

3rd June 2019

# RECOMMENDATION AT REDBUBBLE

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Search & Recommendation Meetup

Karl Grieser - Redbubble

**Redbubble**

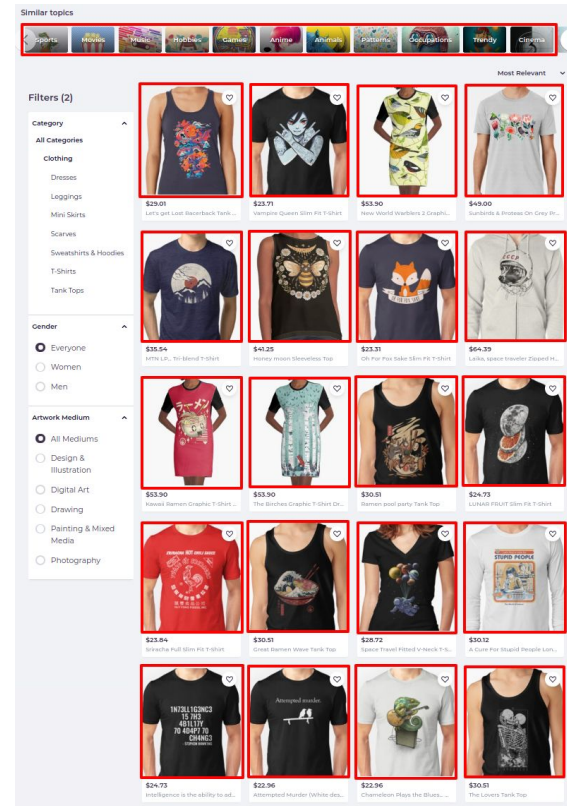
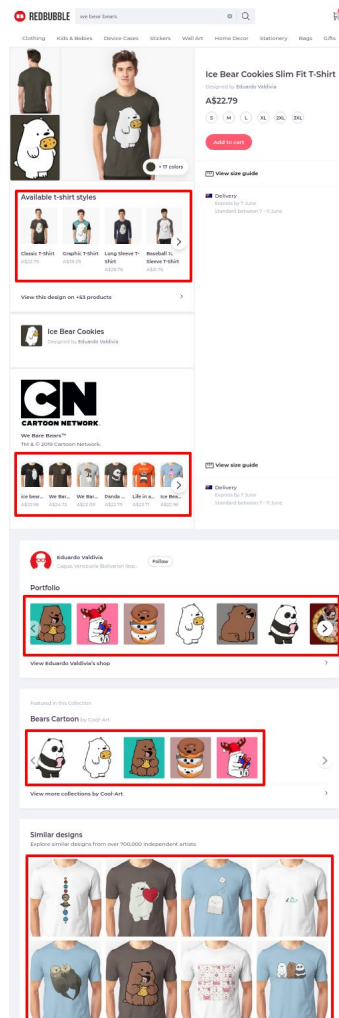
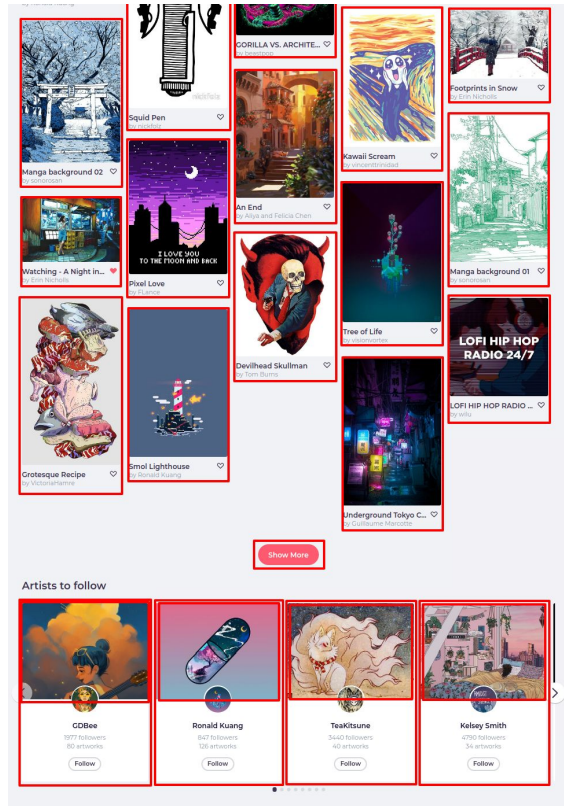
REDBUBBLE IS CREATING THE WORLD'S  
LARGEST MARKETPLACE FOR INDEPENDENT ARTISTS,  
BRINGING  MORE CREATIVITY   
INTO THE WORLD

# Redbubble

- Print-on-demand e-commerce marketplace
- 830,000+ Artists
- 20+ Million Art Works
- 70+ Products
- 250+ Employees
- 3 Offices
- 9 Data Scientists



**Recommendation**



# Recommendation

A **lot** of content

20 million **works** x 70 **products** x  
3-20 **product configurations**

Only a **subset** is user-relevant

**Matrix** of recommendation:

User -> Work

Work -> Product

...

Image

[“Hard Choice // shoes on yellow background”  
by Selma Cardoso](#)



# Recommendation “Experiences”

## Experience (n)

/ɪkˈspɪəriəns, ɛkˈspɪəriəns/

1. practical contact with and observation of facts or events
2. an event or occurrence which leaves an impression on someone
3. business-speak for “a place on a website where you do something”

Broadly, our recommendation uses fall into two groups:

### Primary Recommendation Experiences

Areas of Redbubble that present the recommendation as the focus

### Secondary Recommendation Experiences

Areas of Redbubble where recommendation assists the focus (in a variety of ways)





# Primary Recommendation Experience

Thanks

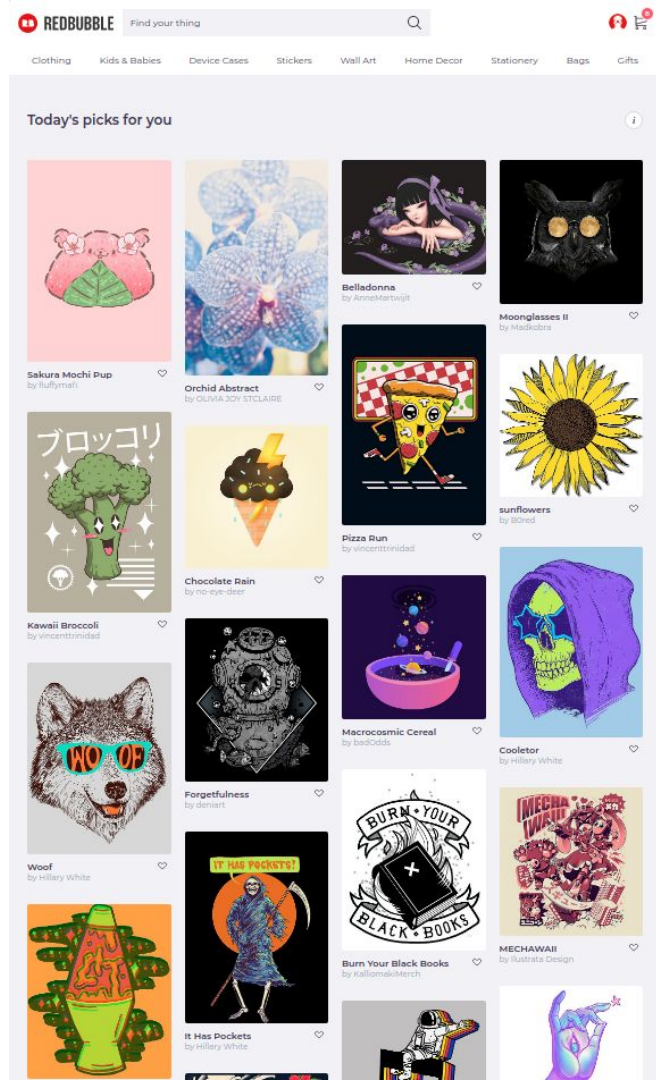
# Explore

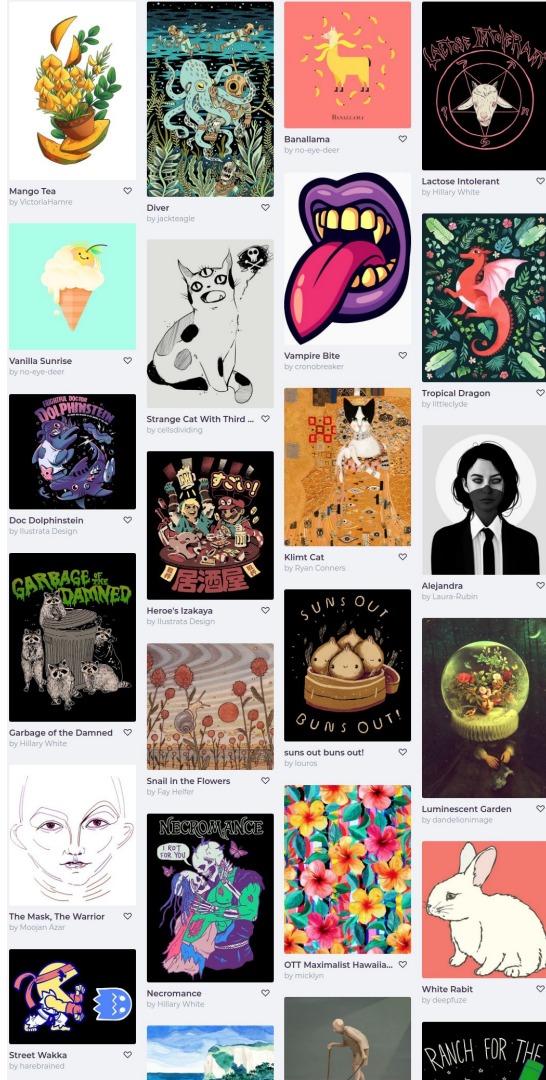
Common experience across **Mobile App** and **Web**

Used as a **customer home page** and **discovery starter**

Provides two sets of recommendation experiences:

**Work Recommendation**  
**Artist Recommendation**





Thanks

# Work Recommendation

User -> Work recommendation

Melds **user interactions** with  
**Collaborative Filtering** model

Facilitates **serendipitous** discovery  
of **new art** relevant to the **user's**  
**interests.**

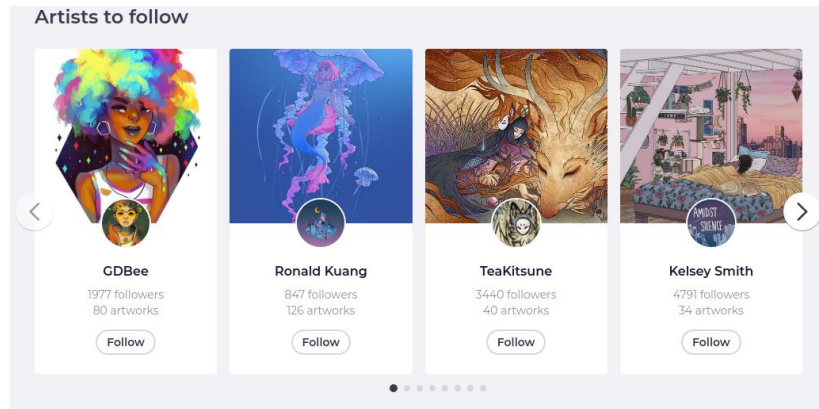
Thanks

# Artist Recommendation

User -> User Recommendation

Again, **user interest** model combined with **Collaborative Filtering** model

Allows user to discover **entire portfolios of art** that reflect their interests



# Recommendation Service

# Exploration vs. Exploitation

Balance **familiarity** with **discovery**

Too much **Exploration**:

User perceives  
recommendations  
as random noise

Too much **Exploitation**:

User only sees things they have  
previously interacted with

Image  
["Jellyspace"](#)  
[by angoes25](#)

# Exploration

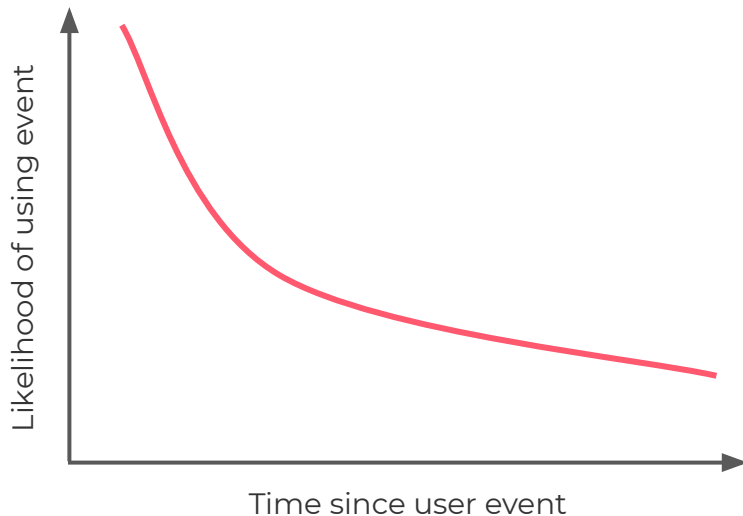
Short-term **user interest** model

User **interaction events** weighed by importance

Recency **weighted random sample** of events

Updated in **real-time**

Used as **seeds** for long-term model



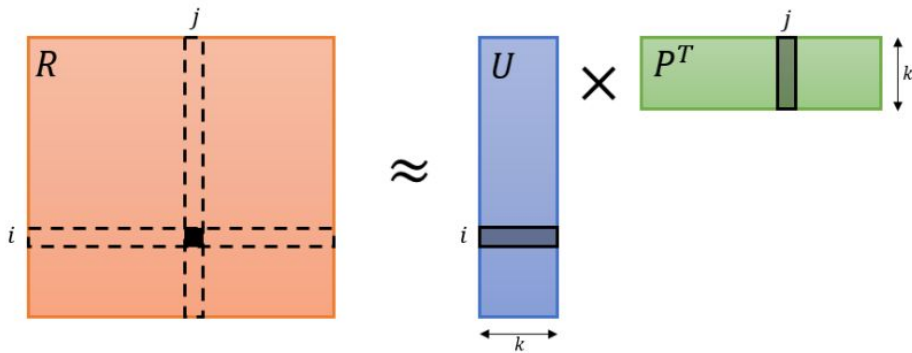
# Exploitation

Long-term **Matrix Factorization**  
model built from user interactions

→ Alternating Least Squares

Retrained at regular intervals using  
large quantities of **historical user  
interaction** data

Main **engine** of Redbubble  
recommendations





# A Versatile Architecture

Abstraction of services allows:

- New applications to consume recommendations
- New recommendation experiences to be added
- New models to be added to the engine
- Us to run A/B tests without consuming applications being aware

Image  
["Crystals and Plants"](#)  
[by doodlesbymeg](#)

# A Common Interface

Applications request an **experience** given a **context** (user, work, product)

Application uses recommendation response to **enhance existing presentation** of content

The **same experience** can be used by multiple applications for **different purposes**

Image  
["Pancake Bot"](#)  
[by Victoria Hamre](#)

## Secondary Recommendation Experience

Image  
*"Homies help homies"*  
by artspacecrafts

## Not Second Best

**Enhance or facilitate** another primary experience

Impact of secondary recommendation measured by **success of primary experience**

## Work + Product -> Work



## Work + Query -> Product

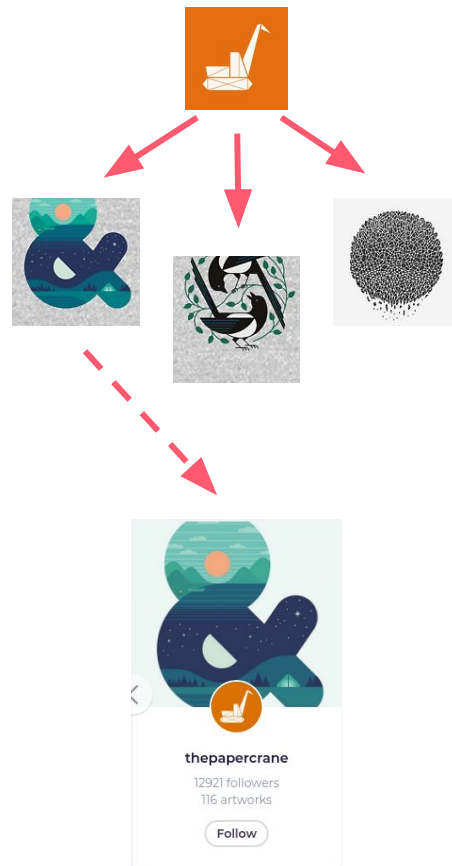


+

*fish stationery*



## Artist + User -> Work



# Data Science at Redbubble

Thanks



## Day-to-Day Data Science

**Prototype** new models + explore site usage patterns

**Build + maintain** systems and applications

**Collaborate** with other RB teams to:

- experiment with **new models**,
- develop **new experiences**,
- provide **expertise and insights**

*"Science Studies Clock"*  
by robyriker

# Prototyping

Validation, discovery,  
demonstrating Proofs of Concept

Tools Used:

BigQuery, Python Notebooks

Image

[“Space Ramen”](#)  
[by salami-spots](#)





# Data Pipelines

Get data to a production usable state

Tools used:

Apache Beam, Apache Airflow,  
BigQuery (again), DynamoDB,  
SQS, Lambdas, AWS Batch

Image

[“Pink Bookcase Pattern Romance Tea Books”  
by Kit Cronk](#)



# Build Applications

Build, enhance and maintain applications to utilise data

Tools used:

Umpteen Languages, AWS,  
Docker, Kubernetes, Github,  
Buildkite (yes, we do CI and CD),  
New Relic, DataDog

Image

[“How to Build a Landscape”  
by Wayne Minnis](#)



REDBUBBLE

Thanks

## Run Experiments

Not quite at Microsoft level

Run multivariate tests in production

Hierarchical Bayesian Analysis

In-flight and post analysis of OEC

Image  
["We Got Science"](#)  
[by Sketchy Sally](#)



REDBUBBLE

**Finally**

## **Multiple Recommendation Experiences**

both as a primary focus, and assisting other experiences

**We build and maintain multiple systems and experiences**

but we also collaborate a lot with other Redbubble teams

[redbubble.com/explore](http://redbubble.com/explore)

Get in touch:

<http://tiny.cc/fb8o7y>