



Top 10 Lessons learned Developing, Deploying and Operating Real-World Recommender Systems

Marc Torrens
Chief Innovation Officer



IJCAI, Industry Day
Barcelona :: July 22, 2011

Agenda

About Strands

What is a Recommender?

The Business Perspective

Top Lessons Learned

Agenda

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About Strands

Year 2003...

- implicit preferences!



Name	Time	Rating	Pla... ▾	Artist	Album by Art...	Year	Genre	Last Played	Date Added	Compos...
De Tus Ojos Soy Cautivo	3:14	★★★	283	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	7/1/10 21:21	1/12/05 12:41	Mann
Aserejé	3:33	★	275	Las Ketchup	Las Ketchup	2002	Latin	6/11/09 11:39	2/9/05 11:57	
Viviré	3:54	★★★★★	271	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	7/1/10 21:05	1/12/05 12:41	
Como El Agua	3:41	★★★★★	270	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	7/1/10 20:58	1/12/05 12:41	
Canastera	3:53	★★★	266	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	5/26/10 18:01	1/12/05 12:41	
Te Lo Dice Camarón	3:37	★★★	261	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	7/1/10 21:02	1/12/05 12:41	
Al Verde Las Flores Lloran (...)	2:42	★★★★★	260	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	7/1/10 21:12	1/12/05 12:41	
Calle Real (Fandangos Del ...)	3:33	★★★★	256	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	7/1/10 21:09	1/12/05 12:41	
Y Mira Que Mira Y Mira (Al...)	3:21	★★★	254	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	5/26/10 18:12	1/12/05 12:41	
La Primavera (Rumba)	3:53	★	253	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	5/26/10 18:05	1/12/05 12:41	
Cada Vez Que Nos Miramos	3:48	★★★	253	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	5/26/10 18:09	1/12/05 12:41	
Salud Antes Que Dinero (Pa...)	2:53	★	252	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	7/1/10 21:18	1/12/05 12:41	
Volando Voy	3:33	★★★★★	251	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	5/26/10 18:29	1/12/05 12:41	
La Leyenda Del Tiempo	3:34	★★★	250	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	7/1/10 21:15	1/12/05 12:41	
Con Roca De Pedernal	3:28		250	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	5/26/10 18:20	1/12/05 12:41	
Soy Gitano	4:17	★★★	250	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	4/18/10 12:42	1/12/05 12:41	
Malito Yo Estaba	4:22		248	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	5/26/10 18:17	1/12/05 12:41	
El Espejo En Que Te Miras (...)	3:07		248	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	5/26/10 18:23	1/12/05 12:41	
Un Tiro Al Aire	4:46	★★	243	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	5/26/10 18:34	1/12/05 12:41	
Viejo Mundo (Bulerías)	2:45		242	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	5/26/10 18:26	1/12/05 12:41	
Rosa María (Tango)	2:18	★★★★★	236	Camarón de la Isl...	Una Leyend...	1994	Flam...	2/15/10 14:15	1/12/05 12:41	
Macaco (Canción Criolla)	4:20		222	Camarón de la Isla	Una Leyenda F...	1994	Flamenco	2/15/10 15:02	1/12/05 12:41	

Provide Recommendations in the Music Space

About Strands

Strands develops **technologies** to better **understand people's taste** and **help them discover** things they like and didn't know about.



music

people
videos
music

Strands **Recommender**
Strands **Fitness**
Strands **Finance**

2003

2004

2005

2006

2007

2008

2009

2010

2011

RecSys'06 summer school RecSys'07 Minneapolis RecSys'08 Lausanne RecSys'09 NY RecSys'10 Barcelona RecSys'11 Chicago

Same mission evolving through different domains

About Strands



Understanding consumer preferences in real-world activities



Understanding consumer habits at the commerce (transaction) level



Understanding consumer behavior at the product level



Highly-targeted Product Placement



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About Strands

strands



The image shows the homepage of the Strands Fitness website. At the top, there's a navigation bar with a Facebook icon, 'Log In' (in blue), 'Blog', 'English', and a yellow 'Login' button. To the right, it says 'Track: Running'. The main headline is 'Get fit and workout like a pro!' followed by a subtext: 'Designed by professional athletes, our platform makes getting in shape fun, easy and rewarding.' Below this are four images of people exercising: running, cycling, lifting weights, and swimming. Each image has a caption: 'Monitor progress through web and mobile devices', 'Track exercise and weight loss', 'Share goals easily', and 'Motivate yourself with community support'. At the bottom left, there's a section for 'Strands Fitness for Mobile Phones' with a smartphone icon and a 'Learn more' button. On the right, there's a large sign-up form with fields for 'Username', 'Contact email', 'Password', and 'Password again', plus a 'Get Fit Now!' button. The background features a large, stylized image of water.

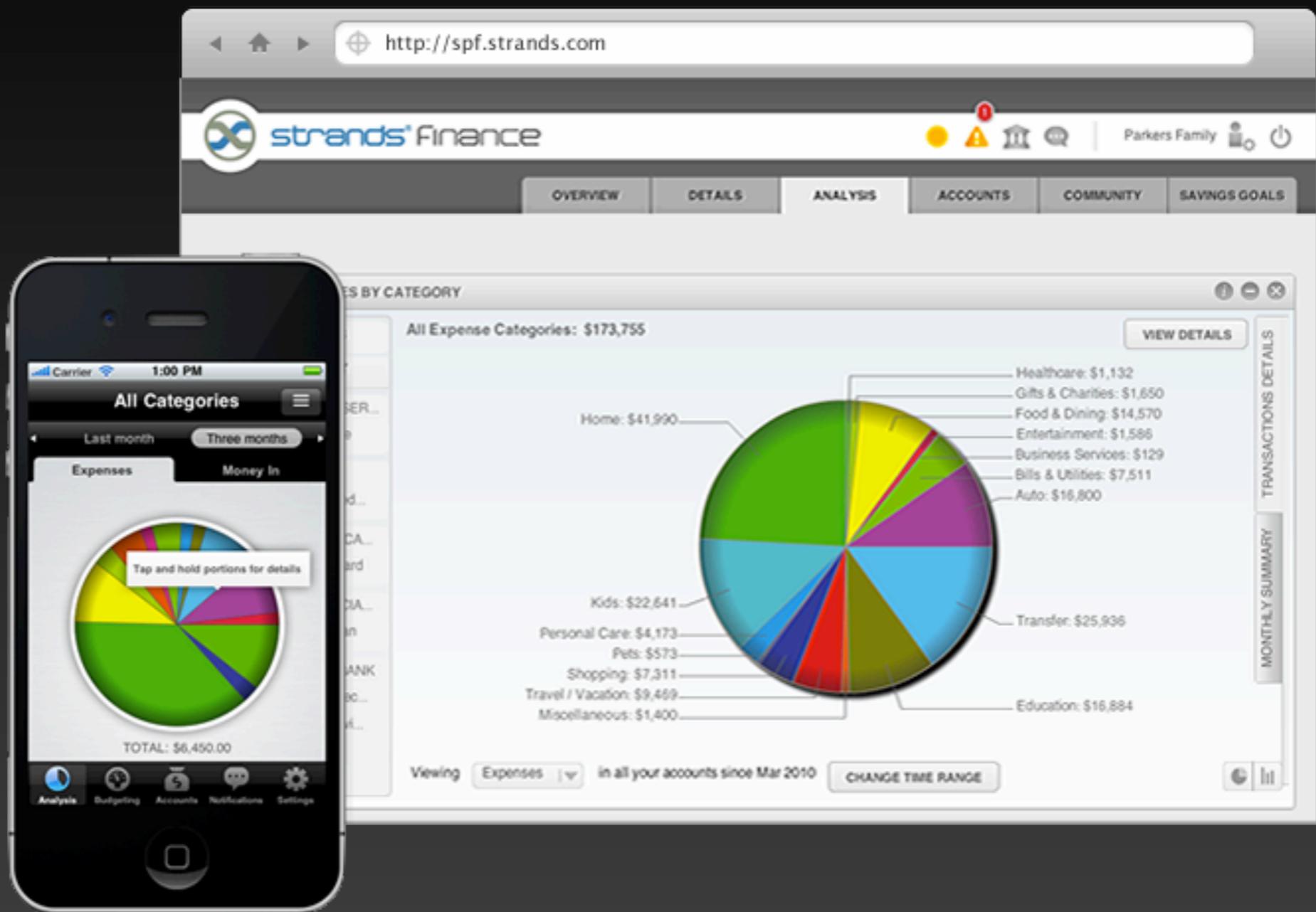
strands

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About Strands



- BBVA, Spain
- ING, Netherlands
- BMO, Canada



About Strands



TRAVELSMITH

DISCOUNT DANCE SUPPLY

COSTUMES INC.



furnitureblue.
Comfort. Made for you.

11870.COM

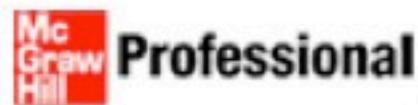


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i^{heart}movies BETA



About Strands

The screenshot shows the homepage of iCasque.com, a motorcycle gear retailer. The top navigation bar includes links for Casques, Equipement, Accessoires Moto, Les Marques, Nouveautés, and Soldes. A prominent banner on the right side features two black motorcycle helmets and the text "SOLDES Casques Nitro NGFP & NGJP Rapport qualité/prix imbattable! A partir de 39€". Below this, there are two smaller product cards: one for a GIVI Jet 10.4 B helmet at 61€ (reduced from 100€, -39%) and another for a GPAX A 400 DS helmet at 109€ (reduced from 140€, -22%). To the right of these cards is a sidebar titled "SOLDES votre casque en 3 clics!" with dropdown menus for category, size, color, and a "Conseillez moi" button. At the bottom, there's a section for "SOLDES : LA SÉLECTION DE LA SEMAINE" featuring five items: RACER State Noir gloves (-21% off to 31.00€), NITRO NGFP Uno Noir (00) helmet (-55% off to 49.00€), NOLAN N43 Air Motomad helmet (-15% off to 220.15€), ONE INDUSTRIES Monster Matrix Black jacket (-15% off to 58.65€), and GPAX A 400 DS Blanc helmet (-22% off to 109.00€).

Agenda

About Strands

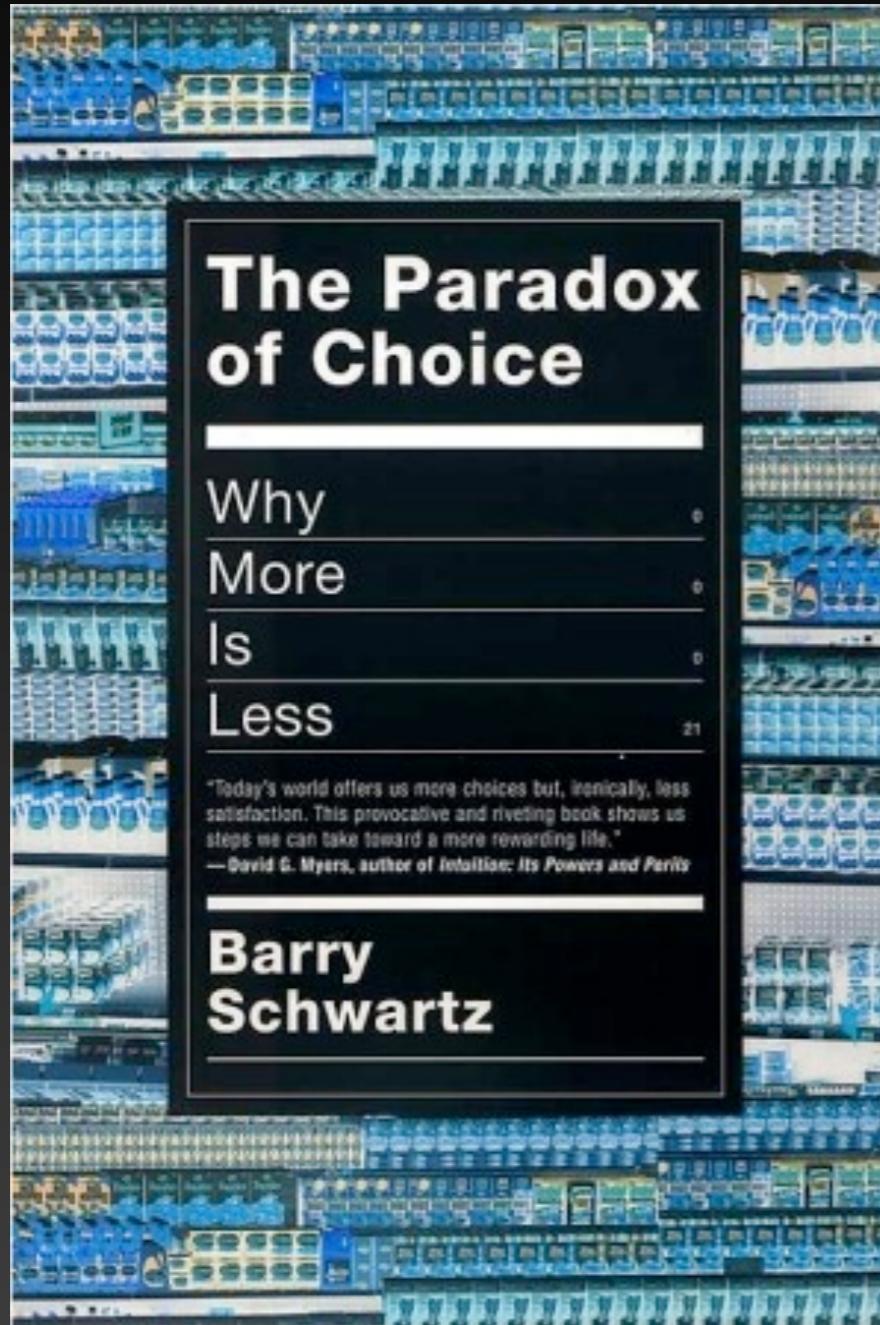
What is a Recommender?

The Business Perspective

Top Lessons Learned

Why Personalize?

The Paradox of Choice by Barry Schwartz

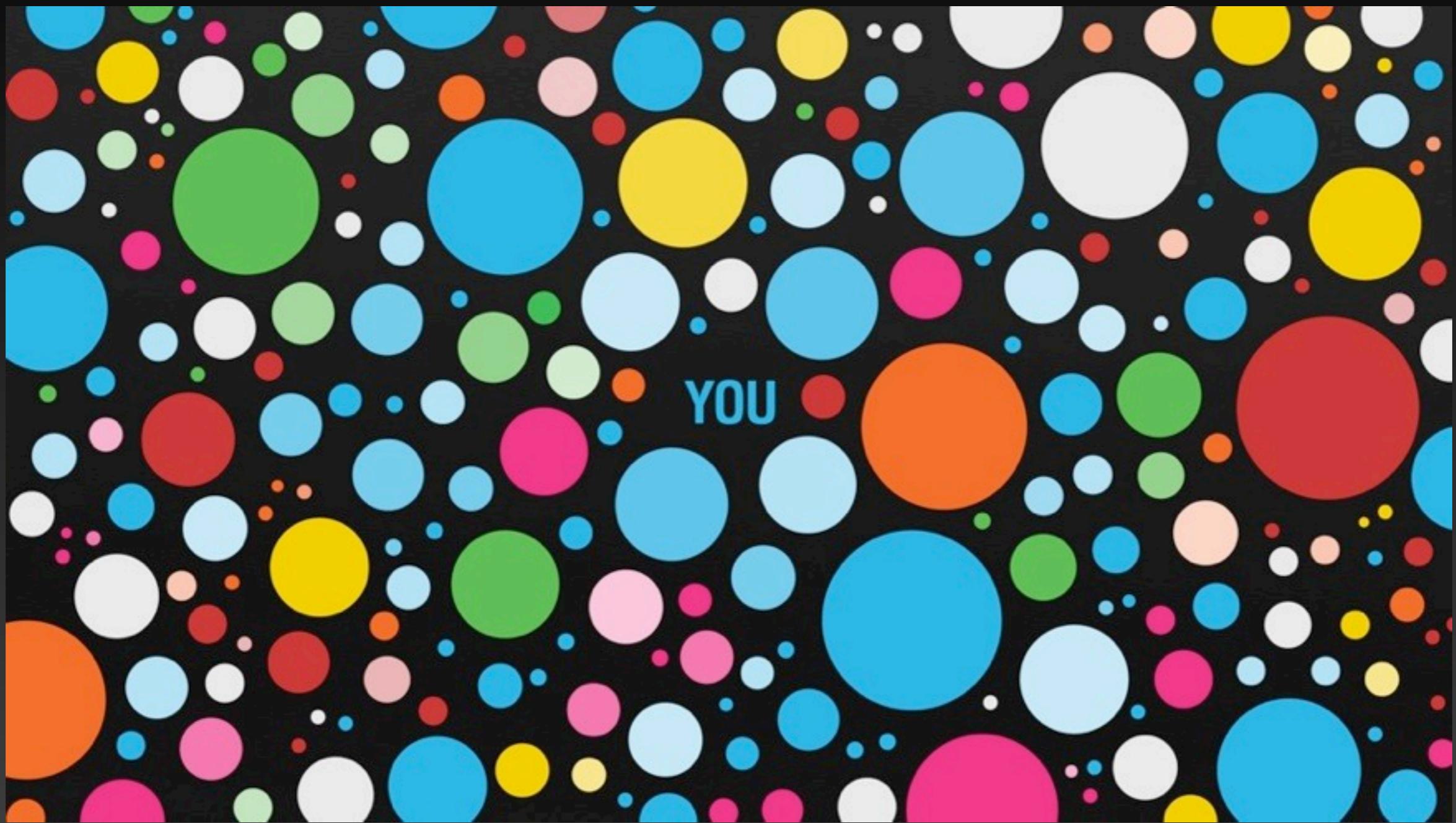


Personalization is great ...but

The Filter Bubble *by Eli Pariser*

Personalization is great ...but

The **Filter Bubble** by Eli Pariser



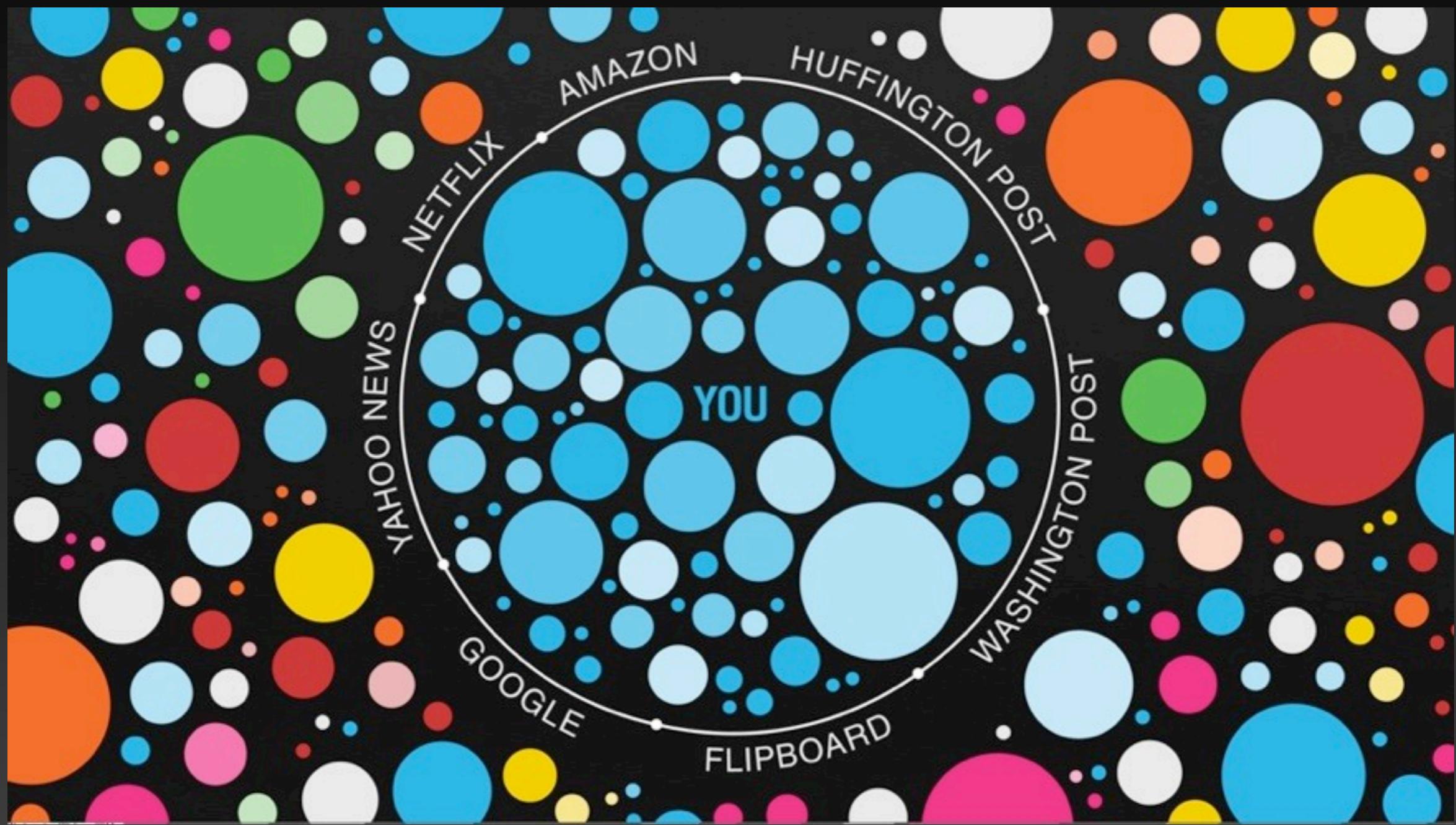
Personalization is great ...but

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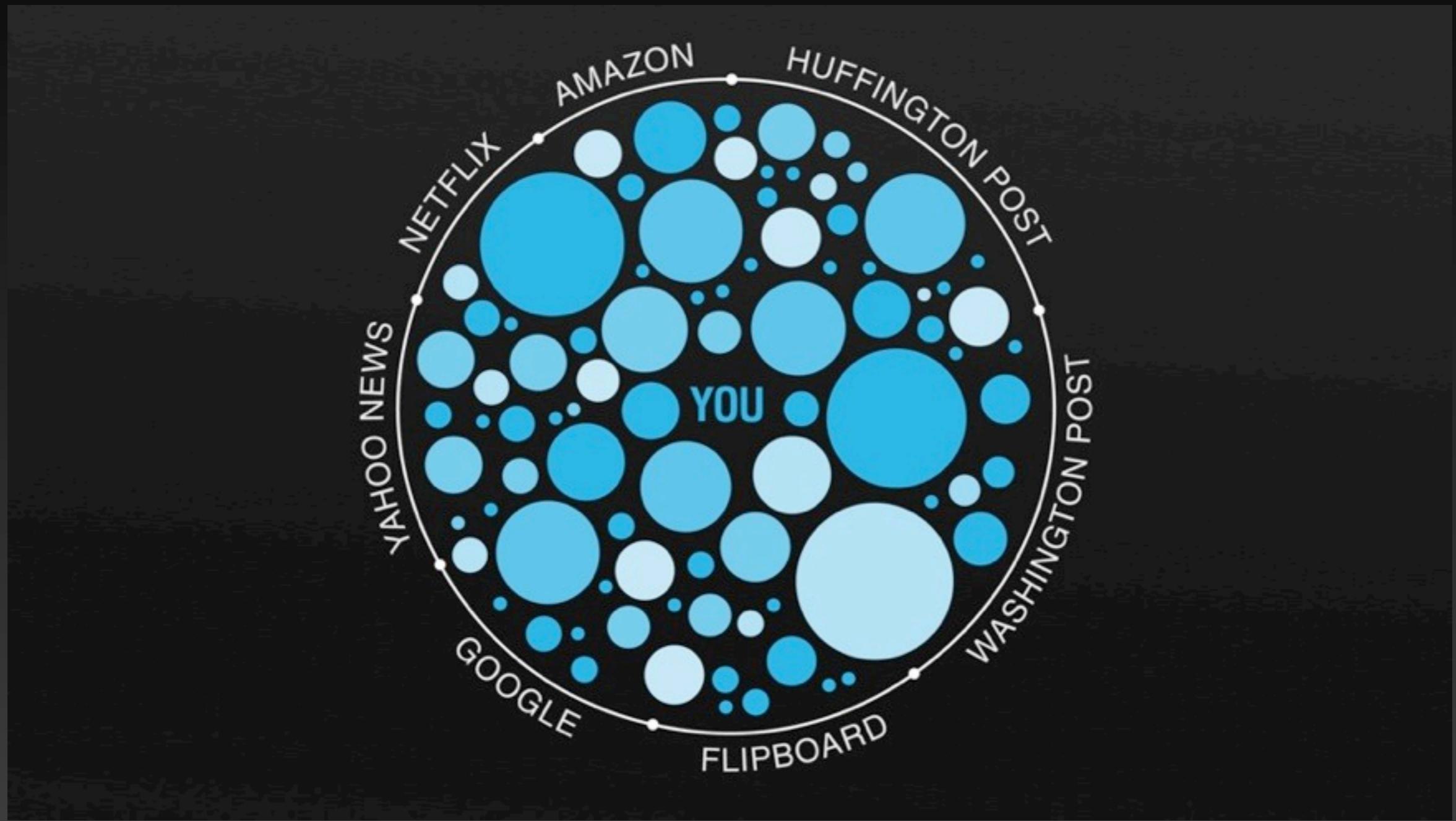
Personalization is great ...but

The Filter Bubble *by Eli Pariser*



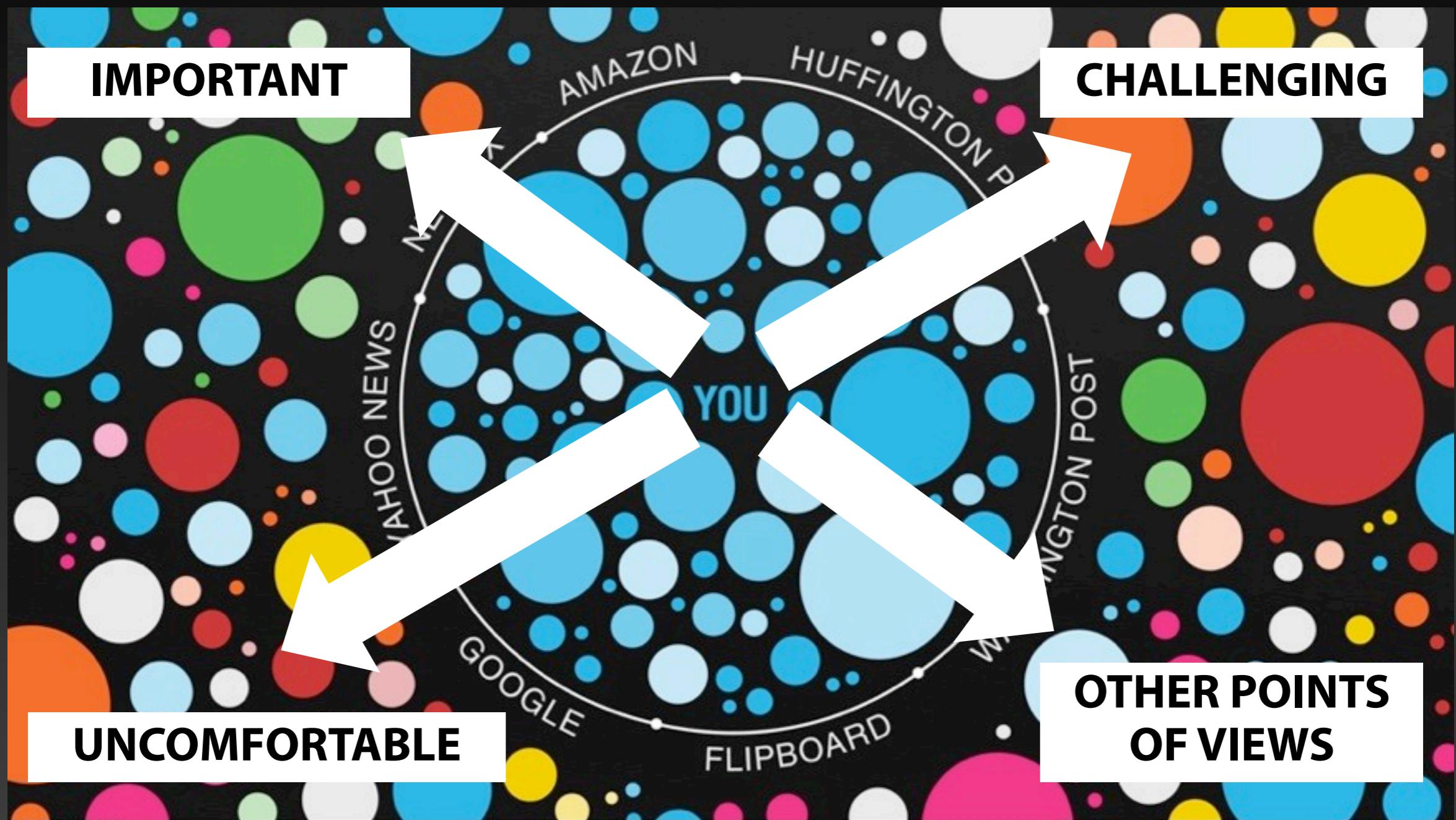
Personalization is great ...but

The **Filter Bubble** by Eli Pariser



Personalization is great ...but

The Filter Bubble *by Eli Pariser*



What is a Recommender?

A blurred background image of a woman shopping in a supermarket aisle, with shelves of colorful products blurred to suggest motion.

A Recommender selects the product that if acquired by the buyer maximizes value of both buyer and seller at a given point in time

What is a Recommender?

A Recommender processes information and transforms it into actionable knowledge

What is a Recommender?

A Recommender processes information and transforms it into actionable knowledge

Recommender Components

What is a Recommender?

A Recommender processes information and transforms it into actionable knowledge

Recommender Components

Knowledge
Base

What is a Recommender?

A Recommender processes information and transforms it into actionable knowledge

Recommender Components

Knowledge
Base

Knowledge
Processing
Application

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Knowledge
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Knowledge
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Business
Control
& Analytics

What is a Recommender?

A Recommender processes information and transforms it into actionable knowledge

Recommender Components

Knowledge
Base

Knowledge
Processing
Application

Business
Control
& Analytics

User
Interface

What is a Recommender?

A Recommender processes information and transforms it into actionable knowledge

Recommender Components

Knowledge
Base

25%

Knowledge
Processing
Application

25%

Business
Control
& Analytics

25%

User
Interface

25%

What is a Recommender?

A Recommender processes information and transforms it into actionable knowledge

Recommender Components

Knowledge
Base

25%

Knowledge
Processing
Application

25%

Business
Control
& Analytics

25%

User
Interface

25%

It has a certain level of **autonomy** presenting recommendations to the end user

Agenda

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What is a Recommender?

The Business Perspective

Top Lessons Learned

The Business Perspective



The Business Perspective



1. Do I need a recommender?

The Business Perspective



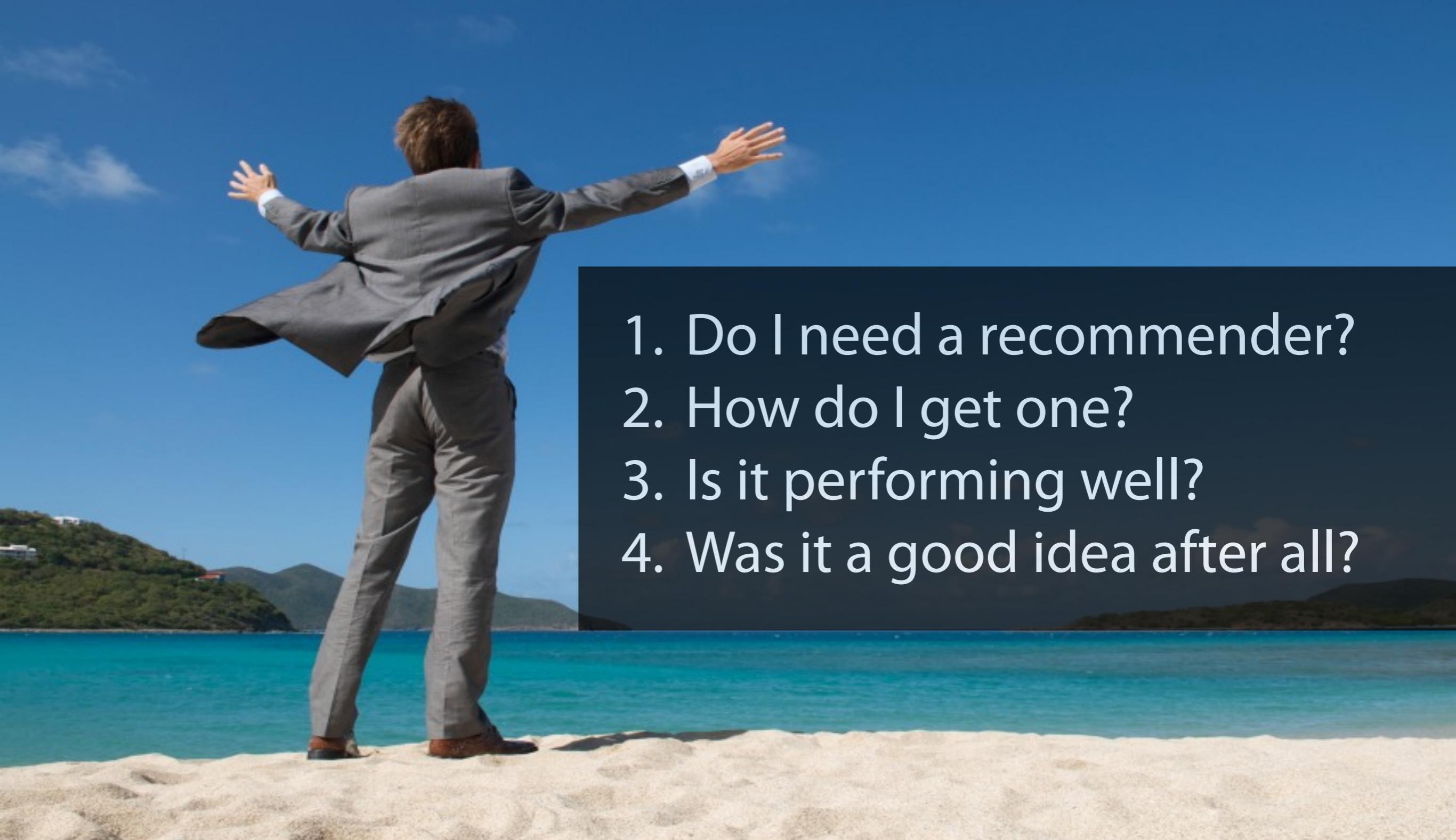
1. Do I need a recommender?
2. How do I get one?

The Business Perspective



1. Do I need a recommender?
2. How do I get one?
3. Is it performing well?

The Business Perspective



1. Do I need a recommender?
2. How do I get one?
3. Is it performing well?
4. Was it a good idea after all?

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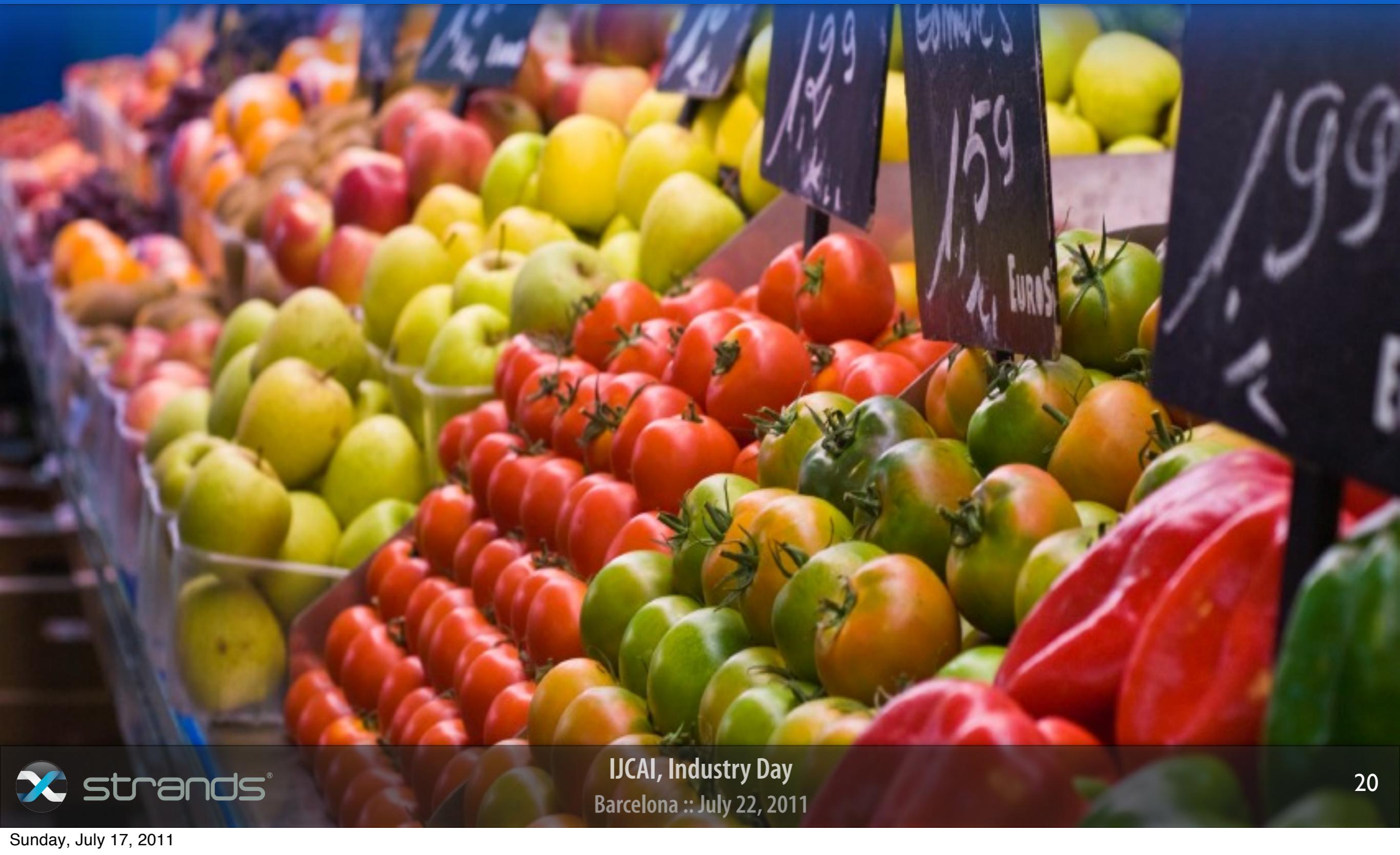
LESSON 1



Make sure it is needed.

LESSON 1

Make sure it is needed.



LESSON 1

Make sure it is needed.



LESSON 1

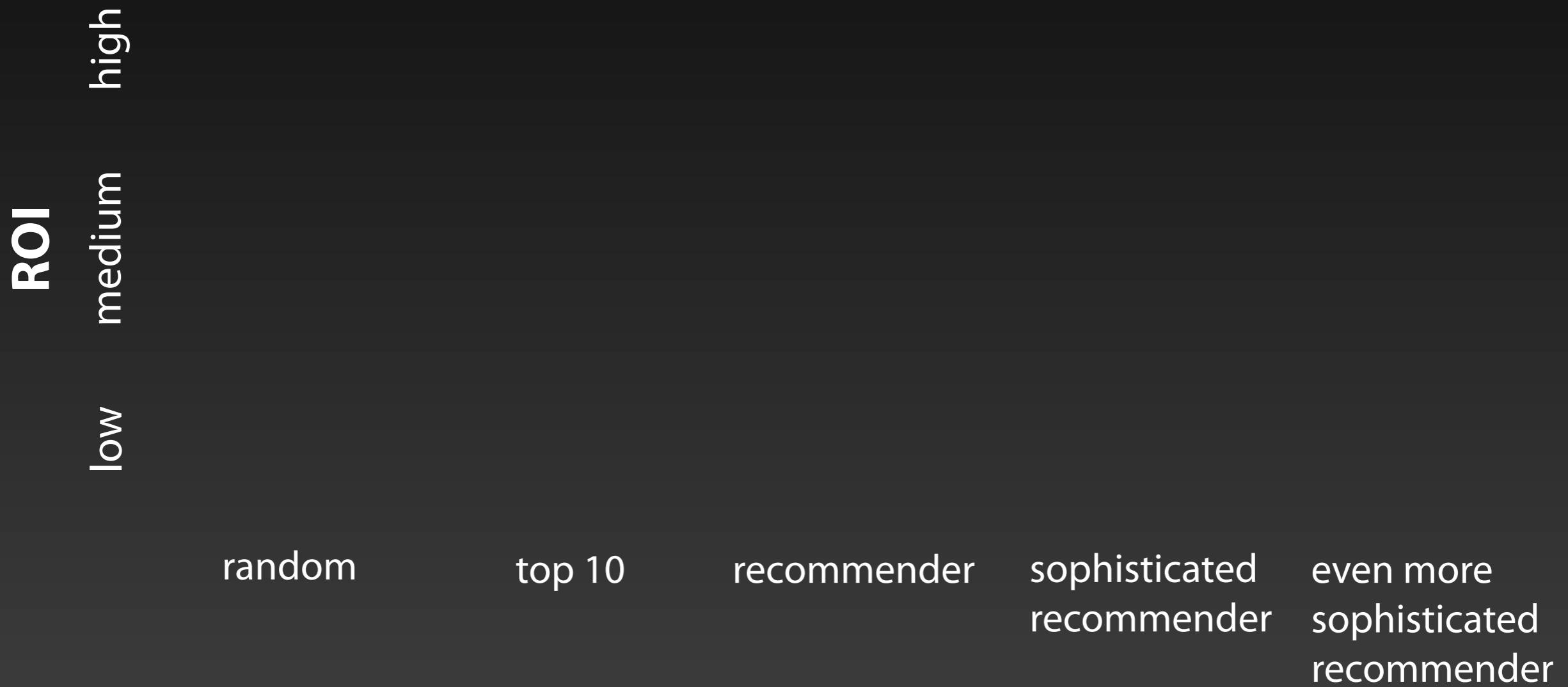
Make sure it is needed.



000s in both products and customers

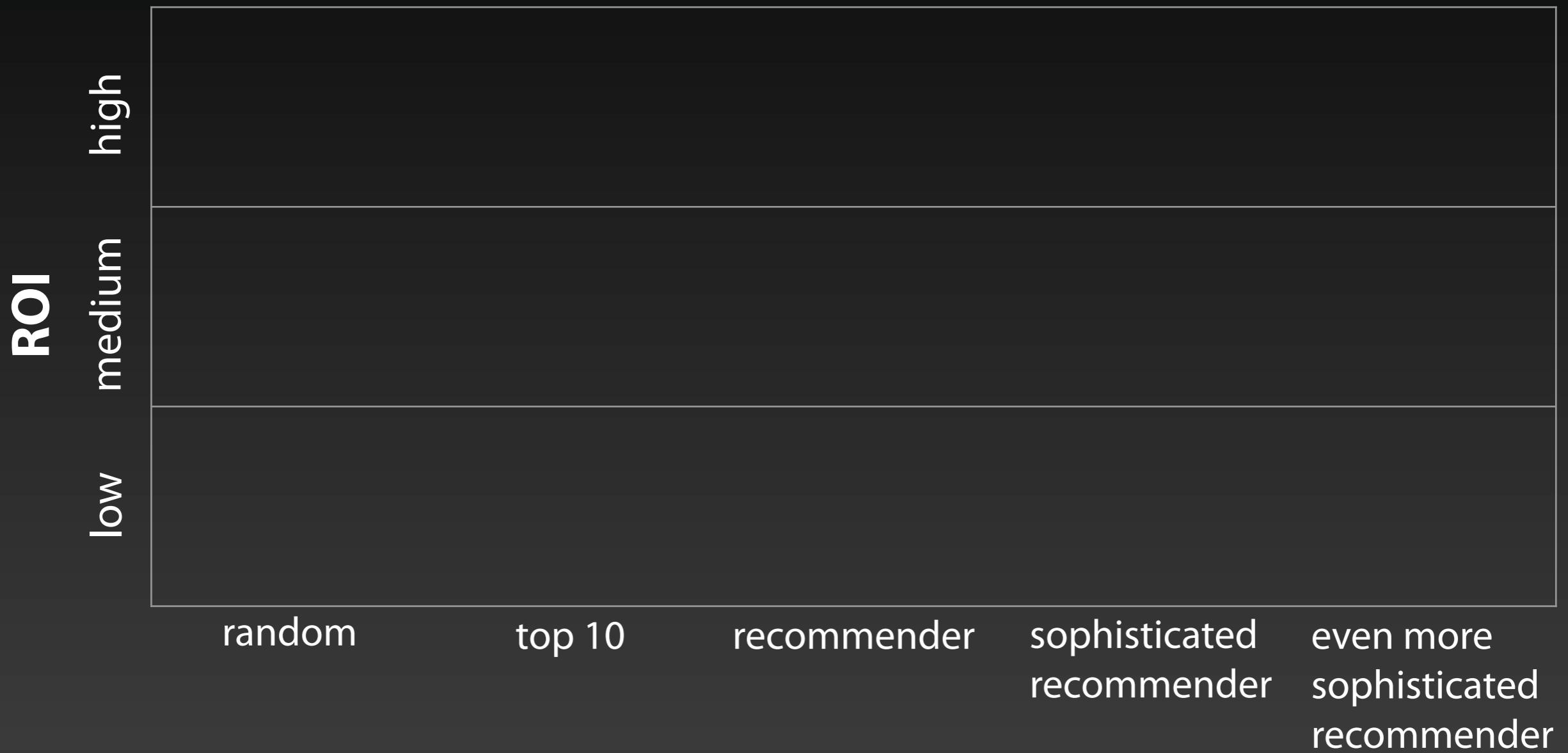
LESSON 1

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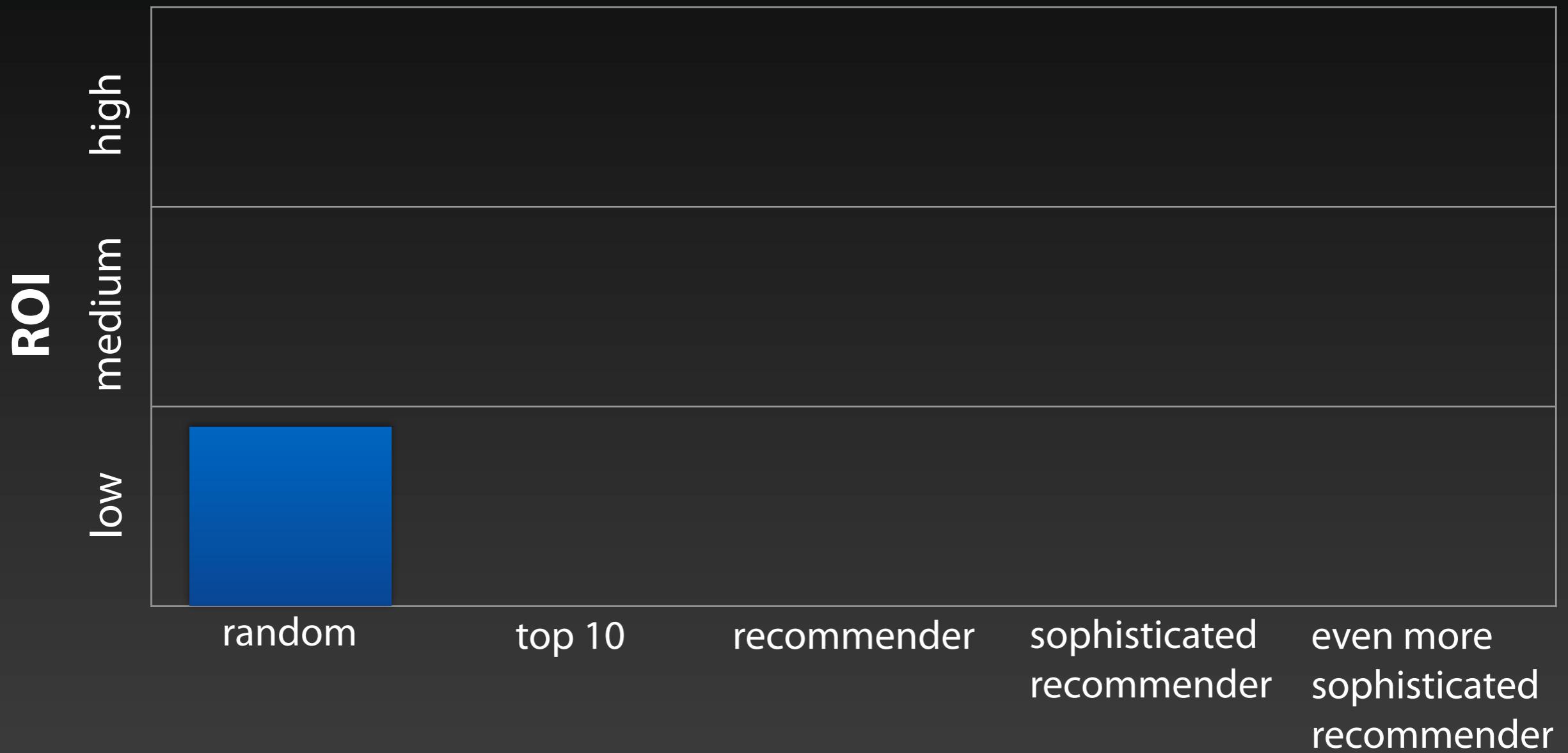
LESSON 1

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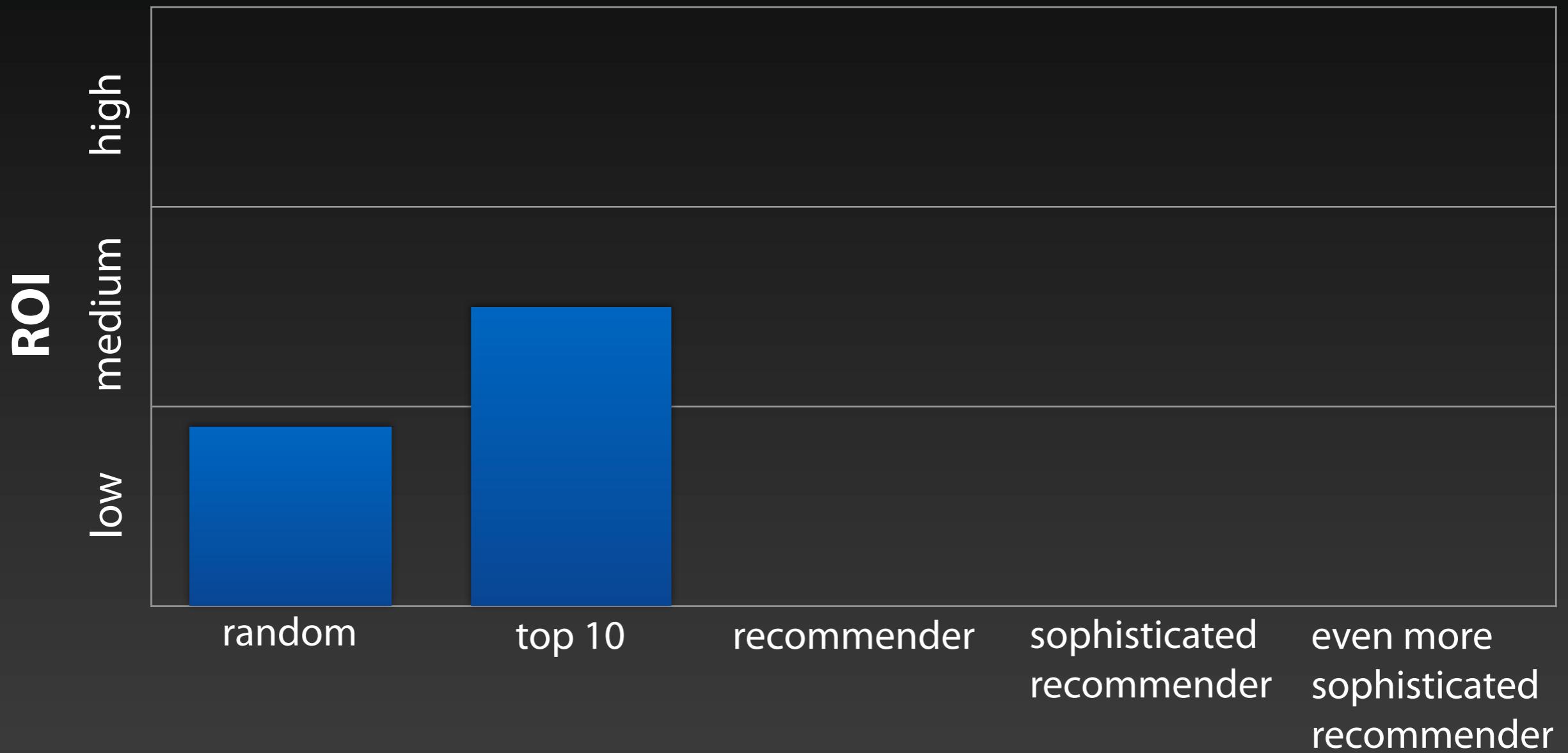
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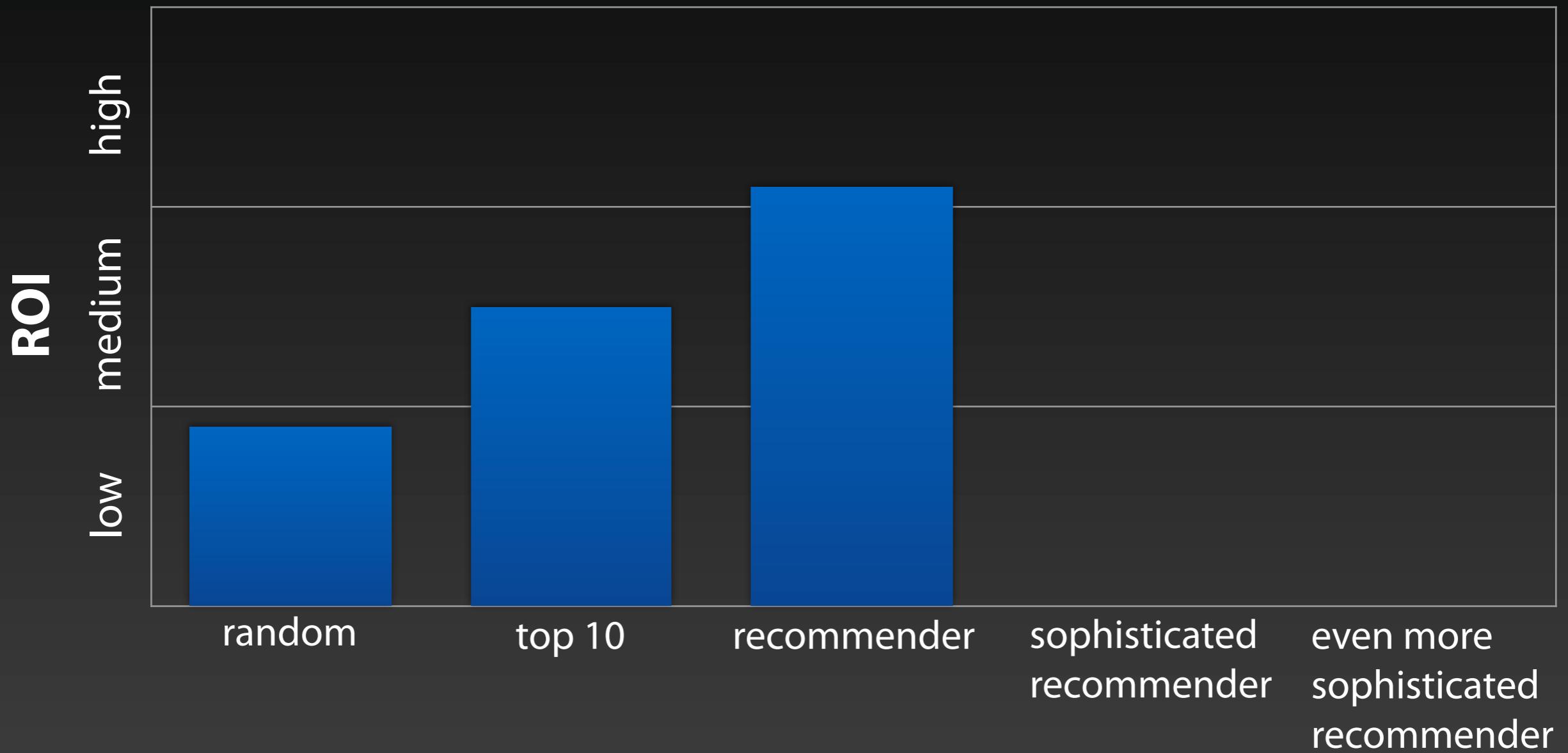
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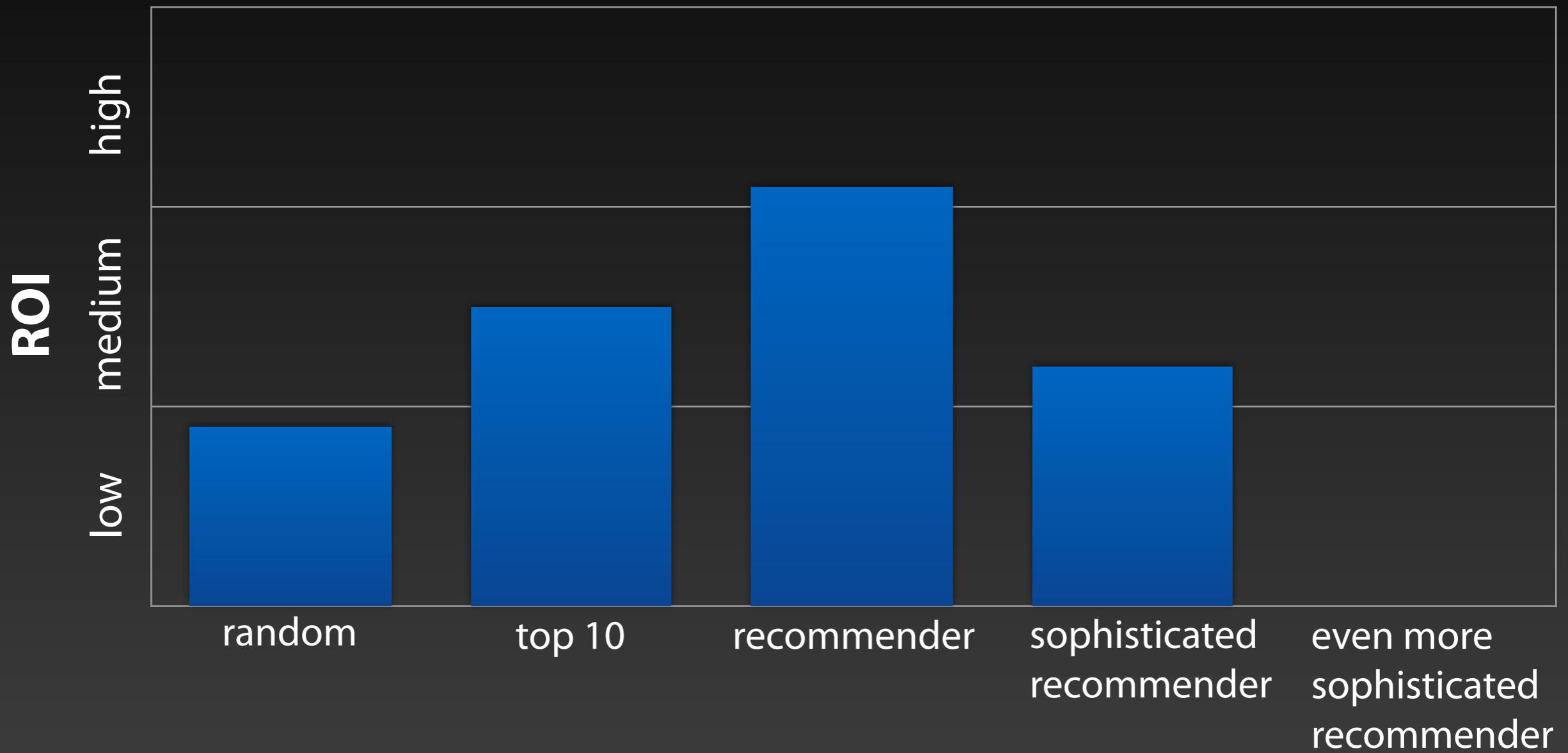
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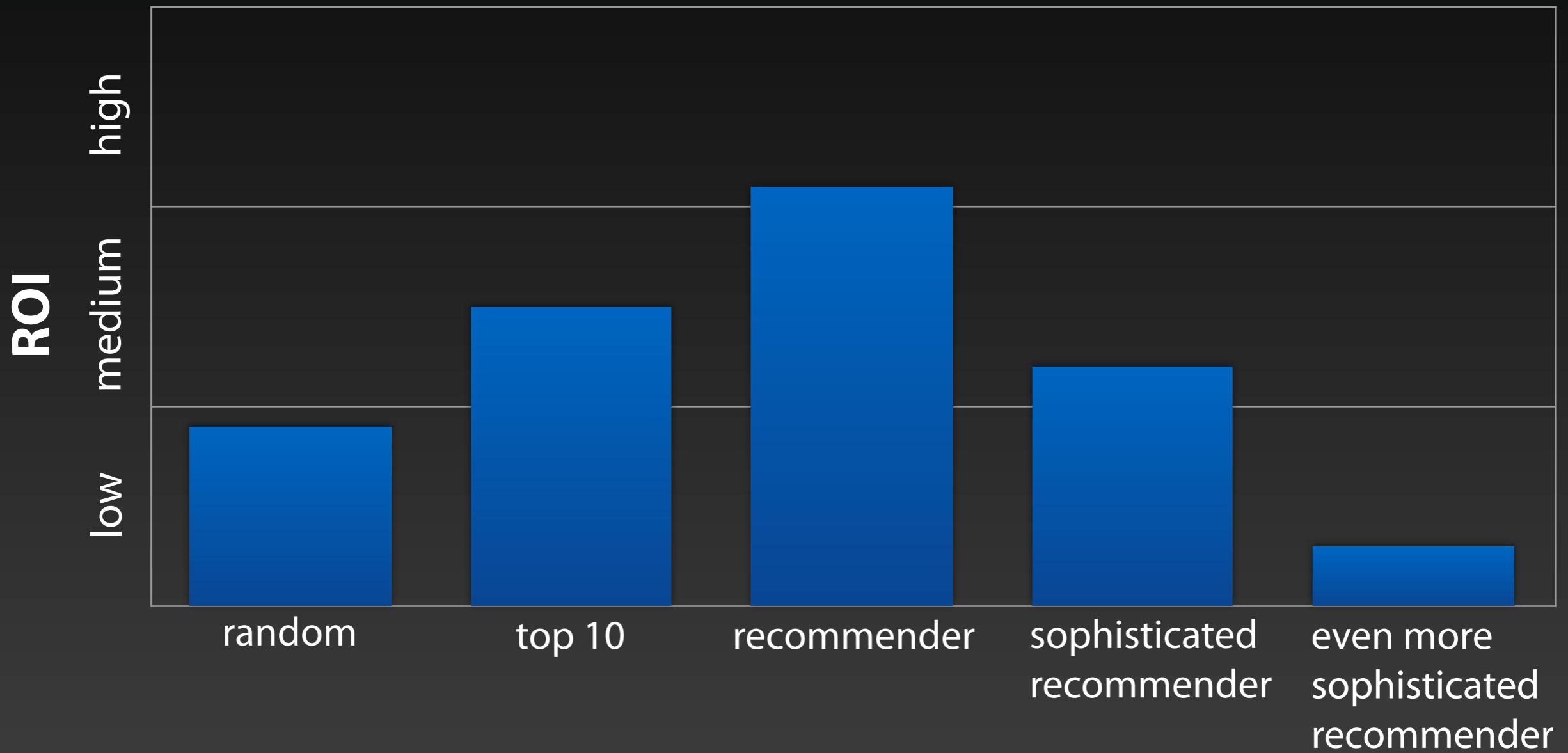
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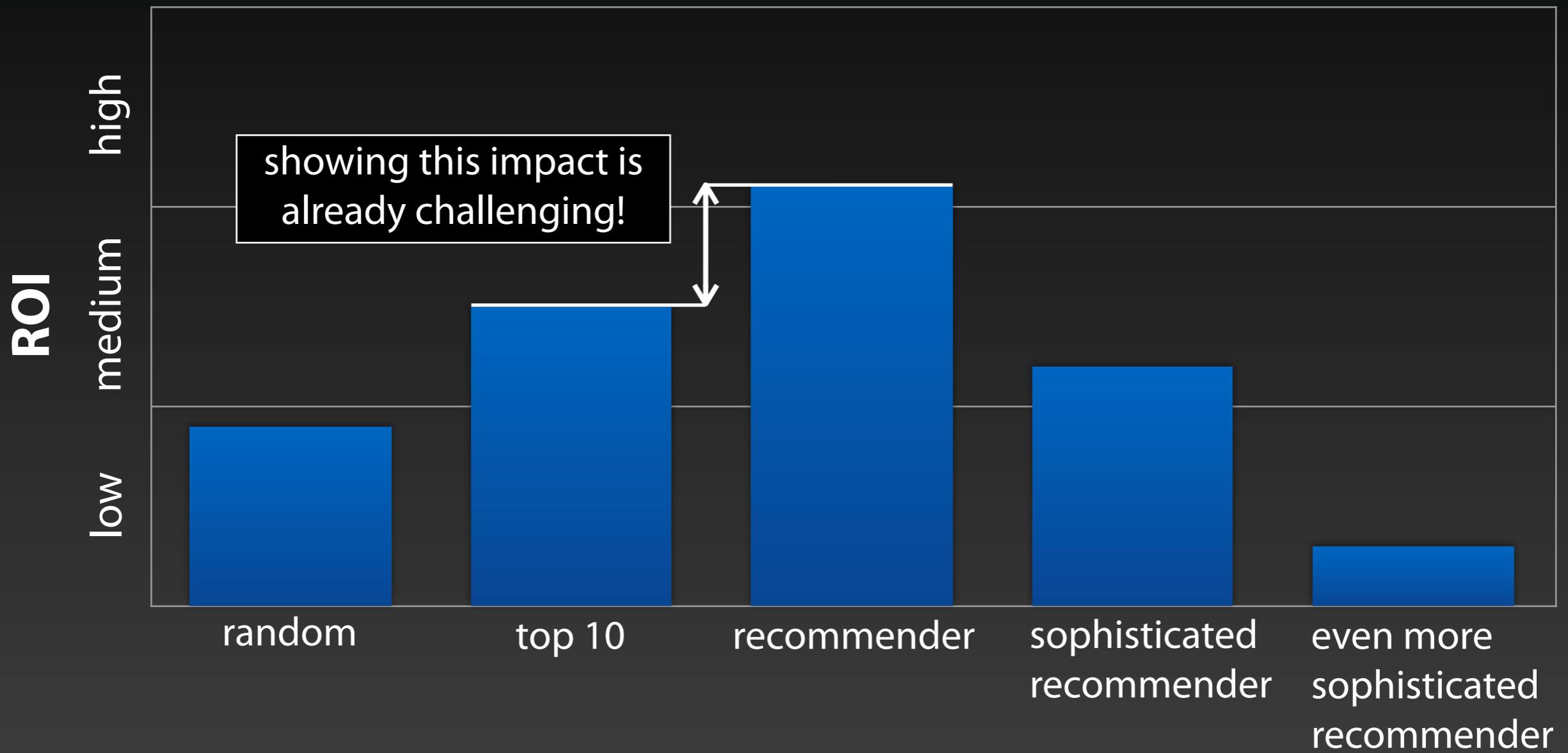
LESSON 1

Make sure it is needed.



LESSON 1

Make sure it is needed.



LESSON 2



It must make “strategic” sense.

LESSON 2

It must make “strategic” sense.



Is the best recommendation for the customer the best recommendation for the business?

LESSON 2

It must make “strategic” sense.

- customer perspective
 - Relevant vs Useful
 - Correctness is often too obvious to be useful
 - Riskier recommendations have less chances of being known
- business perspective
 - Short-term gain vs long-term return

LESSON 2

It must make “strategic” sense.

Knowledge
Base

Knowledge
Processing
Application

? %

Business
Control
& Analytics

? %

User
Interface

LESSON 2

It must make “strategic” sense.

Knowledge
Base



**Knowledge
Processing
Application**

? %



**Business
Control
& Analytics**

? %

User
Interface

LESSON 2

It must make “strategic” sense.

Knowledge
Base



Knowledge
Processing
Application

? %



Business
Control
& Analytics

? %

User
Interface

- How much business logic goes into Recommender?

LESSON 2

It must make “strategic” sense.

Knowledge
Base



Knowledge
Processing
Application

? %



Business
Control
& Analytics

? %

User
Interface

- How much business logic goes into Recommender?
- What's the right level of autonomy a recommender must have?

LESSON 2

It must make “strategic” sense.

Knowledge
Base



Knowledge
Processing
Application

? %



Business
Control
& Analytics

? %

User
Interface

- How much business logic goes into Recommender?
- What's the right level of autonomy a recommender must have?
- How can the business control recommendations?

The Business Perspective



1. Do I need a recommender?
- 2. How do I get one?**
3. Is it performing well?
4. Was it a good idea after all?

LESSON 3



Choose the right partner.

LESSON 3

Choose the right partner.

LESSON 3

Choose the right partner.

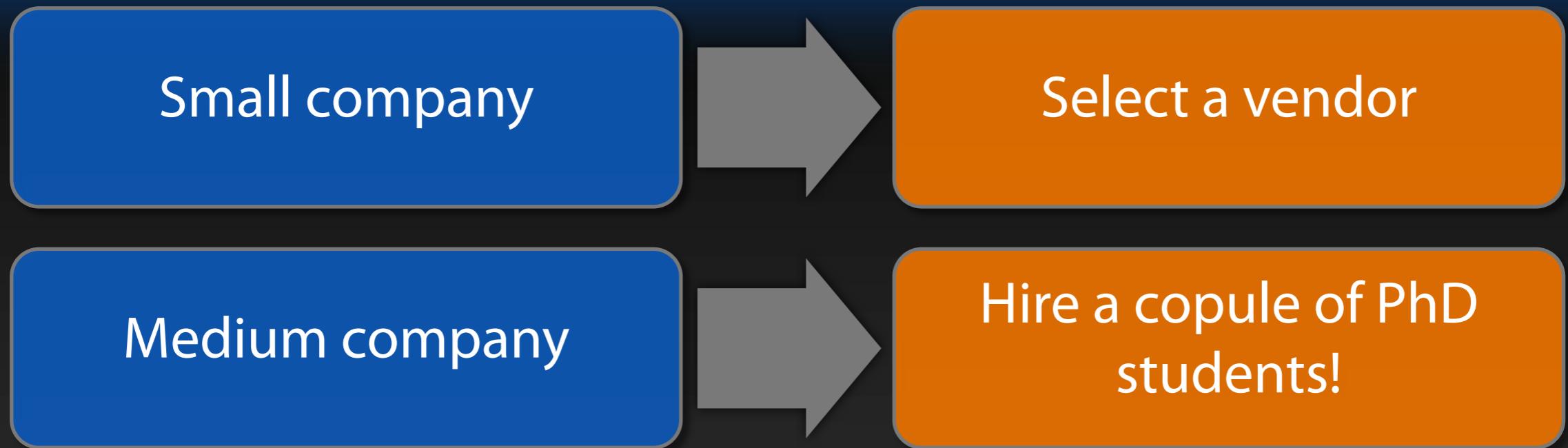
Small company



Select a vendor

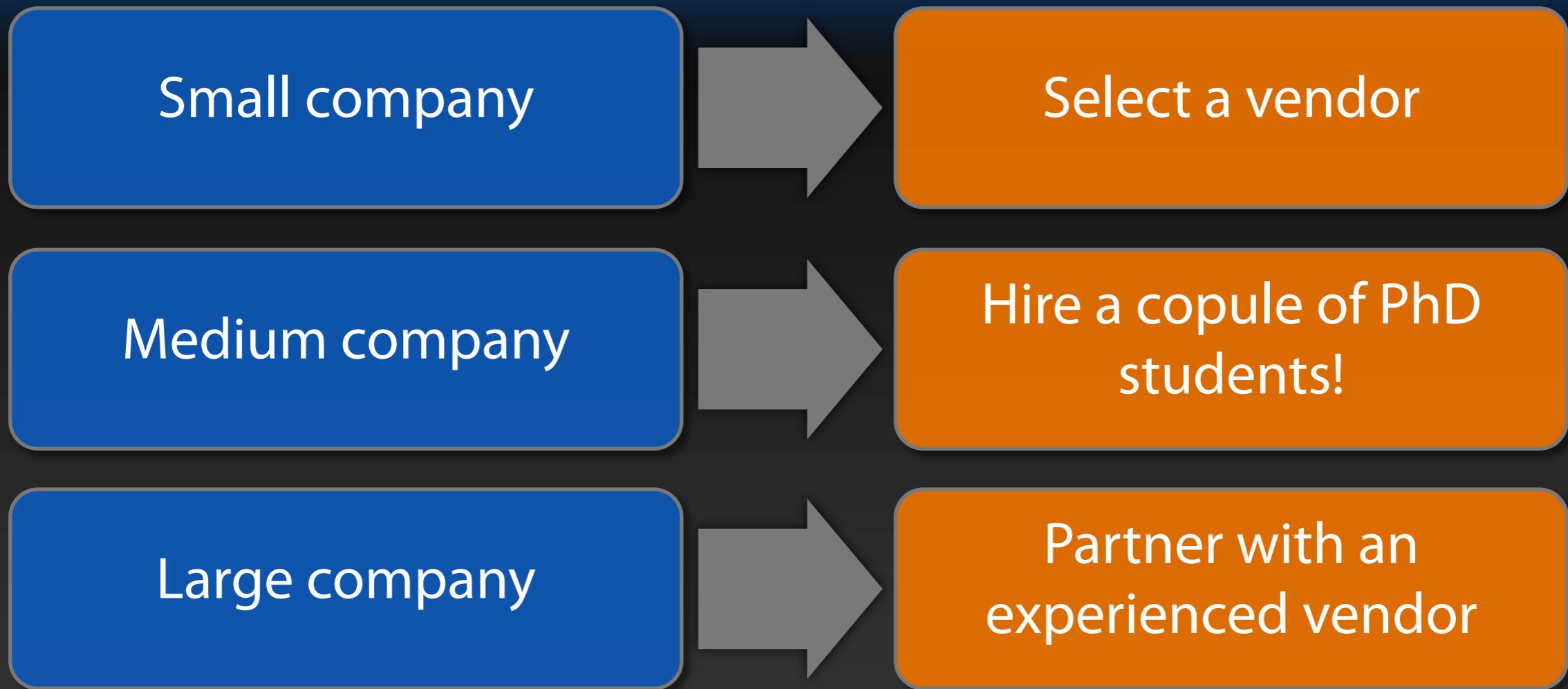
LESSON 3

Choose the right partner.



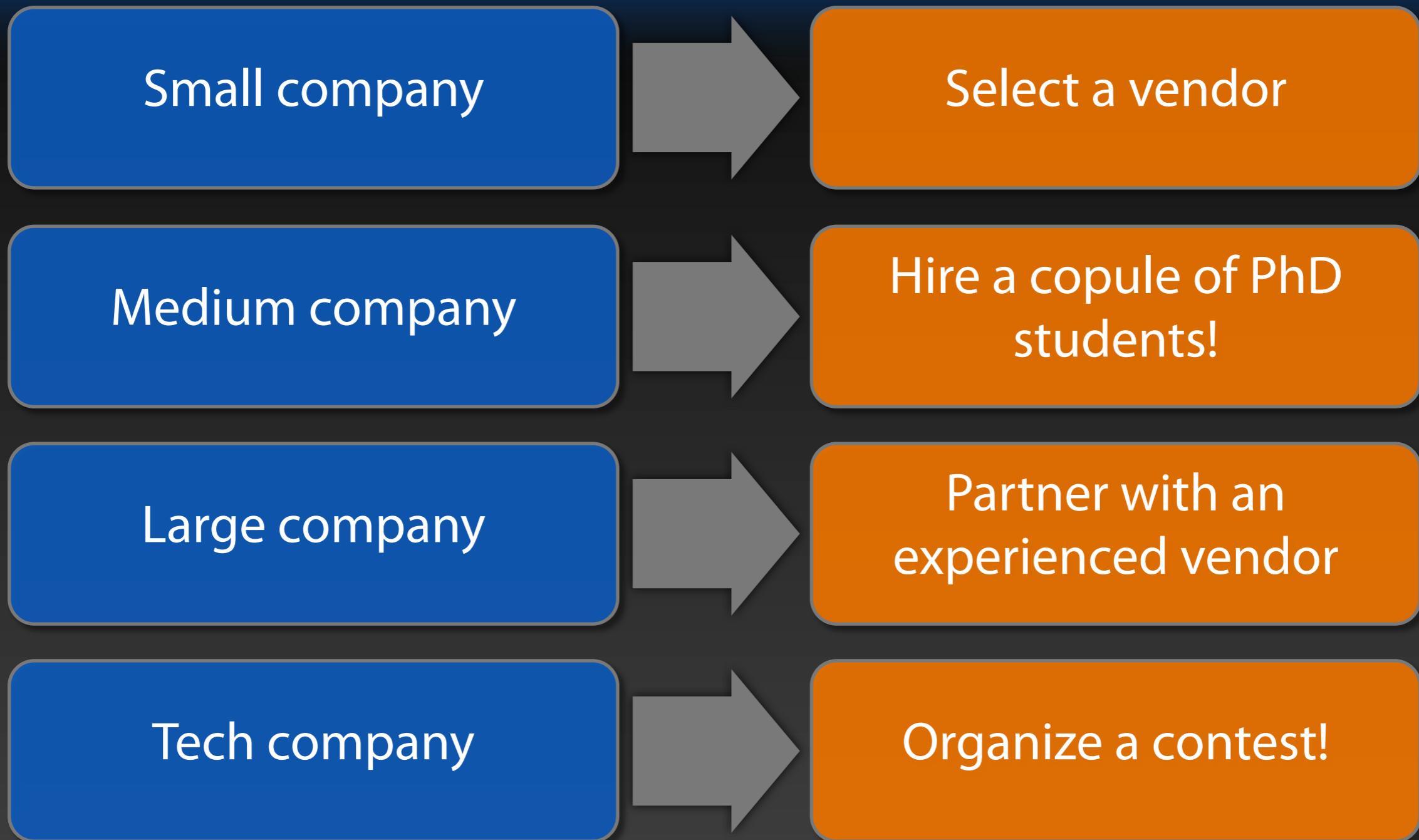
LESSON 3

Choose the right partner.



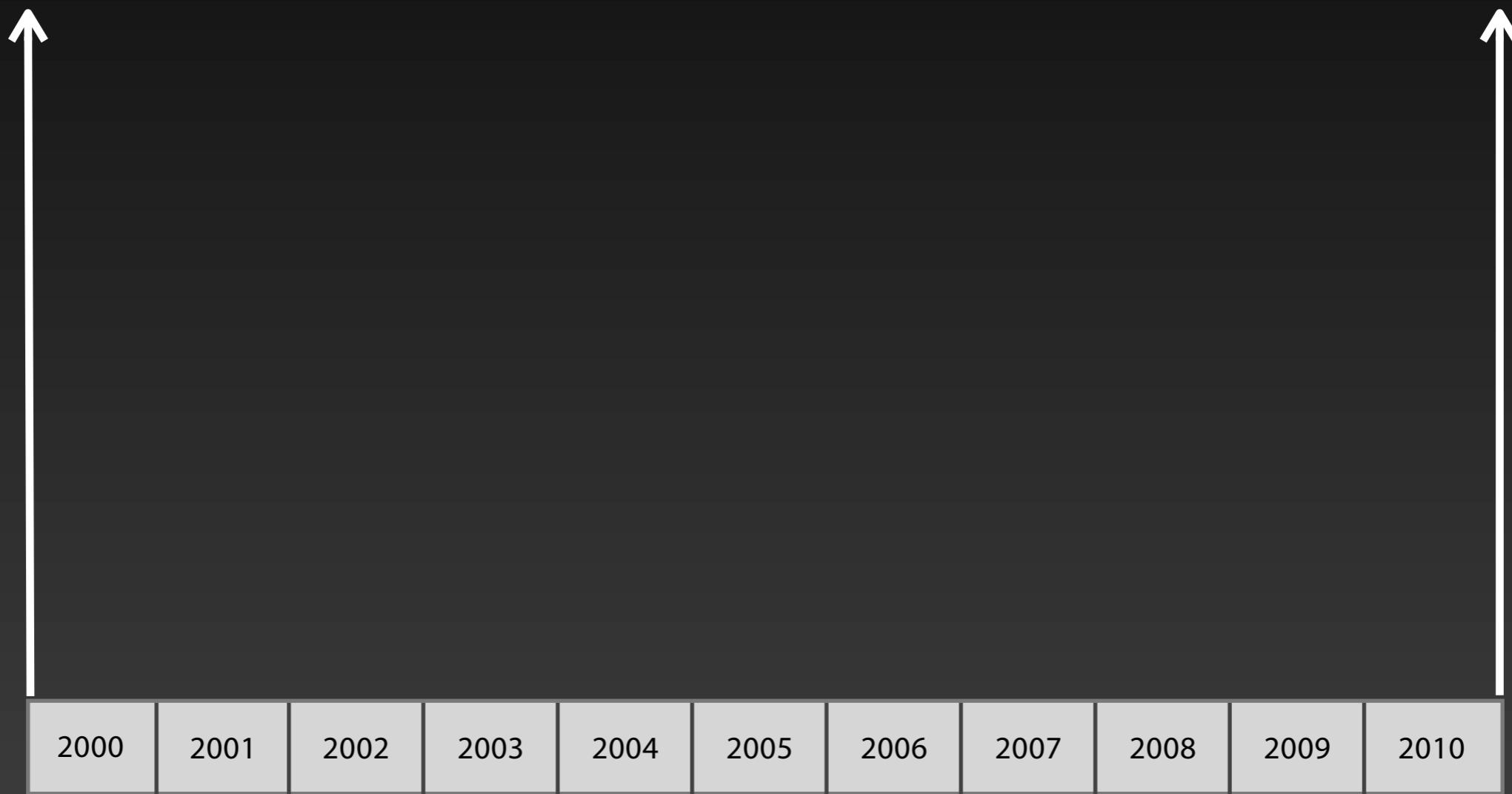
LESSON 3

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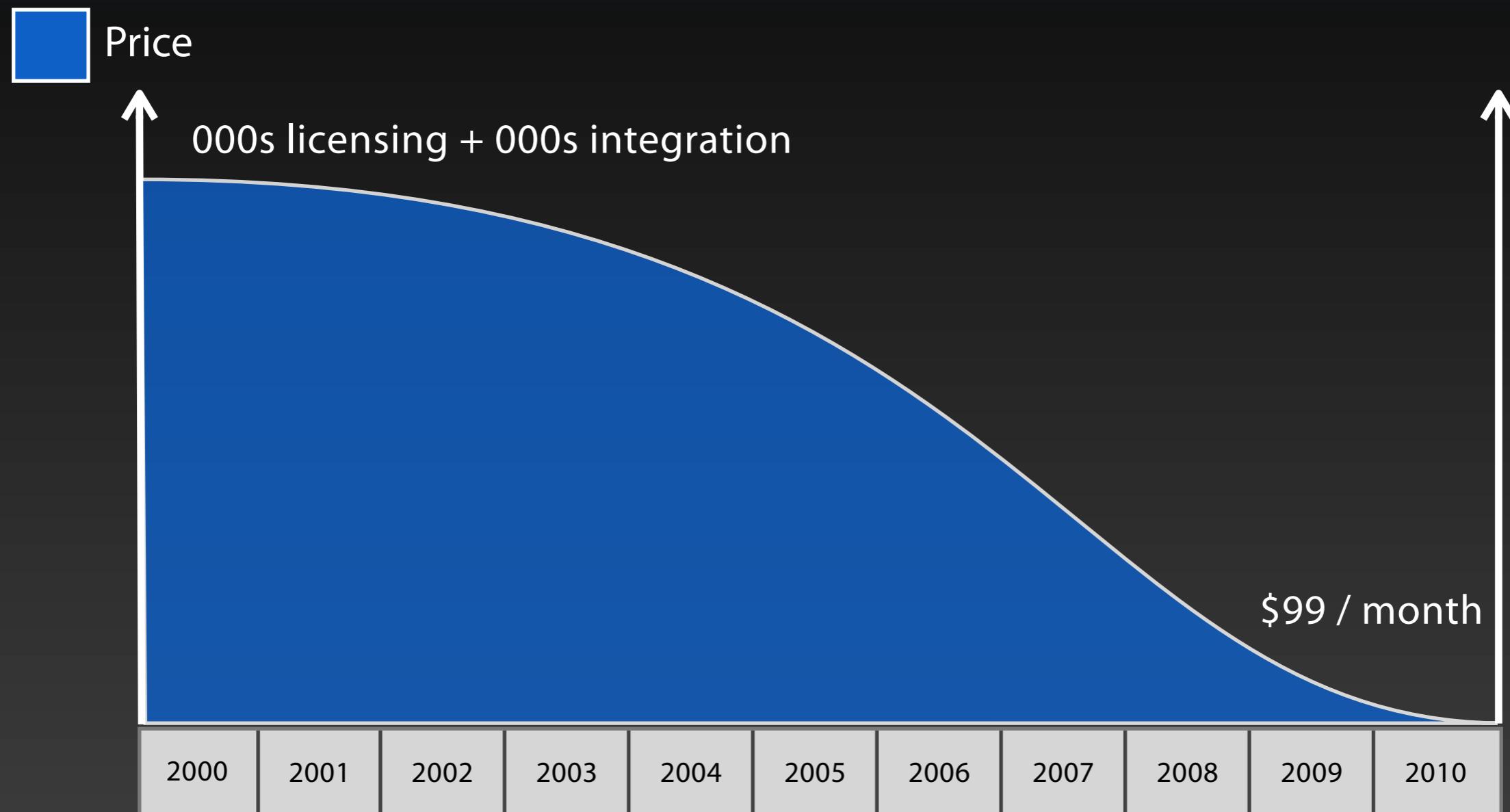
LESSON 3

Choose the right partner.



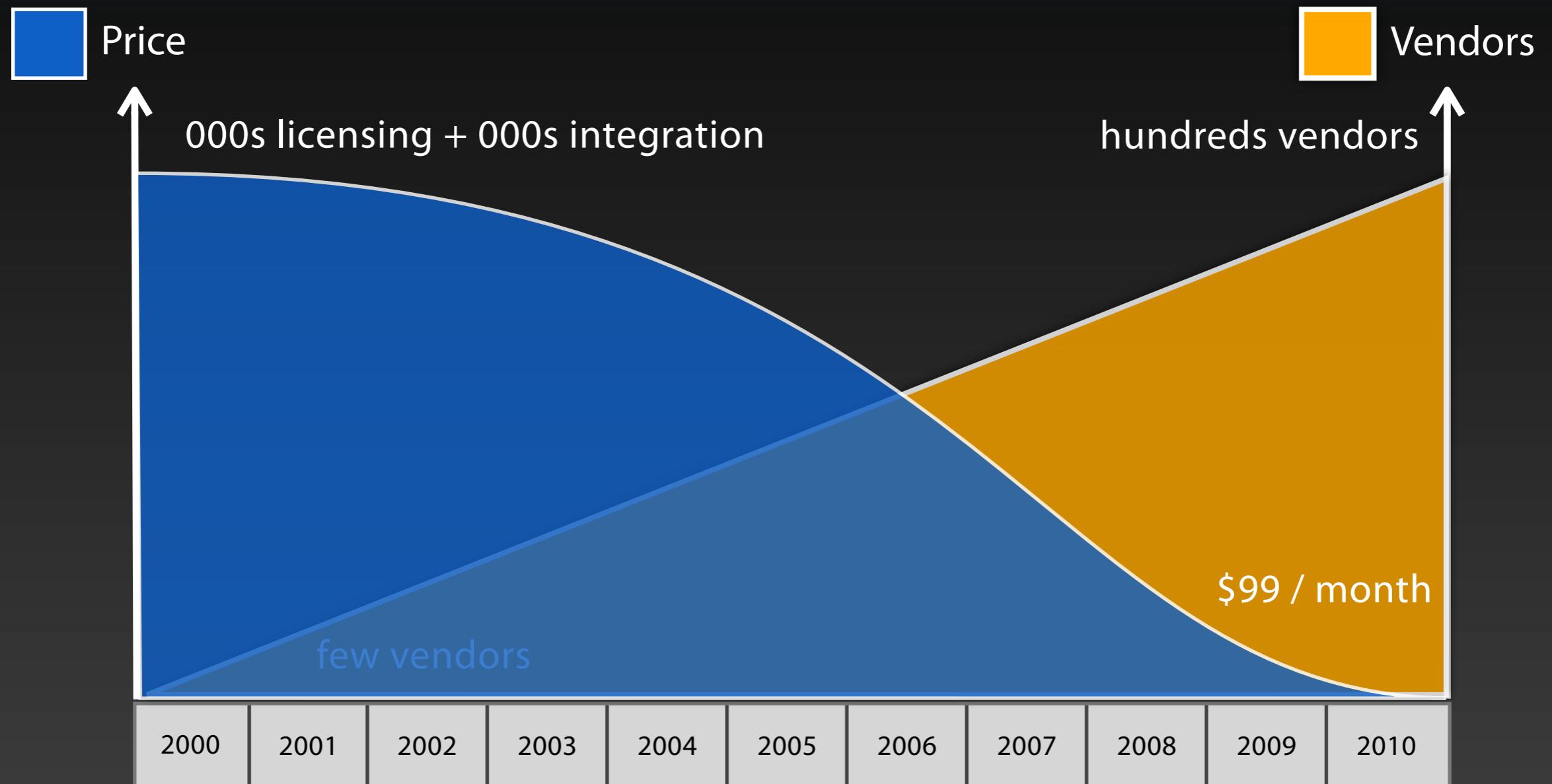
LESSON 3

Choose the right partner.



LESSON 3

Choose the right partner.



LESSON 4



Cold start? Be creative!

LESSON 4

Cold start? Be creative!

**With the advent of the Internet the start for a
Recommender isn't so cold anymore**

LESSON 5



Data and algorithms.

LESSON 5

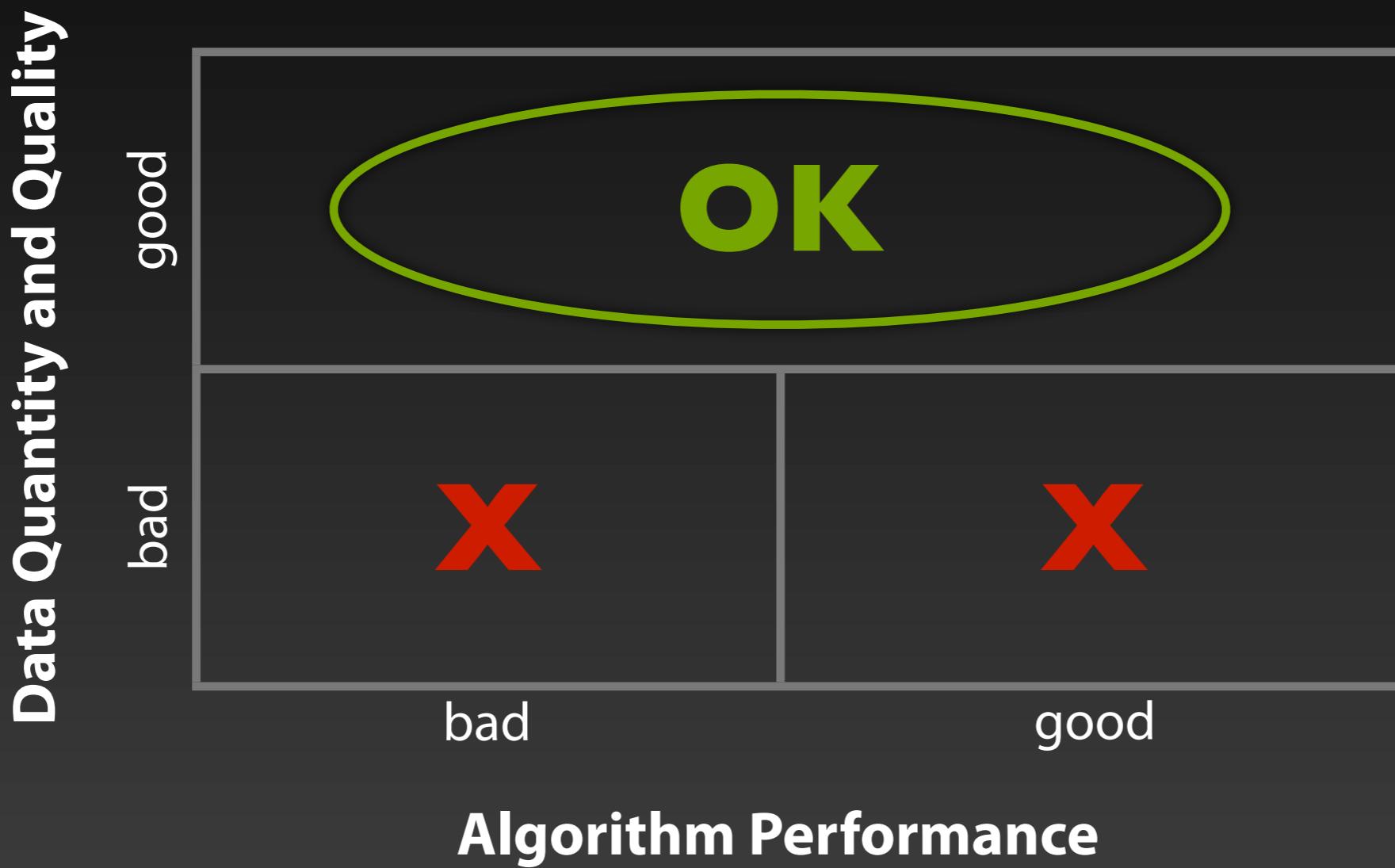
Data and Algorithms.



Which really makes the difference?
Ingredients or Recipe?

LESSON 5

Data and Algorithms.



LESSON 6



Finding correlated items is easy,
deciding what, how, and when
to present to the user is hard.

LESSON 6

Finding correlated items is easy,
deciding what, how, and when to present to the user is hard.

Math

$$\partial \theta^M T(\xi) = \frac{\partial}{\partial \theta} \int_{R_n} T(x) f(x, \theta) dx = \int_{R_n} \frac{\partial}{\partial \theta} T(x) f(x, \theta) dx.$$
$$\frac{\partial}{\partial a} \ln f_{a, \sigma^2}(\xi_1) = \frac{(\xi_1 - a)}{\sigma^2} f_{a, \sigma^2}(\xi_1) = \frac{1}{\sqrt{2\pi}\sigma} e^{-\frac{(\xi_1 - a)^2}{2\sigma^2}}$$
$$\int_{R_n} T(x) \cdot \frac{\partial}{\partial \theta} f(x, \theta) dx = \left(\frac{\partial}{\partial \theta} \ln L(x, \theta) \right) \cdot f(x, \theta) dx = \int_{R_n} T(x) \cdot \left(\frac{\partial}{\partial \theta} \frac{f(x, \theta)}{f(x, \theta)} \right) f(x, \theta) dx.$$
$$\frac{\partial}{\partial \theta} M T(\xi) = \frac{\partial}{\partial \theta} \int_{R_n} T(x) f(x, \theta) dx = \int_{R_n} \frac{\partial}{\partial \theta} T(x) f(x, \theta) dx = \int_{R_n} T(x) \exp \left\{ -\frac{(\xi_1 - a)^2}{2\sigma^2} \right\} \frac{\partial}{\partial \theta} \ln f_{a, \sigma^2}(x) dx.$$

NETFLIX

Kyle Bunch | Your Account | Buy / Redeem Gift | Help

Movies, actors, directors, genres | Search

Home Genres New Releases Previews Netflix Top 100 Critics' Picks Award Winners

You have 287 Recommendations from 1396 ratings

Movies For You

Kyle, the following movies were chosen based on your interest in:
Jesus Camp
The Conformist
Secretary

THE WIRE Season 2
(2-Disc Series)
Cops and criminals get equal attention in HBO's acclaimed drama, and Season 2 delves even deeper into Baltimore's corruption. This season, McNulty... [Read More](#)

Because you enjoyed:
La Dolce Vita
8 1/2
Red Beard

OTHER MOVIES YOU MIGHT ENJOY

Sherrybaby
Golden Globe-nominated Maggie Gyllenhaal stars in director Laurie Collyer's feature film debut about a young woman's struggle for normalcy. After... [Read More](#)

Beer League
Add Non Interested

Car?
Add Non Interested

Water
Add Non Interested

Word Wars
Follow four "word nerds" through their fastidious preparations and smaller tournaments that lead to the national championship

When the Levees Broke
(2-Disc Series)
Add All Non Interested

49 Up
Add Non Interested

Mrs. Henderson Presents
Add Non Interested

Give FREE rentals!
Tell a friend

LESSON 7



Don't waste time calculating
nearest neighbors.

LESSON 7

Don't waste time calculating nearest neighbours.

Let people tell you!



LESSON 8



Don't wait too long to get ready to scale.

LESSON 8

Don't wait too long to get ready to scale.



When is the right moment?

- **if you do too soon and recommendations don't take off...**
- **if you do too late and recommendations do take off...**

LESSON 9



Choose the right feedback
mechanism.

LESSON 9

Choose the right feedback mechanism.



LESSON 9

Choose the right feedback mechanism.

The screenshot shows a TechCrunch article titled "YouTube Comes To A 5-Star Realization: Its Ratings Are Useless" by MG Siegler, published on Sep 22, 2009. The article has 38 likes, 17 Buzz shares, 1 tweet, and 75 comments. Below the article, there is a horizontal 5-star rating scale. The first star is circled in red, while the other four stars are grouped together and also circled in red. This visual emphasizes the concept of choosing the right feedback mechanism, likely referring to the effectiveness of different rating scales.

LESSON 9

Choose the right feedback mechanism.



LESSON 9

Choose the right feedback mechanism.

- Implicit Ratings vs Explicit Ratings
- Implicit Semantics vs Explicit Semantic of Ratings

LESSON 9

Choose the right feedback mechanism.

The Ideal (explicit) Rating system...

feedback



Good so-so* Bad

actions



I have it (i knew it, i saw it)



has it (knew it, saw it)



Show it to me later



Don't show it any more

*optional at it may help to confirm some implicit actions.

LESSON 9

Choose the right feedback mechanism.

COMMENTS

■ 0 COMMENTS

SORT BY: OLDEST | RECENT

SEE MORE 0 COMMENTS

POST COMMENT

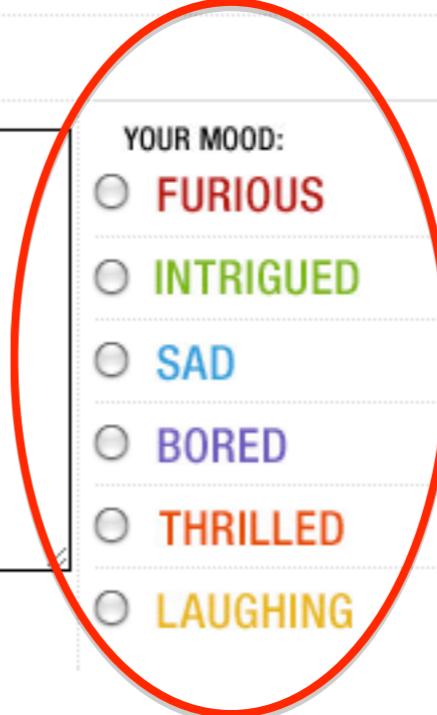
COMMENT:

YOU HAVE 2000 CHARACTERS LEFT

POST ANONYMOUSLY  PUBLISH TO FACEBOOK  POST

YOUR MOOD:

- FURIOUS
- INTRIGUED
- SAD
- BORED
- THRILLED
- LAUGHING



LESSON 10



Measure everything.

LESSON 10

Measure everything.



LESSON 10

Measure everything.

Statistics from Sep 08, 2009 to Oct 08, 2009

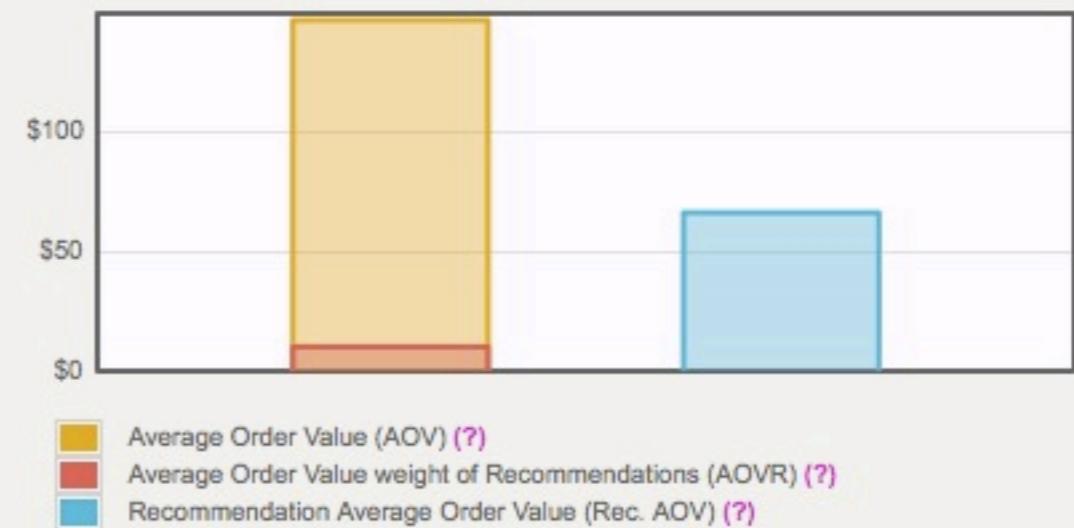
1W 1M 3M 6M 1Y Custom period Raw data

Total Revenue: \$4,501,523.54 Revenue from Recs.: \$310,163.37 (6.89%) CTR: 41.09% Conversion: 4.42% Rec. AOV: \$66.29

Revenue From Recommendations (%)



AOV, AOVR and Recommendation AOV



So, what have we learned?

Recommender Components

Knowledge
Base

Knowledge
Processing
Application

Business
Control
& Analytics

User
Interface

So, what have we learned?

Recommender Components

Knowledge
Base

Knowledge
Processing
Application

Business
Control
& Analytics

User
Interface

50%

So, what have we learned?

Recommender Components

Knowledge
Base

Knowledge
Processing
Application

Business
Control
& Analytics

User
Interface

20%

50%

So, what have we learned?

Recommender Components

Knowledge
Base

Knowledge
Processing
Application

5%

Business
Control
& Analytics

20%

User
Interface

50%

So, what have we learned?

Recommender Components

Knowledge
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Questions?

Thank you!

