

# data science & the design process

problem solving in the face of ambiguity

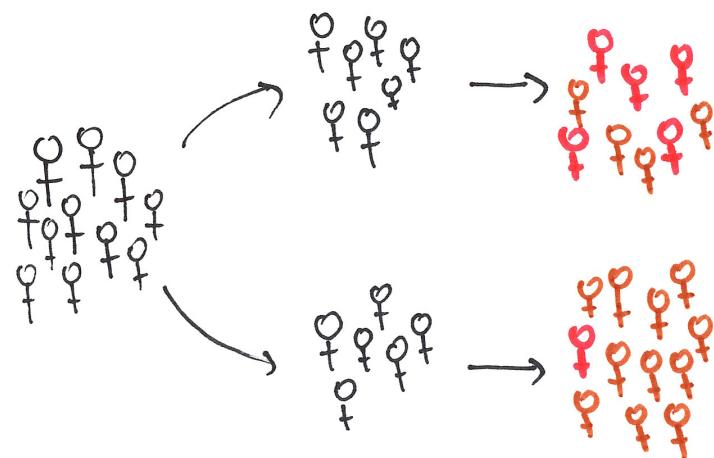
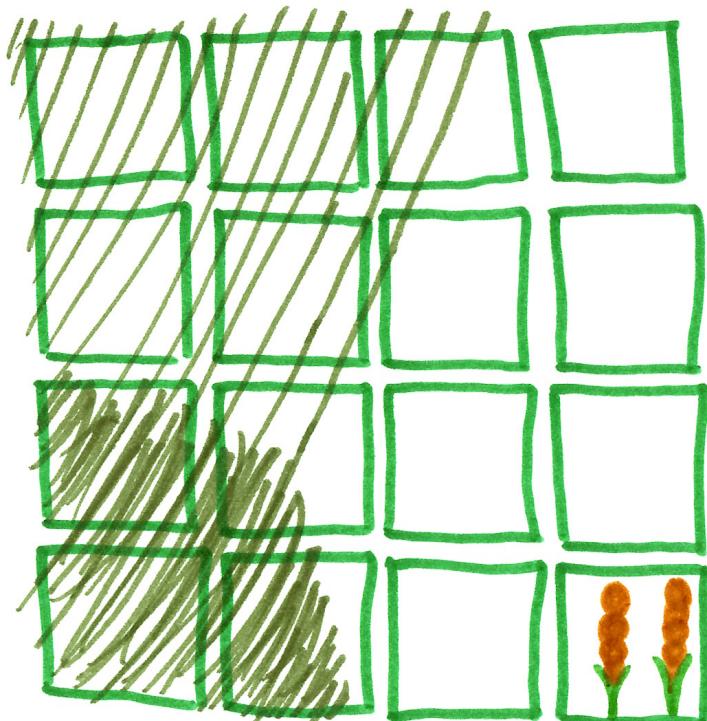
Bo Peng



design.

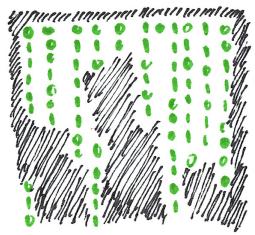


# experimental design.



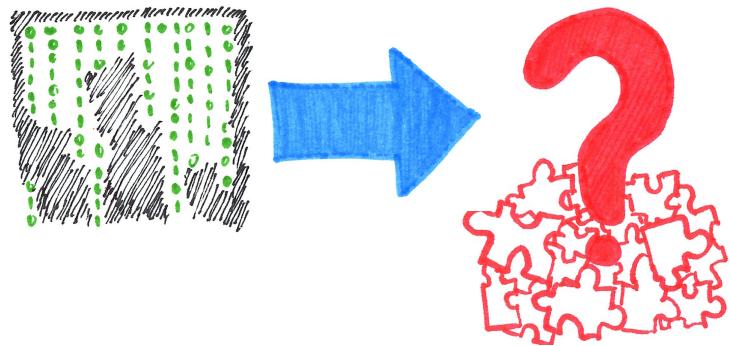
design is a process.

O. data

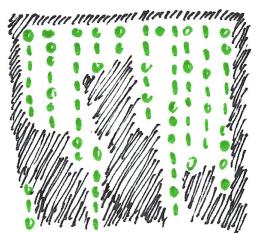


0. data

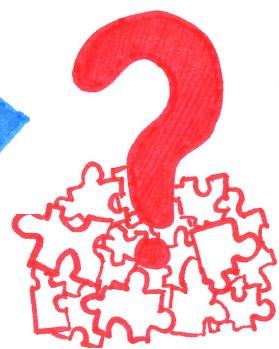
1. problem



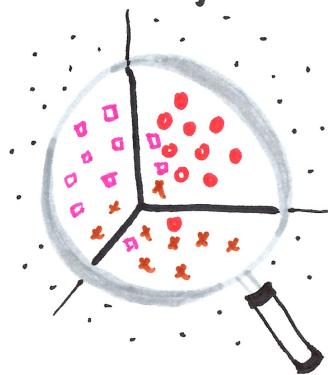
0. data

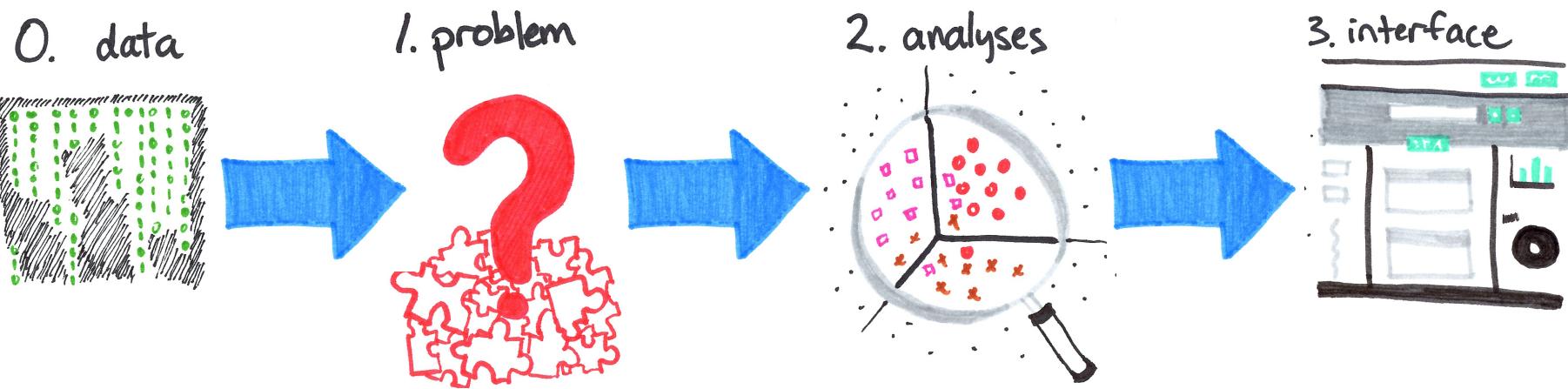


1. problem



2. analyses





0. data



1. problem



**LINEAR**

2. analyses



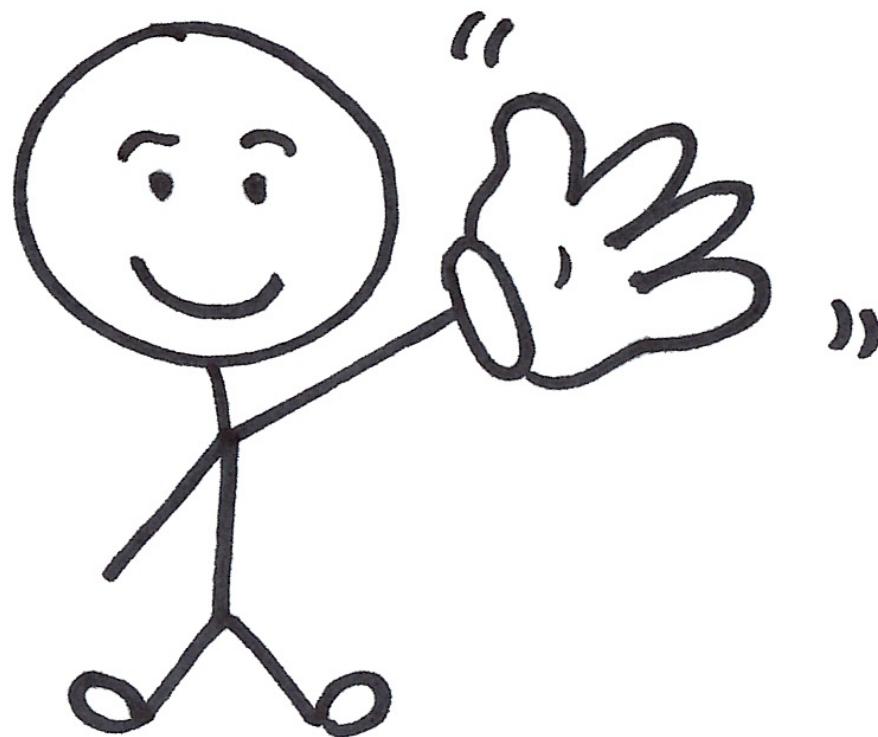
3. interface



# the design process - an overview

# our design process - an overview

end user



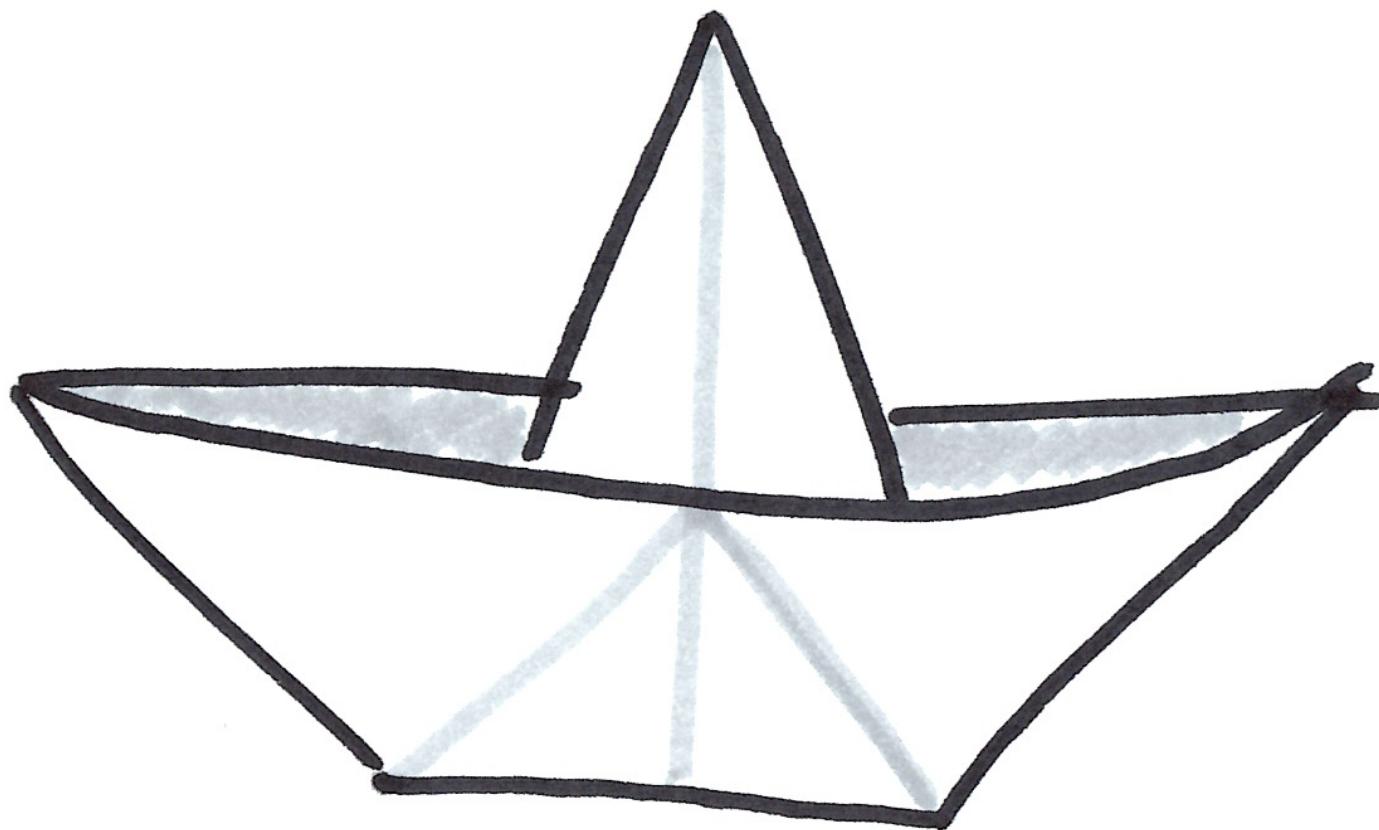
# our design process - an overview

brainstorm



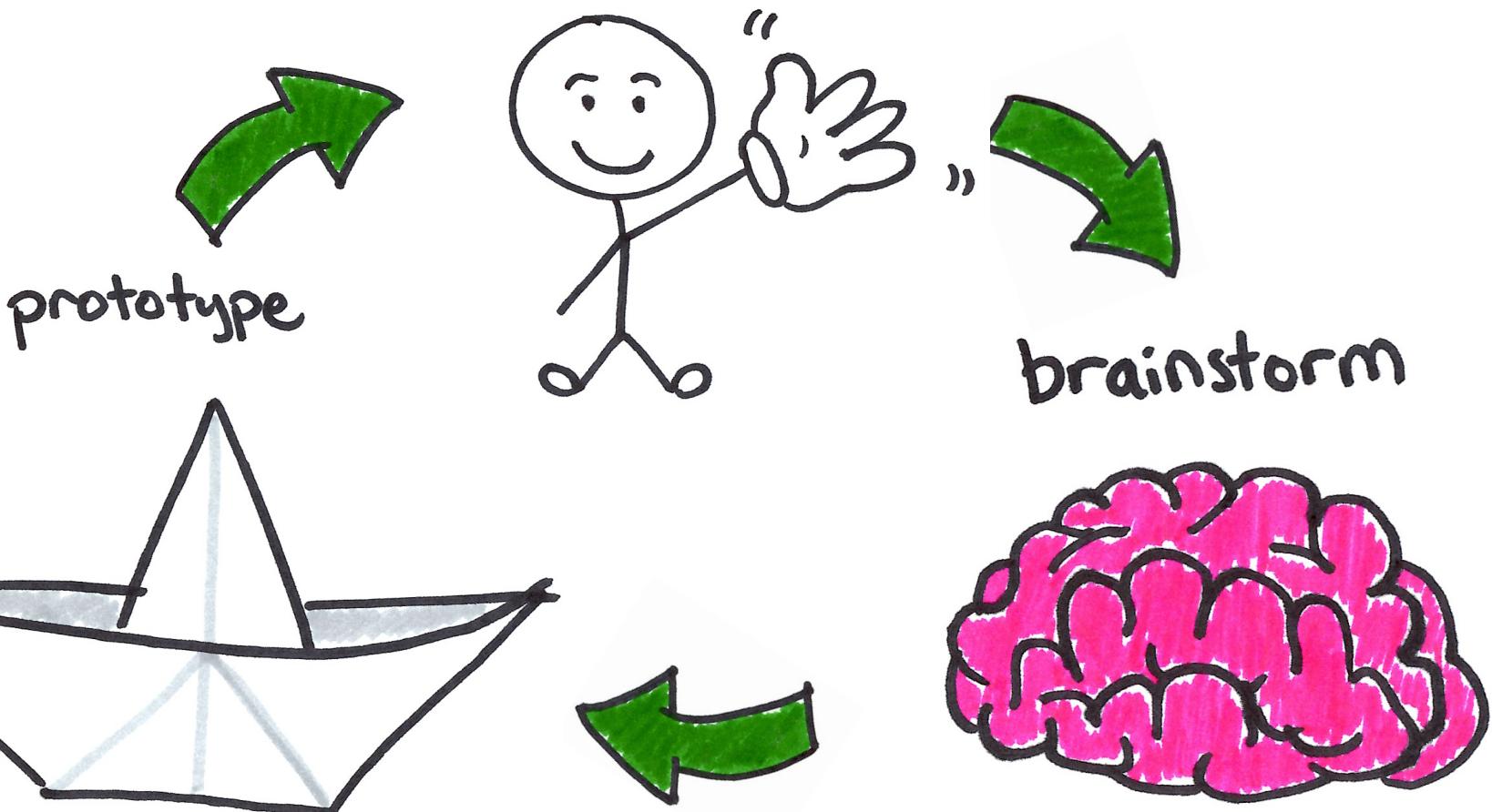
# our design process - an overview

prototype



# iterate, iterate, iterate

end user



and now, the example.

informal beginnings



# the client

- fortune 50 international company
- major restructuring of 20,000+ personnel



# initial brainstorm

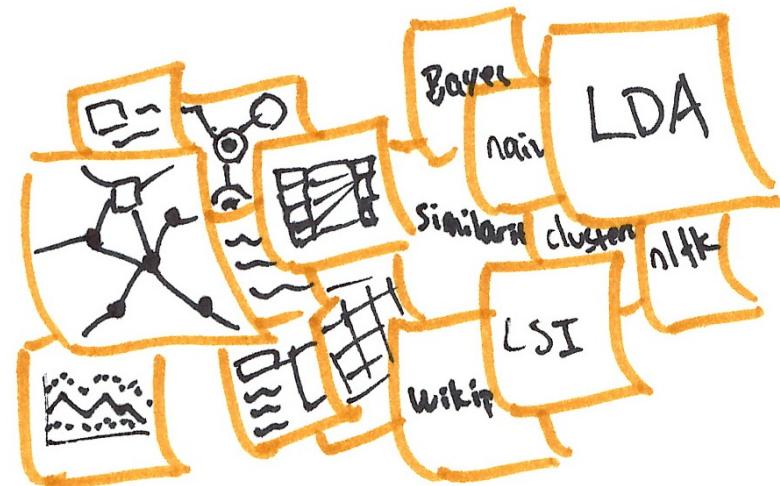


# initial brainstorm

## Data Sources?

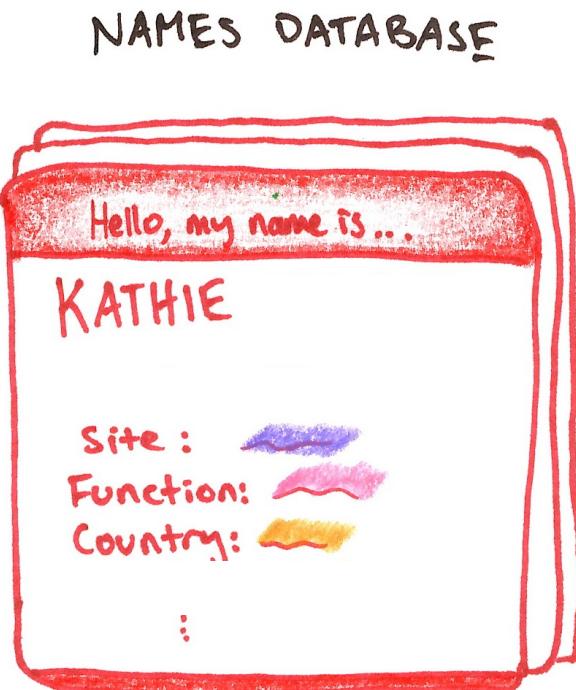


## Visuals & analyses?



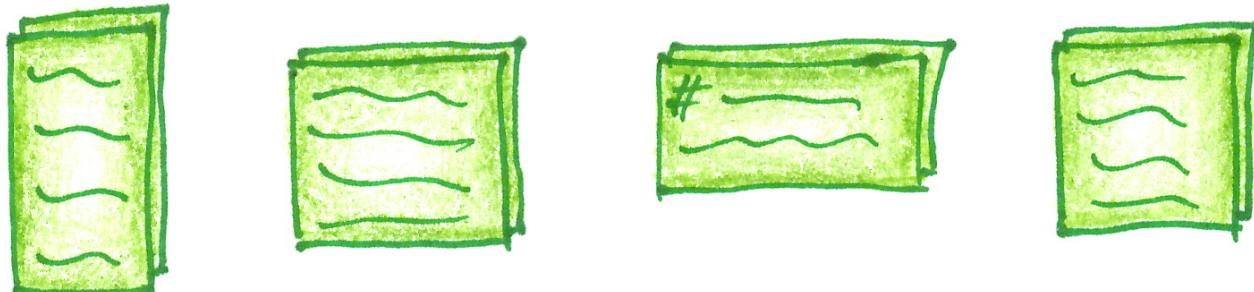
# the data

- every person has attributes: function, location, division, etc

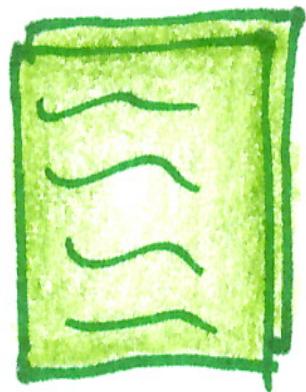


# the data

- everyone is encouraged to write about their work
- when people write, they are encouraged to write together
- most people took a survey



# example data



On Chemical X and  
its Y-related effects on diaper absorption

**Author: Charlie Brown**

**Date: 31 Jan 2012**

Lorem Ipsum is a dummy text used when typesetting or marking up documents. It has a long history starting from the 1500s and is still used in digital millennium for typesetting electronic documents, page designs, etc.

In itself, the original text of Lorem Ipsum might have been taken from an ancient Latin book that was written about 50 BC. Nevertheless, Lorem Ipsum's words have been changed so they don't read as a proper text.

Naturally, page designs that are made for text documents must contain some text rather than placeholder dots or something else. However, should they contain a proper English words and sentences almost every reader will deliberately try to interpret it eventually missing the design itself.

However, a placeholder text must have a natural distribution of letters and punctuation or otherwise the markup will look strange and unnatural. That's what Lorem Ipsum helps to achieve.

I would like to thank **Peppermint Patty** for her support on studying Chemical X, as well the infinite wisdom of

**Linus van Pelt** and his willingness to use his blanket in my experiments.

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# project goals - v. 1

reveal areas of expertise



- Reveal latent areas of expertise within Transformations

Given that it is difficult to keep up with your closest friends' hobbies and passions, imagine the difficulty in

# project goals - v. 1

evaluate connectivity of subject matter experts

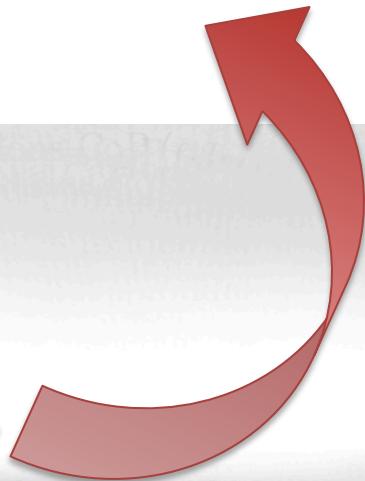
**Evaluate connectivity of subject matter experts**



# project goals - v. 1

management directed subject matter connections

**Management-directed subject matter connections**

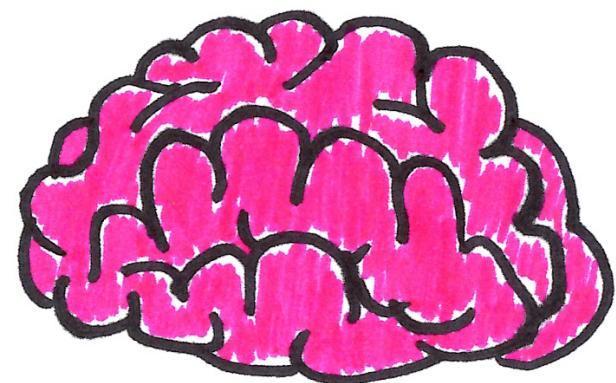


# consider the end user

original use case: to help Kathie connect people



# brainstorm



GOALS  
HABITS  
(IN GREEN)?  
WHO IS A  
GOLD DIGGER?  
WHO TO INVITE?

GROUP / INDIVIDUAL  
Q&A

is the  
community helping?

CLOSELY  
CONNECTED  
TEAMS  
LARGE  
COMM.

FEELING MORE  
INVOLVED/  
INVOLVED  
IN TEAM

DIVERSITY OF  
EXPERIENCE  
ARE  
HIGHLY  
VALUED

WORK OF  
EXTERNAL  
COMPANIES

MULTIPLE  
COLLABORATION  
PROJECTS

multiple  
collaborating  
long ago

PEOPLE HAVE  
DIFFERENT  
INTERESTS  
& NEEDS

Natural  
respect  
mutual  
cognition  
syndicated  
connected  
but not  
SLR connected

Successful  
products  
the results are  
big for them  
WHAT IS  
Productivity?  
A score?  
SPEED TO  
MARKET  
of a company  
including  
GOALS  
NUMBER/ABILITY  
TO APPLY THEM

nuclei of collab.  
Collaboration  
that becomes  
commonplace  
over time  
with increasing  
number of  
participants

POTENTIAL  
good products?  
successful  
products

HMW IDENTIFY  
SYMPTOMS OF  
PRODUCTIVE  
COLLABORATION?

HMW QUANTIFY/  
IDENTIFY STRENGTH OF  
COLLABORATIONS?  
(GOOD - BAD)

INDIVIDUAL LVR  
bring knowledge  
& reapply

molding printing stuff

HMW IDENTIFY  
MECHANISMS OF  
SHARING/  
MARKETING  
IDEAS?

HMW IDENTIFY  
IDEAS THAT ARE  
NOT SHARED

func, org  
site  
level  
(matrix)

HMW QUANTIFY  
IN KNOWLEDGE  
TRANSFER  
(DEVELOPMENT OF METRICS)

other people action  
sharing other  
first we do  
influence  
team

Organization  
(FEM CAKE)

"FEM CAKE"

Expert  
Finder  
individual  
level

GOAL

HMW IDENTIFY/  
QUANTIFY  
AWARENESS OF  
NEW KNOWLEDGE

Mine  
Sources/Cited  
(Individual)

SLR no  
SLR for  
count  
BRAD  
in THE  
MAN

First appear  
in community  
and then  
published

FREQUENCY  
OF QUALITY  
PUBLICATIONS

BRAIN STORM

CO  
R&D  
R&D  
R&D  
R&D

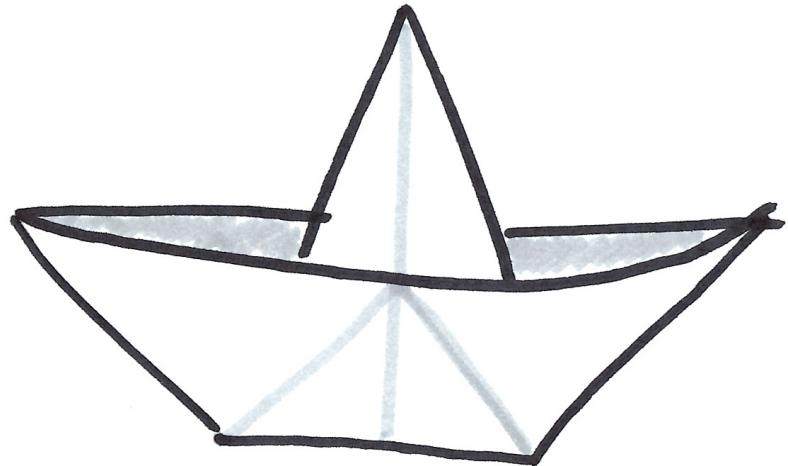
Individual-level  
term  
genesis

Starkey

sky

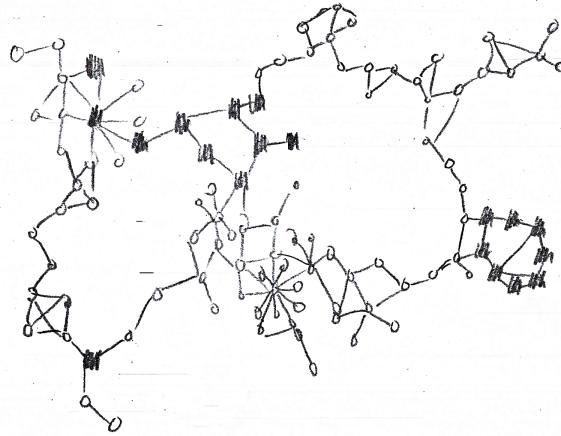
- citations

then, prototype



Subject matter experts

- Extrusion
- Nanofibers
- Machining
- Web handling
- Manufacturing



Brown, Chuck

TU7263

Location: Cincinnati, OH USA

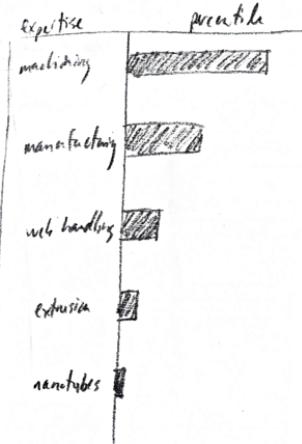
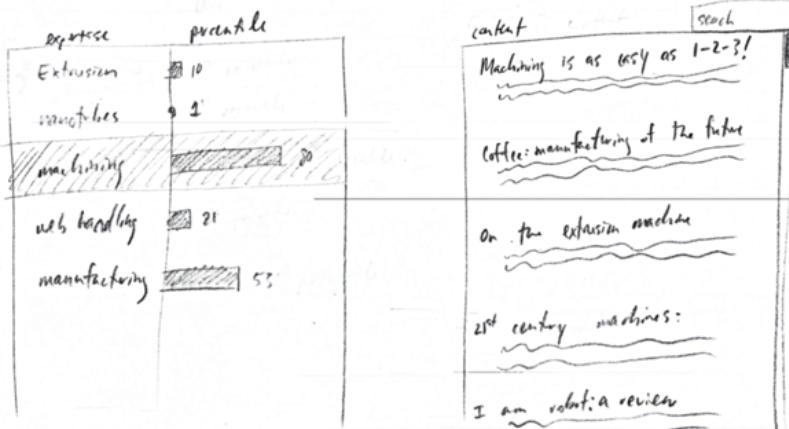
Education: University of Maryland

Band: 4

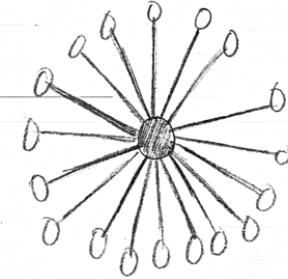


GBU: Design

Products: Tide



connected By	
<input checked="" type="checkbox"/>	survey
<input checked="" type="checkbox"/>	coauthors
<input type="checkbox"/>	coexpertise
Russell, Bill	
Worthy, James	
Liberon, James	
Jordan, Michael	
Lange, Brian	
Pippen, Scotia	
Grant, Horace	
Cartwright, Bill	



Asker: Jim Jamson

Anyone done work on using  
nonwoven fabrics in packaging?  
#Transformations

Find

Top recommended:



Hob Jobson

3 reports on nonwoven fabrics

2 wiki answers on "non wovens"

✉ email

You've emailed  
Hob 4 times in the  
last year

Subject matter experts

- Extrusion
- Nanofibers
- Machining
- Web handling
- Manufacturing

# research & testing



Brown, Chuck  
TU7263

Location: Cincinnati, OH USA  
Education: University of Maryland  
Band: 4



GBU: Design  
Products: Tide



Asker: Jim Jamson

Anyone done work on using  
nonwoven fabrics in packaging?  
& Transformations

Find

Top recommended:

Hob Jobson

3 SLS reports on nonwoven fabrics

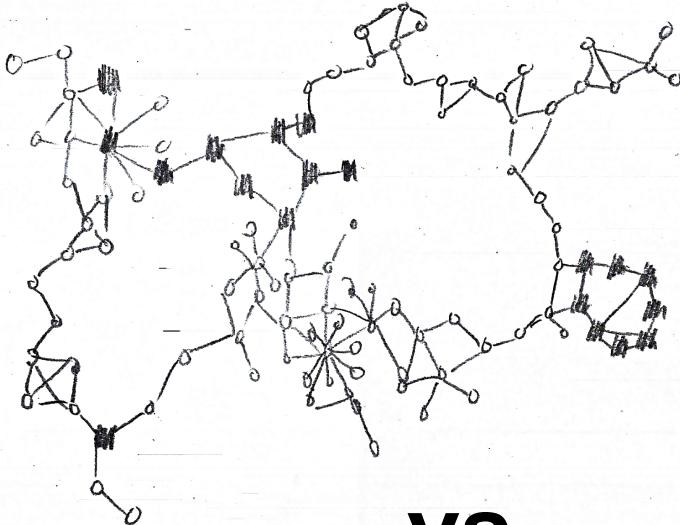
2 wiki answers on "non wovens"

email

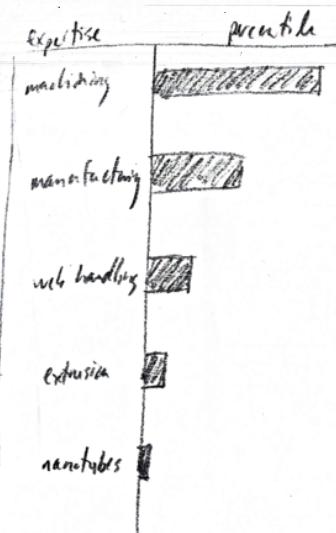
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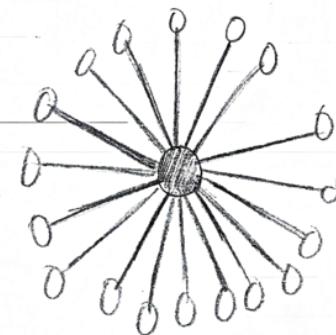
**VS.**

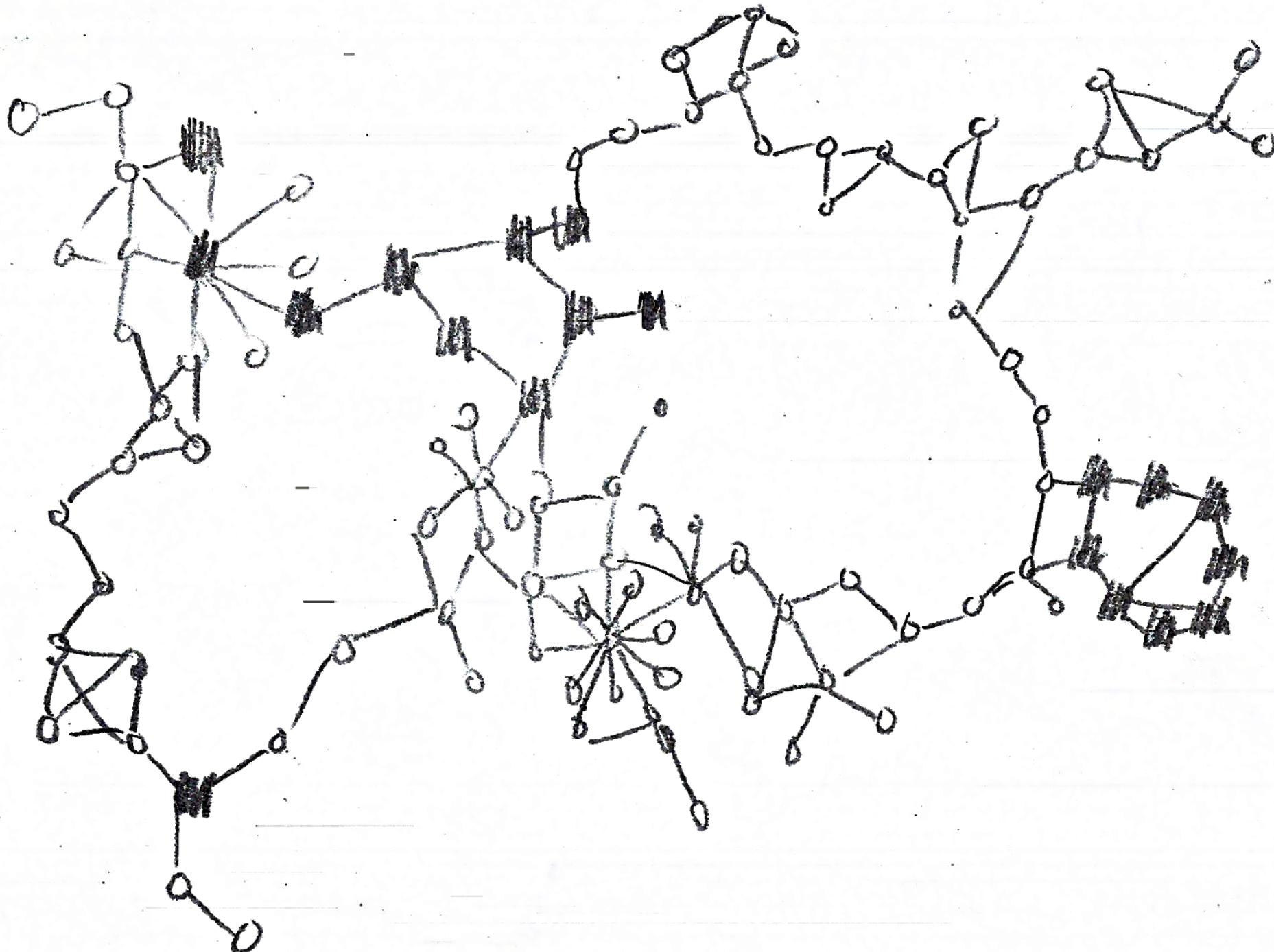


connected by

- survey
- coauthors
- corexpertise

Russell, Bill  
Worthy, James  
Lebron, James  
Jordan, Michael  
Lange, Brian  
Pipkin, Scottish  
Grant, Horace  
Cartwright, Bill





## Subject matter experts

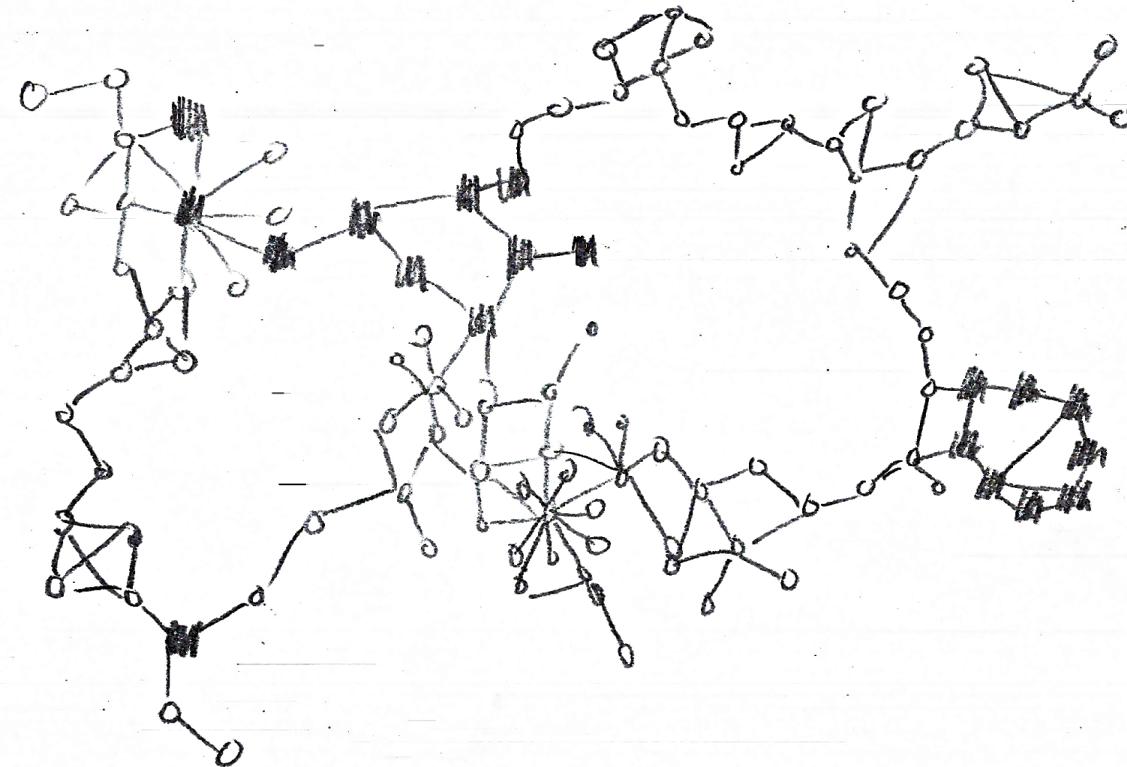
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Subject matter experts

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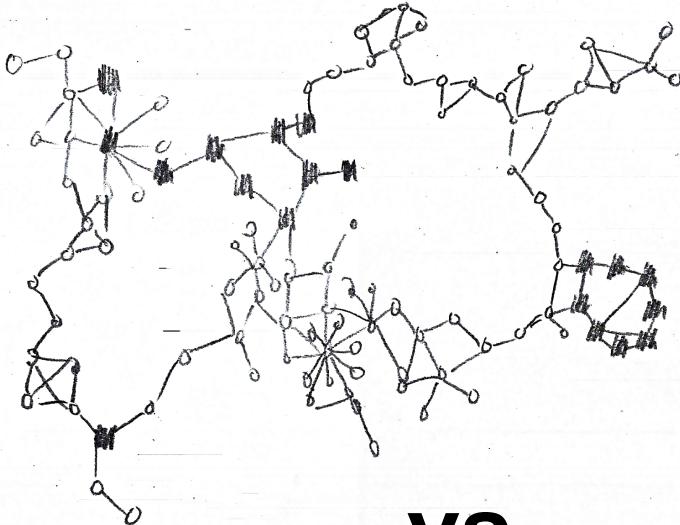
Subject matter experts

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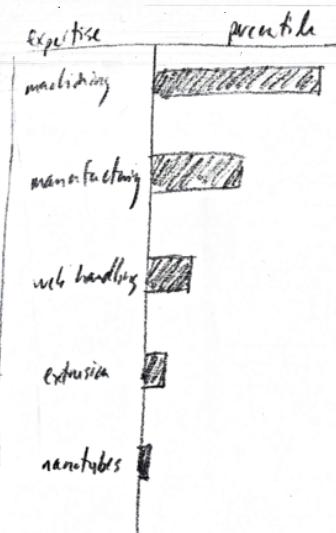


Subject matter experts

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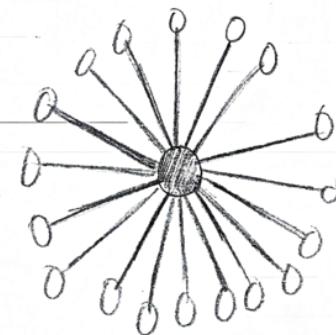
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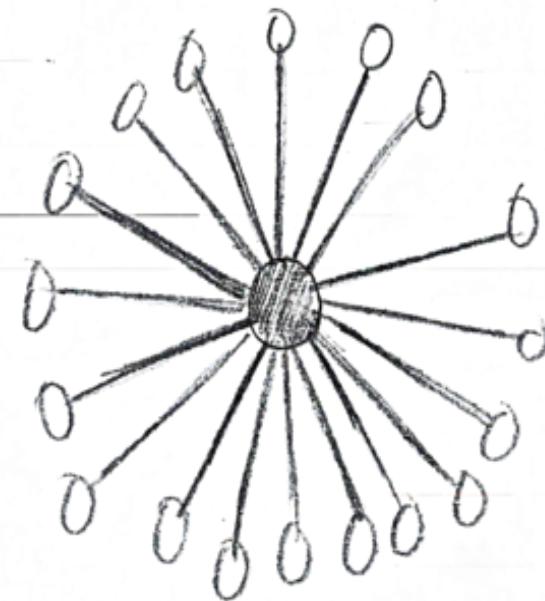
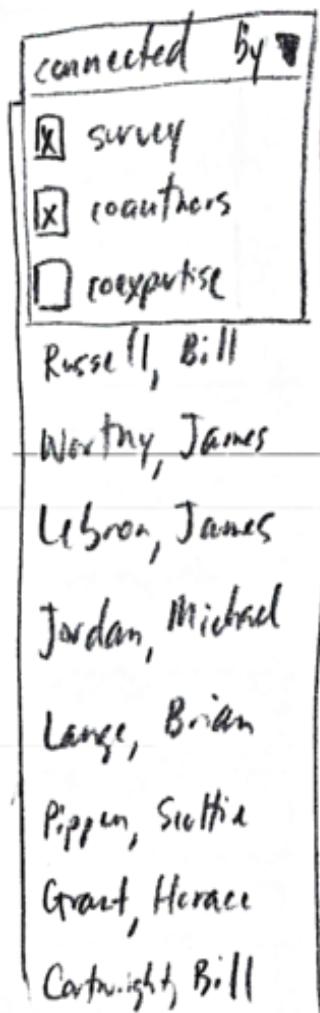
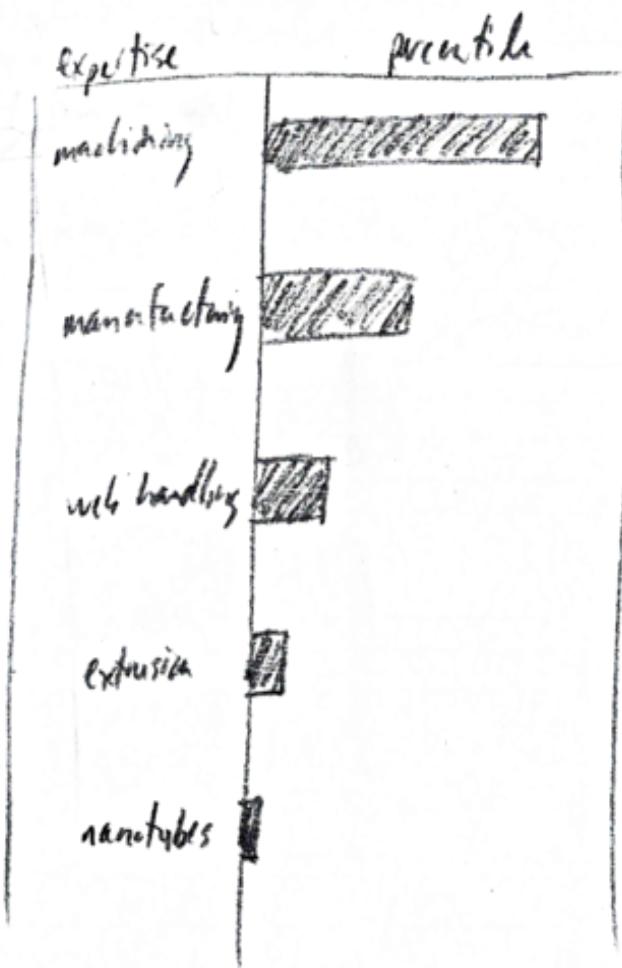


connected by

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Russell, Bill  
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Grant, Horace  
Cartwright, Bill





connected by ▼

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- co-expertise

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- coexpertise

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Worthy, James

Lebron, James

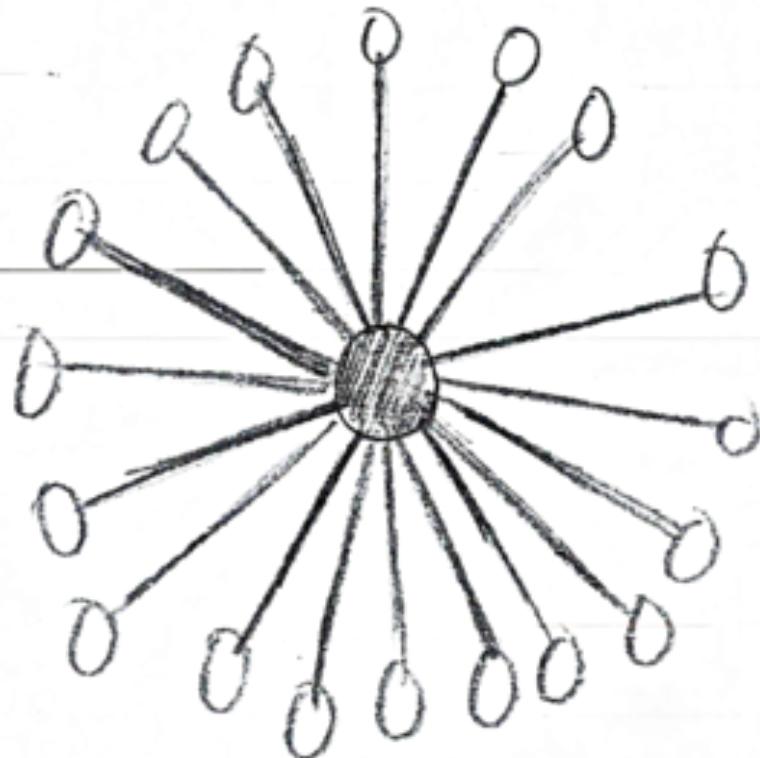
Jordan, Michael

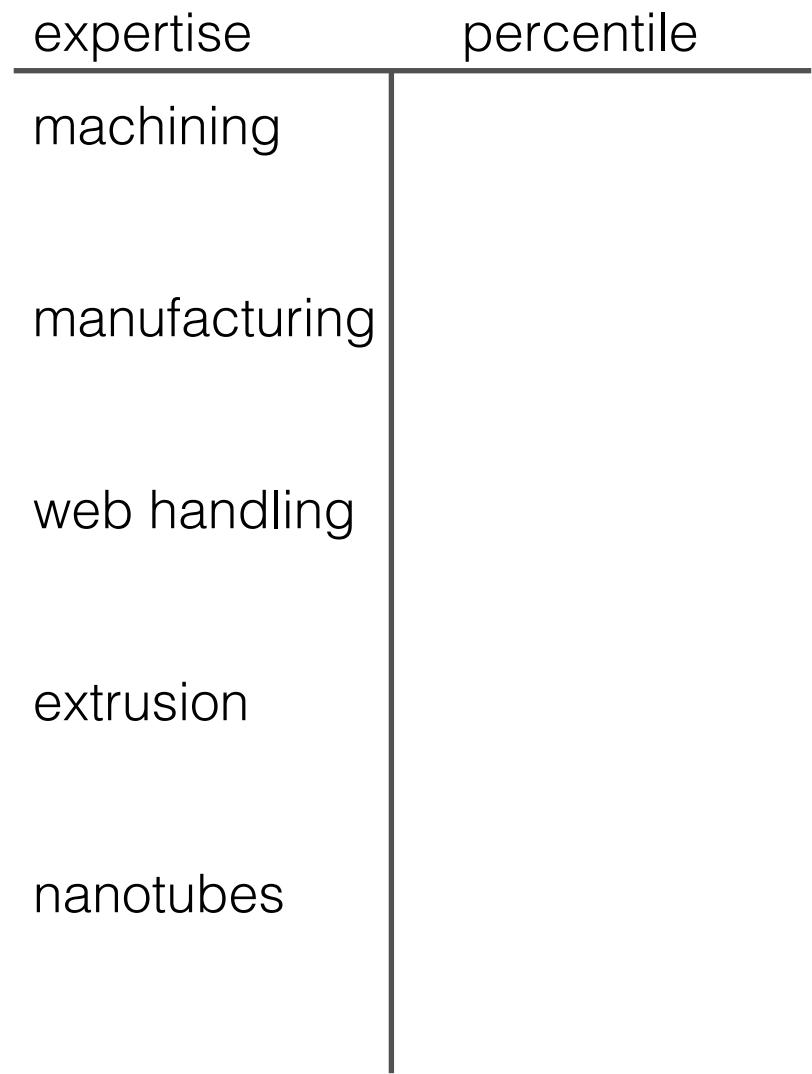
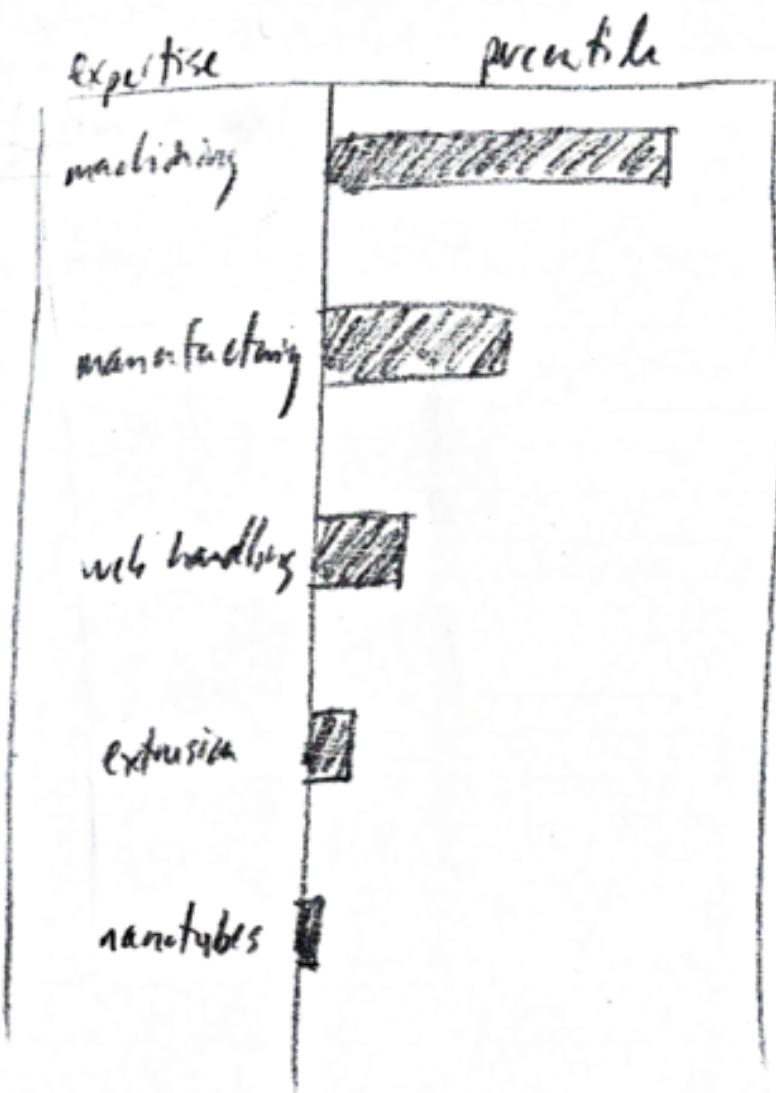
Lange, Brian

Pippen, Scottie

Grant, Horace

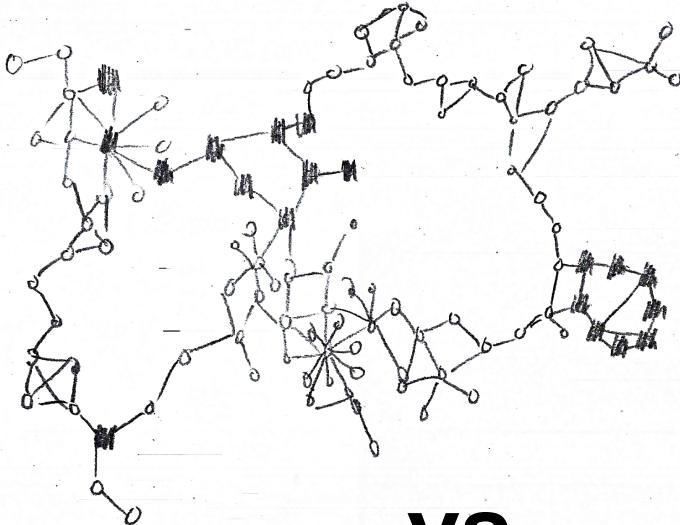
Cartwright, Bill



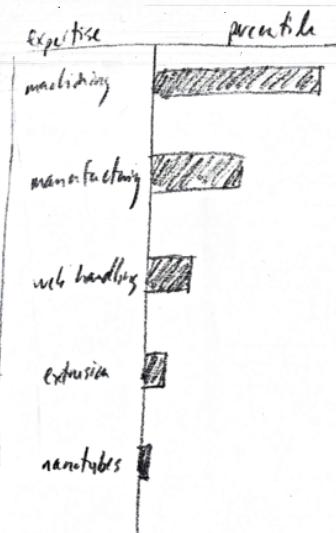


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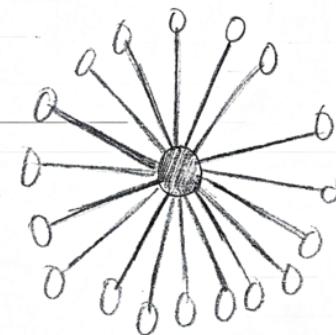
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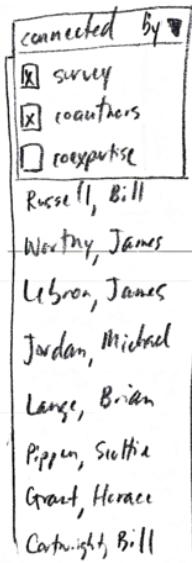
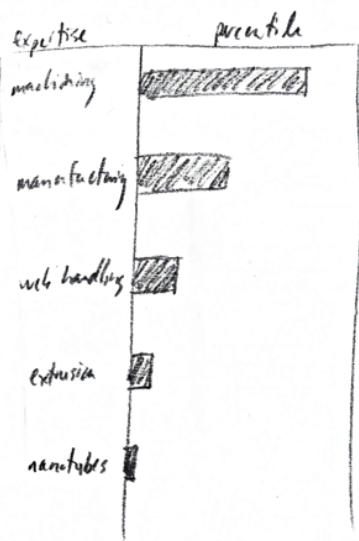


connected by

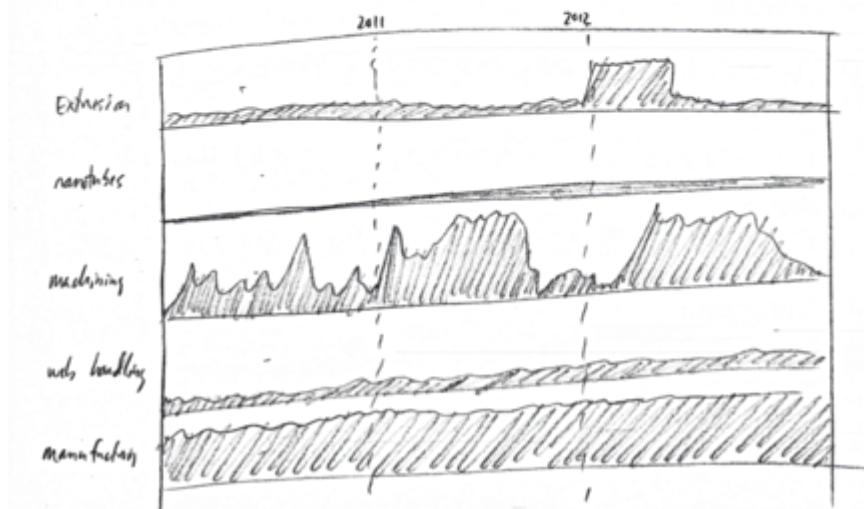
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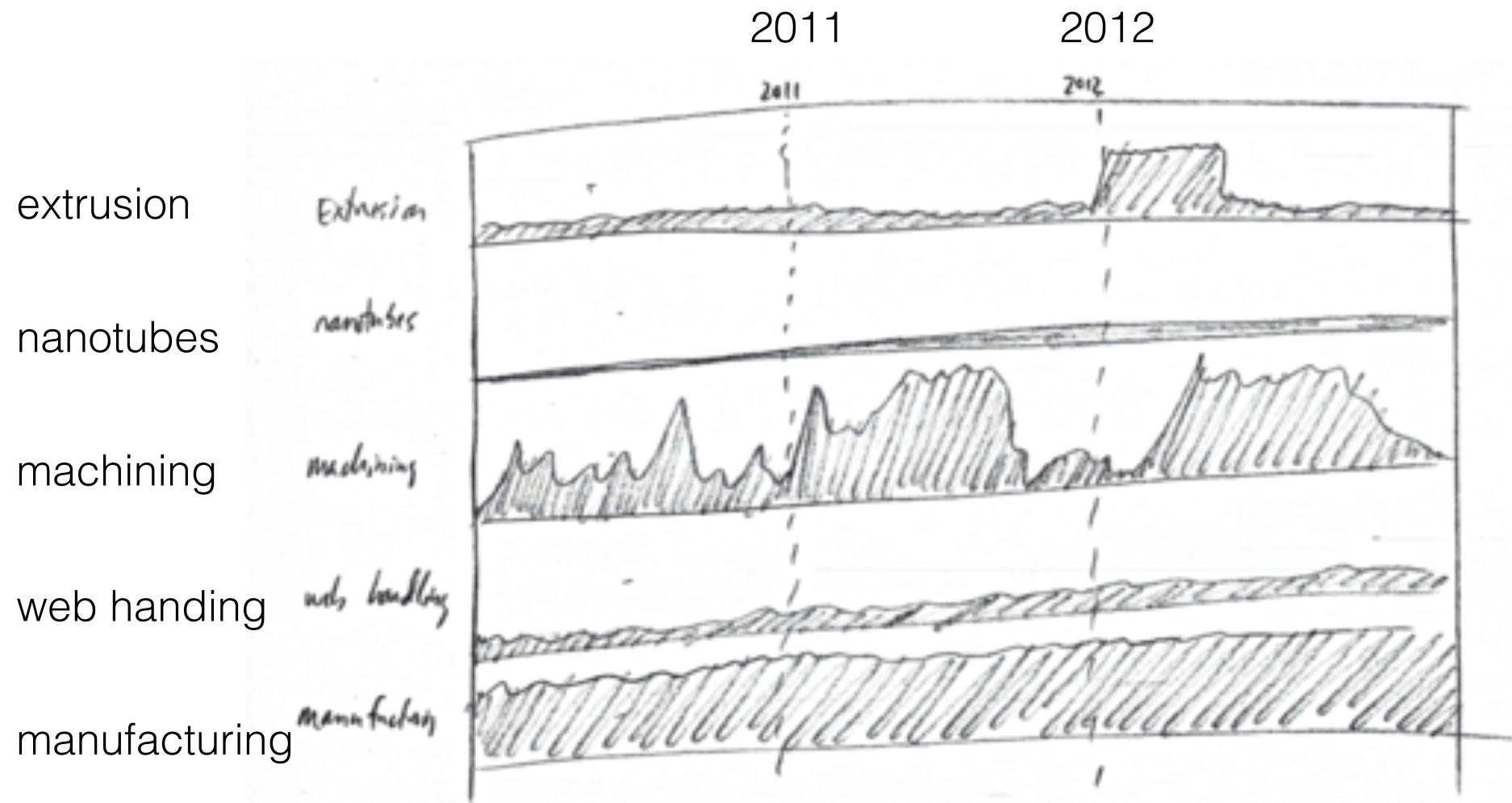
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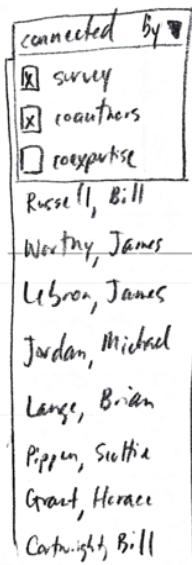
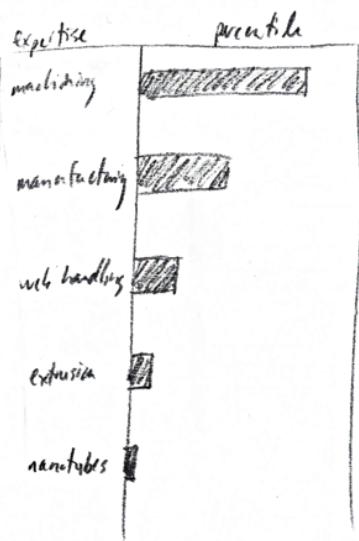




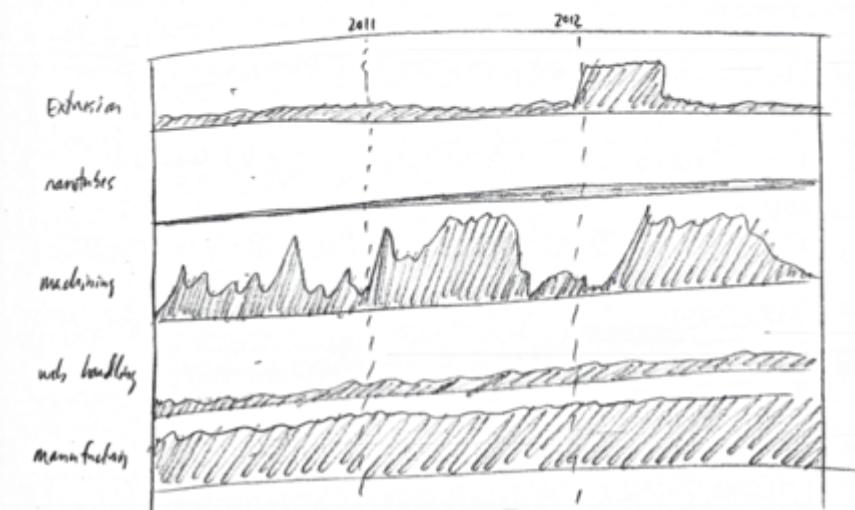
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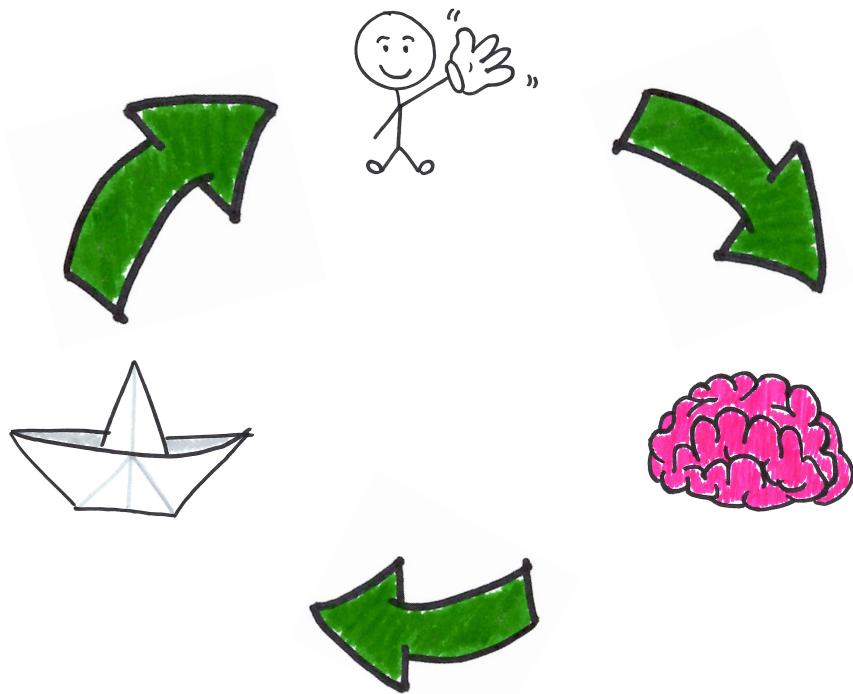




# VS.



# The design process involves frequent iterations throughout.



Asker: Chip Dipson

Anyone have experience machining aluminum at micron-level tolerances?

search

e-mail selected

Chuck Brown

expertise index ▶ activity index

Sue Bruston

Ted Bedson

Tim Thomson

load more...



Brown, Chuck

Cambridge, MA, USA

Chemical Engineer



3 mutual connections with: < question asked >



#### Area of Expertise

Machining



Manufacturing



Web handling



Extrusion



Nanotubes



#### Activity

Machining ▾

Manufacturing ▶ 3 [redacted] reports

5 Wiki answers

1 Conference/presentation

# expert finder

asker:  **Chip Dipson**

Anyone have experience machining aluminum at micron-level tolerances?

[Redo search](#)

[Email Chip w/ 3 selections](#)

▼ expertise index    activity level    degrees separated

<input checked="" type="checkbox"/>	 Chuck Brown	★★★★★	● ● ●	 2
<input checked="" type="checkbox"/>	 Sue Bruston	★★★★★	●	 3
<input type="checkbox"/>	 Jed Bedson	★★★★★	● ●	 1
<input checked="" type="checkbox"/>	 Tim Thomson	★★★	● ● ●	 2
<input type="checkbox"/>	 Bing Kingston	★★★	●	 3
<input type="checkbox"/>	 Daniel Manson	★★	● ●	 1

[load more...](#)



## Chuck Brown

Research Fellow

Cambridge, MA, USA

Hill Technical Center

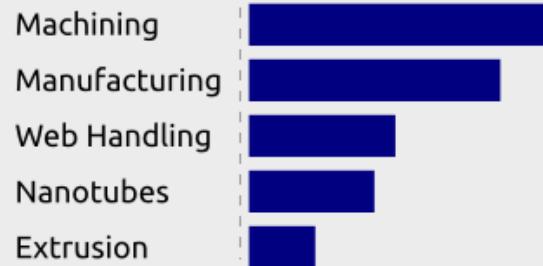
17 recommendations



2 mutual connections with Chip



### Expertise



### Additional Info

[Social Network Survey Page](#)

[Profile](#)

[Articles](#)

# Where's Waldo?

where's waldo? ▾

hi DsA, logout

asker

who asked the question?

query

soap

search

email 4 recommendations

Showing results for: "soap"

experts ▾

expertise alignment

authored

mentioned

degrees separated

lloyd

★★

blake

★★★

scott

★

antony

★★★

lou

★

joyce

★★

gypsy

★★

don

★

clay

★

roman

★

miles

★

think

★



**lloyd**

ca

ca

ca, AAIJK

0 recommendations

## Expertise

Boris Pasternak

Barry Goldwater

Amos Bronson Alcott

Allen Ginsberg

Amazing Grace

## Additional info

> network analysis

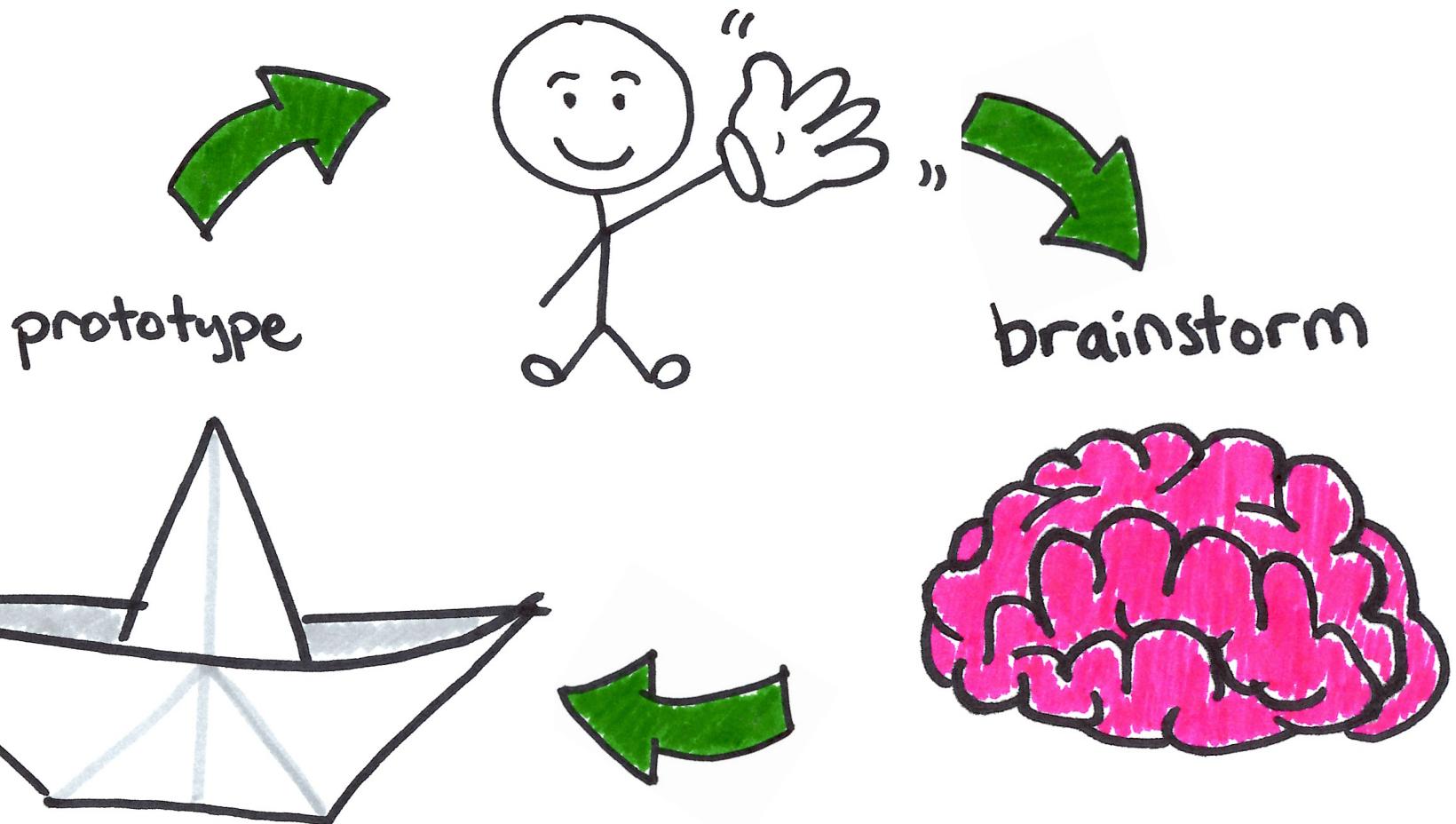
> One Profile

> Lookup

The design process allows for  
the development and changes  
to client requests

# back to our design process

end user



GOALS  
HABITS  
(IN GREEN)?  
WHO IS A  
GOLD DIGGER?  
WHO TO INVITE?

GROUP / INDIVIDUAL  
Q&A

is the  
community helping?

CLOSELY  
CONNECTED  
TEAMS  
LARGE  
COMM.

FEELING MORE  
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INVOLVED  
IN TEAM

DIVERSITY OF  
EXPERIENCE  
ARE  
HIGHLY  
VALUED

WORK OF  
EXTERNAL  
COMPANIES

MULTIPLE  
COLLABORATION  
PROJECTS

multiple  
collaborating  
long ago

PEOPLE HAVE  
DIFFERENT  
INTERESTS  
BUT CAN  
COLLABORATE

Natural  
respect

NATURAL  
CITATION

synchronised  
but not  
SLR connected

PEOPLE WHO  
DON'T WORK  
WEBSITE  
BUT CAN  
COLLABORATE

Successful  
products  
the results are  
big for them

WHAT IS  
Productivity?

A score?

Stress to  
market  
of a company  
including

BIGGEST  
NUMBER/ABILITY  
TO APPLY THEM

HMW IDENTIFY  
MECHANISMS OF  
CREATING  
MOTIVATION  
SIMILARITY?

HMW IDENTIFY  
RESOURCES THAT ARE  
NOT HARVESTED

HMW IDENTIFY  
WHAT IT IS TO  
DO AS A  
COMMUNITY  
CHAMPION?

INDIVIDUAL LVR  
bring knowledge  
+ reapply

molding printing stuff

nuclei of collab.

Challenging  
that nucleus  
connectivity  
is low

potential  
good/negative  
would produce

func, org  
site  
level  
(matrix)

HMW QUANTIFY  
IN KNOWLEDGE  
TRANSFER  
(DEVELOPMENT OF METRICS)

other people action  
sharing other  
first we do  
in first  
level

knowledge  
across levels  
see & keep  
track of that  
knowledge  
by time like

team  
individual  
knowledge

HMW IDENTIFY/  
QUANTIFY  
AWARENESS OF  
NEW KNOWLEDGE

brain storm

BB  
BB  
BB  
BB

Expert  
Finder  
Individual  
level

Division of  
knowledge  
to be  
applied

# of  
years for  
SLR  
Paul's  
method  
4 years  
Lee's  
method  
7 years

HMW IDENTIFY  
SYMPTOMS OF  
PRODUCTIVE  
COLLABORATION?

HMW QUANTIFY/  
IDENTIFY STRENGTH OF  
COLLABORATIONS?  
(GOOD - BAD)

Mine  
Sources/Cited  
(individual)

SLR no  
subset for  
each year

BRAD  
in the  
MAN

SCOPES  
efforts

Starkey

DK

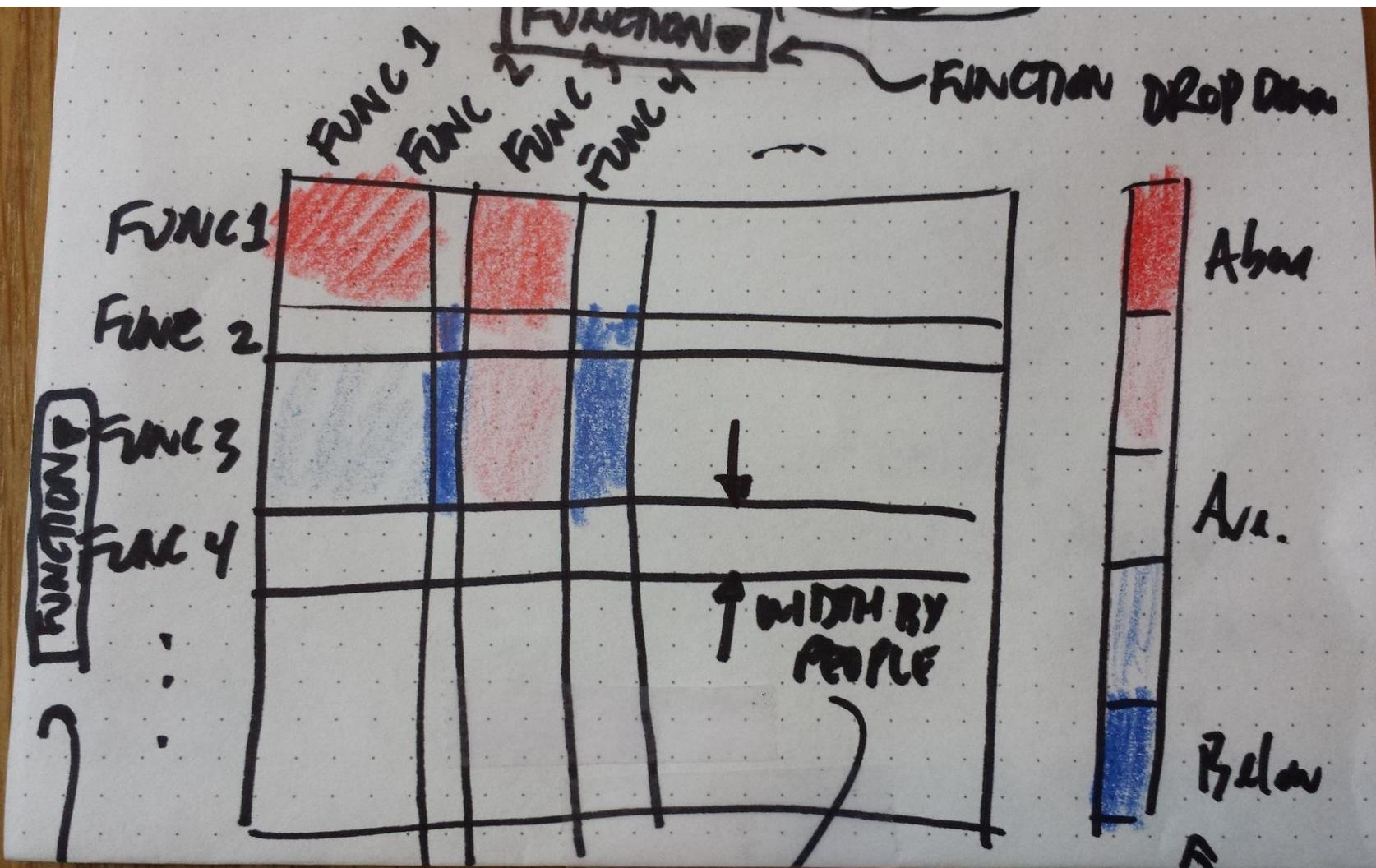
DK

- citations

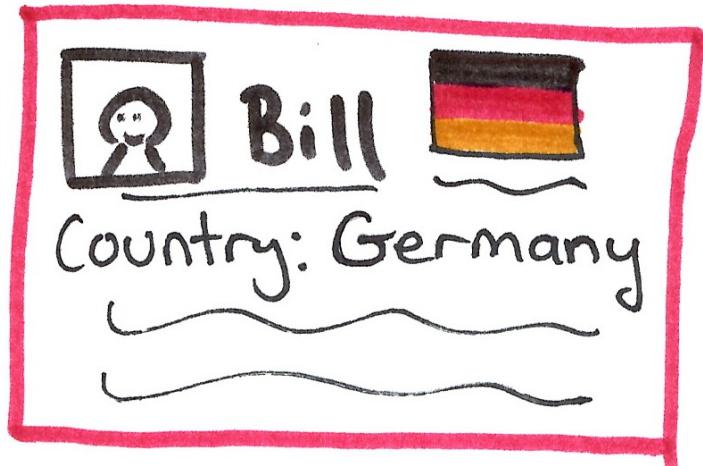
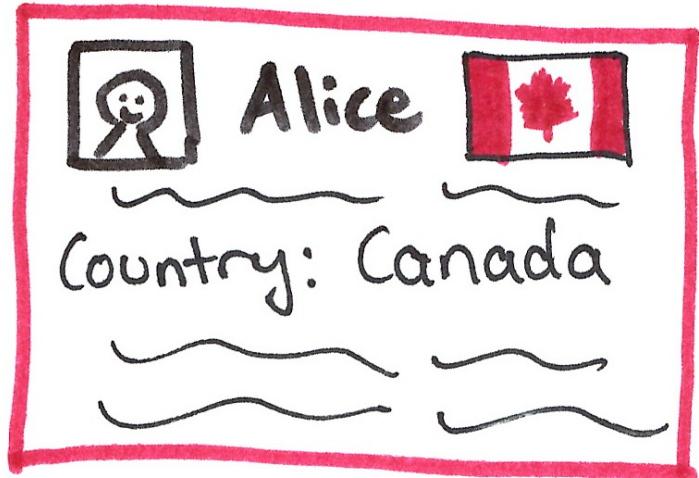
Individual-level  
term  
genesis

GOAL

reveal areas of expertise.  
evaluate connectivity within experts.



let's compare countries.



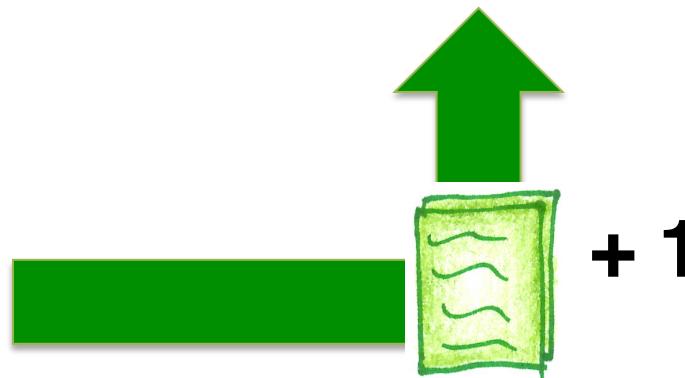
author's country

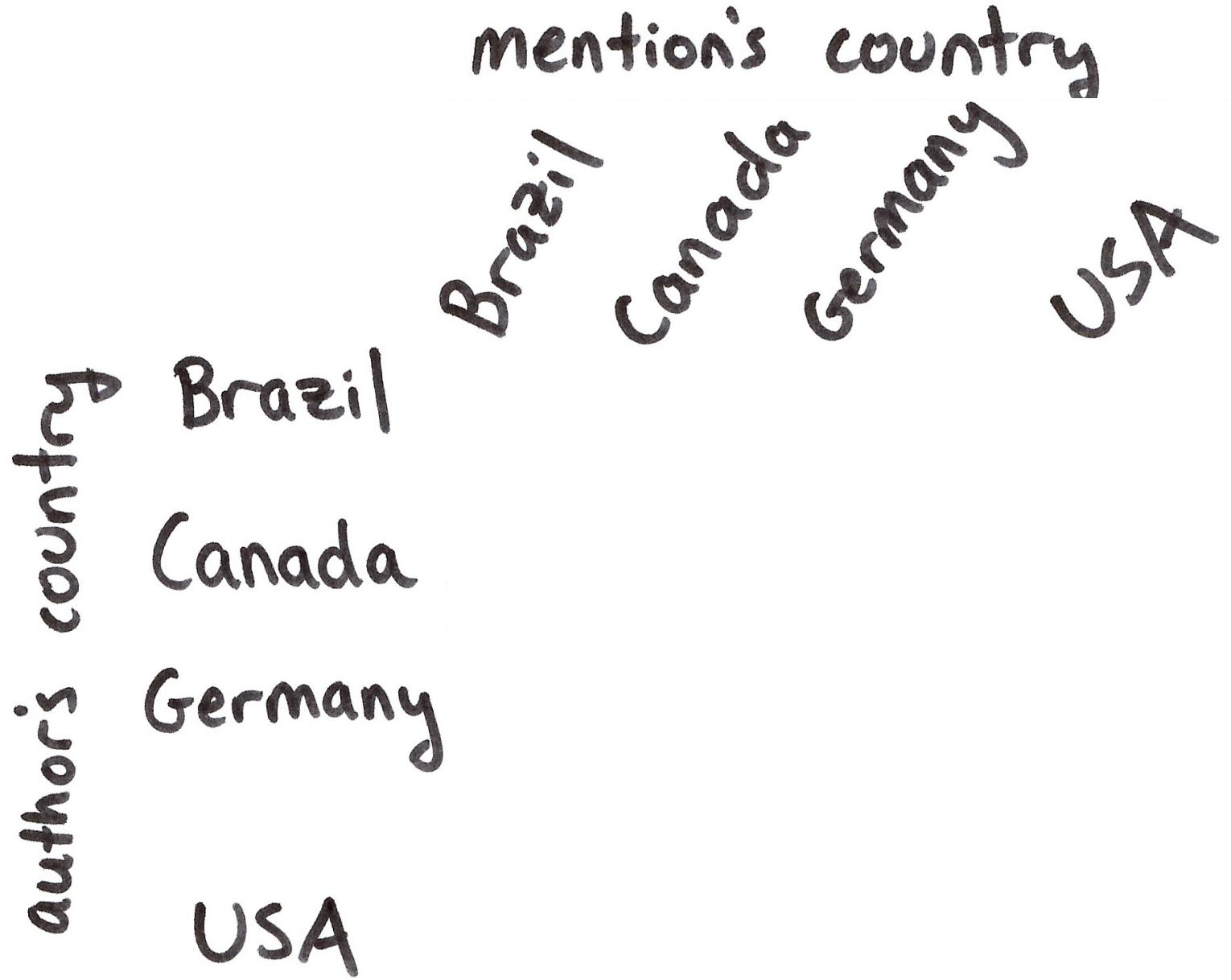
Canada



mention's country

Germany





author's country

Brazil

Canada

Germany

USA

mention's country

Brazil Canada Germany USA


author's country

Brazil

Canada

Germany

USA

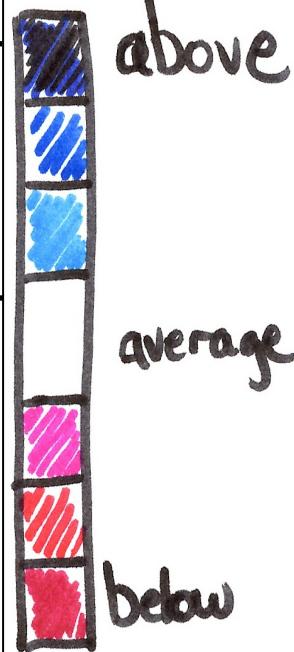
mention's country

Brazil	Canada	Germany	USA
10	5	5	20
8	25	2	5
12	3	30	10
1	20	25	50

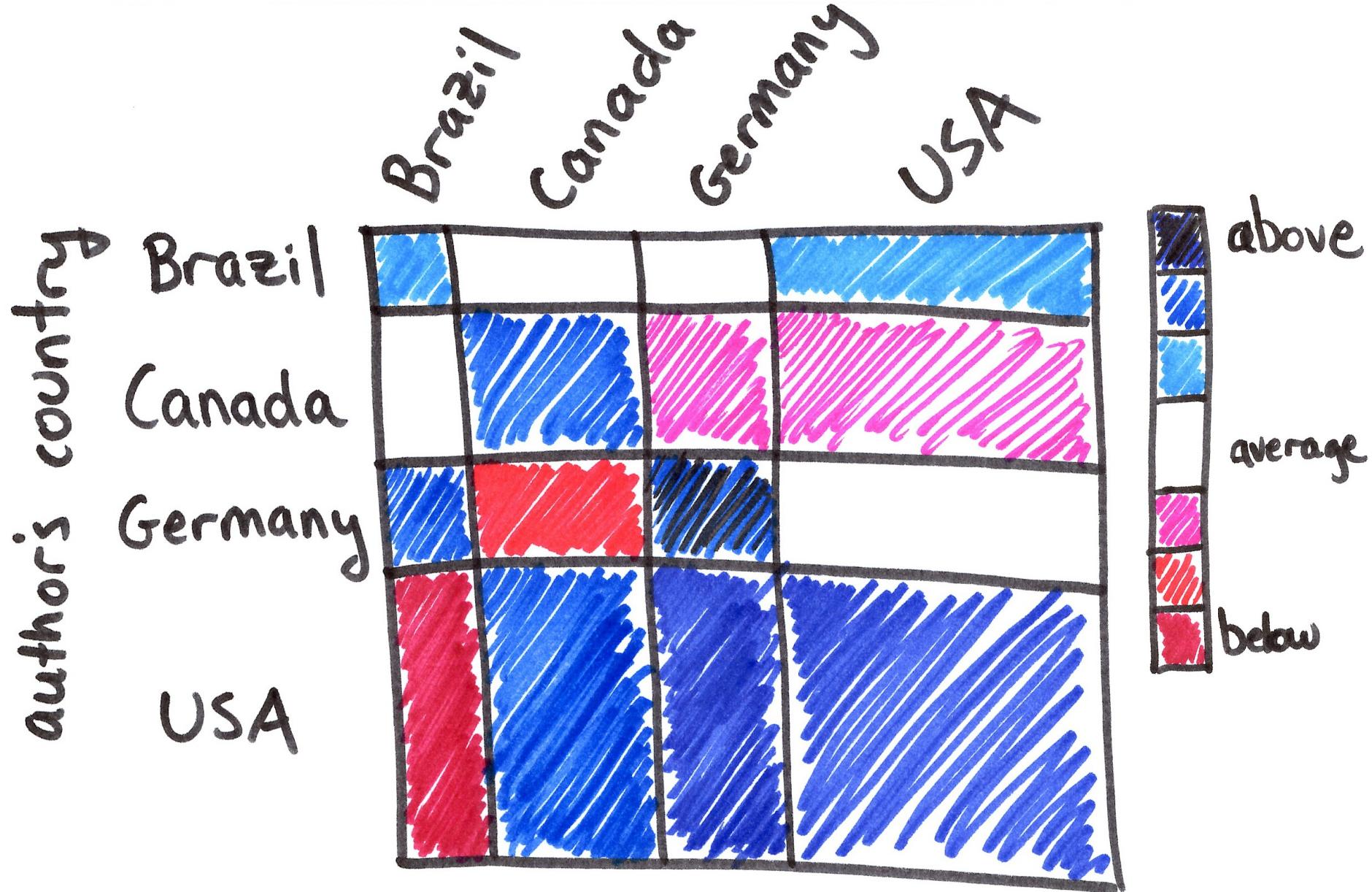
mention's country

Brazil Canada Germany USA

author's country  
Brazil  
Canada  
Germany  
USA

# mention's country



mention's country

author's country

Brazil

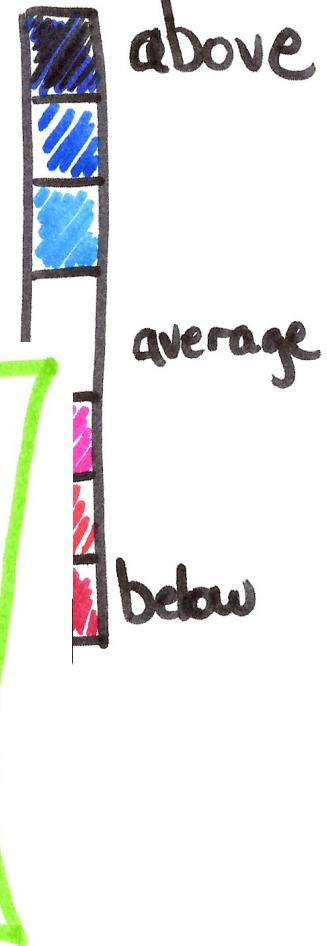
Canada



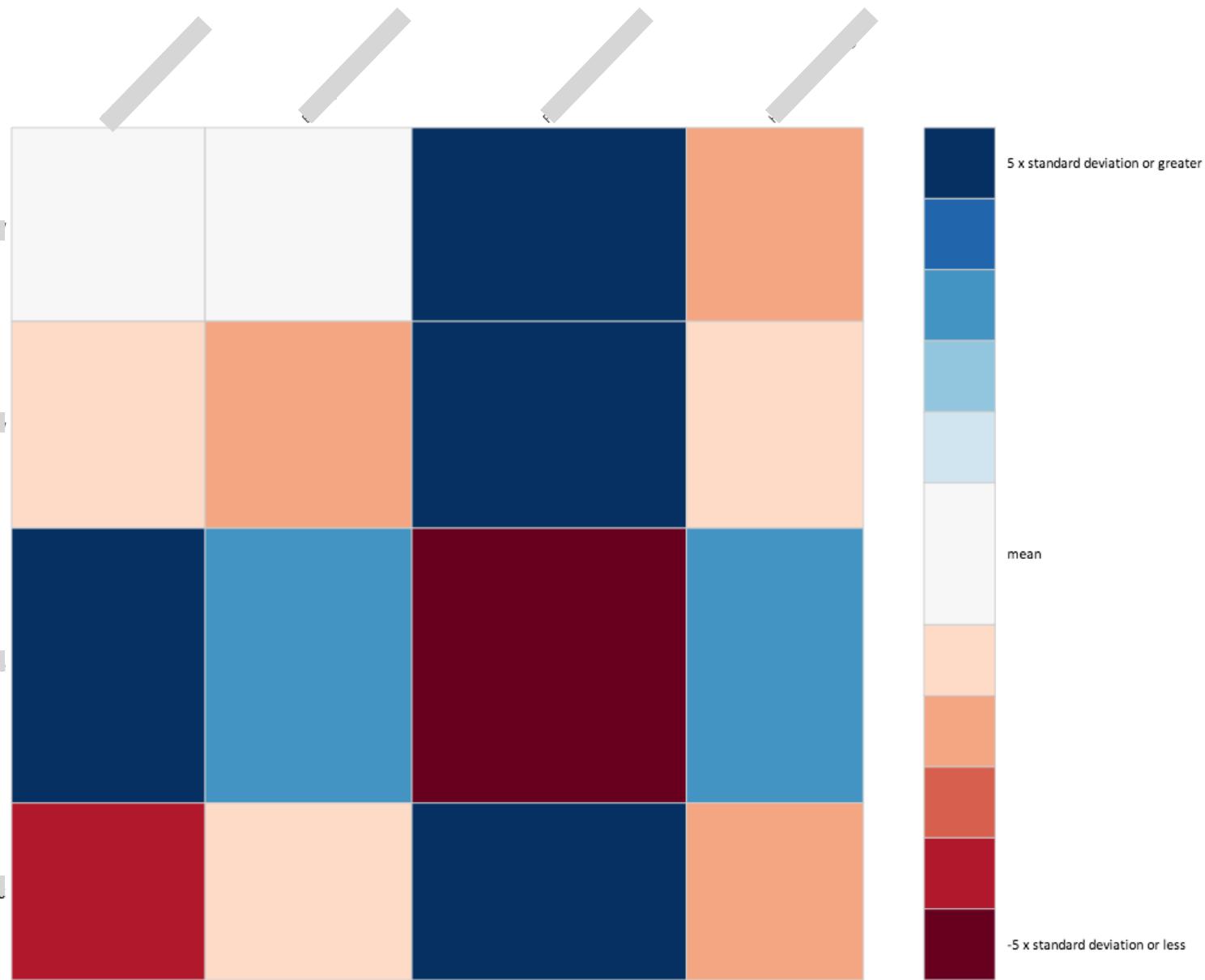
Germany

USA

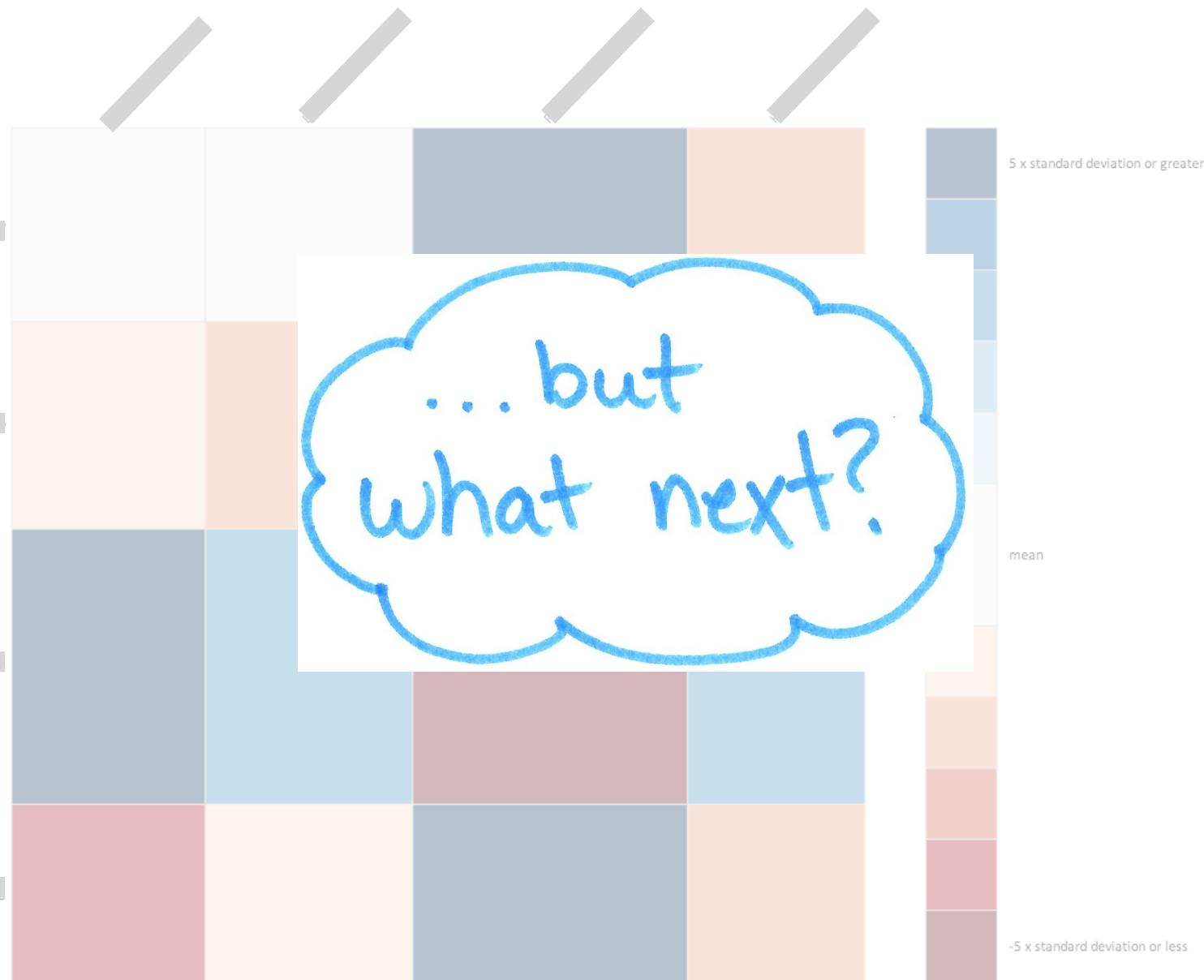
Brazil  
Canada  
Germany  
USA



7168 people  
associated with  
62149 documents  
match your filters.

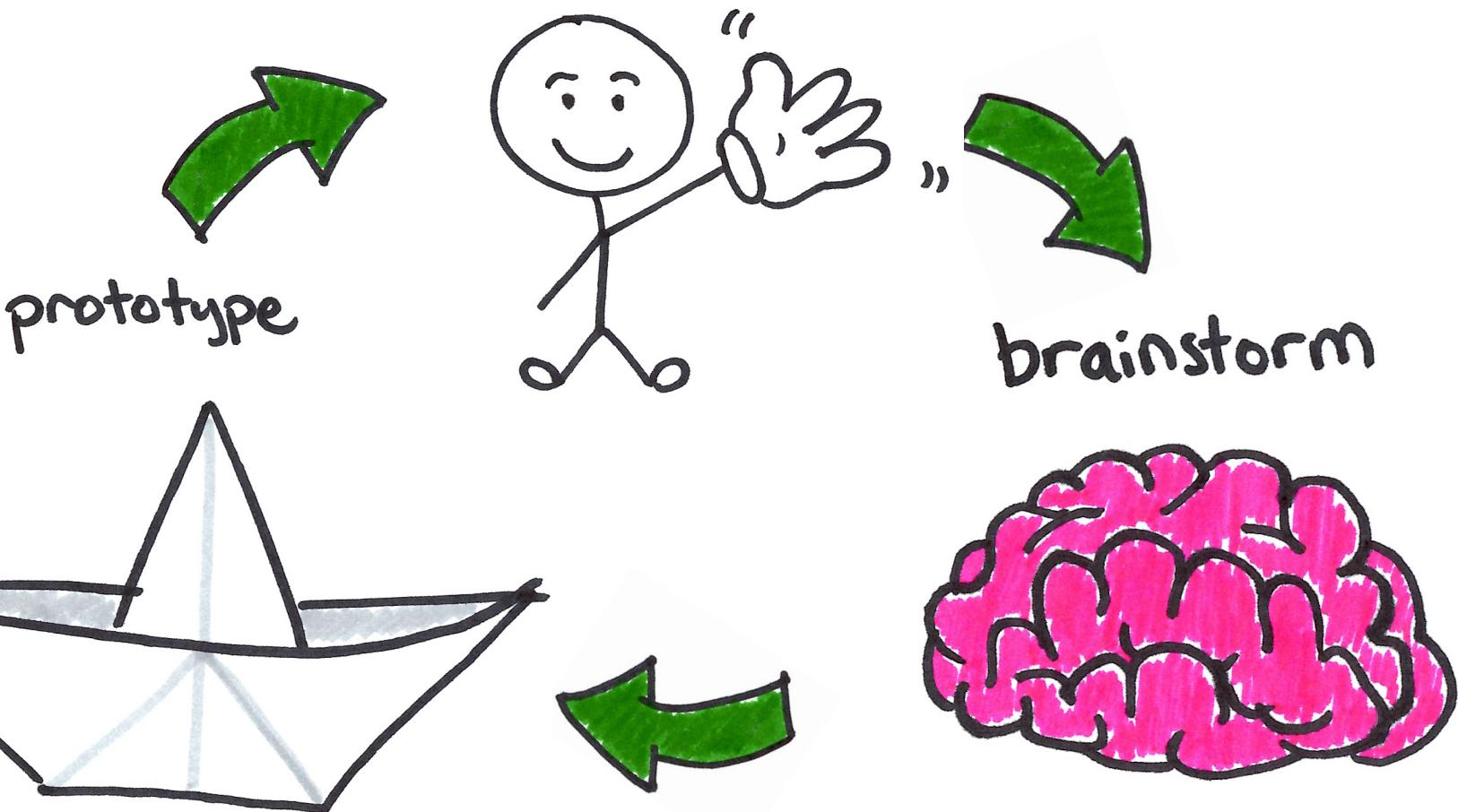


7168 people  
associated with  
62149 documents  
match your filters.

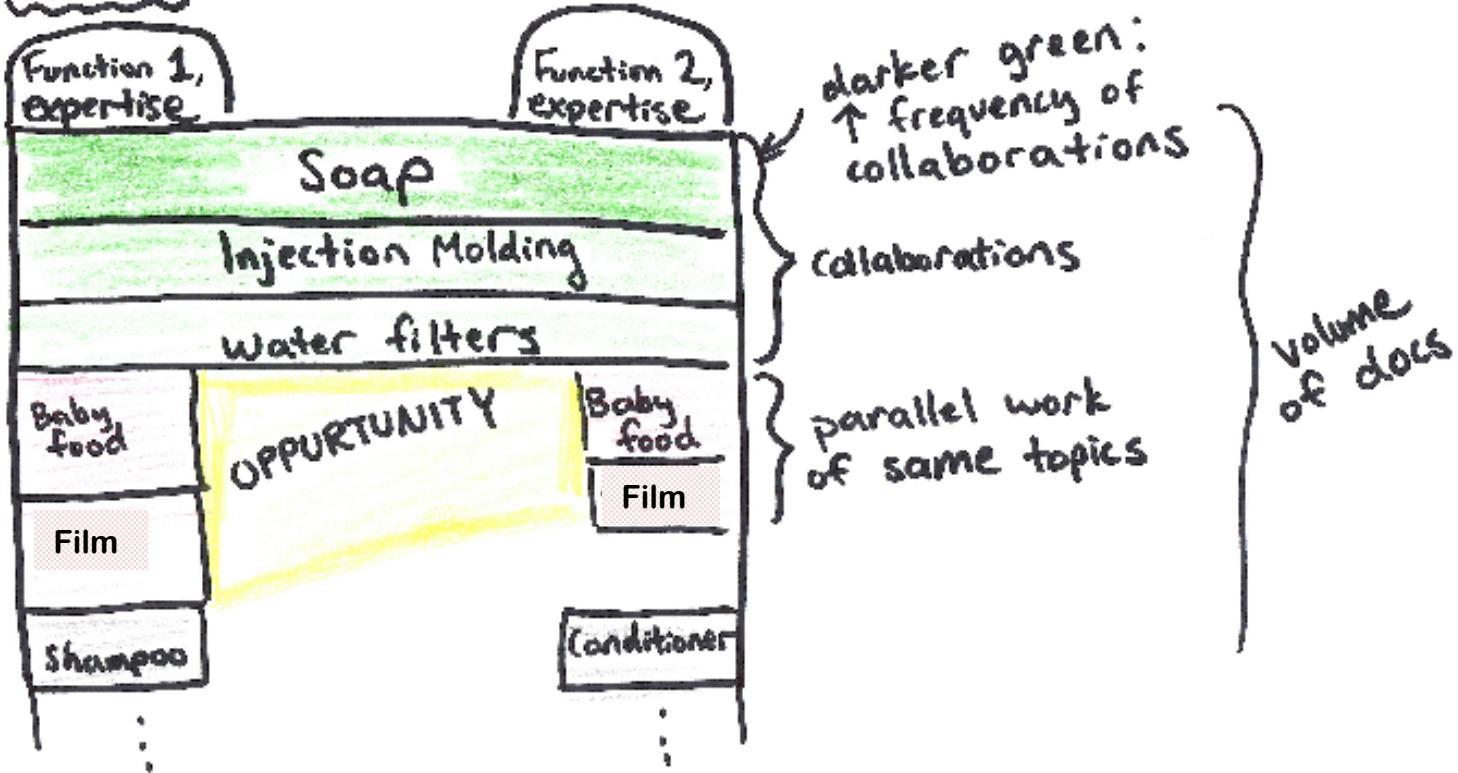


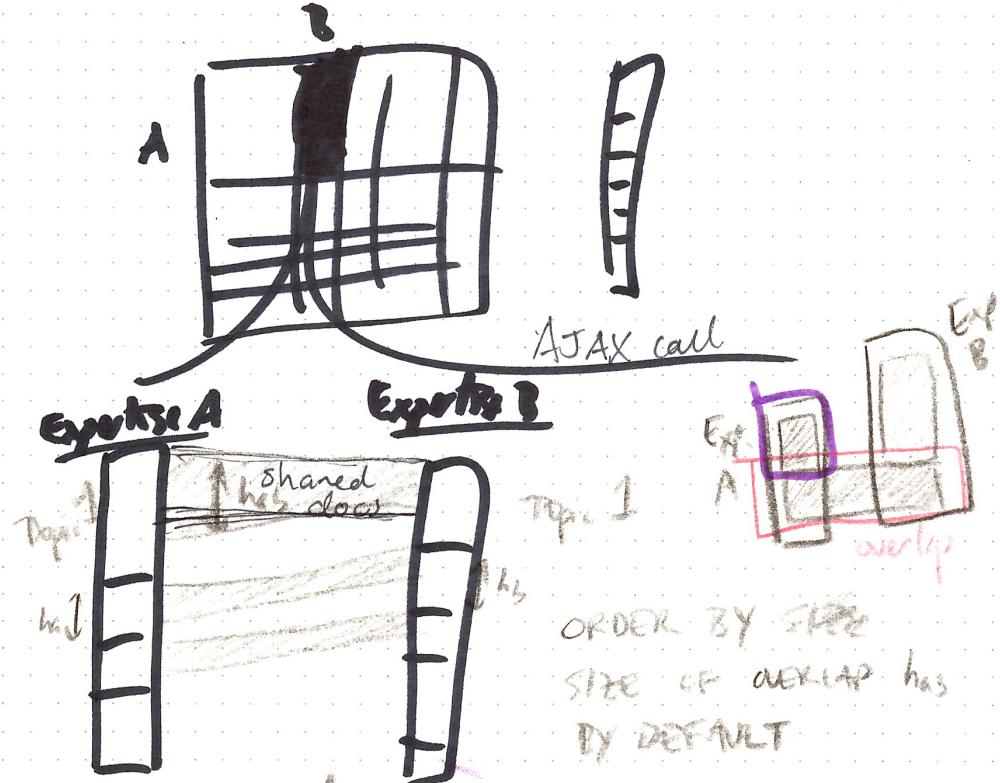
# back to our design process

end user



## Drill-In



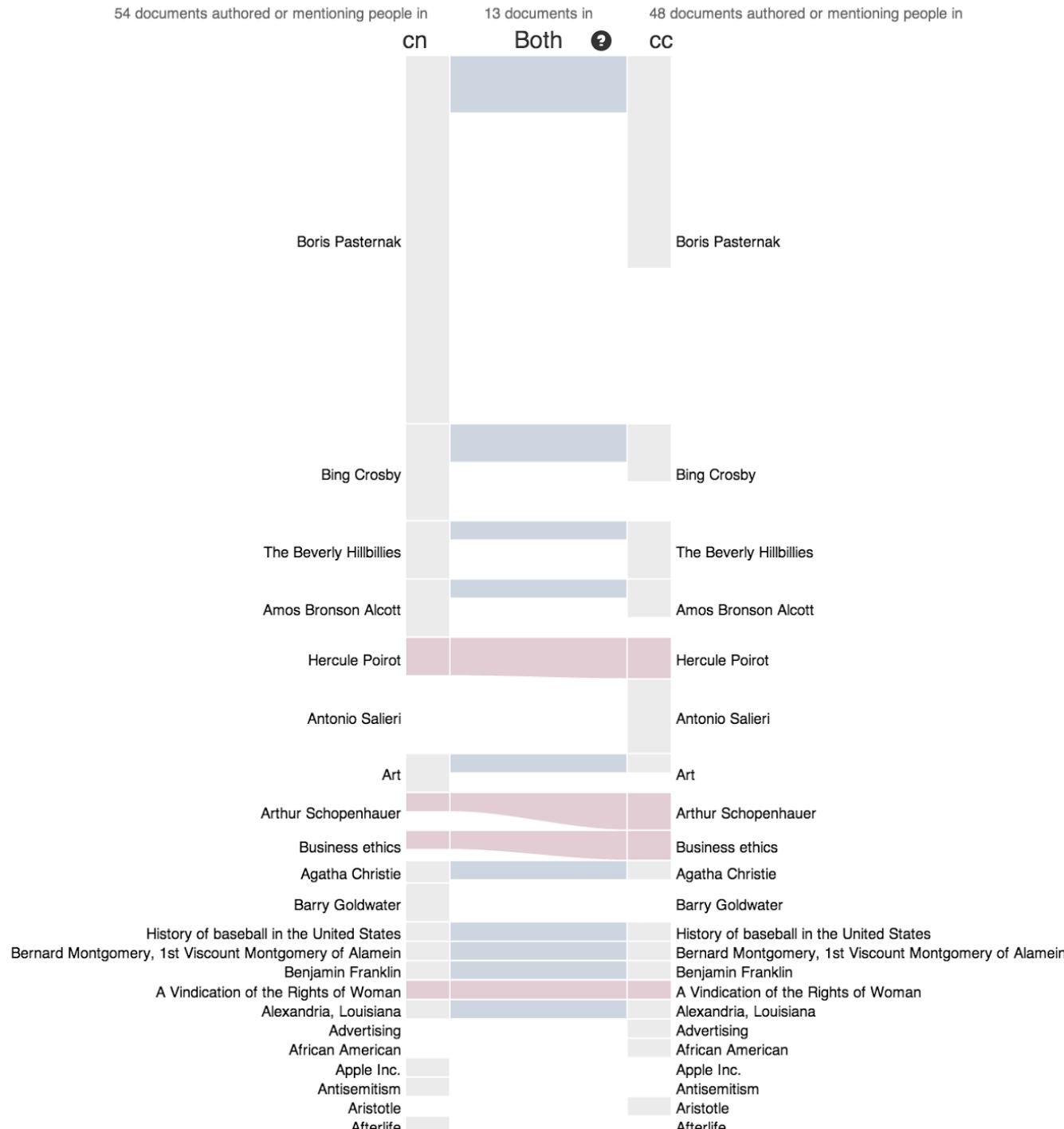


ORDER BY SIZE  
SIZE OF OVERLAP HAS  
BY DEFAULT

$h_x = \frac{1}{\text{size}}$  proportional  
to #docs that  
CAN CROCK BY  
this topic

Q: WILL  
THIS EXPERT  
CROCK OF  
SOMETHING?

- $h_a \leftrightarrow$  INC. AREAS w/ LEAST OVERLAP
- $h_b \leftrightarrow$  DEL AREAS w/ MOST OVERLAP
- $h_a - h_b \leftrightarrow$  INC. B EXPERT AREAS w/ MOST OVERLAP w/ A
- $h_b - h_a \leftrightarrow$  DEL B EXPERT AREAS w/ LEAST OVERLAP w/ A
- $h_a - h_b \leftrightarrow$  INC. A EXPERT AREAS w/ MOST OVERLAP w/ B
- $h_b - h_a \leftrightarrow$  DEL A EXPERT AREAS w/ LEAST OVERLAP w/ B



54 documents authored or mentioning people in

cn

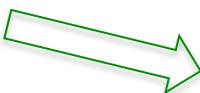
13 documents in

Both

48 documents authored or mentioning people in

cc

# Bing Crosby



Boris Pasternak



Boris Pasternak

Bing Crosby



Bing Crosby

The Beverly Hillbillies



The Beverly Hillbillies

Amos Bronson Alcott



Amos Bronson Alcott

Hercule Poirot



Hercule Poirot

Antonio Salieri



Antonio Salieri

Art



Art

Arthur Schopenhauer



Arthur Schopenhauer

Business ethics



Business ethics

Agatha Christie



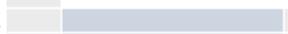
Agatha Christie

Barry Goldwater



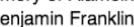
Barry Goldwater

History of baseball in the United States

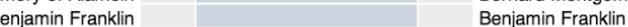


History of baseball in the United States

Bernard Montgomery, 1st Viscount Montgomery of Alamein



Bernard Montgomery, 1st Viscount Montgomery of Alamein



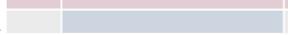
Benjamin Franklin

A Vindication of the Rights of Woman



A Vindication of the Rights of Woman

Alexandria, Louisiana



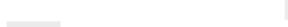
Alexandria, Louisiana

Advertising



Advertising

African American



African American

Apple Inc.



Apple Inc.

Antisemitism



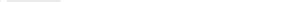
Antisemitism

Aristotle

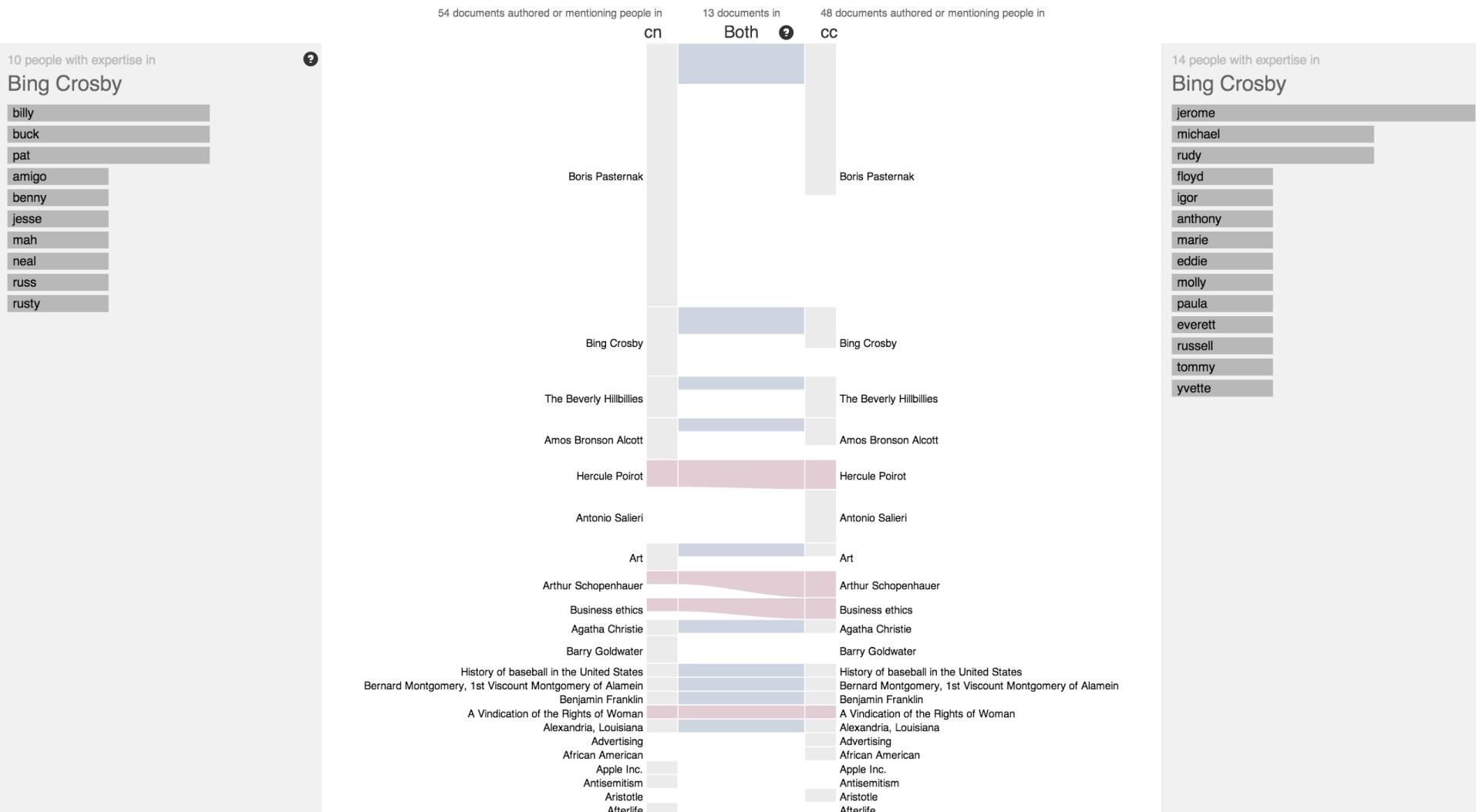


Aristotle

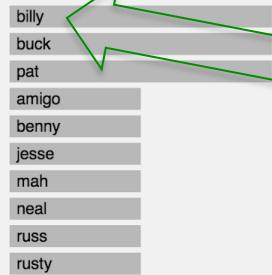
Afterlife



Afterlife



10 people with expertise in  
Bing Crosby



# billy

54 documents authored or mentioning people in

CN

13 documents in

Both

48 documents authored or mentioning people in

CC

Boris Pasternak

Boris Pasternak

Bing Crosby

Bing Crosby

The Beverly Hillbillies

The Beverly Hillbillies

Amos Bronson Alcott

Amos Bronson Alcott

Hercule Poirot

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Art

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Antisemitism  
Aristotle  
Afterlife

14 people with expertise in  
Bing Crosby





# billy

cn

cn

cn, LA

0 recommendations

## Expertise

[Bing Crosby](#)

[Boris Pasternak](#)

[Battle of Blenheim](#)

[Hercule Poirot](#)

[Amos Bronson Alcott](#)

## Additional info

- > [network analysis](#)
- > [Profile](#)
- > [Lookup](#)

# notes about related ideas:

## agile development

- common ideas:
  - continual communication with clients
  - frequent deployment of software
  - rapid response to change, even late
- agile is mainly focused on culture for software development
  - pair programming

# notes about related ideas:

## lean startup

- common ideas:
  - continual communication with clients
  - mvp
- the lean startup idea more broadly applies to developing a business in the most efficient way possible

# design in a nutshell

end user

