

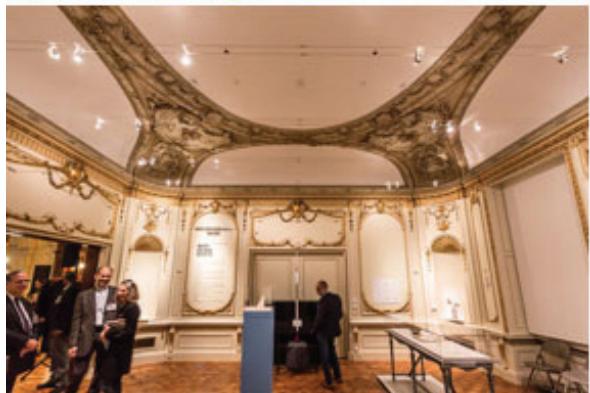
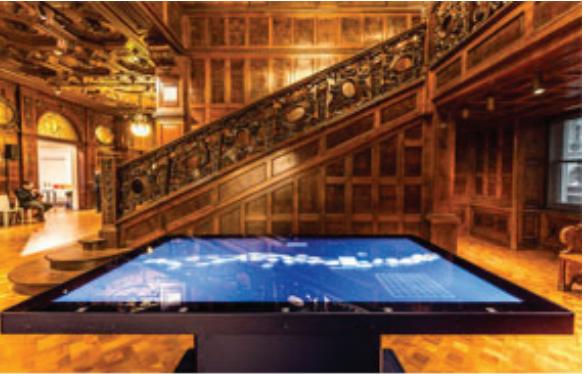
A RECOMENDATION SYSTEM FOR

COOPER

HEWITT

Smithsonian Design Museum

About the Cooper Hewitt



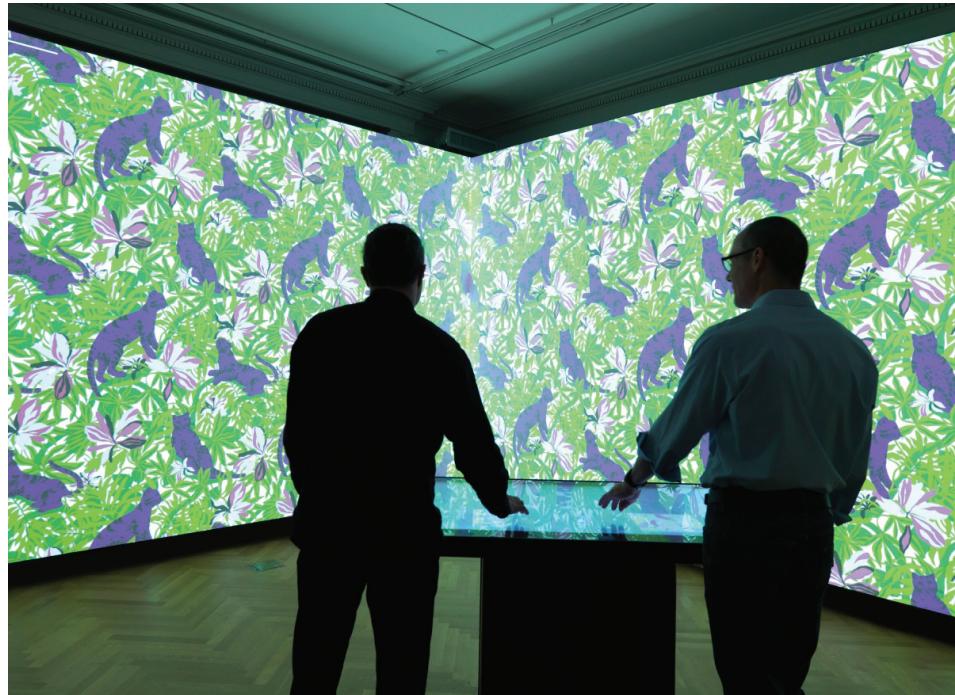
- the museum is housed in the former mansion of Andrew Carnegie
- the mansion was the first private residence in the US to have a structural steel frame
- also the first to have a residential elevator
- the first private residence to have central heating and a precursor to central AC
- completed in 1901
- received landmark status in 1974 and reopened as the museum in 1976
- recent renovation took 3 years and reopened in Dec 2014

About the Cooper Hewitt

RECOMMENDATION SYSTEM FOR THE
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The Pen
RECOMMENDATION SYSTEM FOR THE
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immersion room



process lab

Interactive & The Pen
RECOMMENDATION SYSTEM FOR THE
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YOUR VISIT TO THE MUSEUM ON APRIL 03, 2015

This visit is also known by the shortcode **pjct**. There are a total of **42 items** associated with this visit and 42 of them were objects you collected . See [all the items](#) for this visit or see [all of your visits](#).

Search

SEARCH THIS VISIT



Lithotomy Surgical Set (France) Hi Seb



Swiss Champ SOS Pocket Knife/Multitool



Awl And Cord (USA)

You **collected** this object at **12:49 PM**. This selection is **private** and can only be seen by **you** but you can **make it public** if you'd like. You can also **remove this item** entirely.

You **collected** this object at **12:49 PM**. This selection is **private** and can only be seen by **you** but you can **make it public** if you'd like. You can also **remove this item** entirely.

You **collected** this object at **12:49 PM**. This selection is **private** and can only be seen by **you** but you can **make it public** if you'd like. You can also **remove this item** entirely.

Accessing your visits
RECOMMENDATION SYSTEM FOR THE
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The Data

objects data frame:

- 194,316 total objects in the collection
- contains features for each object: ID, country of origin, tags, type, medium, museum department, dimensions, description, etc.
- some features had too many unique levels (type, tag, medium)

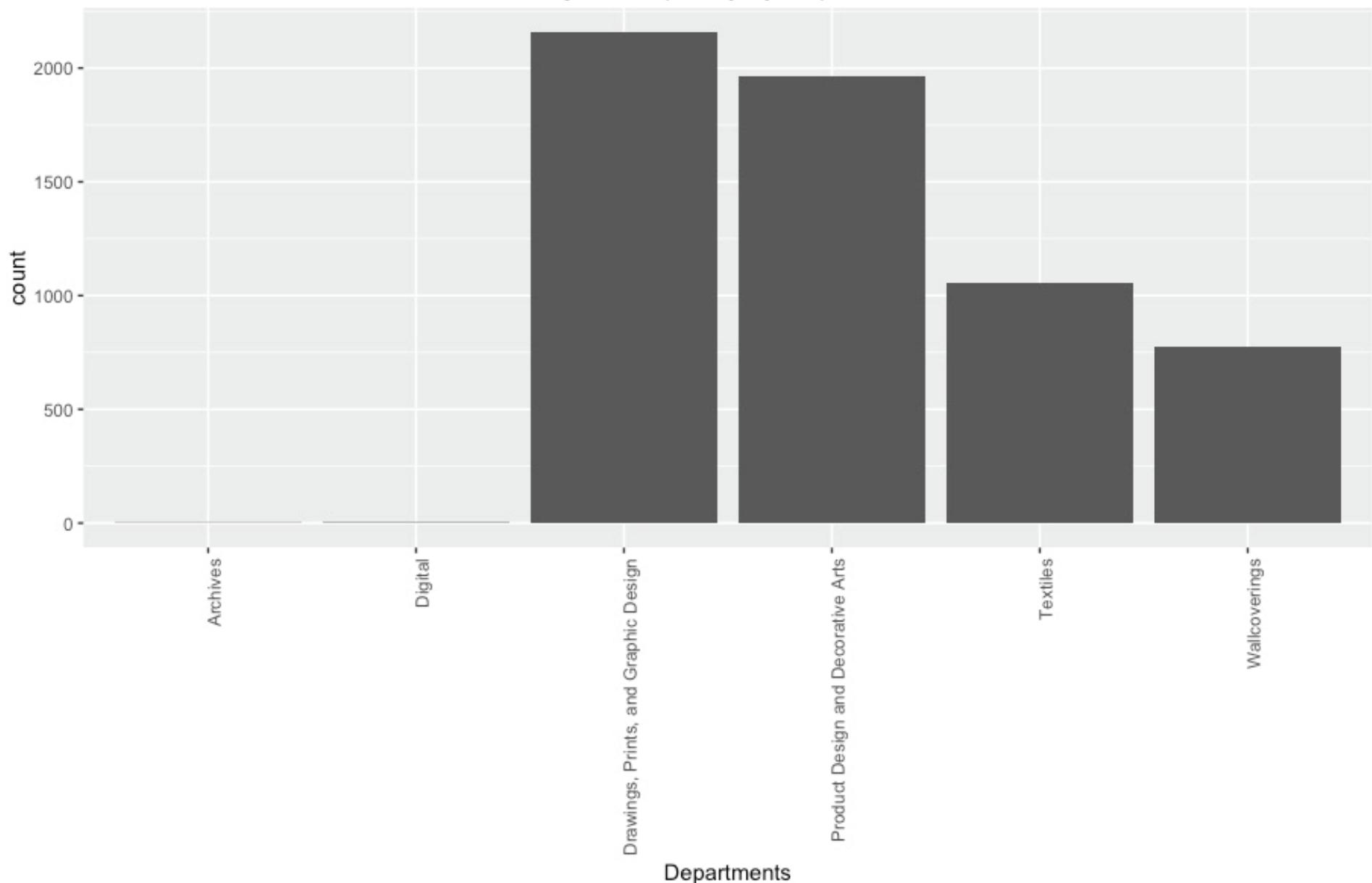
user data from the pen:

- 3,559,735 scanned items between Aug 16, 2014 to Feb 15, 2016
- 584 days of data
- 111,467 unique visits
- 7,784 unique items scanned

The Data
RECOMMENDATION SYSTEM FOR THE
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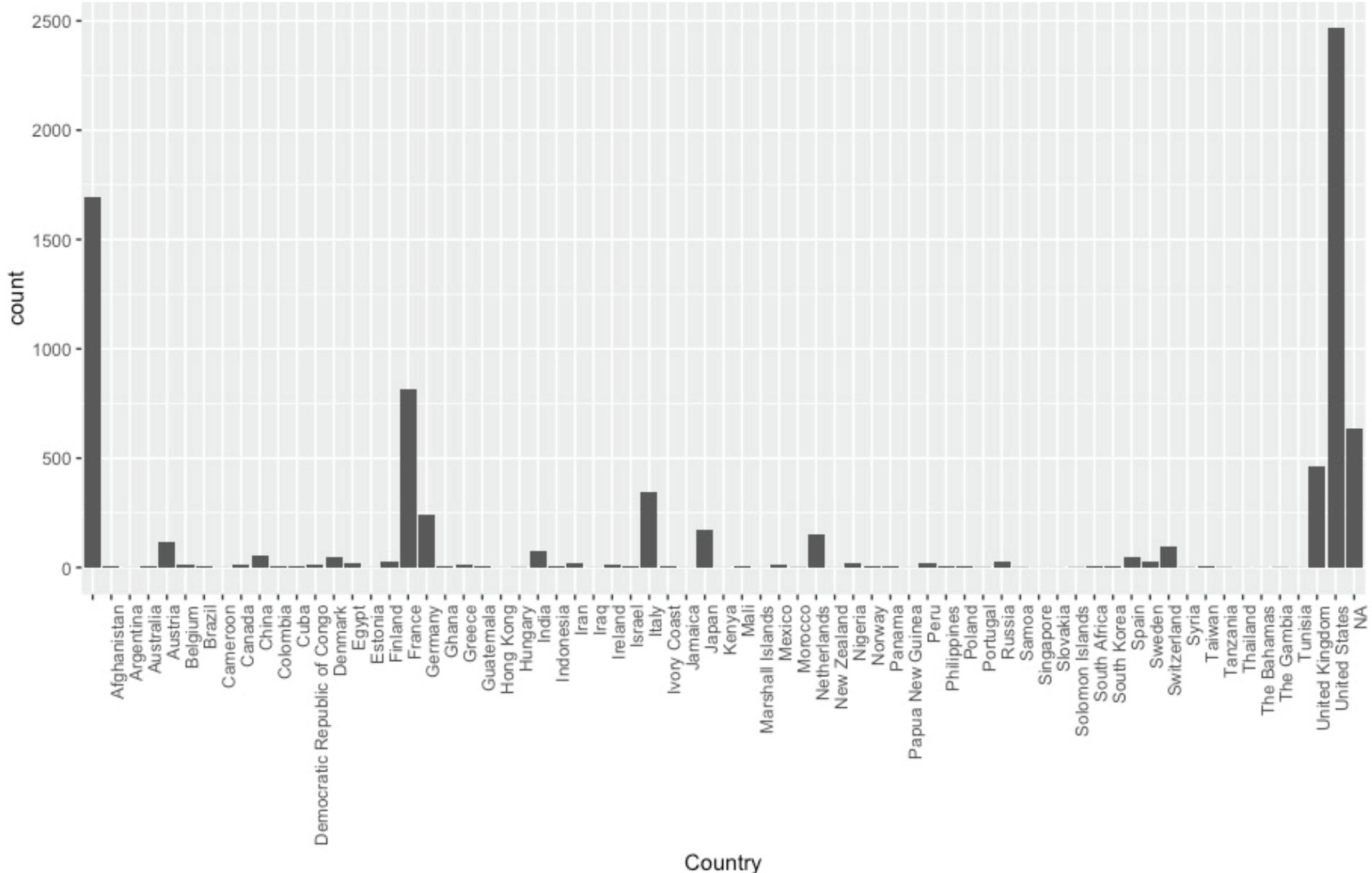
Exploring the Data

Object Frequency by Department



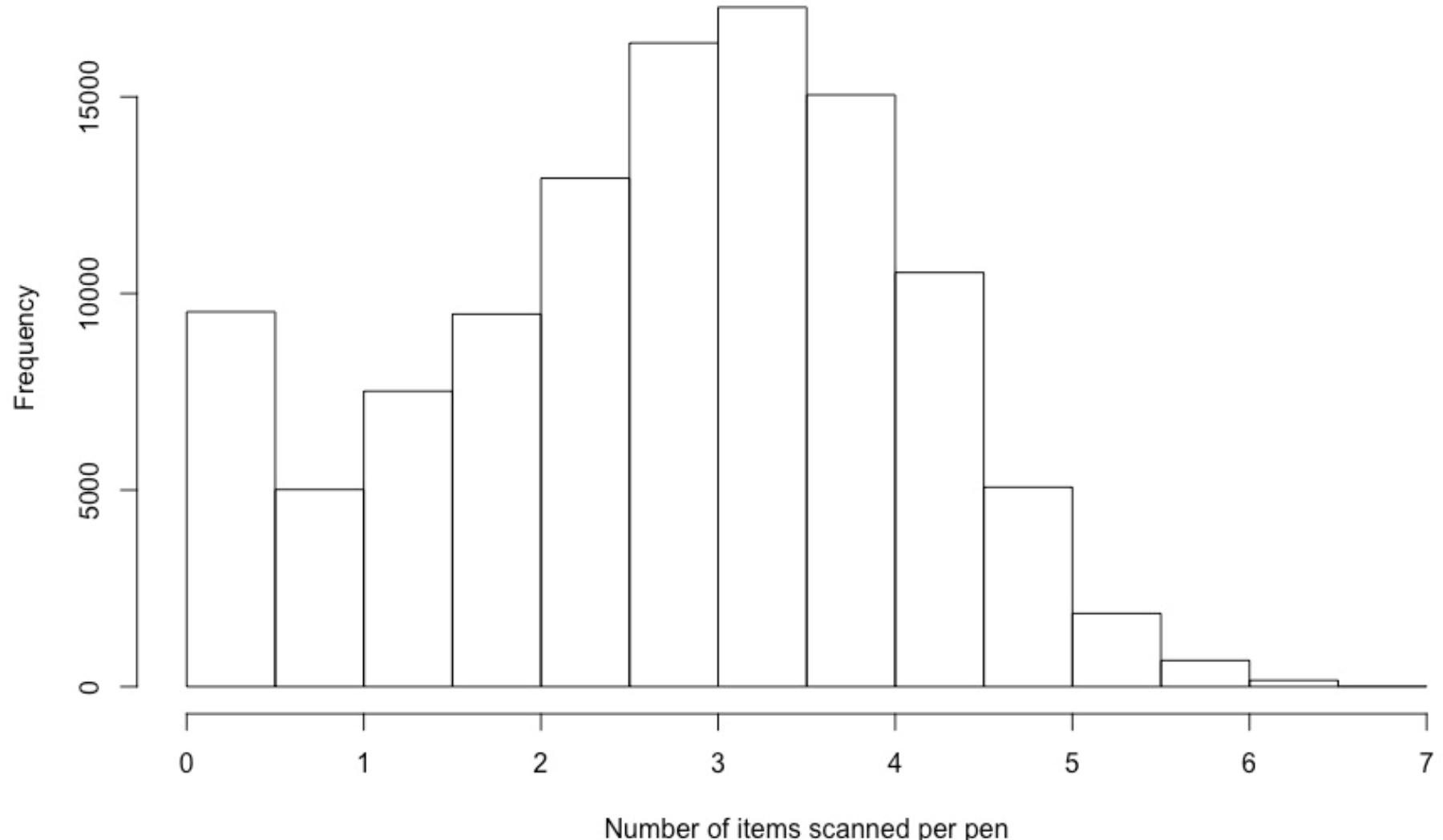
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Object Frequency by Country



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Histogram of $\log(\text{size}(\text{visits}))$



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collaborative filtering

	i_1	i_2	i_3	i_4	i_5	i_6	i_7	i_8
u_1	0	1	1	1	1	0	0	0
u_2	1	0	0	0	1	1	0	0
u_3	0	0	0	1	0	1	0	1
u_4	0	0	0	1	1	1	0	1
u_5	1	1	0	0	0	0	0	1
u_6	0	1	0	0	1	1	0	1
u_a	0	0	1	1	0	1	0	1
Recommendation: i_3, i_2								

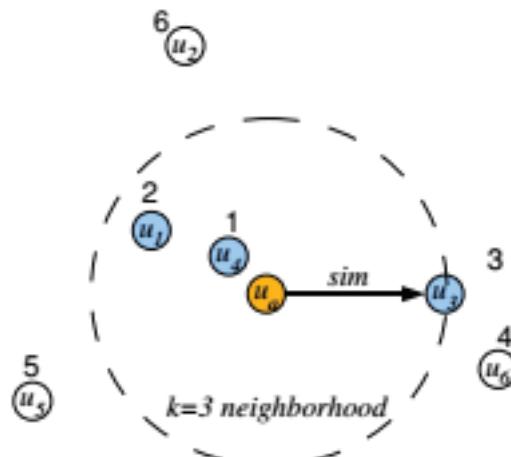


Figure 1: User-based collaborative filtering.

	i_1	i_2	i_3	i_4	i_5	i_6	i_7	i_8	
i_1	✗	0.1	✗	0.3	0.2	0.4	✗	0.1	
i_2	0.1	✗	0.8	0.9	✗	0.2	0.1	✗	
i_3	✗	0.8	✗	✗	0.4	0.1	0.1	0.5	
i_4	0.3	0.9	✗	✗	✗	0.3	0.1	0.1	
i_5	0.2	✗	0.4	✗	✗	0.1	✗	✗	
i_6	0.4	0.2	✗	0.3	0.4	✗	0.1	0.1	
i_7	✗	0.1	0.3	✗	✗	✗	✗	✗	
i_8	0.1	✗	0.5	0.1	✗	0.1	✗	✗	
Recommendation: i_3, i_6, i_4									
0.3	0	0.9	0.4	0.2	0.5	0	✗		

Figure 2: Item-based collaborative filtering

Hahsler, M., 2011

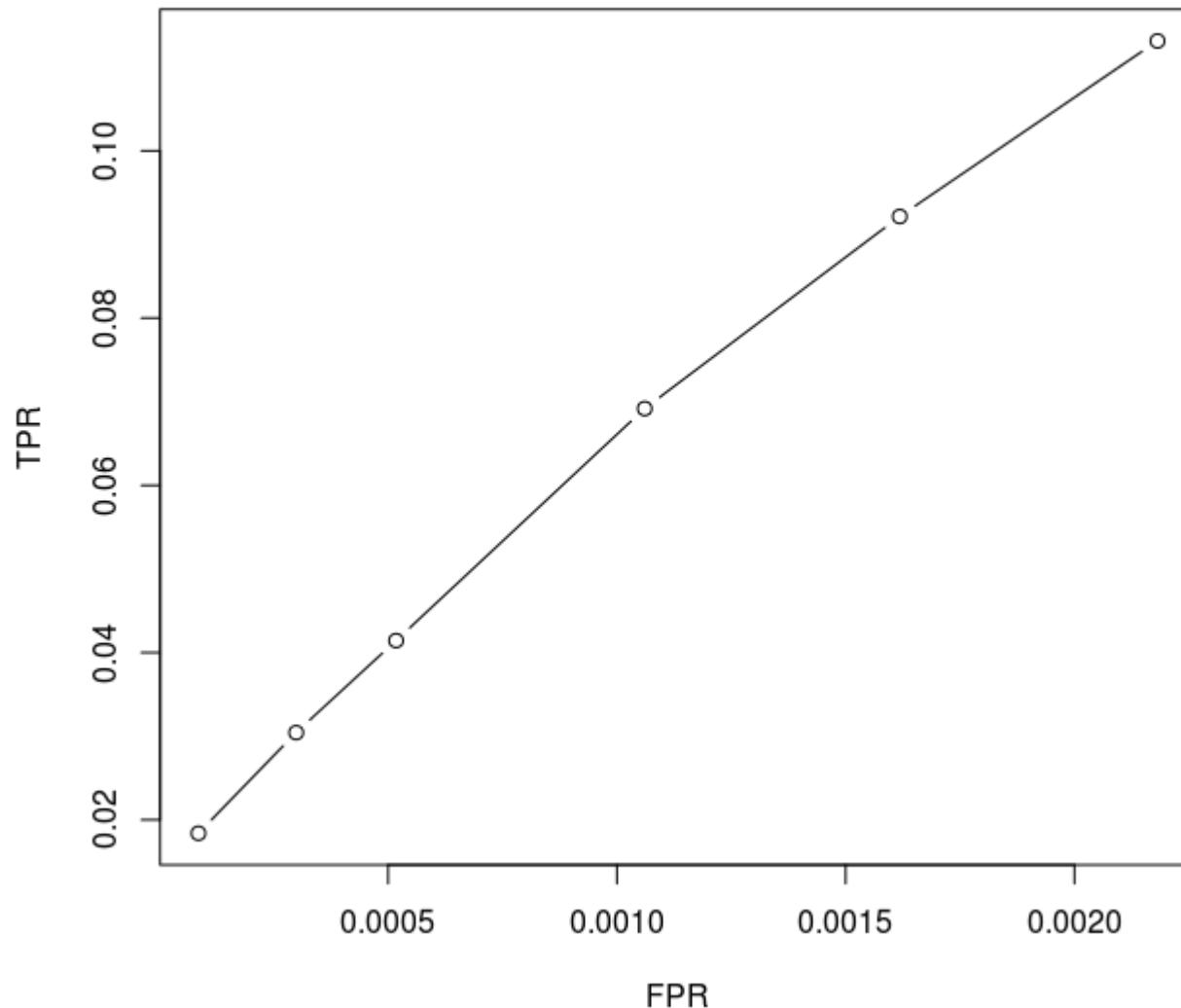
Methods:

- Popular
- Association Rules
- User-based Collaborative Filtering
- Item-based Collaborative Filtering
- Hybrid Model

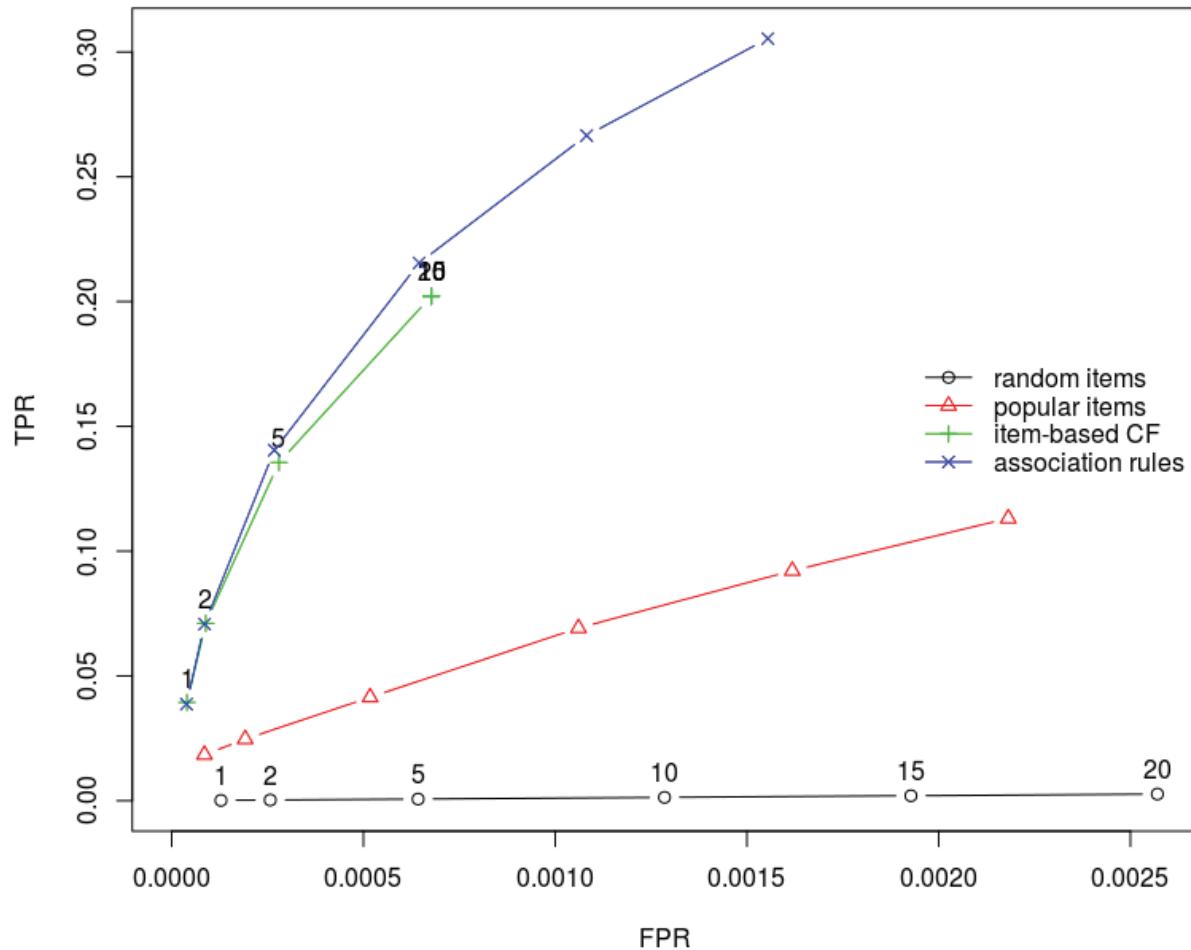
Training:

- filtered out users that scanned more than 5 items
- 10-fold cross-validation with 3 randomly selected items left out at each fold

Collaborative Filter, Popular method

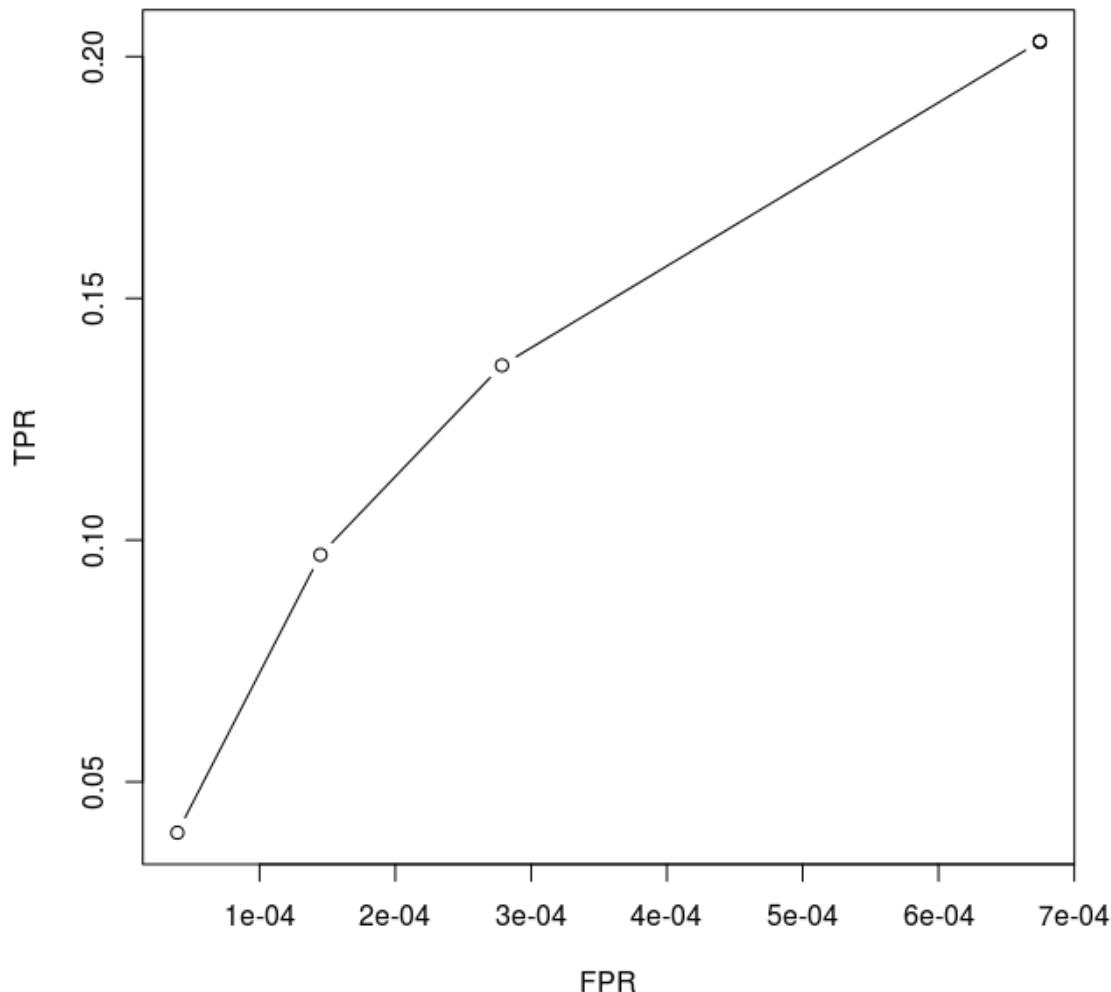


recommenderlab : popular method
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recommenderlab : hybrid model
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Item-based Collaborative Filter



recommenderlab : item-based method
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association rules



ID: 18703475
staircase model
France



ID: 18703477
staircase model
France



ID: 18703503
staircase model
France



ID: 85006475
Pacific Place
T. Heatherwick



ID: 85006443
Masdar Mosque
T. Heatherwick



ID: 85006419
rolling bridge
T. Heatherwick



ID: 85006453
Teesside Power Station
T. Heatherwick



ID: 85006461
Al Fayed Park
T. Heatherwick



ID: 85006445
Worthing Swimming Pool
T. Heatherwick

	rules	support	confidence	lift
1213	{85006419, 85006451, 85006479, 85006487} => {85006445}	0.0839344	0.8469268	7.909948
1214	{85006419, 85006461, 85006479, 85006487} => {85006451}	0.0839344	0.9996795	7.488225
1215	{85006419, 85006451, 85006461, 85006487} => {85006479}	0.0839344	0.9996795	7.510431
1216	{85006451, 85006461, 85006479, 85006487} => {85006419}	0.0839344	0.9993591	7.524253
1217	{85006419, 85006451, 85006461, 85006479} => {85006487}	0.0839344	0.8701637	7.861518
1218	{85006419, 85006451, 85006479, 85006487} => {85006461}	0.0839344	0.8469268	7.883527

RHR_titles
Worthing Swimming Pool, 2009
Large Span Rolling Bridge (not Yet Realized), 2009
UK Pavilion, 2007-2010
Rolling Bridge, 2002-2004
Garden Bridge, 2012-
Al Fayah Park, 2010-2017 (scheduled date of completion)

LHR_titles
1213 Rolling Bridge, 2002-2004, Large Span Rolling Bridge (not Yet Realized), 2009, UK Pavilion, 2007-2010, Garden Bridge, 2012-
1214 Rolling Bridge, 2002-2004, Al Fayah Park, 2010-2017 (scheduled date of completion), UK Pavilion, 2007-2010, Garden Bridge, 2012-
1215 Rolling Bridge, 2002-2004, Large Span Rolling Bridge (not Yet Realized), 2009, Al Fayah Park, 2010-2017 (scheduled date of completion), Garden Bridge, 2012-
1216 Large Span Rolling Bridge (not Yet Realized), 2009, Al Fayah Park, 2010-2017 (scheduled date of completion), UK Pavilion, 2007-2010, Garden Bridge, 2012-
1217 Rolling Bridge, 2002-2004, Large Span Rolling Bridge (not Yet Realized), 2009, Al Fayah Park, 2010-2017 (scheduled date of completion), UK Pavilion, 2007-2010
1218 Rolling Bridge, 2002-2004, Large Span Rolling Bridge (not Yet Realized), 2009, UK Pavilion, 2007-2010, Garden Bridge, 2012-

unique items recommended
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ID: 18703475
staircase model
France, 1800



ID: 18703477
staircase model
France, 1800



ID: 18733333
bronze gate
US, 1920



ID: 18703473
staircase model
France, 1800



ID: 18699461
origami pleat
Japan, 2002



ID: 85006451
Large Span Rolling
Bridge
2009



ID: 85006479
UK Pavillion
2010



ID: 85006419
rolling bridge
T. Heatherwick



ID: 18703503
staircase model
France



ID: 18703485
staircase model
France



ID: 35460287
arch. model
France



ID: 85006463
Olympic Cauldron
2012

Top 12 items scanned
RECOMMENDATION SYSTEM FOR THE
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challenges:

- object data frame was downloaded as a snapshot and was missing data that resulted in excluding potential objects to recommend in order to make the shiny app run.
- because of the sparse matrix sometimes the model will return no predictions
- recommenderlab: cannot see the rules for AR method
- recommenderlab: after training and cross-validating the hybrid model, predict function had a glitch and would now work... requires more research

the app prototype

**RECOMMENDATION SYSTEM FOR THE
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next steps:

- Refine graphics on the app: info of object when hovering over, object name shown with image, and allow the user to select the number of recommendations returned.
- Make the app realtime by integrating API calls for most up-to-date data.
- Implement NLP on the tags and types to get more distinct classifiers to improve recommendations.
- Can we predict a persons area of interest or profession based on the items they scan? Can this information help the museum curators as they plan for future exhibitions?
- Spatial analysis to see how much influence an object's location within the exhibition space has on how many scans it gets.
- Create exploded axonometric floorplans with objects mapped to the locations.

this project made possible by the generous contributions of:
zeyu, kyle + joe, and CPM