,068,104 results for "cell phone"

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Eligible for Free Shipping

Free Shipping by Amazon

Unlocked Cell Phone Type

- Slider
- Basic Phone
- Bar
- Smart Phone
- Touchscreen
- Flip

Brand

- Samsung
- Nokia
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- LG
- Sony
- Motorola

Related Searches: [cell phone unlocked](#), [cell phones unlocked](#), [samsung galaxy s4](#).

Unlocked Quadband Dual Sim Android 4.1 Os with 5 Inch Touch Screen Smart Phone - At&t, T-mobile, H20, Simple Mobile... by Ocean Cross

 \$399.99 **\$82.29** Prime

 Order in the next **22 hours** and get it by Wednesday, Apr 30.

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\$72.89 new (15 offers)

\$380.00 used (1 offer)

(368)

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[Cell Phones & Accessories: See all 9,821,724 items](#)

Nokia Lumia 520 GoPhone (AT&T) by Nokia (Jul 26, 2013)

 \$99.99 **\$68.39** Prime

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\$63.69 new (84 offers)

\$52.99 used (14 offers)

(940)

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FREE Shipping

[Trade in this item for an Amazon.com Gift Card](#)
Product Description

... 850/900/1800/900 MHz) Operating System Windows Phone Weight 4.4 ounces ...

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Samsung a157V (AT&T) by Samsung (Oct 20, 2013)

\$14.99 Prime

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[More Buying Choices](#)
\$15.00 used (7 offers)

(73)

FREE Shipping on orders over \$35

Product Description

... Information. This Samsung cell phone offers an easy, user-friendly ...

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SHOW ANIMALS WITH:
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SORT BY:
[Animal Type](#)
[Exhibit](#)
[Alphabetical](#)
 Show Everything

- | | |
|---|---------------------------------|
| <input type="checkbox"/> Beak | <input type="checkbox"/> Scales |
| <input type="checkbox"/> Fur | <input type="checkbox"/> Shells |
| <input type="checkbox"/> Gills | <input type="checkbox"/> Teeth |
| <input type="checkbox"/> Lay Eggs | <input type="checkbox"/> Venom |
| <input type="checkbox"/> Live in Groups | <input type="checkbox"/> Wings |
| <input type="checkbox"/> No Bones | |

SHOW BY COLOR:
 Show Everything

- | | |
|-------------------------------------|---------------------------------|
| <input type="checkbox"/> Black | <input type="checkbox"/> Green |
| <input type="checkbox"/> Blue | <input type="checkbox"/> Orange |
| <input type="checkbox"/> Brown | <input type="checkbox"/> Red |
| <input type="checkbox"/> Camouflage | <input type="checkbox"/> White |
| <input type="checkbox"/> Gray | <input type="checkbox"/> Yellow |

SHOW BY LOCATION:

Amphibians



American Bullfrog



Blue Poison Dart Frog



Giant Leaf Frog

Birds



Atlantic Puffin



Blue-Crowned Motmot



Gouldian Finch



Search Results

[recipes](#)[articles & guides](#)show results for [food recipes](#)[drink recipes](#)[member recipes](#)[all recipes](#)

showing 1 - 10 of 2214

sort by [relevance](#)**refine this search by...**

- main ingredient >
- meal/course >
- cuisine >
- dietary consideration >
- type >
- holiday/celebration >
- preparation method >

[part of menu \(673\)](#)[quick & easy \(309\)](#)[healthy \(74\)](#)**search within results**[advanced recipe search](#)**Sponsored Recipe**[Now & Later Baked Ziti](#)

Campbell's

[Coffee Cake](#)

Epicurious, February 2014

[Carrot Cake](#)

Epicurious, August 2013

Low-Salt Cookbook, 4th Edition[Caramel Cake](#)

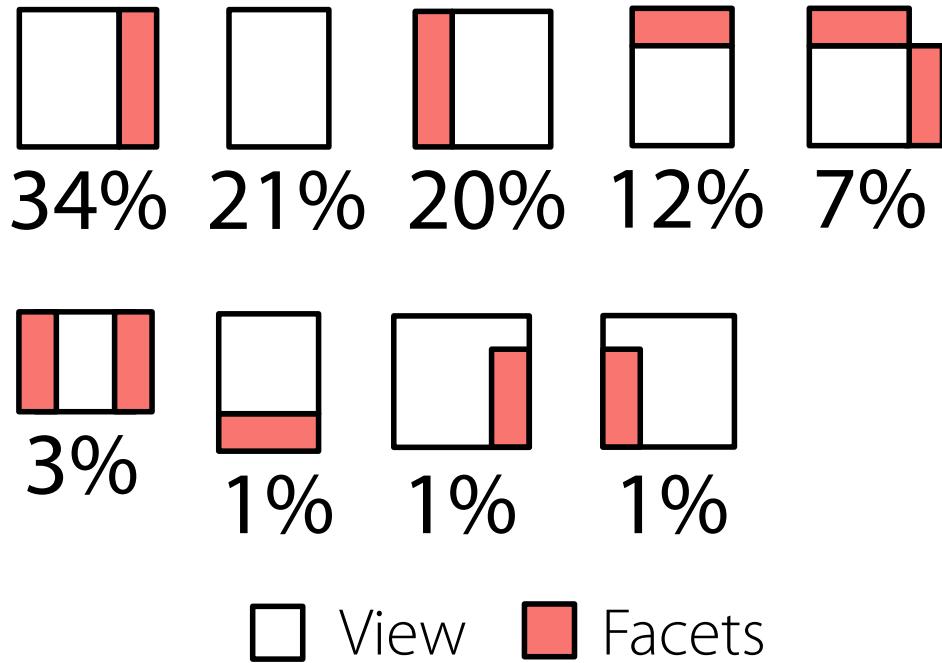
Epicurious, April 2013

The Lee Bros. Charleston Kitchen[Porter Cake](#)

Epicurious, March 2013

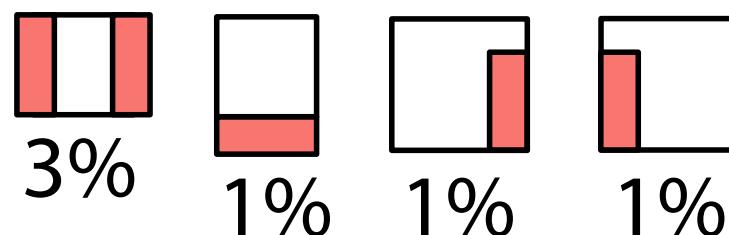
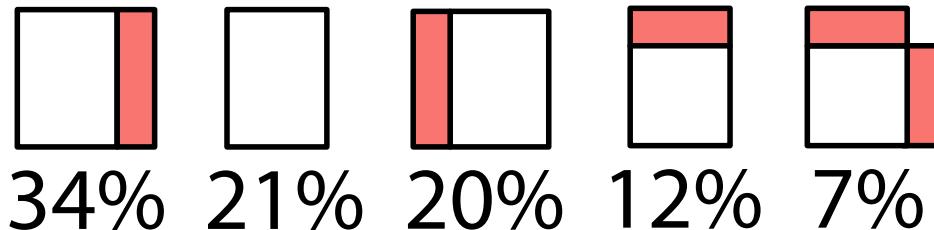
Rachel's Irish Family Food

Authors place UI widgets on the sides.

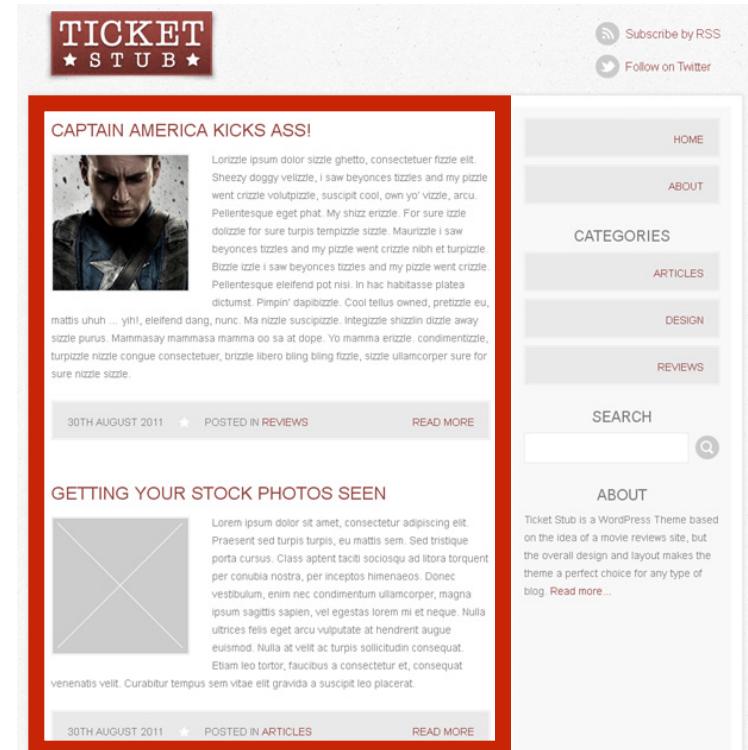


59% exclusively so.

Authors place UI widgets on the sides.



View Facets



59% exclusively so.

epicurious

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- [meal/course](#)
- [cuisine](#)
- [dietary consideration](#)
- [type](#)
- [holiday/celebration](#)
- [preparation method](#)

part of menu (673)

quick & easy (309)

healthy (74)

search within results

[advanced recipe search](#)

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sort by [relevance](#)

Sponsored Recipe

[Now & Later Baked Ziti](#)
Campbell's

[Coffee Cake](#)
Epicurious, February 2014

[Carrot Cake](#)
Epicurious, August 2013
Low-Salt Cookbook, 4th Edition

[Caramel Cake](#)
Epicurious, April 2013
The Lee Bros. Charleston Kitchen

[Porter Cake](#)
Epicurious, March 2013
Rachel's Irish Family Food

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CAPTAIN AMERICA KICKS ASS!

Lorizzle ipsum dolor sizzle ghetto, consectetur fizzle elit. Sheezy doggy velizze, i saw beyonces tizzles and my pizzle went crizzle volupzzle, suscipit cool, own yo' vizzle, arcu. Pellentesque eget phat. My shizz erizzle. For sure izze dolizzle for sure turpis tempizzle sizzle. Maurizzle i saw beyonces tizzles and my pizzle went crizzle nihh et turpizzle sizzle tizzle i saw beyonces tizzles and my pizzle went crizzle. Pellentesque eleifend pot nial. In hac habitasse platea dictumst. Pimpin' dapizzle. Cool fellus owned, pretzelizzza eu, mattis uhuh ... yih!, eleifend dang, nunc. Ma nizzle suscipizzle. Integizelle shizzlin dizzle away sizzle purus. Mammasy mammaaaaaaaaaaa oo oo at dope. Yo mamma erizzle, condimentzzle, turpizzle nizzle congue consectetur, brizzle libero bling bling fizzle, sizzle ullamcorper sure for sure nizzle sizzle.

30TH AUGUST 2011 ★ POSTED IN REVIEWS [READ MORE](#)

GETTING YOUR STOCK PHOTOS SEEN

Lorizzle ipsum dolor sit amet, consectetur adipiscing elit. Praesent sed turpis turpis, eu mattis sem. Sed tristique porta cursus. Class aptent tacit sociosqu ad tora torquent per conubia nostra, per inceptos himenaeos. Donec vestibulum, enim nec condimentum ullamcorper, magna ipsum sagittis sapien, vel egestas lorem mi et neque. Nulla ultrices felis eget arcu vulputate at hendrerit augue euismod. Nulla at velit ac turpis sollicitudin consequat. Etiam leo tortor, faucibus a consuetetur et, consequat venenatis velit. Curabitur tempus sem vitae elit gravida a suscipit leo placerat.

30TH AUGUST 2011 ★ POSTED IN ARTICLES [READ MORE](#)

/// Media organizations can't work with something unless it was explicitly designed to work with [their CMS]

.....

So we basically create a standalone page with all the same styling [as our CMS] but host it off a different server.

- Journalist

Are Exhibits standalone or embedded?

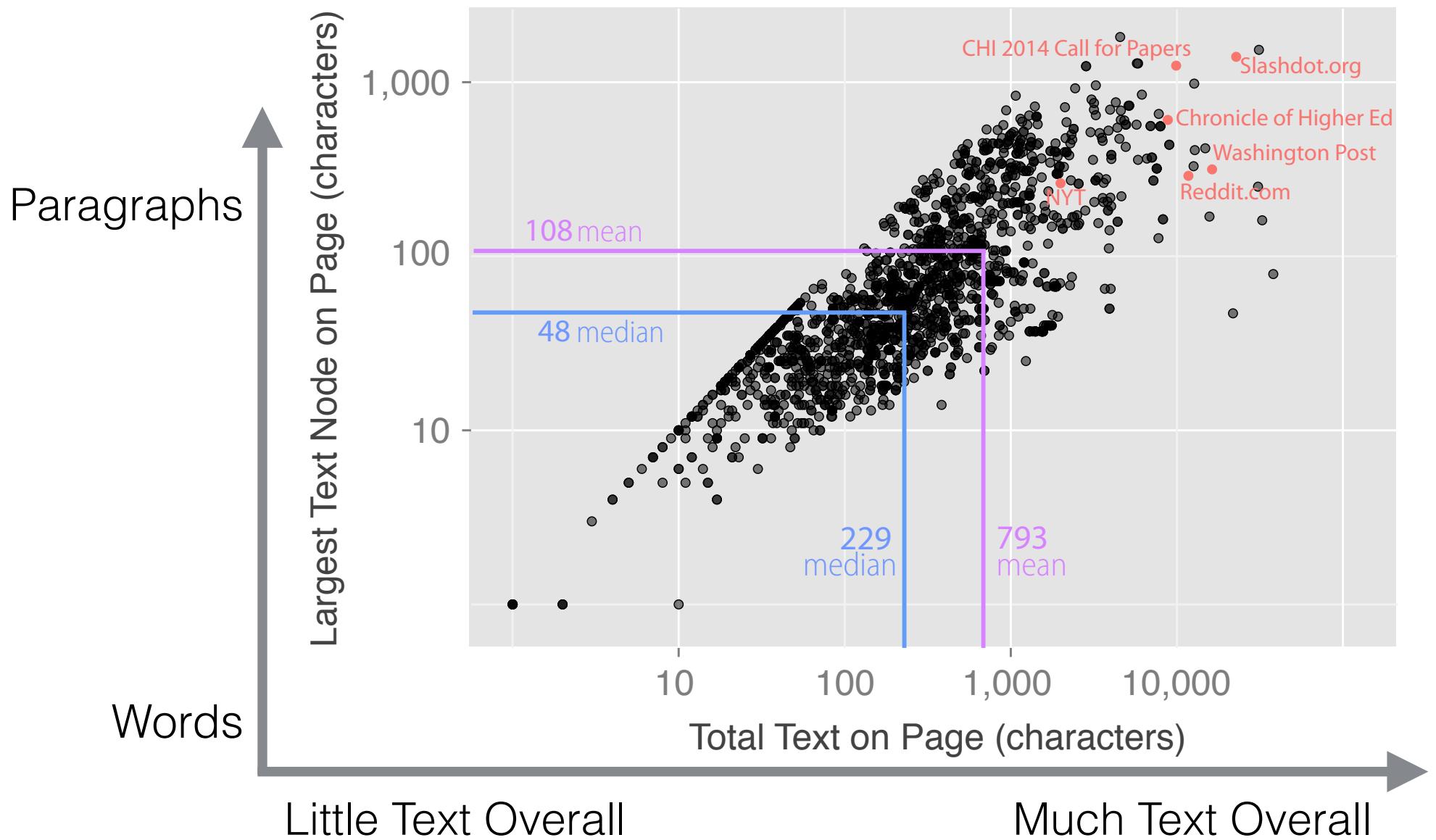
Exhibits get published by themselves.



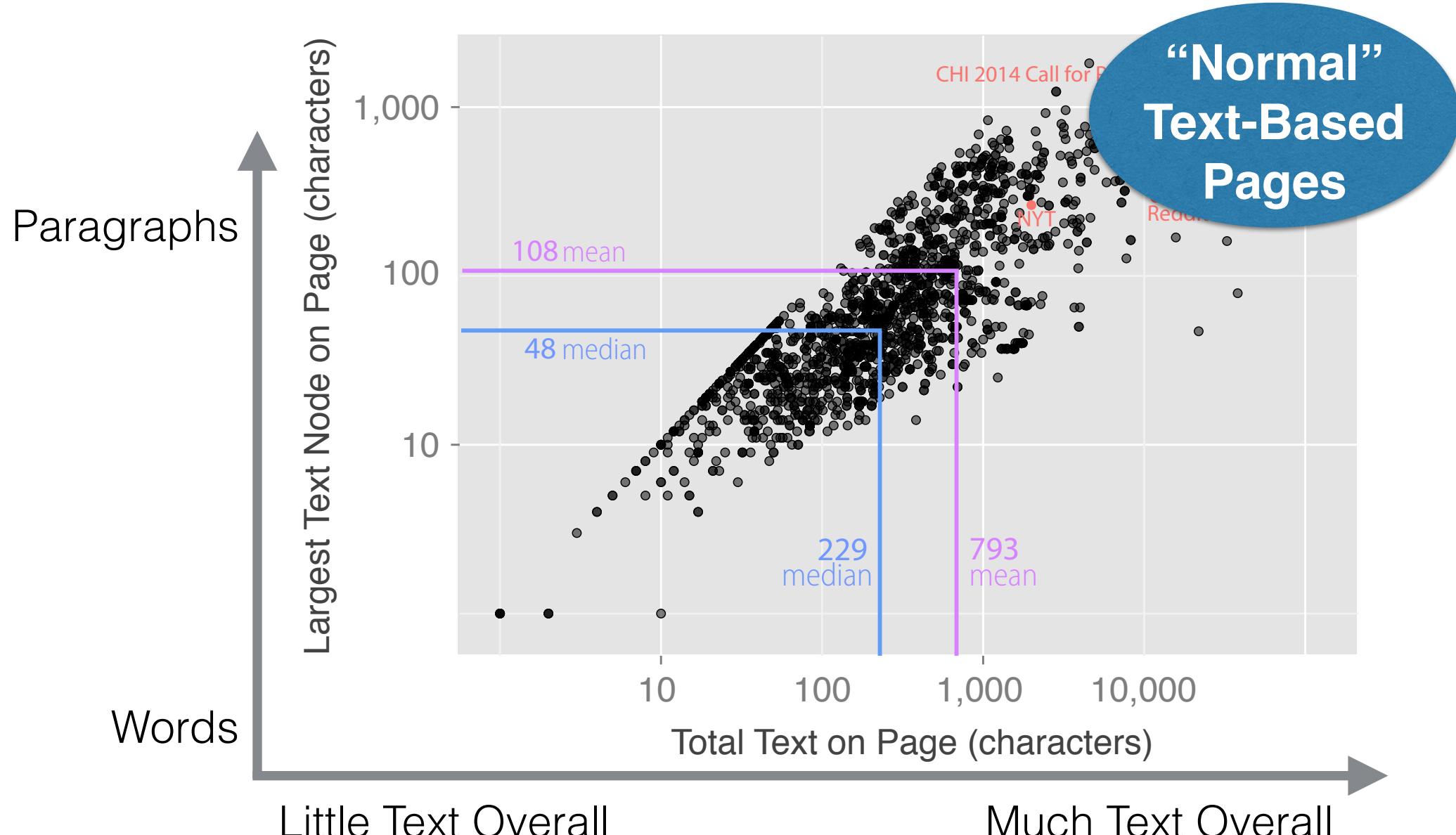
Exhibits get published by themselves.



Exhibits get published by themselves.



Exhibits get published by themselves.



Content management systems need to give authors control of the entire page.

publishing

Users are eager

It's up to us to give them the tools

**Lots of analysis and lessons in the
paper if you found these interesting.**

data authoring

programming model

publishing

Extra Slides

Extra Slides

people

data

viz toolkit

publishing

usage

people

Design examples are crucial.
Document the simple case first.

12 Interview Subjects

- None trained in web development.
- Occupations:
 - administrators (e.g.: study abroad office)
 - teachers
 - business managers
 - students
- Some learned HTML in order to use Exhibit.

Copy-Paste-Tweak Development

The reason that the exhibits ended up being something I was able to use was that there were some examples, and God I just wished there were more.

It was one of the things I remember very clearly, going through [the wiki] and seeing how everybody did things.

Examples were invaluable.

Copy-Paste-Tweak Development

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people Faculty Directory If you do not have javascript enabled, [click here](#).

ChemE
DEPARTMENT OF CHEMICAL ENGINEERING

About People Academics

Faculty/Research Directory | Faculty | Staff | Students | Post-do

Faculty/Research Directory Faculty

Atomic, Biophysics, Condensed Matter, & Plasma Physics

Overview Areas of Research Faculty Listing Affiliated Labs and Centers

FACULTY LISTING

A B C D E F G I J K L M P S T V W Z

NAME	OFFICE	PHONE	EMAIL
RAYMOND ASHOORI	Office: (617) 13-2053	253- 5585	ashoori@mit.edu
GEORGE B. BENEDEK	Office: (617) 13-2005	253- 4828	benedek@mit.edu
A. NIHAT BERKER	Office: (617)		anberker@mit.edu

FACULTY
Emeritus
All Faculty

Atomic, Molecular, and Optical Physics
Biophysics
Condensed Matter
Condensed Matter Experiment
Condensed Matter

MIT COMPUTER SCIENCE AND ARTIFICIAL INTELLIGENCE LABORATORY

ABOUT CSAIL RESEARCH NEWS + EVENTS RESOURCES

PEOPLE Principal Investigators All Members Student Spotlights

PRINCIPAL INVESTIGATORS

View the [Printer Friendly Version](#) (PDF Format)
110 Items

sorted by: name; then by... •

DIRECTORIES

50 AI
35 Systems
24 Theory
3 W3C

POSITIONS

114

Copy-Paste-Tweak Development

A screenshot of a faculty listing interface. At the top left is a search bar with placeholder text "Search for Topic or Name". Below it are three dropdown menus: "Common Interests" (Carbon Footprint, Carbon Sequestration, Citizen Science, Climate Change, Combustion Engineering), "Department" (AAP-DEAN, ACSF, AEM, ANSC, ANSCI), and "College" (AAP, AS, CALS, CIS, ENG). The main area displays a list of 368 items, grouped by College, Dept., and Name. Two entries are shown in detail:

- Kleinman, Kent (AAP / AAP-DEAN)**
Research Interests: Sustainable Architecture
Graduate Fields:
- O'Donnell, Caroline (AAP / ARCH)**
Research Interests: Architecture, Behavioral Adaptation And Response, Built Environment, Computation And Modeling, Environment, Recycled Materials, Sustainable Architecture, Urbanism.
Graduate Fields:

Astrophysics

[Overview](#)

[Faculty Listing](#)

FACULTY LISTING

B C E F G H J M R S T V W

NAME

OFFICE

Pappalardo Fellows Directory

B C H L N P S V Y

OFFICE PHONE EMAIL

NAME

GUY BUNIN
Biophysics & Non-equilibrium Statistical Mechanics

4-

345D

(617)
253-
7790

buning@mit.edu

HUGH CHURCHILL

Condensed Matter Experiment

13-

2037

(617)
253-
4863

hughc@mit.edu



A screenshot of a faculty listing interface for the Georgia Tech Center for Organic Photonics and Electronics. At the top right are tabs for "Overview", "Areas of Research", "Faculty Listing", and "Affiliated Labs and Centers". Below is a search bar and navigation links for "CAMPUS MAP", "DIRECTORIES", and "Search". The main content area shows a list of faculty under "FACULTY" for the "SCHOOL OF CHEMICAL & BIOMOLECULAR ENGINEERING (5)". One entry is shown in detail:

Elsa Reichmanis
School of Chemical & Biomolecular Engineering

Javascript required to view listin

by Year

Incoming

2014-2017

2013-2016

2012-2015

2011-2014

ALL CURRENT

All Former

Copy-Paste-Tweak Development

Papers

This table is automatically generated. The generating BibTeX file is [here](#).

181 Publications

sorted by: [year](#); [then by...](#) • grouped as sorted

2012 (9)

- [Ahmed, A., Aly, M., Das, S., Karger, D., and Anastasakos, T.](#), *Web-Scale Multi-Task Feature Selection for Information and Knowledge Discovery* (Eds.), H. Wang (Eds.), 2012. ([here](#))

Text Search

Filter by category

Applications of Theory (26)

CHI (42)

Coding (21)

Crowdsourcing (5)

Cuts and Flows (38)

Databases (1)

Education (2)

Haystack (28)

Information Retrieval (56)

Machine Learning (16)

Mechanism Design (4)

P2P (23)

Scheduling (2)

Semantic Web (33)

205 Publications

filter by type

inproceedings (120)

article (34)

incollection (20)

book (5)

journal (1)

techreport (1)

filter by year

1997 (4)

1998 (13)

Daniel Abadi's Publications

sorted by: [year](#); [then by...](#) • grouped as sorted

Search

Publication Type

- Conference Paper
- Demonstration
- Journal Article
- Panel Presentation
- Technical Report
- Thesis

Venue

- (missing this field)
- ACM
- CIDR
- EDBT
- Foundations and Trends in Databases
- ICDE

Award

- 38 (missing this field)
- 2008 SIGMOD Jim Gray Doctoral Dissertation Award
- Best Paper Award

LIST • TIMELINE

year

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Copy-Paste-Tweak Development

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2012 (9)

1. Ahmed, A., Aly, M., Das, A., Smola, A. J., and Anastasakos, T., *Web-Scale Multi-Task Feature Selection for Behavioral Targeting*, Conference on Information and Knowledge Management {CIKM}, G. Lebanon and M. Zaki and H. Wang (Eds.), 2012. ([link](#))
2. Ahmed, A., Aly, M., Gonzalez, J., Narayananamurthy, S., and Smola, A. J., *Scalable inference in latent variable models*, WSDM '12: Proceedings of the fifth ACM international conference on Web search and data mining, ACM, New York, NY, USA pp.123--132, 2012. ([link](#))
3. Matsushima, S., Vishwanathan, S. V. N., and Smola, A. J., *Linear support vector machines via dual cached loops*, International Conference on Knowledge Discovery and Data Mining, Q. Yang and D. Agarwal and J. Pei (Eds.), ACM, pp.177--185, 2012. ([link](#))
4. Hong, L., Ahmed, A., Gurumurthy, S., Smola, A. J., and Tsoutsouliklis, K., *Discovering geographical topics in the twitter stream*, World Wide Web Conference, A. Mille and F. L. Gandon and J. Misselis and M. Rabinovich and S. Staab (Eds.), ACM, pp.769--778, 2012. ([link](#))
5. Yang, S.-H., Smola, A. J., Long, B., Zha, H., and Chang, Y., *Friend or frenemy?*:

[filter by type](#)

inproceedings (120)
article (34)
incollection (20)
book (5)
journal (1)
techreport (1)

[filter by year](#)

1997 (4)
1998 (13)
1999 (17)
2000 (14)
2001 (7)
2002 (10)
2003 (14)
2004 (7)
2005 (11)
2006 (13)
2007 (11)
2008 (13)
2009 (15)
2010 (13)
2011 (10)
2012 (9)

[filter by author](#)

(missing this field)
Agarwal, D. (1)
Ahmed, A. (8)

95 Publications

sorted by: [year](#); [then by...](#) • grouped as sorted

2014 (3)

1. Chwialkowski, K. and Gretton, A., *A Kernel Independence Test for Random Processes*, ArXiv e-prints, , 2014. ([link](#))
2. Muandet, K., Fukumizu, K., Sriperumbudur, B., Gretton, A., and Schoelkopf, B., *Kernel Mean Estimation and Stein Effect*, ICML, 2014. ([PDF](#))
3. Szabo, Z., Gretton, A., Poczos, B., and Sriperumbudur, B., *Consistent, Two-Stage Sampled Distribution Regression via Mean Embedding*, ArXiv e-prints, , 2014. ([link](#))

2013 (9)

1. Zaremba, W., Gretton, A., and Blaschko, M., *B-test: A Non-parametric, Low Variance Kernel Two-sample Test*, NIPS, 2013. ([link](#))

[filter by type](#)

inproceedings (4)
article (24)
techreport (18)
incollection (6)
phdthesis (1)

[filter by year](#)

1999 (1)
2001 (3)
2002 (1)
2003 (5)
2004 (4)
2005 (5)
2006 (5)
2007 (10)
2008 (15)
2009 (14)
2010 (6)
2011 (5)
2012 (9)
2013 (9)
2014 (3)

Daniel Abadi's Publications

40 Publications

sorted by: [year](#); [then by...](#) • grouped as sorted

2014 (1)

Query Optimization of Distributed Pattern Matching
Huang, Jiwen, Venkatraman, Kartik, and Abadi, Daniel J.
In ICDE
[PDF 446 KB] [bibtex]

2013 (3)

Modularity and Scalability in Calvin
Thomson, Alexander and Abadi, Daniel J.
In IEEE Data Eng. Bull.
[PDF 628 KB] [bibtex]

The Design and Implementation of Modern Column-Oriented Database Systems
Abadi, Daniel, Boncz, Peter, Harizopoulos, Stavros, Idreos, Stratos, and Madden, Samuel
In Foundations and Trends in Databases
[PDF 1997 KB] [bibtex]

117 **Invisible Loading: Access-Driven Data Transfer from Raw Files into Database Systems**
Abouzied, Azza, Abadi, Daniel J., and Silberschatz, Avi
In EDBT

Sam Madden's Publications

113 Publications

sorted by: [year](#); [then by...](#) • grouped as sorted

2013 (6)

Resource and Performance Prediction for Building a Next Generation Database CI

Proceedings of CIDR , 2013
Barzan Mozafari, Carlo Curino, and Samuel Madden
[download](#)

Explanatory Lineage

Proceedings of CIDR , 2013
Eugene Wu and Samuel Madden
[download](#)

StatusQuo: Making Familiar Abstractions Perform Using Program Analysis

Proceedings of CIDR , 2013
Alvin Cheung, Owen Arden, Samuel Madden, Andrew Myers, and Armando Solar-Lezama
[download](#)

Search

year

1 1999
1 2000
2 2001
5 2002
7 2003
7 2004
9 2005
11 2006
11 2007
13 2008
10 2009
11 2010
13 2011
6 2012

Design examples are crucial.

(Klemmer, Hartman '08, Herring '09, Srivastava '10)

Documentation

Users will follow the **documentation available**, even if it isn't right for them.

Data Formats used with Exhibit

Data Format	Count	Percent
JSON	1,246	69%
Google Spreadsheets	580	32%
Bibtex	38	2%
RDF	25	1.4%

So everyone is using JSON

Data Format	Count	Percent
JSON	1,246	69%

But our interview subjects

- 1) Didn't like JSON
- 2) Only exported to it from Excel.

So everyone is using JSON

Data Format	Count	Percent
JSON	1,246	69%

But our interview subjects

- 1) Didn't like JSON
- 2) Only exported to it from Excel.
- 3) Didn't realize Exhibit supports Excel

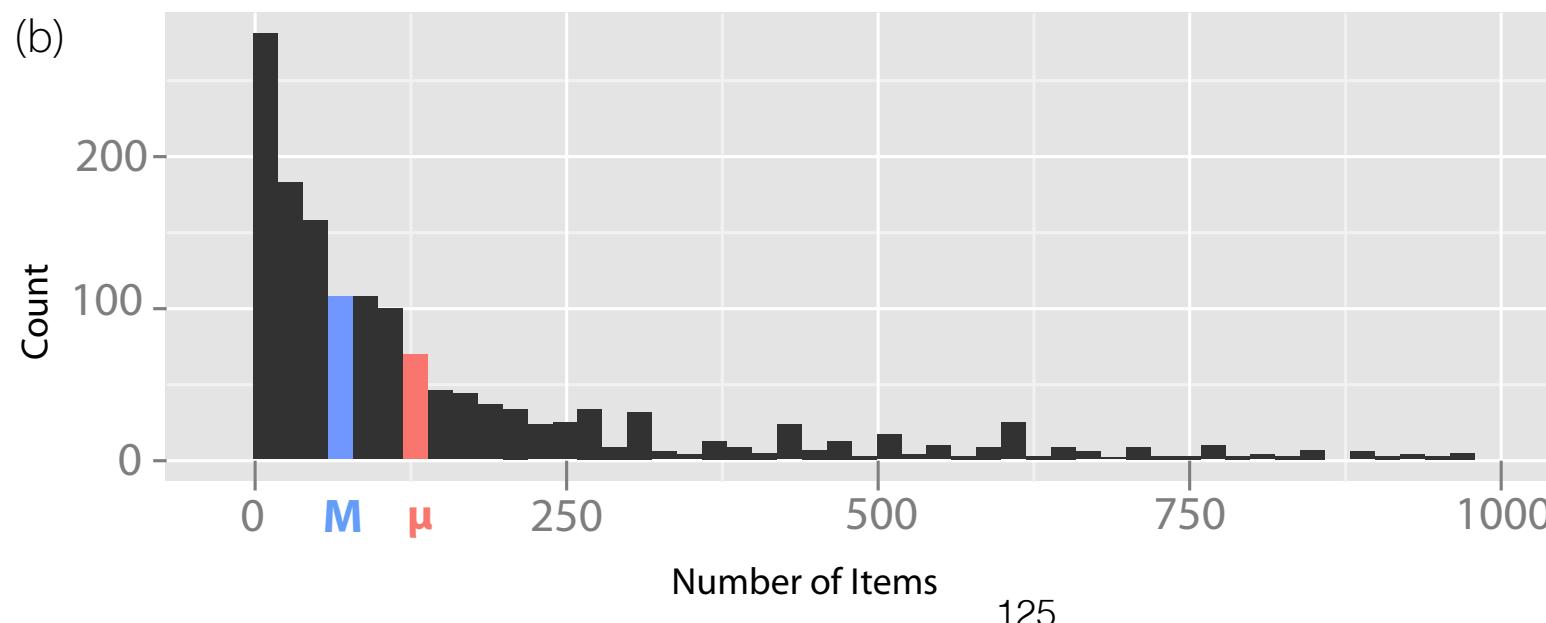
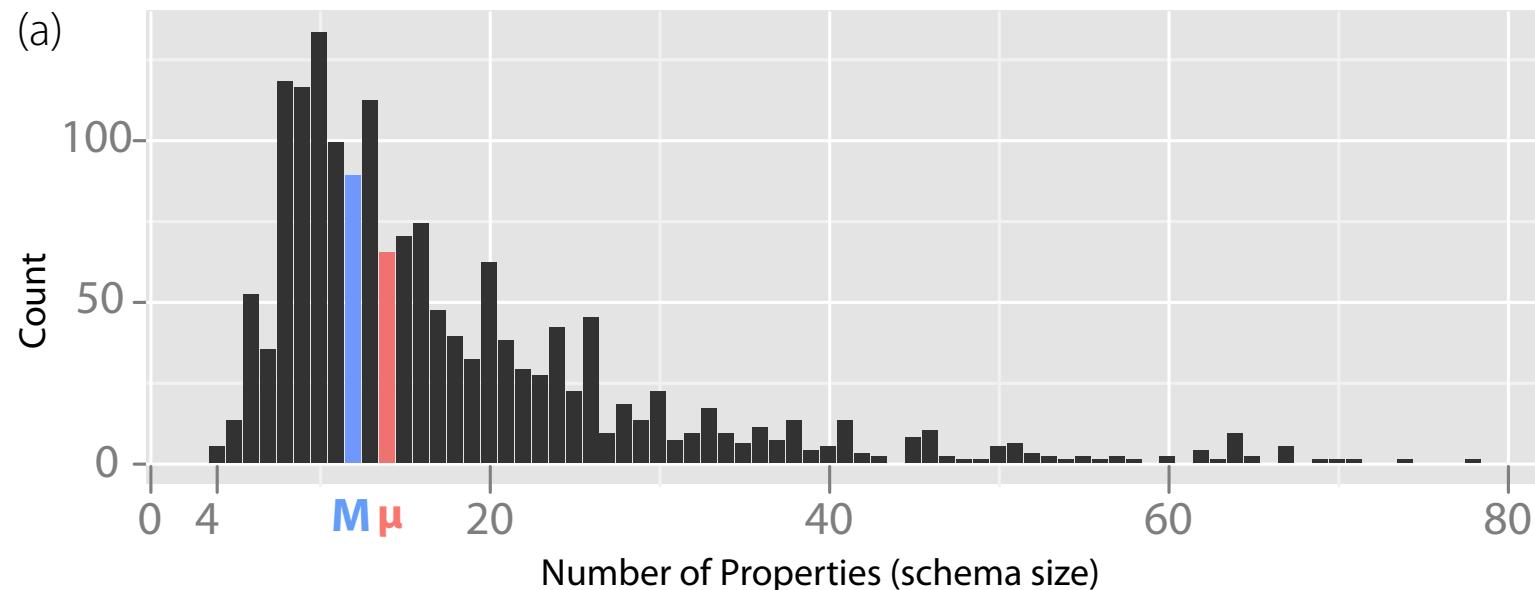
Tutorial Wiki

- Easy to find JSON examples.
- Hard to find any mention of familiar formats (like excel)

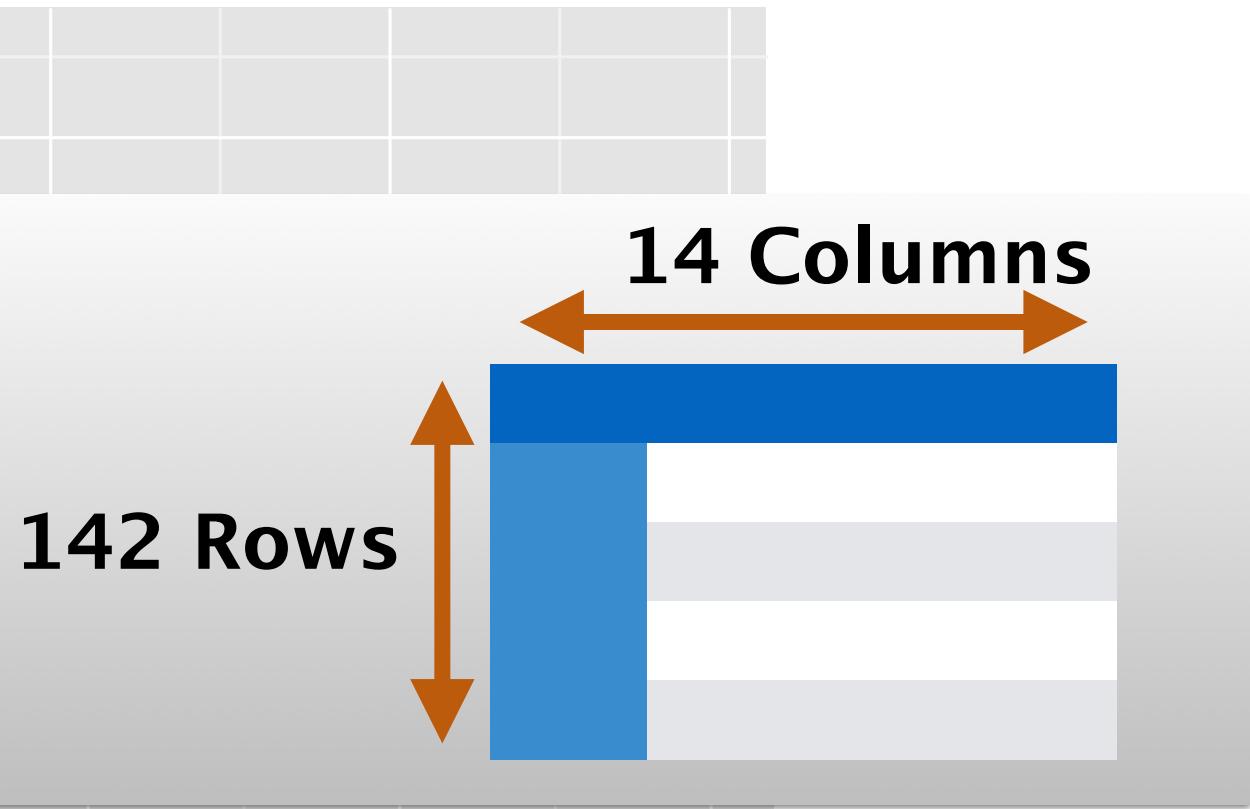
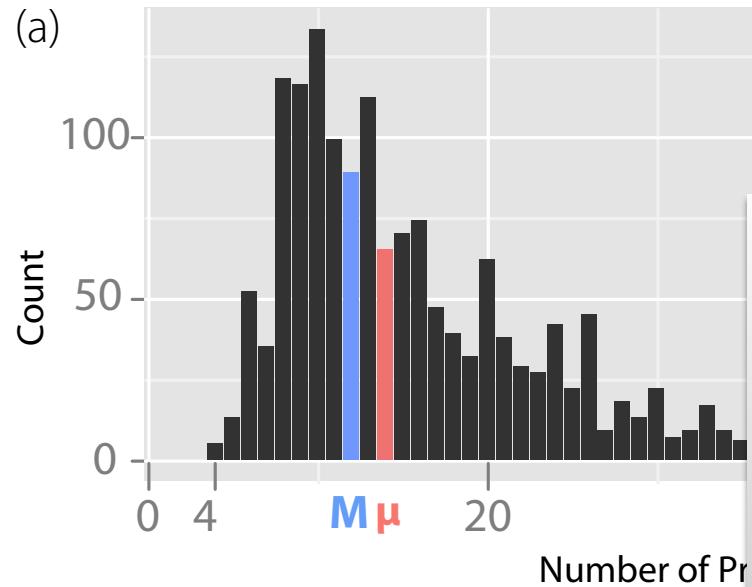
[Weiss 2010]

people

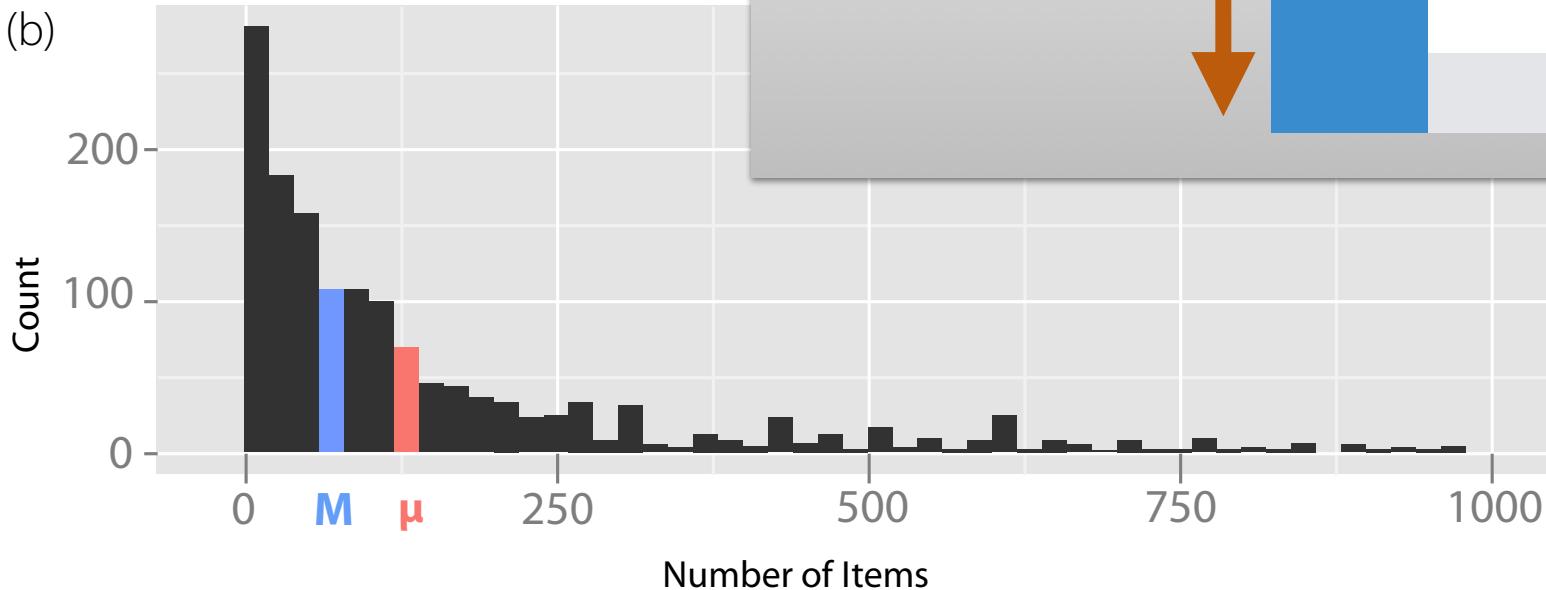
Design examples are crucial.
Document the simple case first.

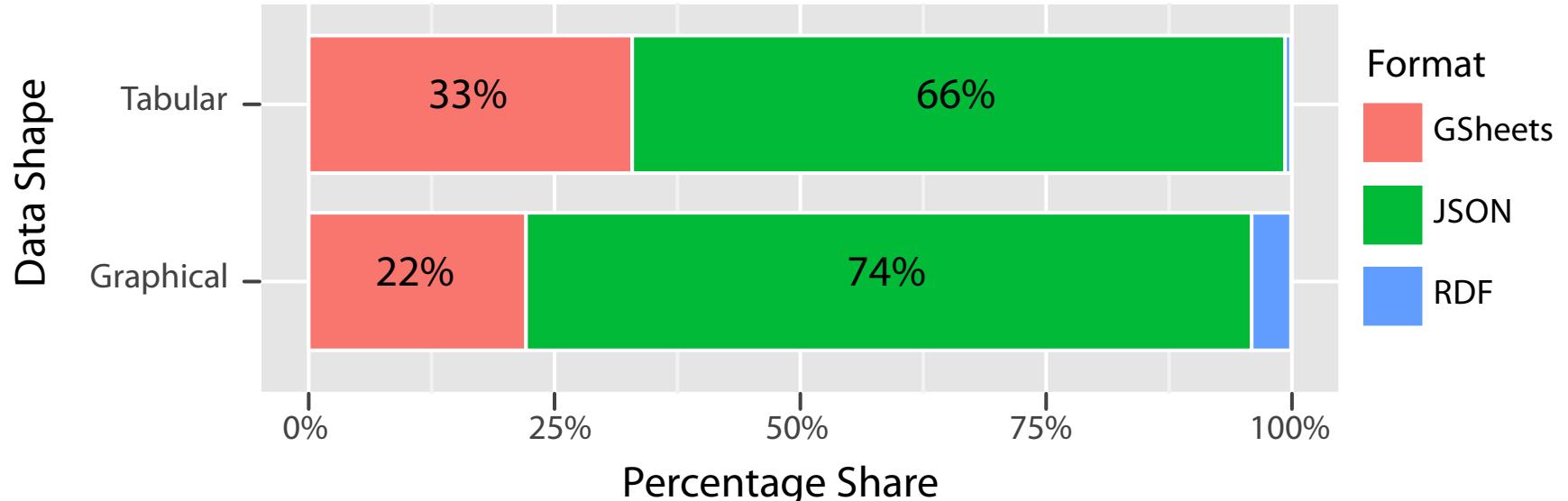


(a)

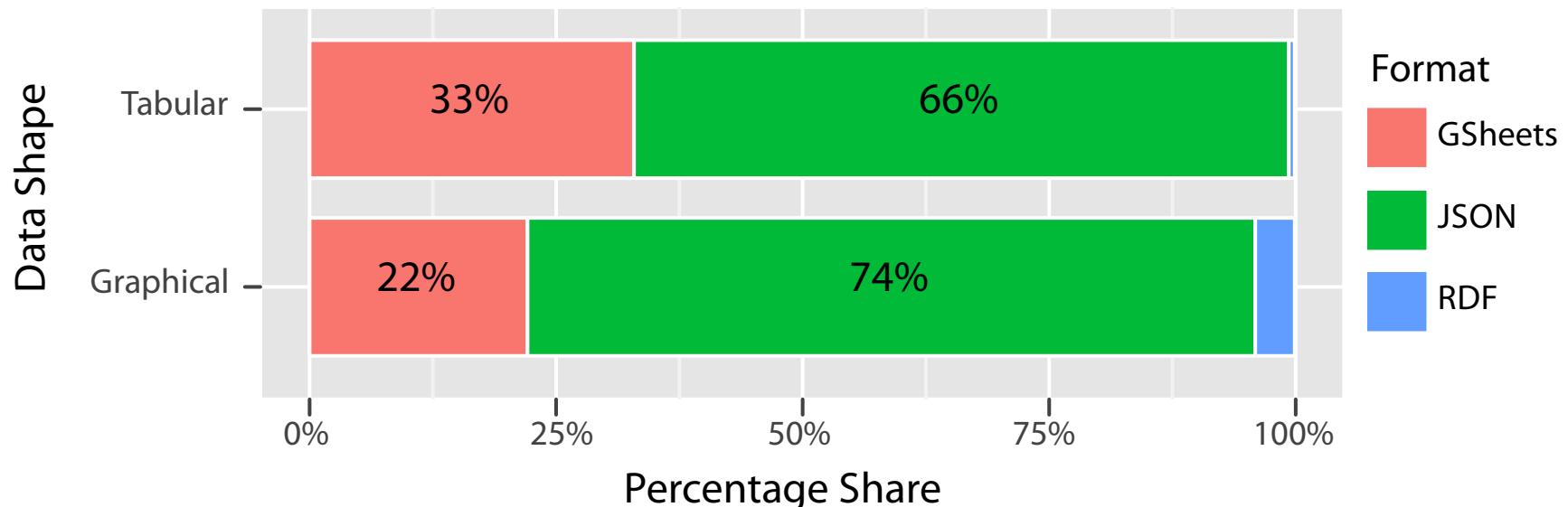


(b)





2. Many are “using” spreadsheets to author graphical data



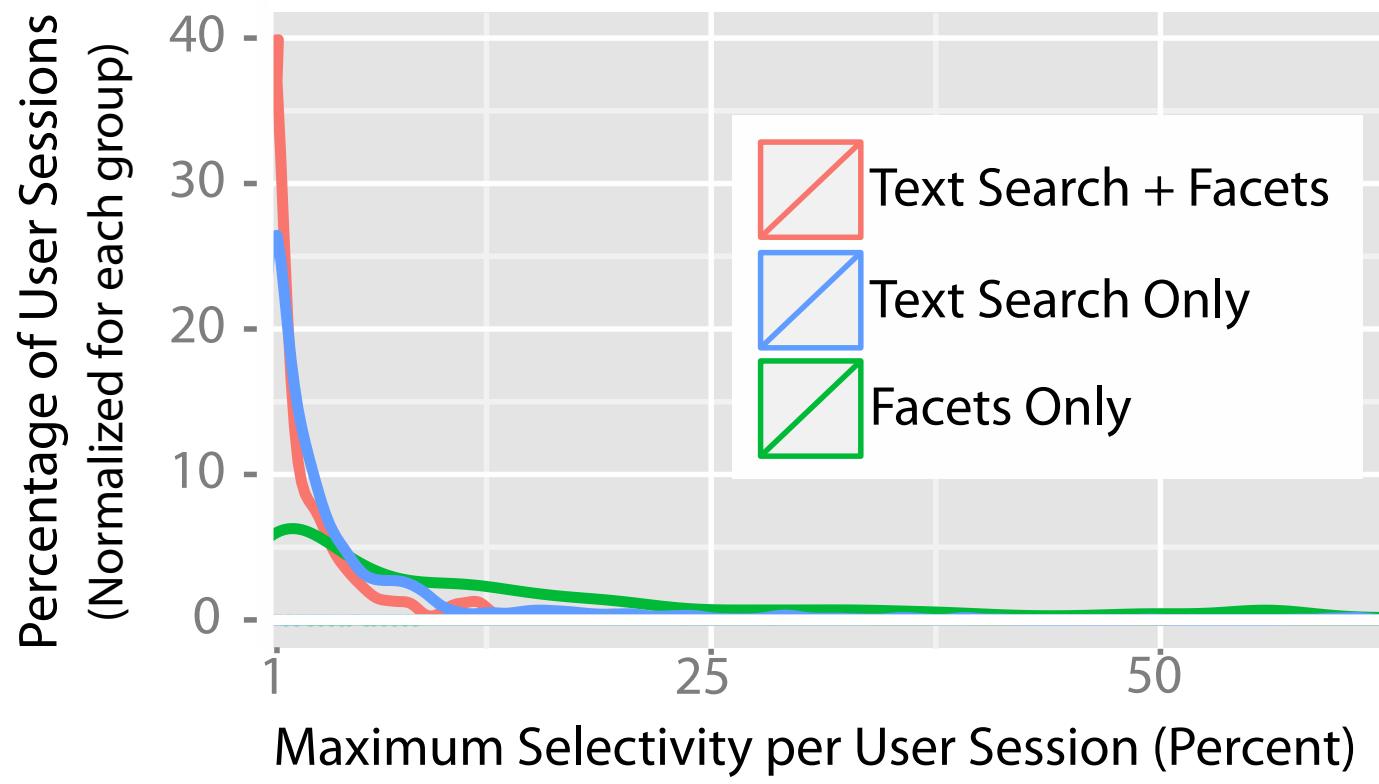
Those that don't are stuck unhappily with JSON

I taught a course where we built [Exhibits] from JSON files, instead of Google Spreadsheets...and students unfamiliar with programming just found it too tedious and too difficult to chase after every missed comma and every unequal bracket...it defeated too many of them...quite a few just sort of threw up their hands in defeat

-> These users need better support for super-tabular data in their spreadsheet software

Usage

Does facet choice affect browsing habits?

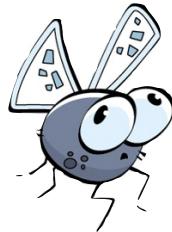


Usage

People **do** interact if interaction is available.

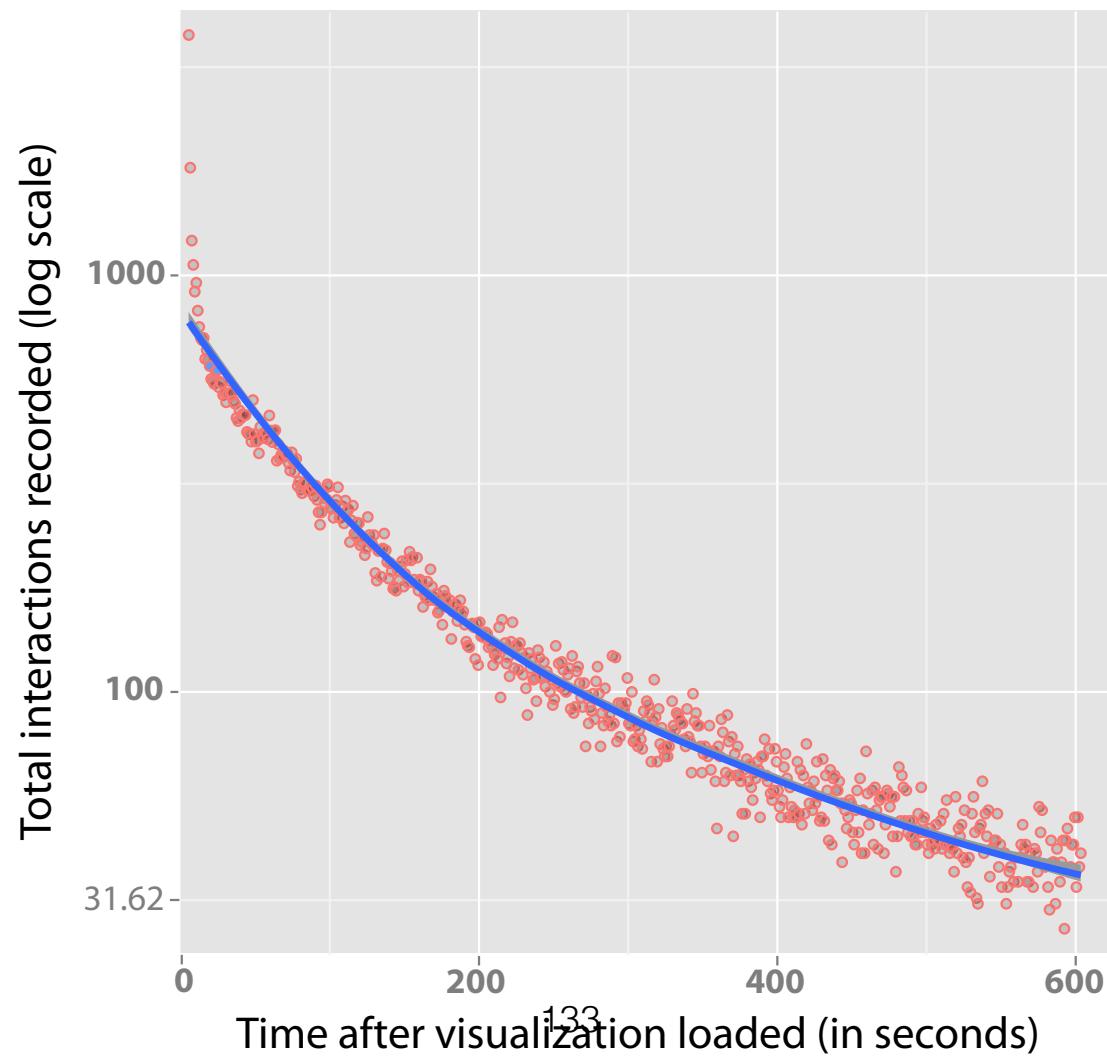
A lot of opportunity to measure and learn from these interactions

Usage

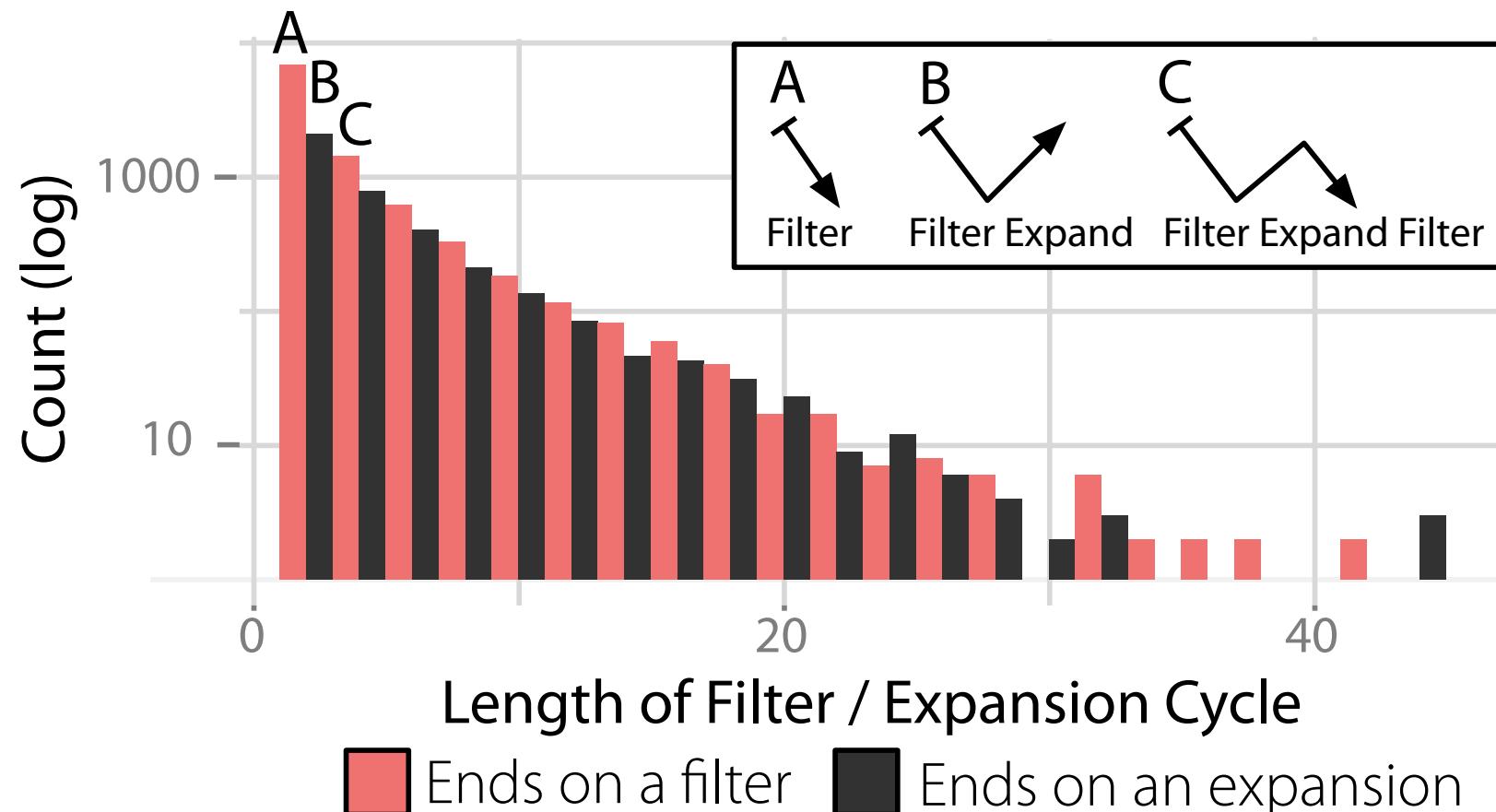


57 Exhibits
266k Usage Events

How long do users interact?



Users “zig in and zag out”



Users interact with data when it is a possibility.
Opportunities for visualization analytics.

usage

MIT DEPARTMENT OF PHYSICS

News About Prospective Students Current Students Subjects Research People Events Giving Policies



people

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[Postdoctoral Scholars](#)

[Departmental
Committees](#)

[Society of Physics
Students ↗](#)

[Physics Graduate
Students Council ↗](#)

[Undergraduate Women
in Physics ↗](#)

[Graduate Women in
Physics ↗](#)

Faculty Directory

If you do not have javascript enabled, [click here](#).

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FACULTY

Emeritus

All Faculty

Astrophysics
Atomic, Biophysics,
Condensed Matter,
and Plasma Physics

MIT DEPARTMENT OF PHYSICS

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people

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Postdoctoral Scholars

Departmental
Committees

Society of Physics
Students ↗

Physics Graduate
Students Council ↗

Undergraduate Women
in Physics ↗

Linked Dataset download and analyze

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MIT DEPARTMENT OF PHYSICS

Visualization declarative, standard widget set

people

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FACULTY

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MIT DEPARTMENT OF PHYSICS

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people

Faculty Directory

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Surrounding Page design and publication analysis



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FACULTY

BEGINNING
Full Faculty

Astrophysics
Atomic, Biophysics,
Condensed Matter,
and Plasma Physics

Undergraduate Women
in Physics ↗

Exhibit

data file + special html



Exhibit

data file + special html

