

Search and Recommendation

Daan Odijk & Anne Schuth
data scientists



Plan today

- **Search Engines that Learn from their Users**

Plan today

- **Search Engines that Learn from their Users**
- **Struggling and Success in Web Search**

Plan today

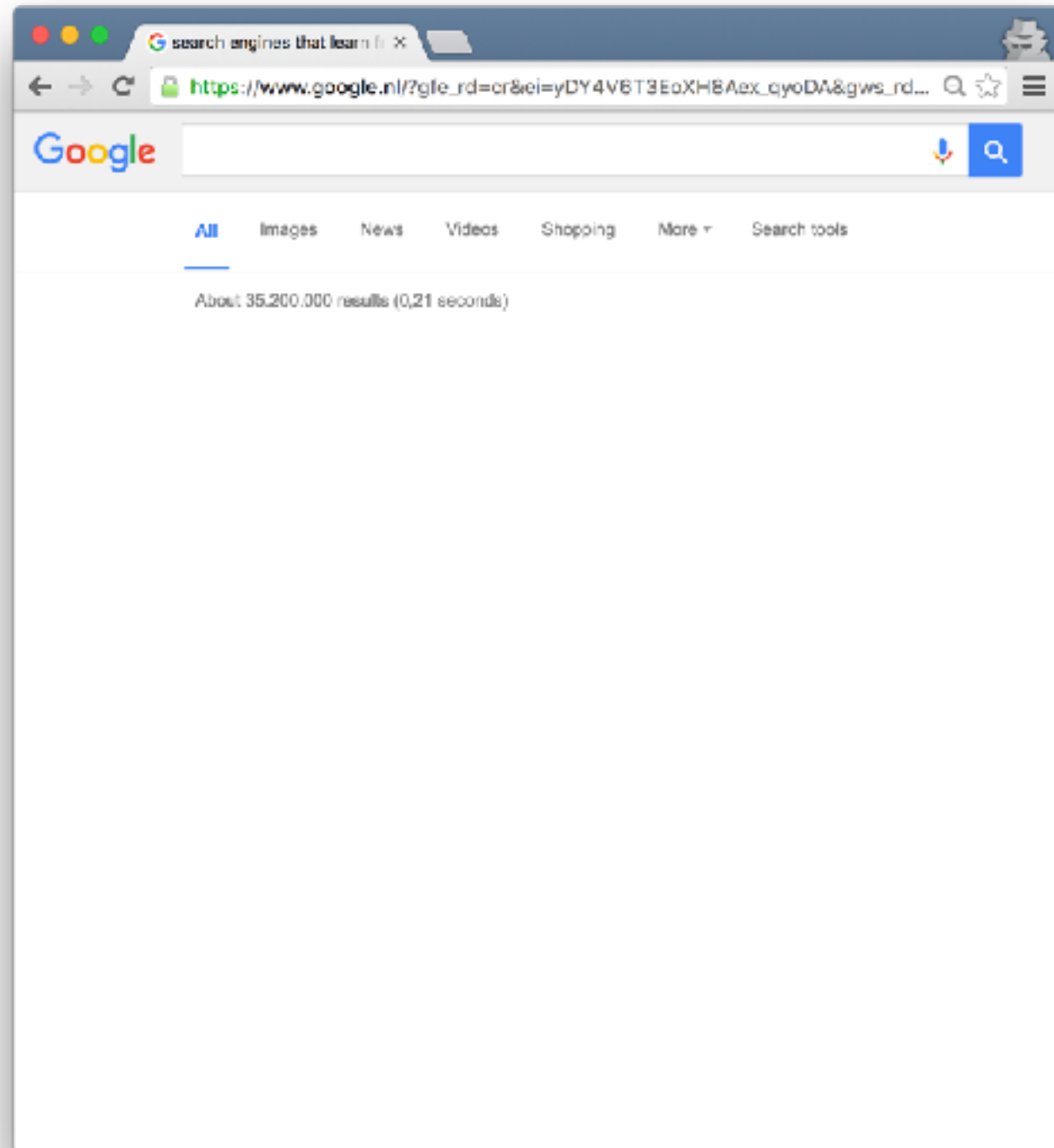
- **Search Engines that Learn from their Users**
- **Struggling and Success in Web Search**
- **Real-time recommendations at Blendle**
 - Article- and User profile enrichment
 - Streaming Architecture (*Docker, Kubernetes and Kafka*)
 - Demo



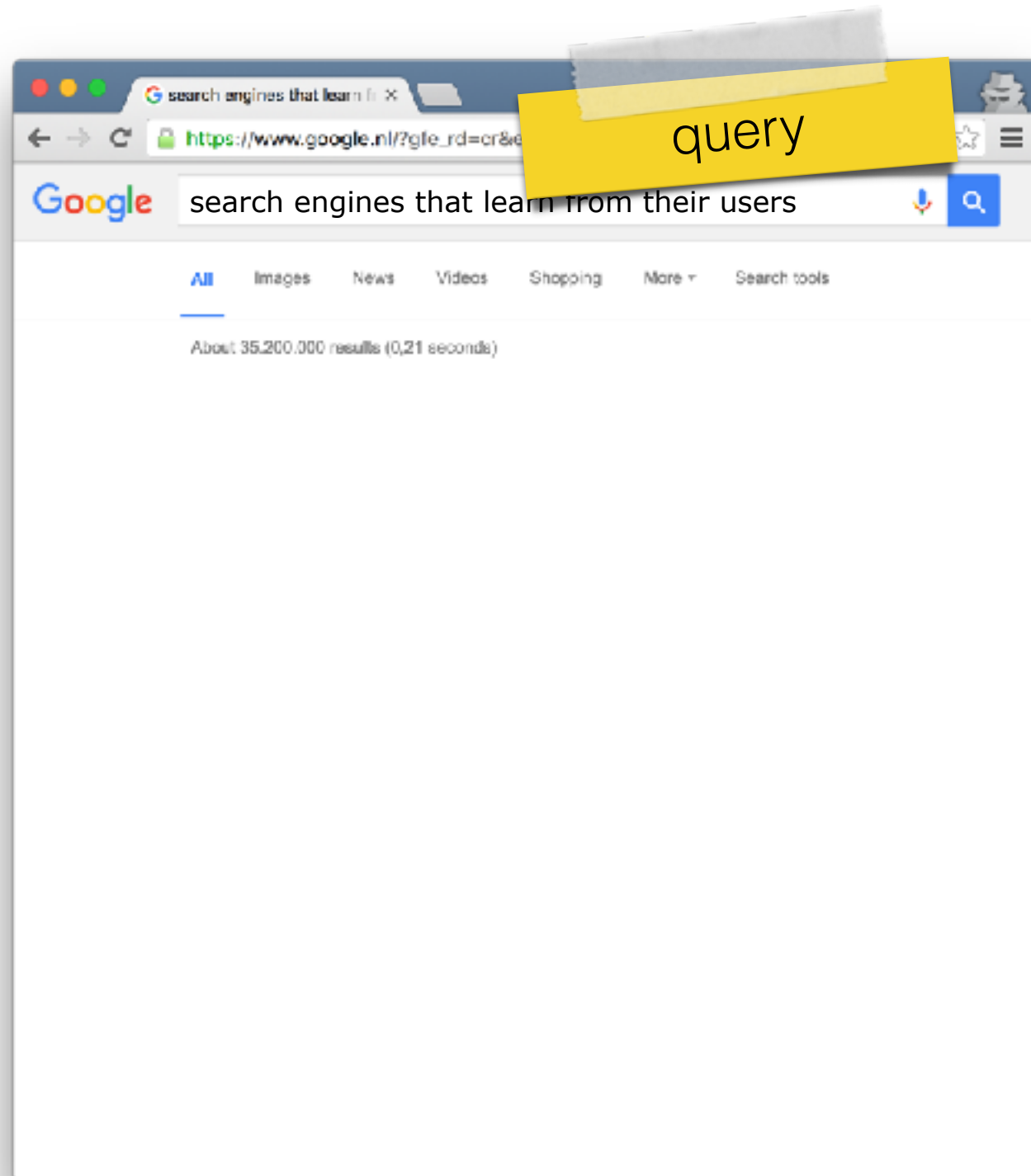
SEARCH ENGINES THAT LEARN FROM THEIR USERS

ANNE SCHUTH

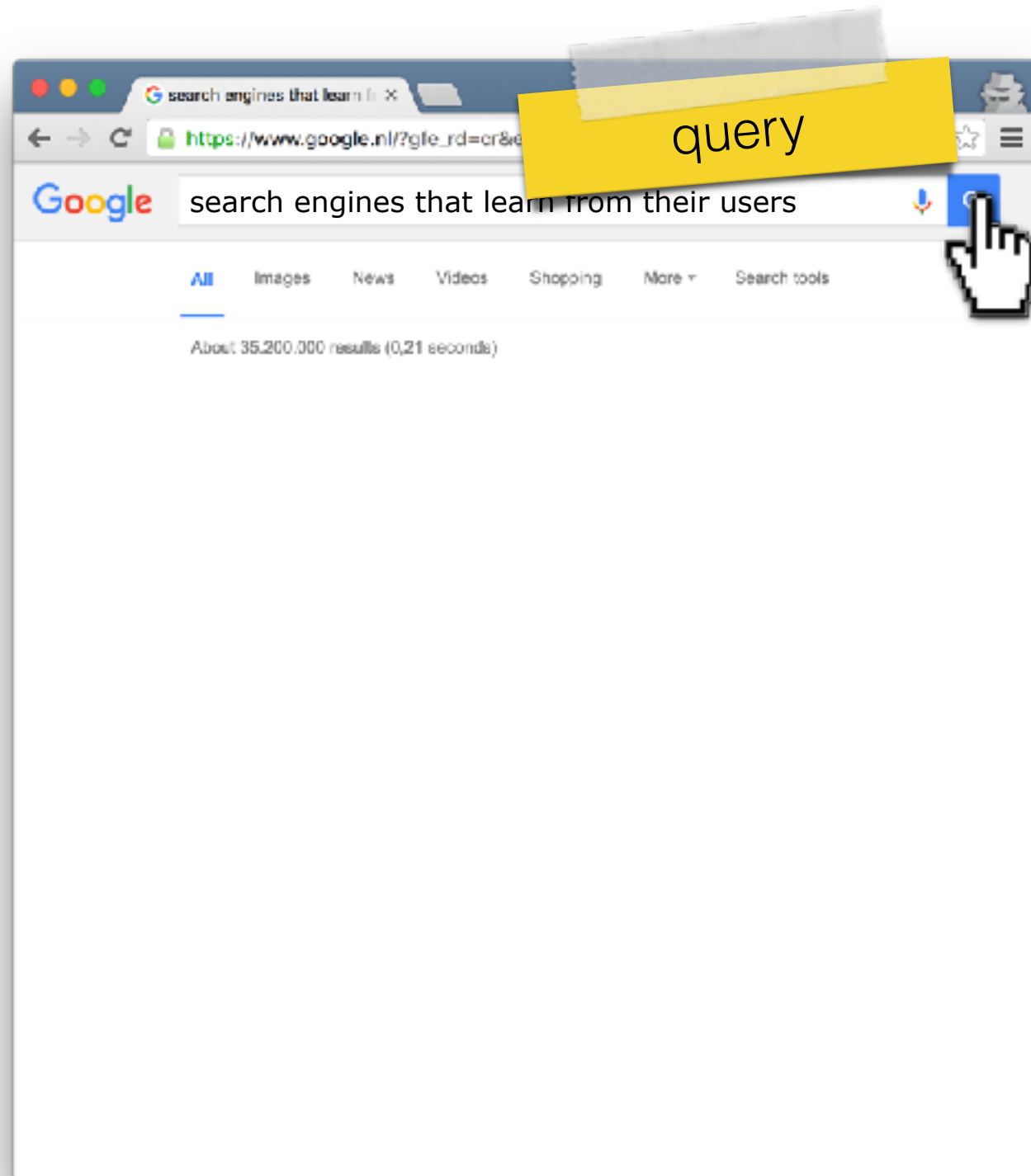
SEARCH ENGINES



SEARCH ENGINES



SEARCH ENGINES



SEARCH ENGINES

query

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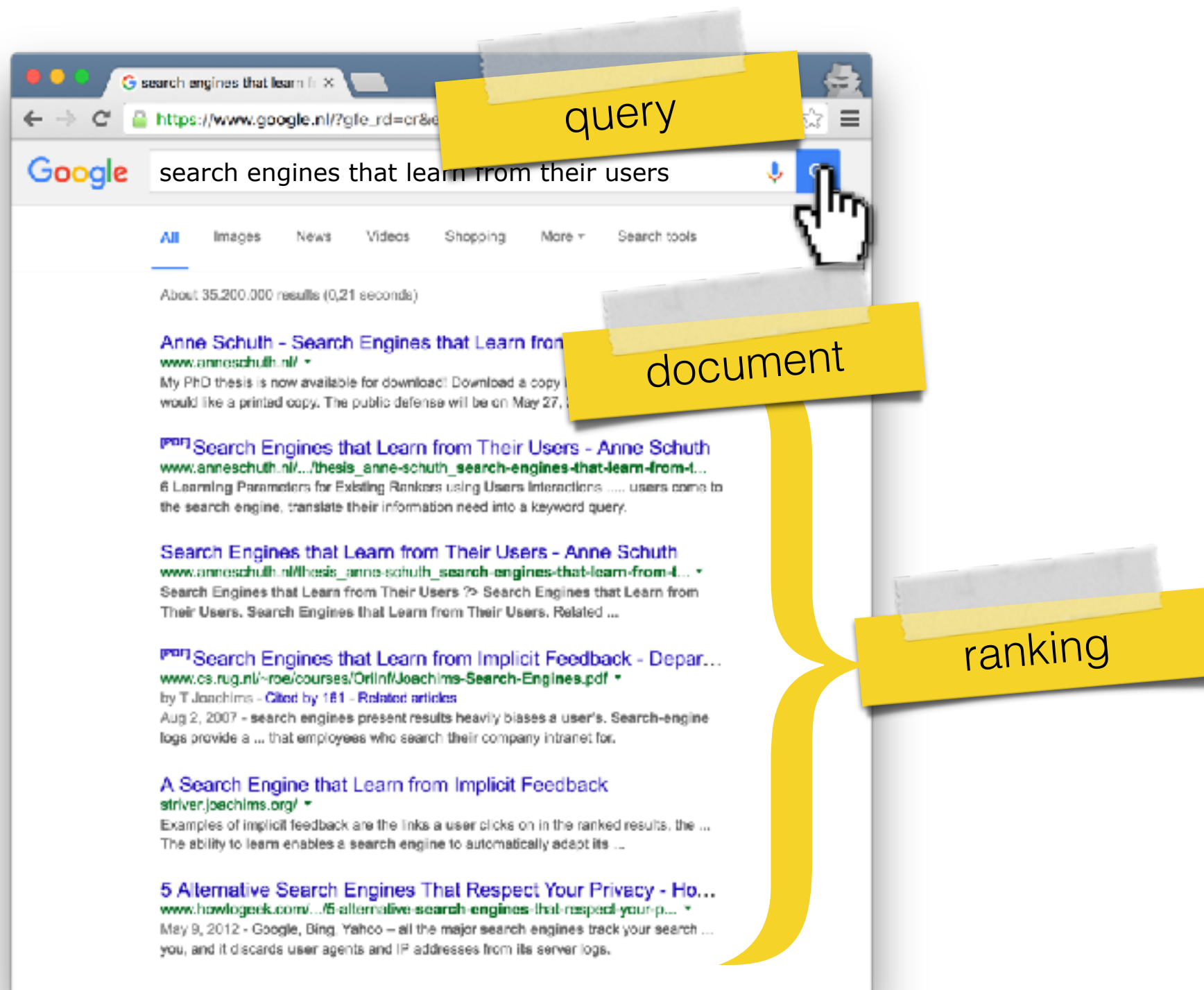
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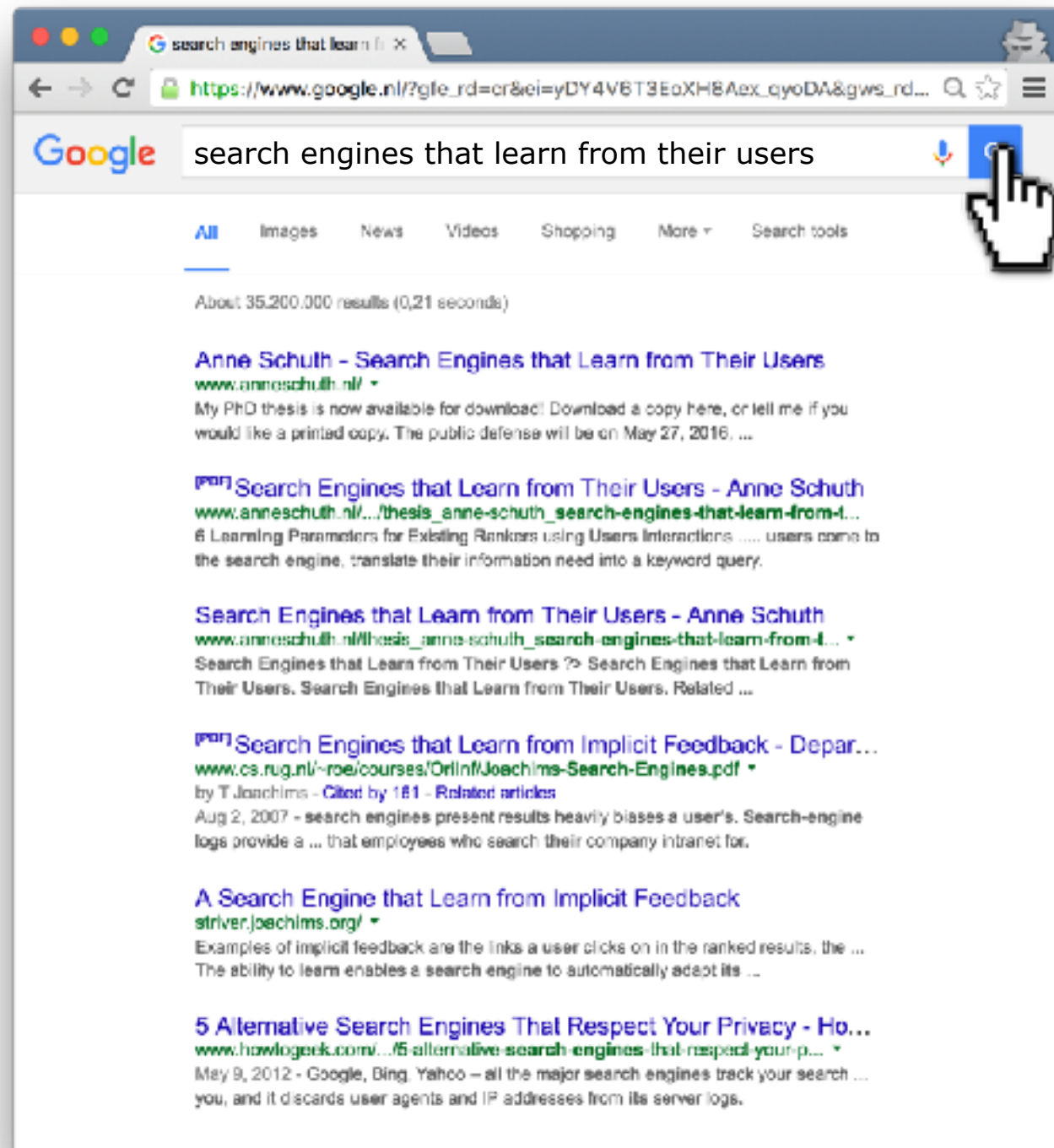
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#query
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#query
terms

#document
terms

7

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| #query terms | #document terms | pagerank |
|--------------|-----------------|----------|
| 7 | 500 | 0.2 |
| 7 | 80000 | 0.2 |
| 7 | 80000 | 0.2 |
| 7 | 5000 | 0.5 |
| 7 | 2000 | 0.4 |
| 7 | 1000 | 0.6 |

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| #query terms | #document terms | pagerank | #query terms in document |
|--------------|-----------------|----------|--------------------------|
| 7 | 500 | 0.2 | 7 |
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| 7 | 5000 | 0.5 | 7 |
| 7 | 2000 | 0.4 | 7 |
| 7 | 1000 | 0.6 | 6 |

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|--------------|-----------------|----------|--------------------------|-----------------------|
| 7 | 500 | 0.2 | 7 | 7 |
| 7 | 80000 | 0.2 | 7 | 7 |
| 7 | 80000 | 0.2 | 7 | 7 |
| 7 | 5000 | 0.5 | 7 | 5 |
| 7 | 2000 | 0.4 | 7 | 5 |
| 7 | 1000 | 0.6 | 6 | 3 |

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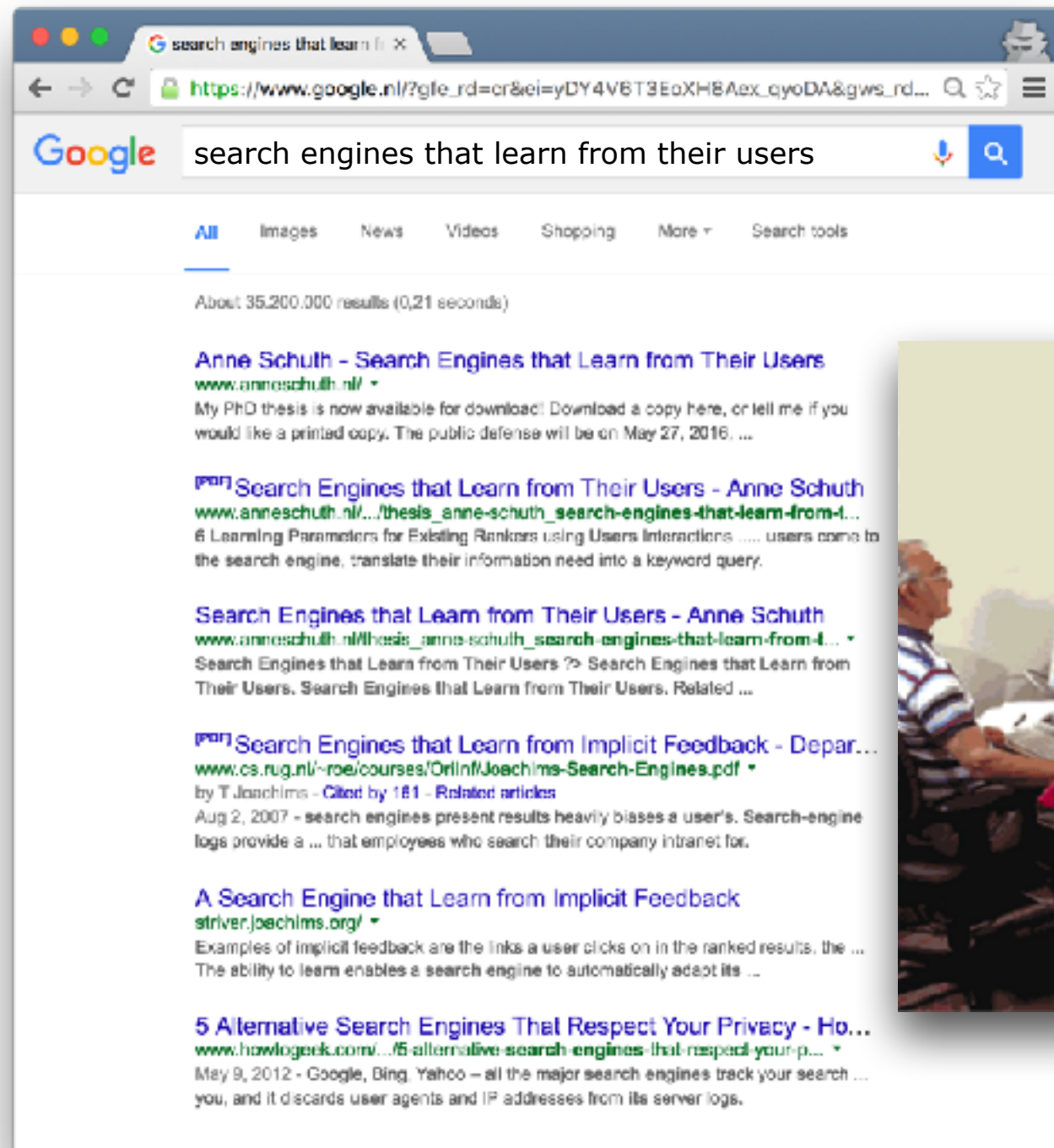
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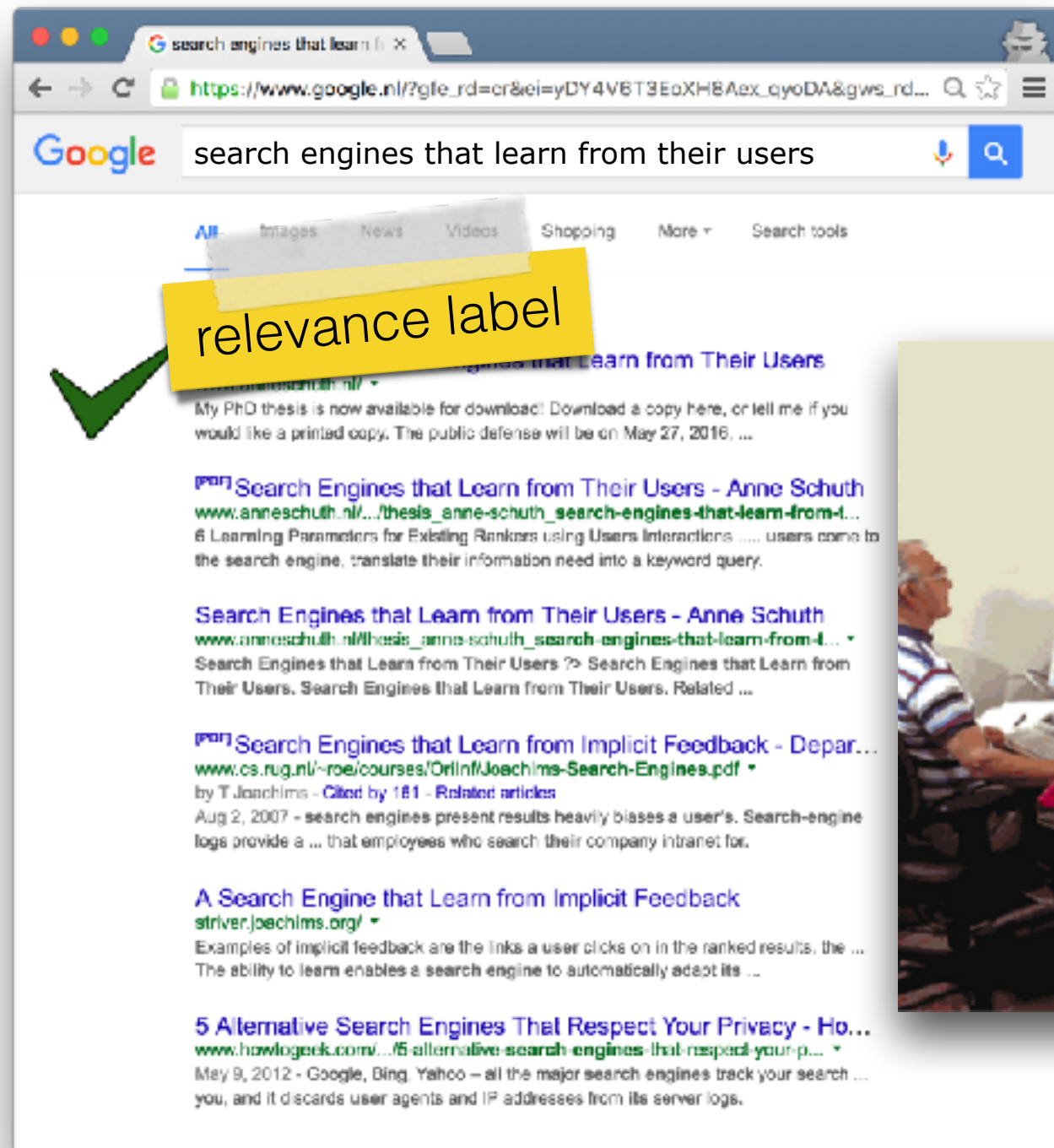
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|--------------|-----------------|----------|--------------------------|-----------------------|-----|
| 7 | 500 | 0.2 | 7 | 7 | |
| 7 | 80000 | 0.2 | 7 | 7 | |
| 7 | 80000 | 0.2 | 7 | 7 | |
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| 7 | 2000 | 0.4 | 7 | 5 | |
| 7 | 1000 | 0.6 | 6 | 3 | |

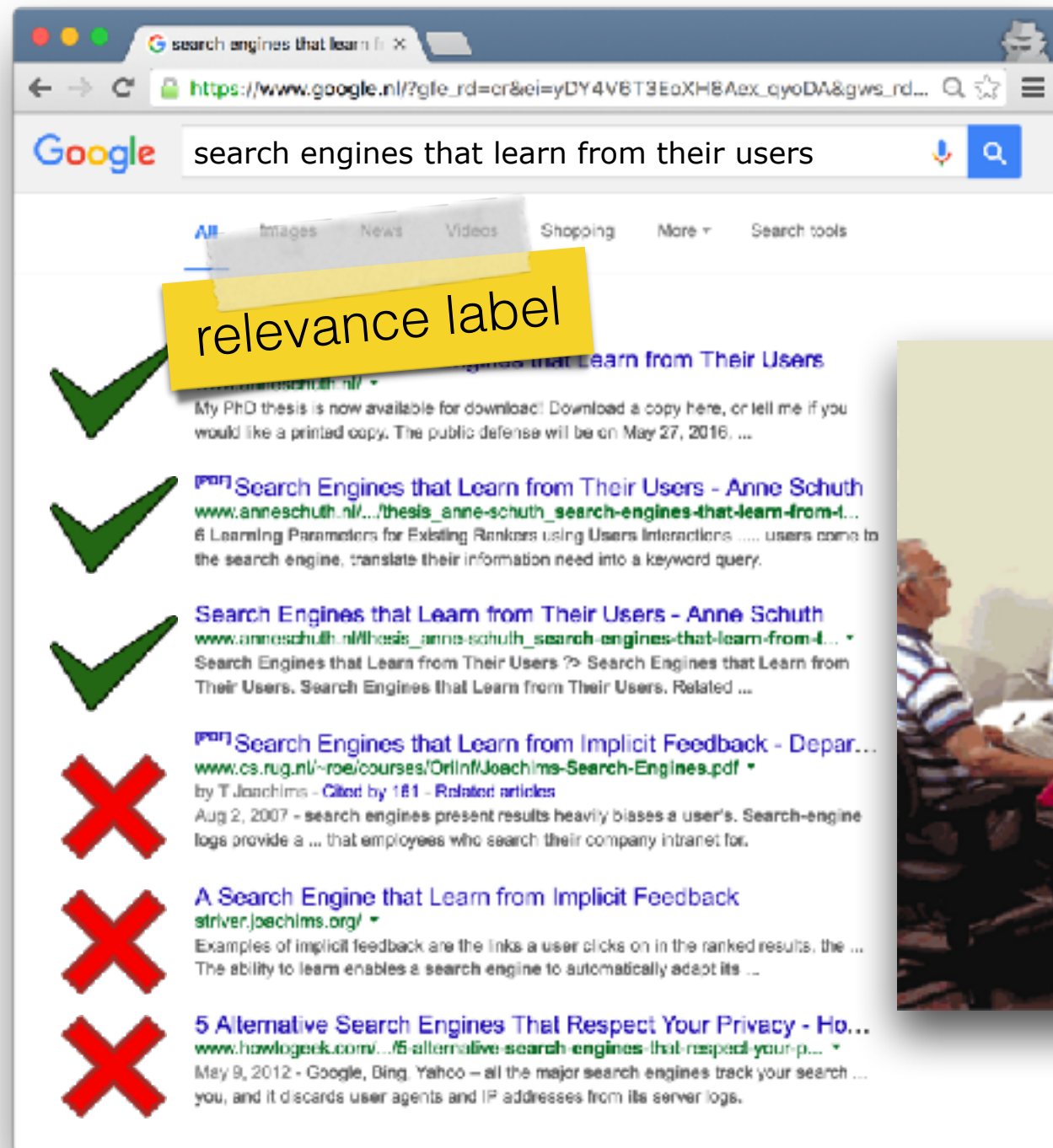
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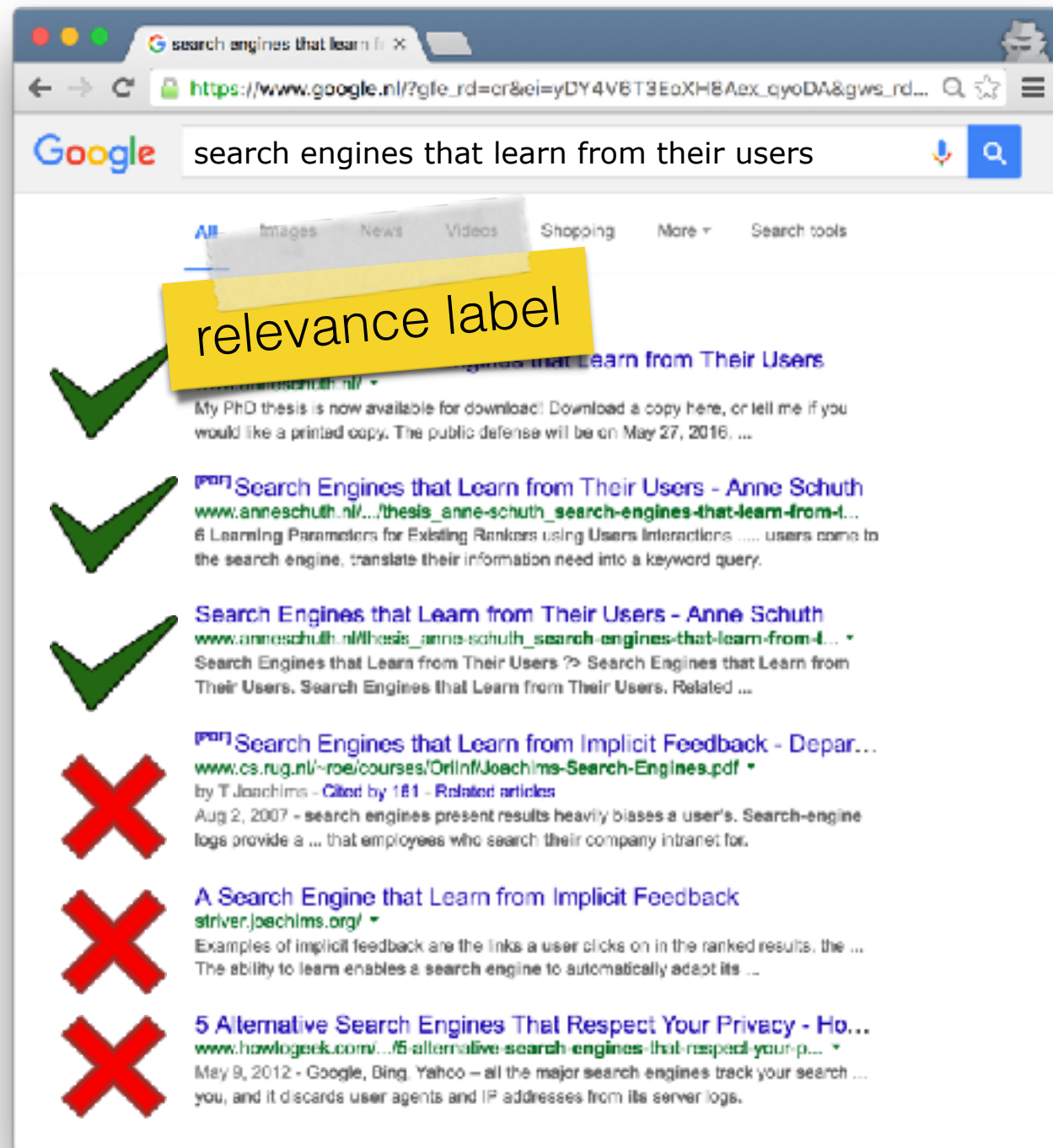


The screenshot shows a Google search results page for the query "search engines that learn from their users". The browser's address bar shows the URL: https://www.google.nl/?gfe_rd=cr&ei=yDY4VBT3EoXH8Aex_qyoDA&gws_rd=.... The search bar contains the text "search engines that learn from their users". Below the search bar, there are tabs for "All", "Images", "News", "Videos", "Shopping", and "More". The search results are listed below, with a yellow label "relevance label" pointing to the first result. The results are as follows:

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About 35,200,000 results (0,21 seconds)

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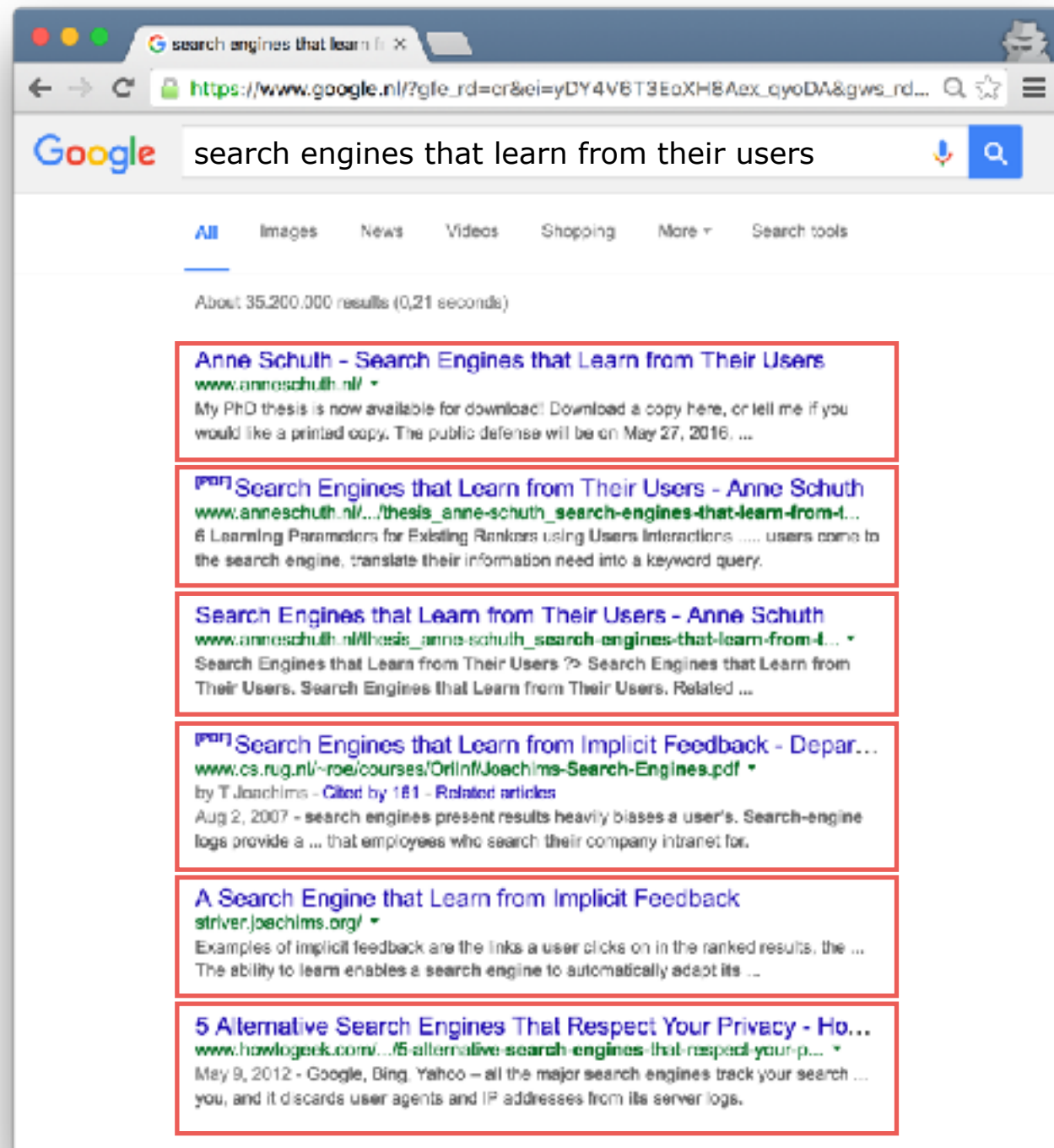
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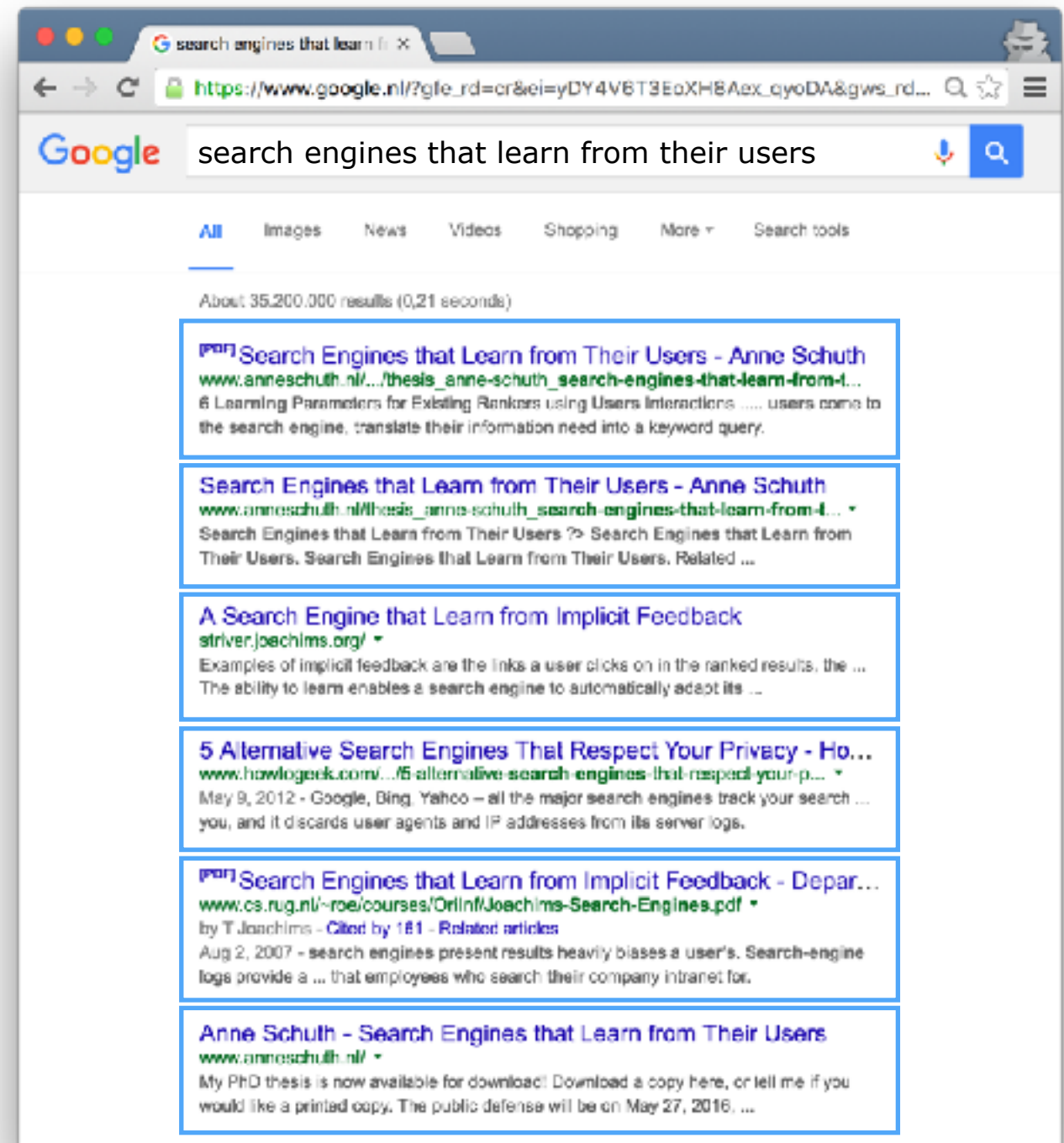
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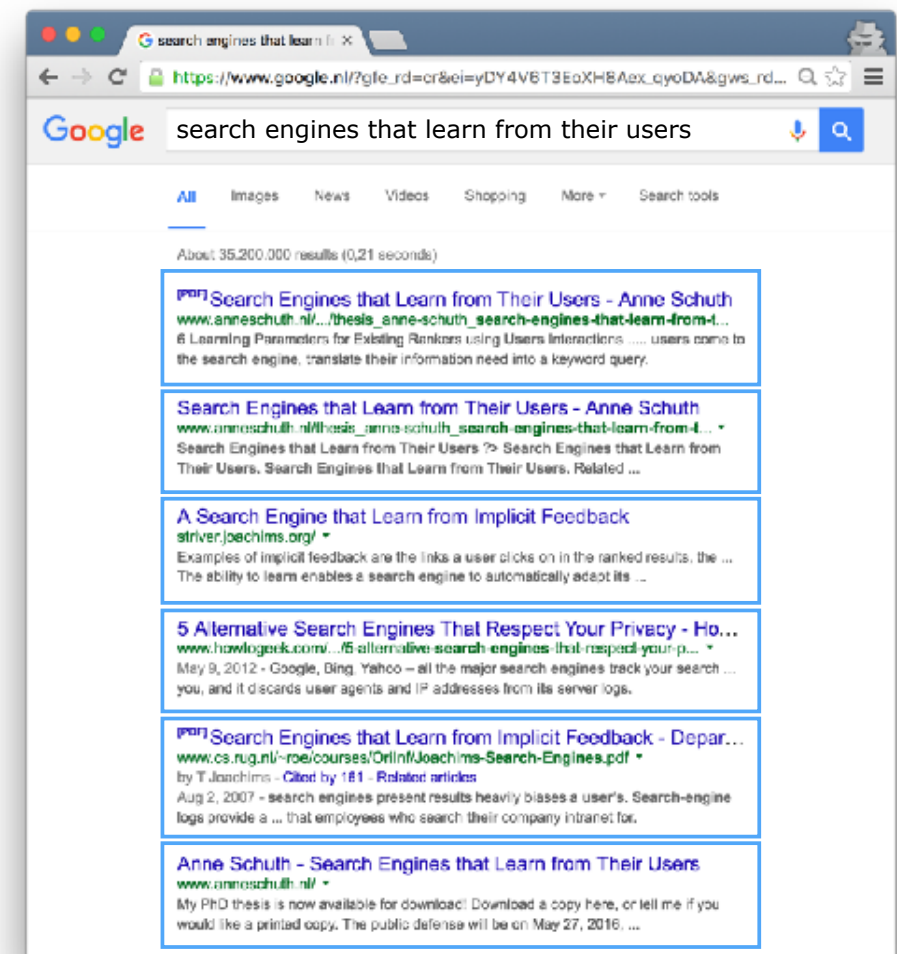
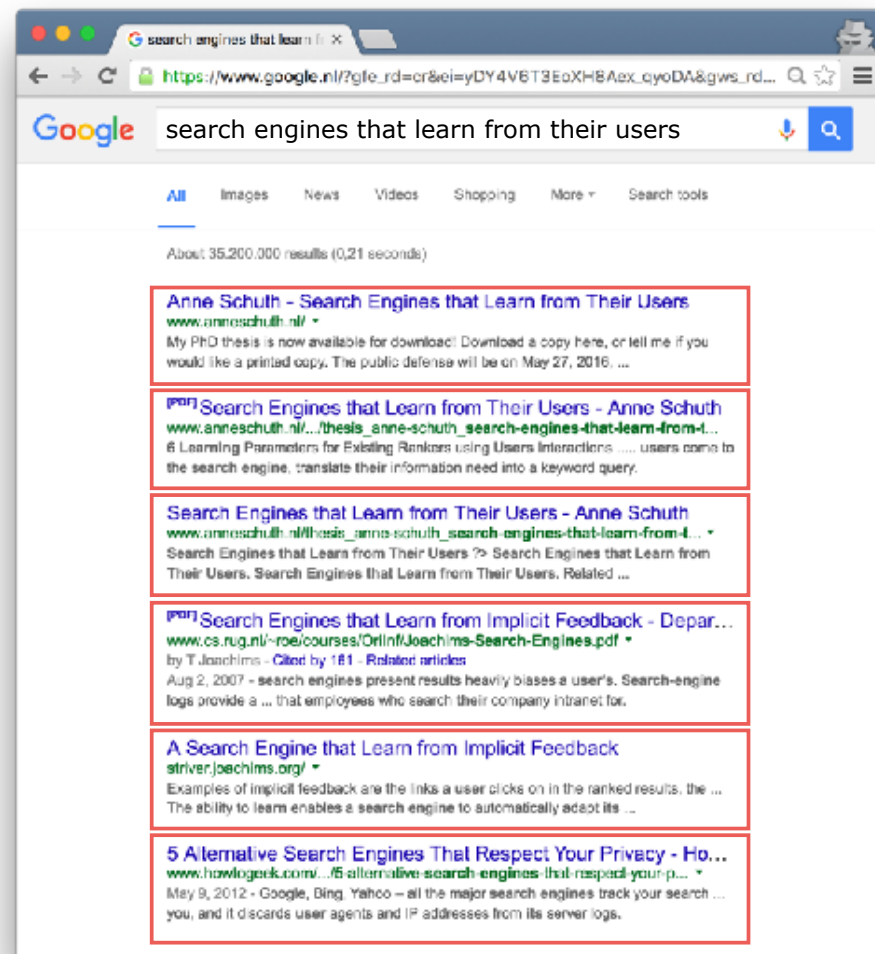
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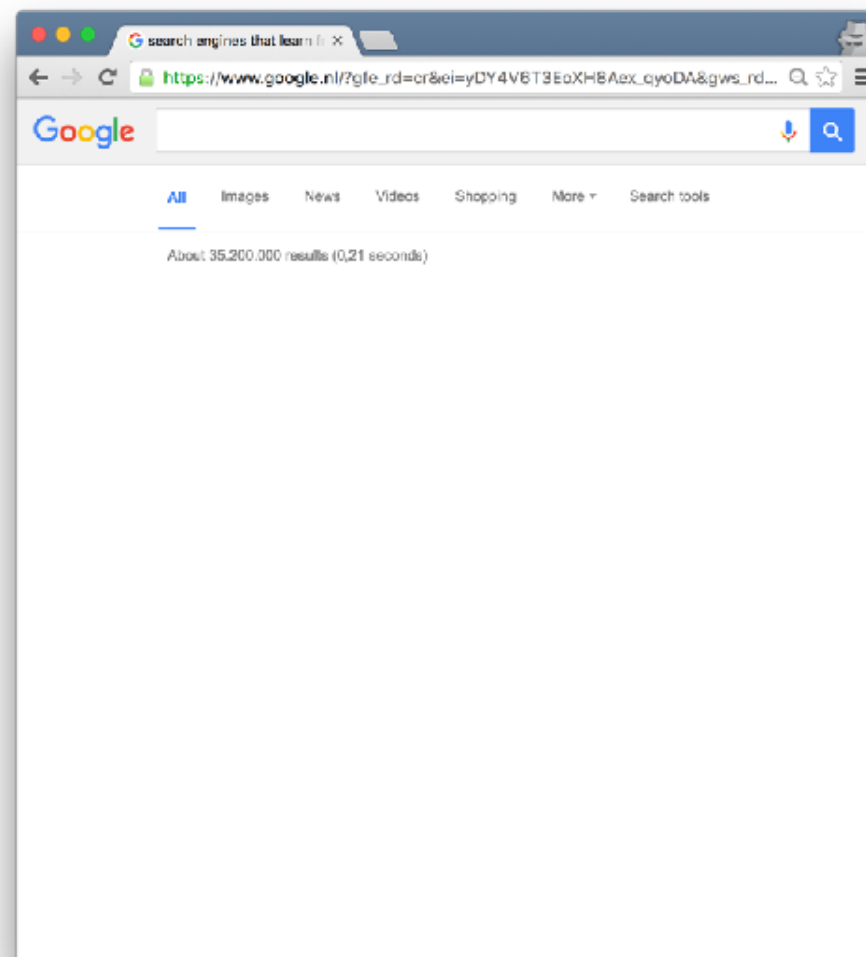
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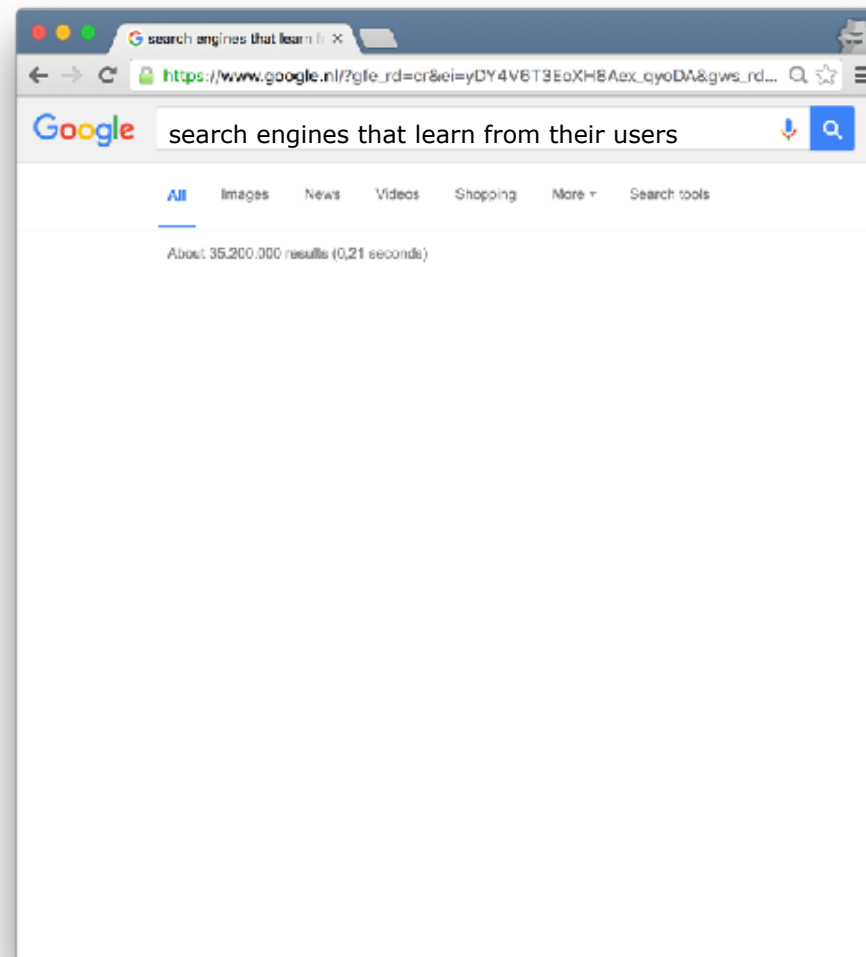
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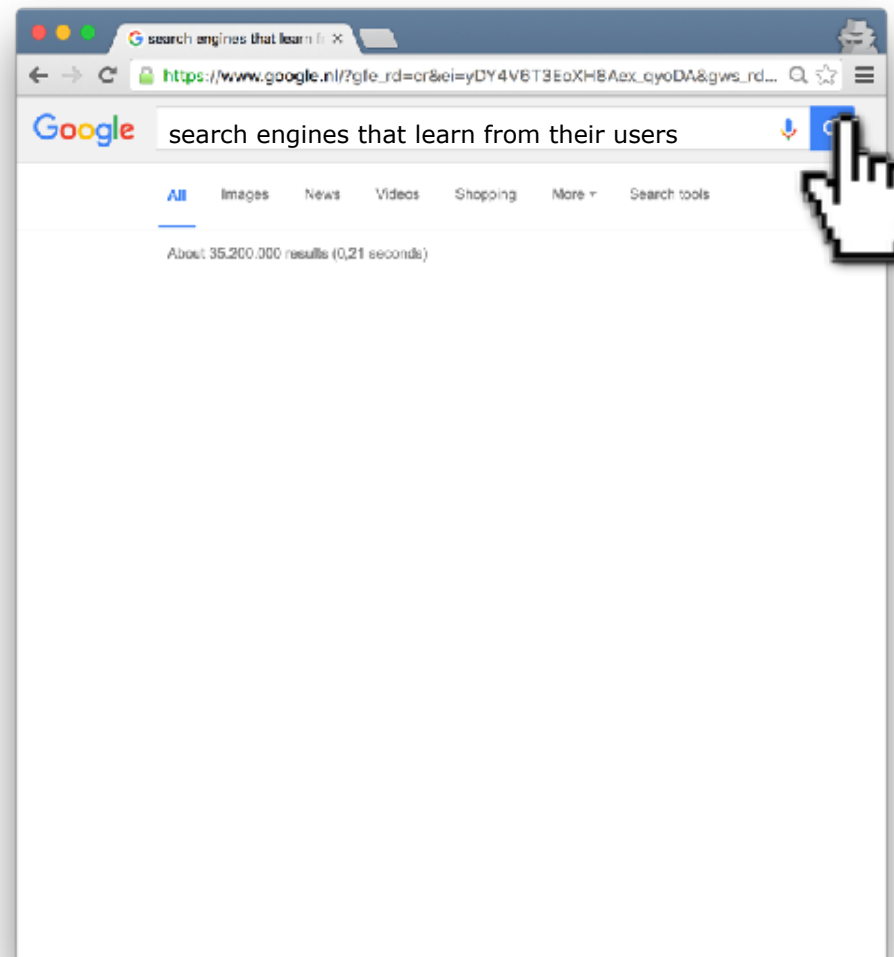
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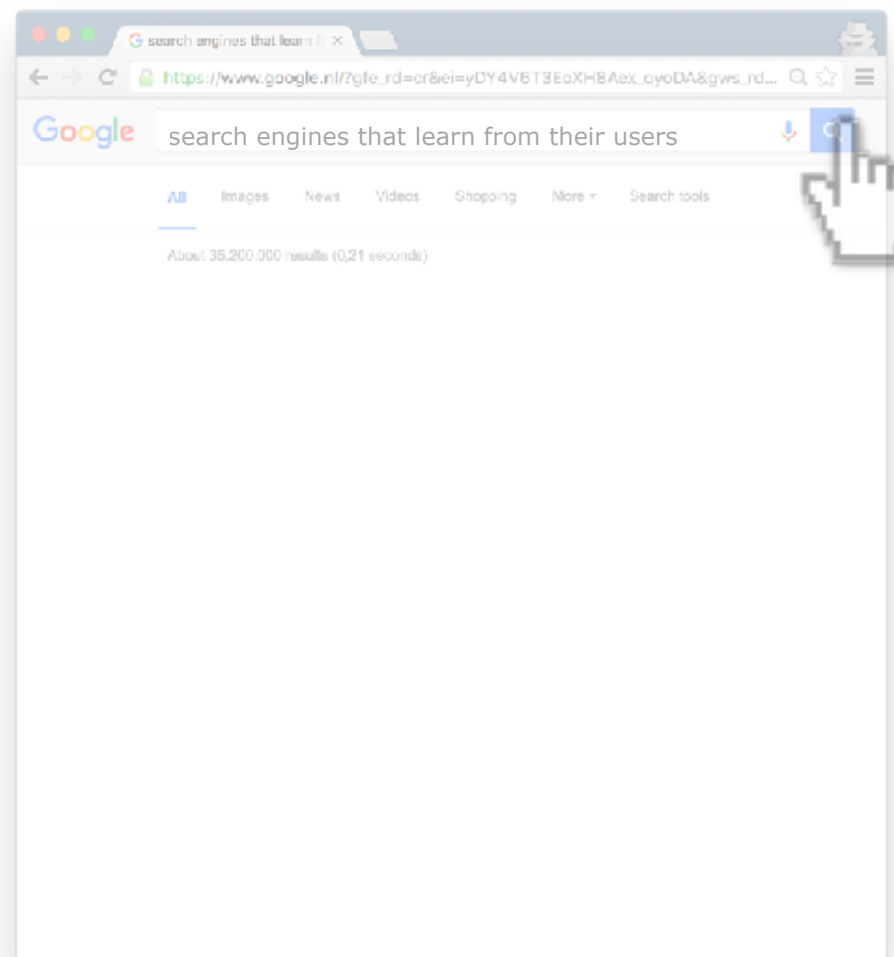
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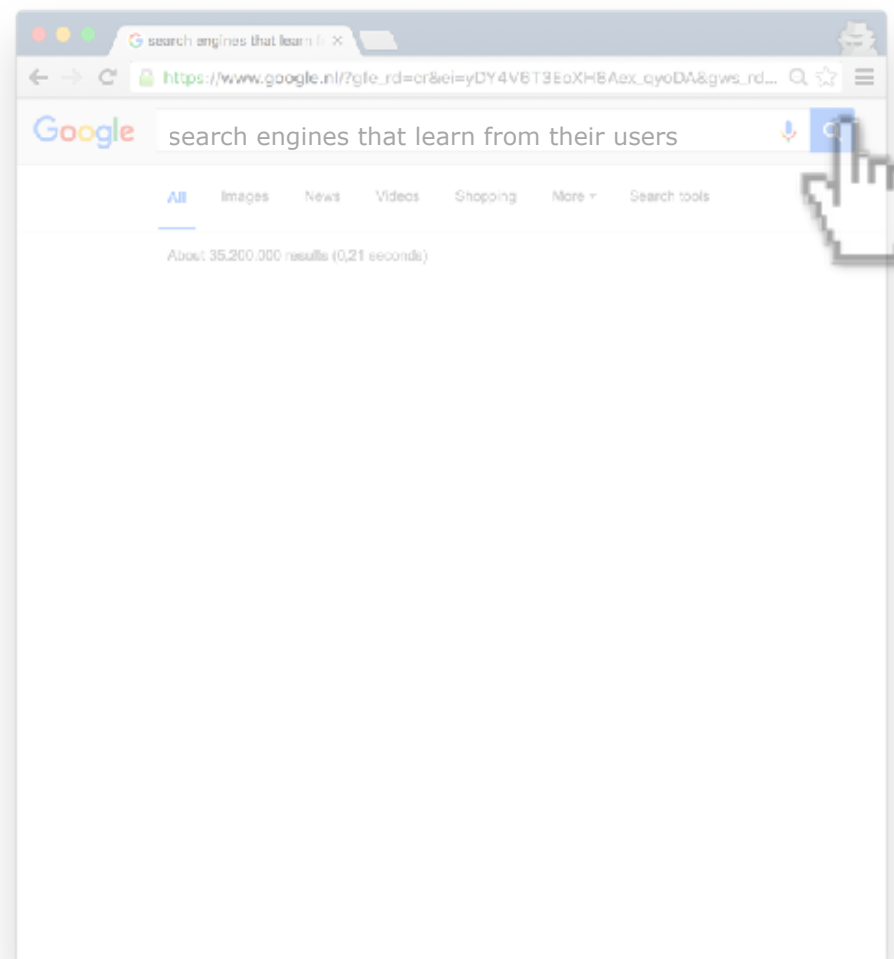
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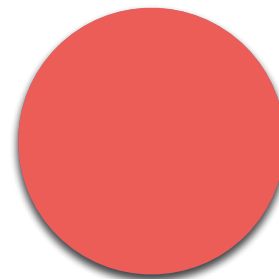
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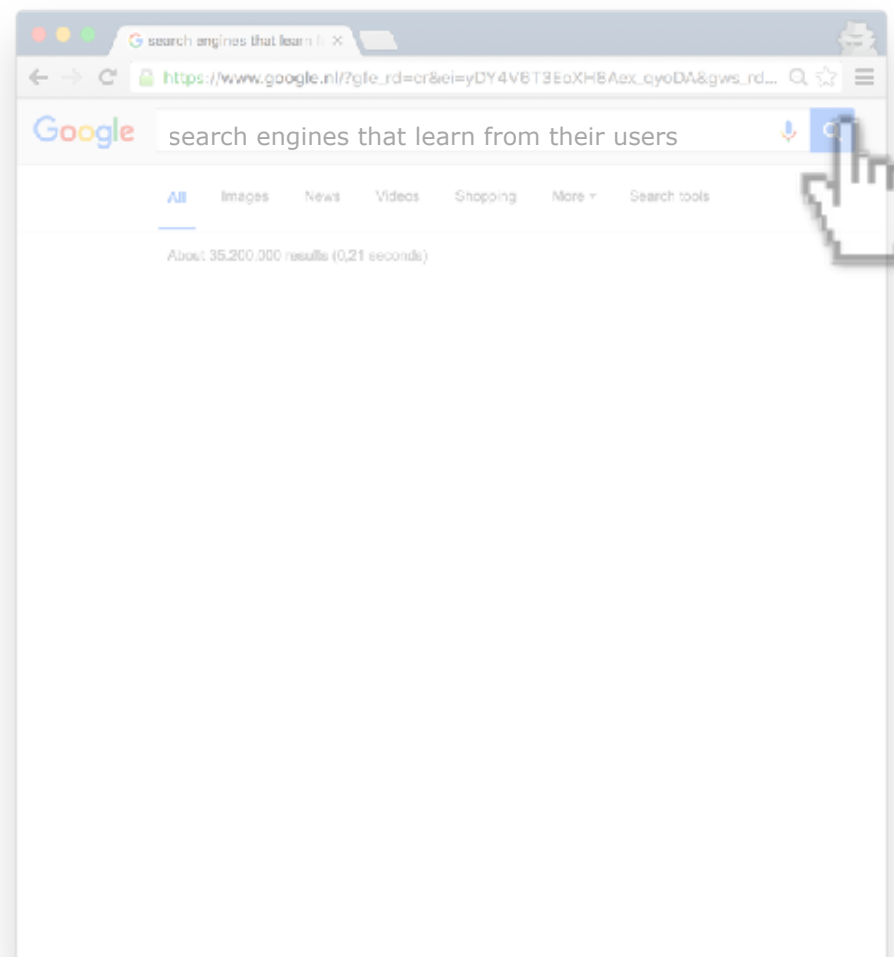
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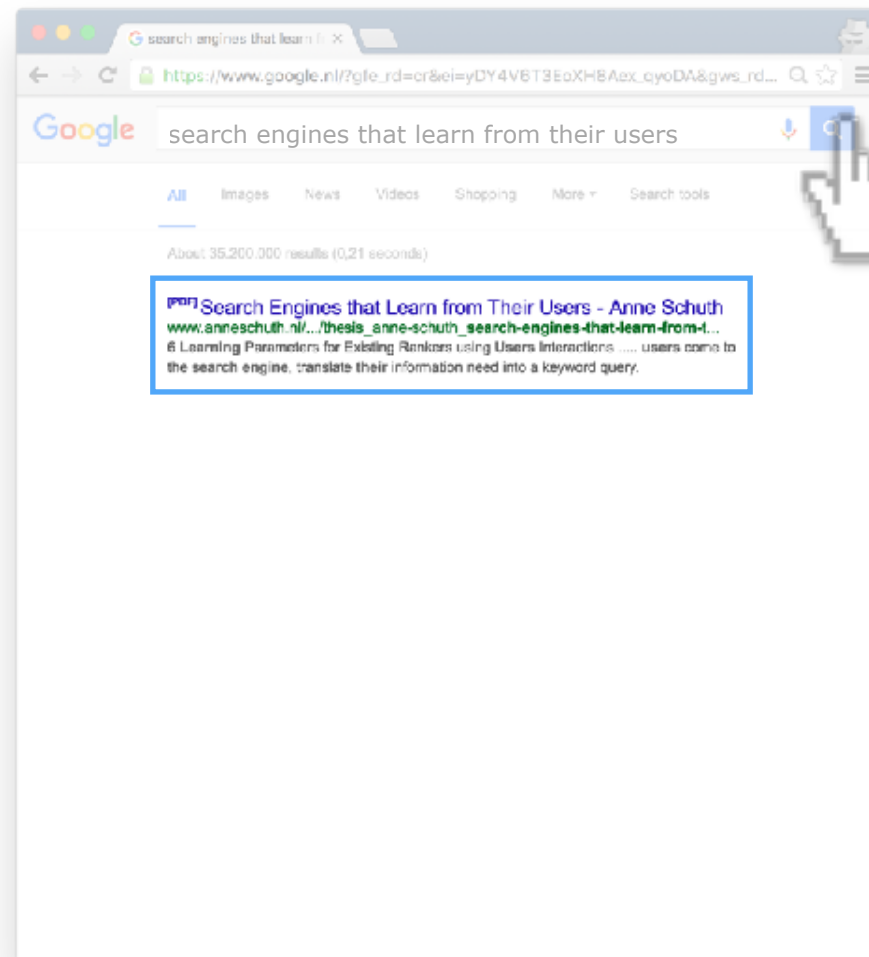
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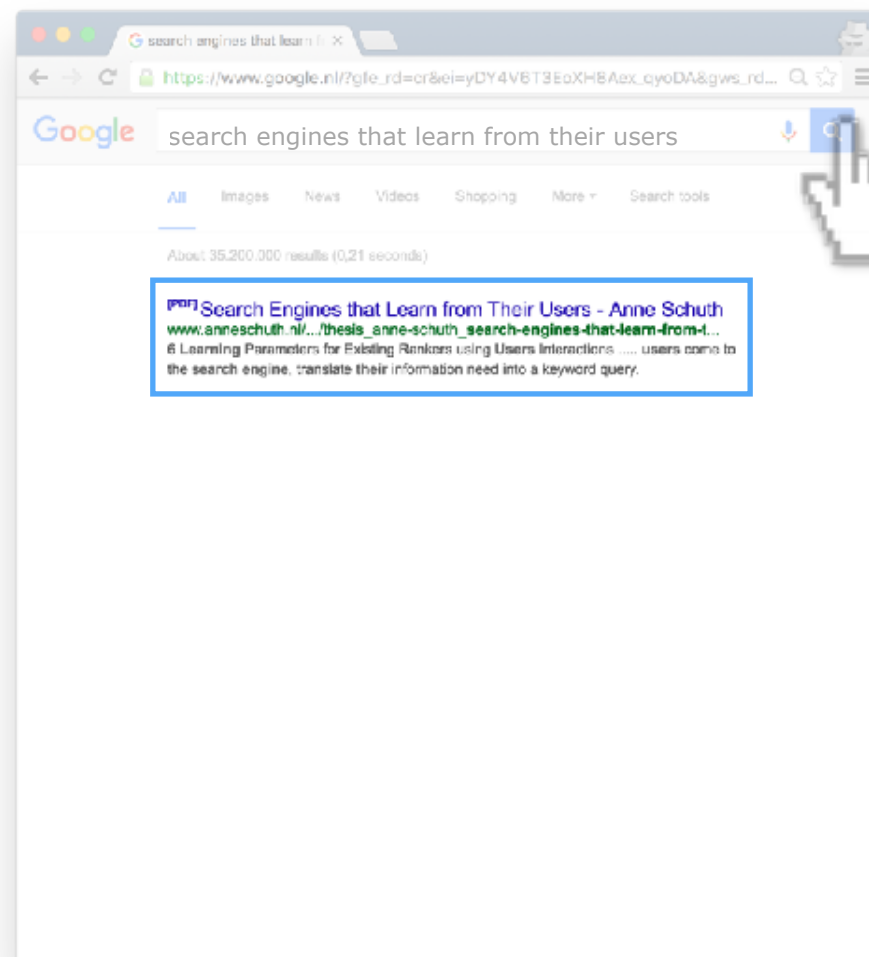
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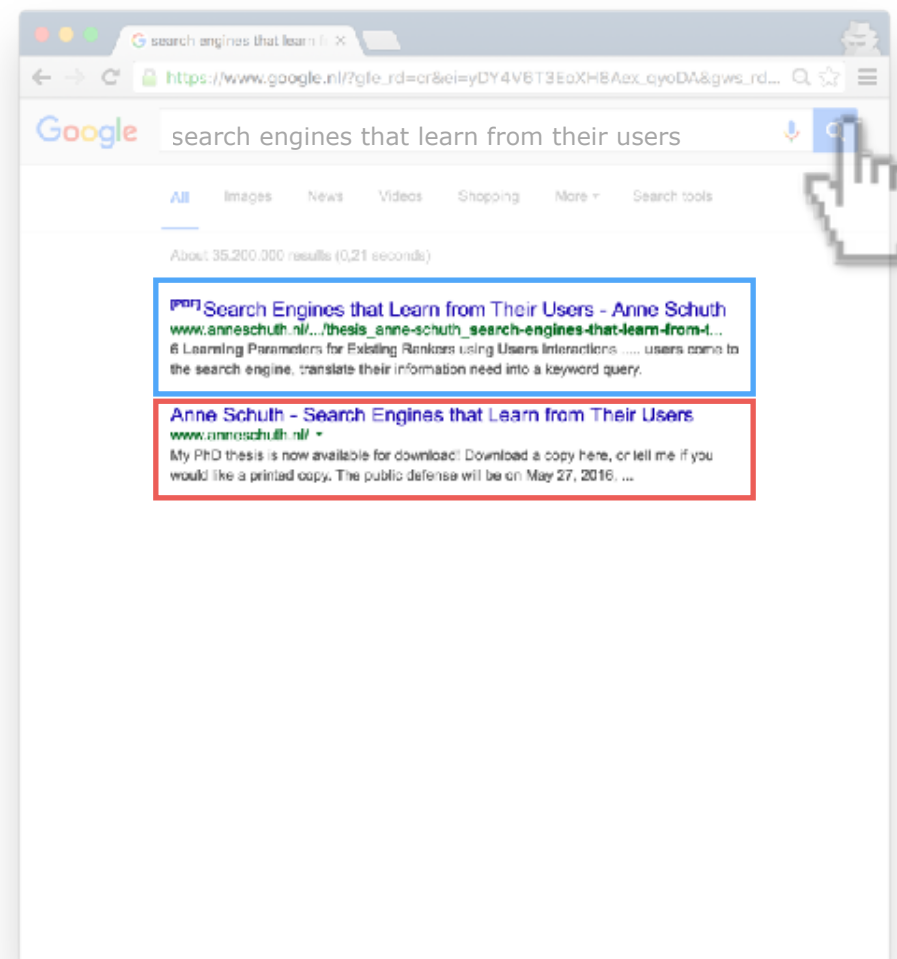
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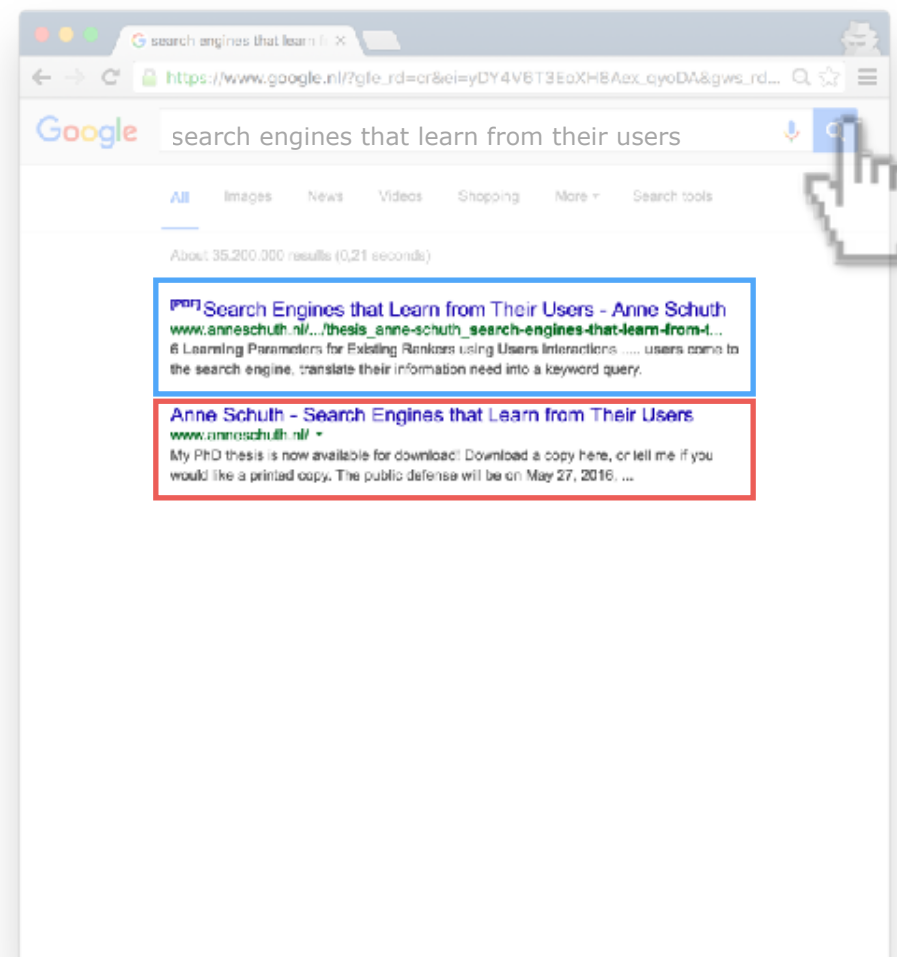
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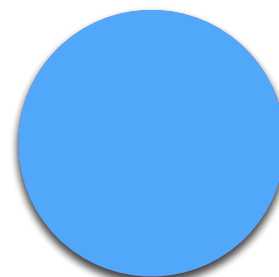
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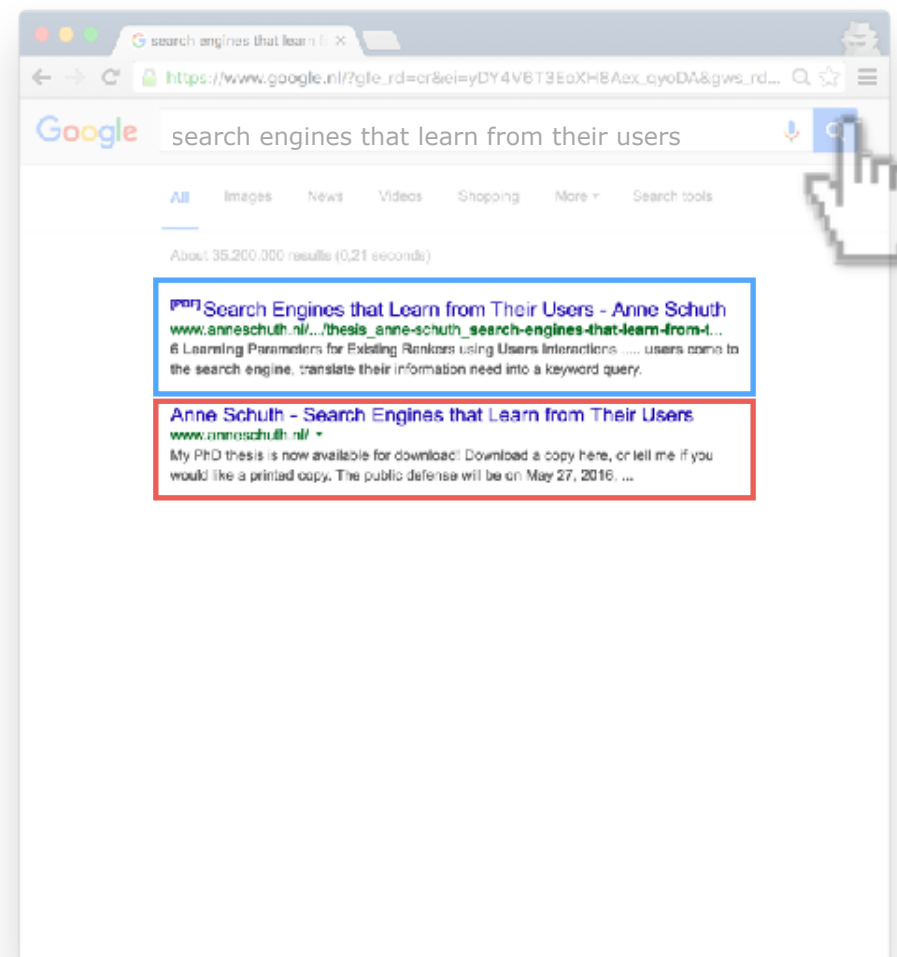
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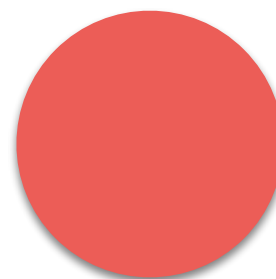
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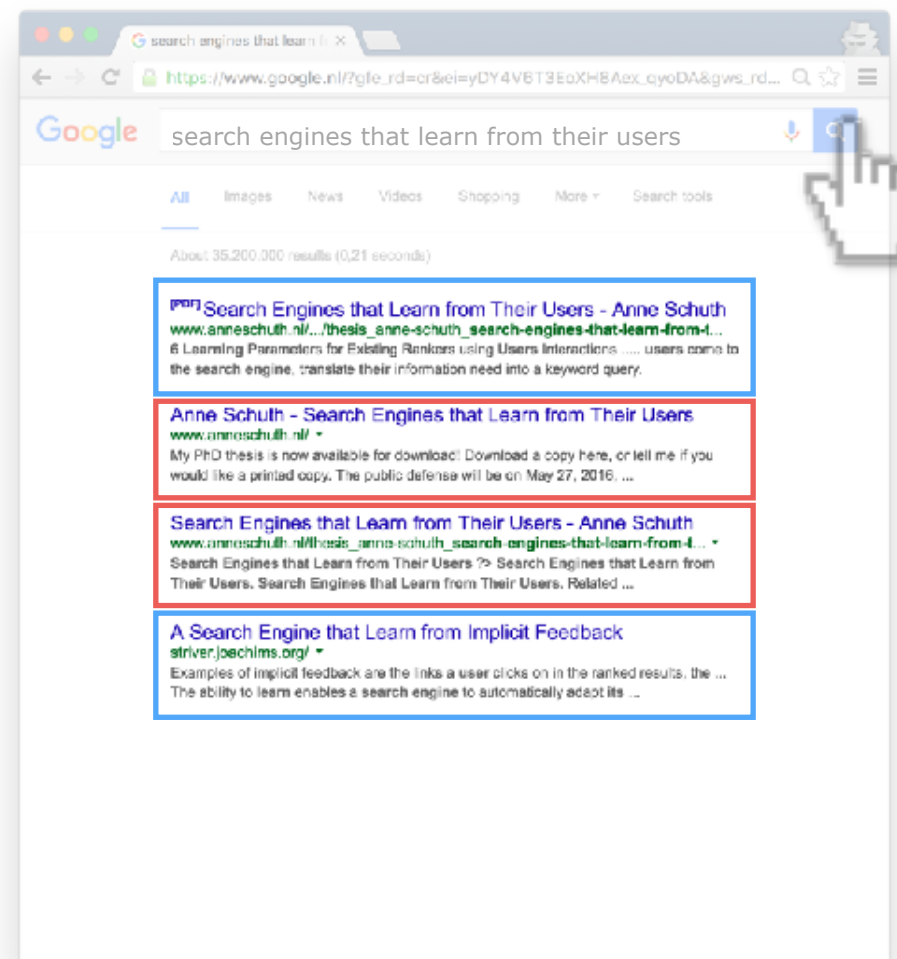


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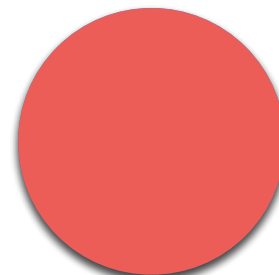
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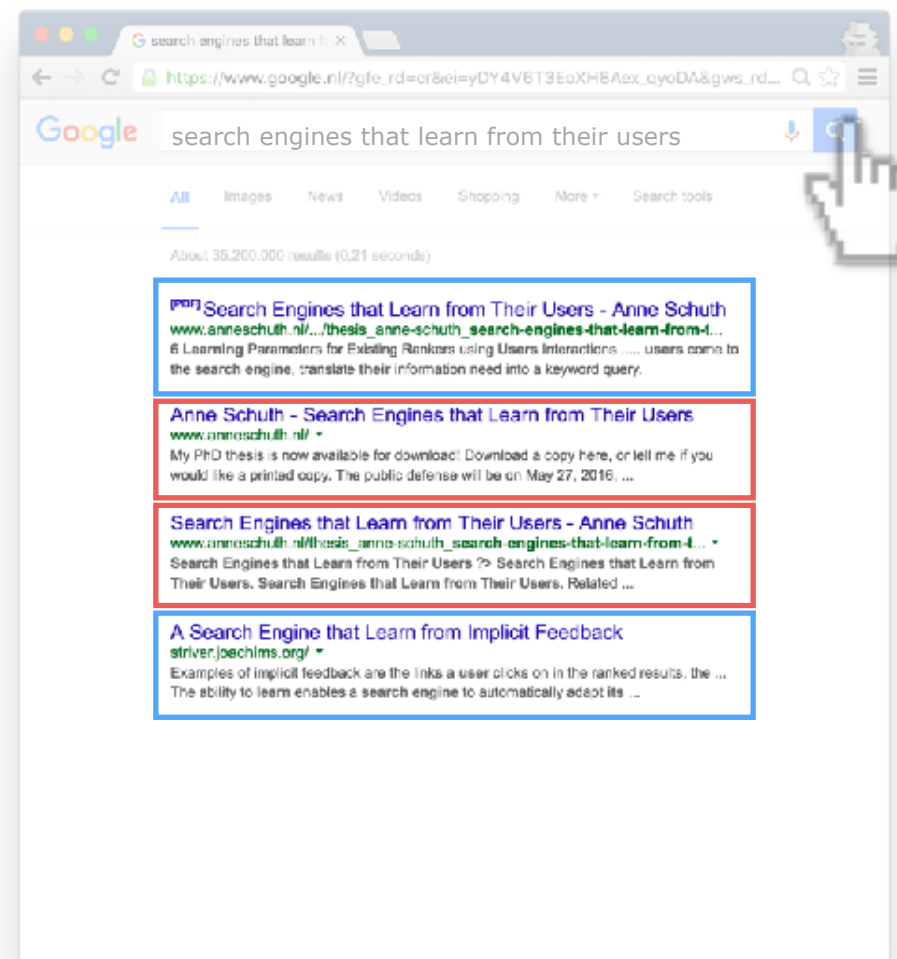


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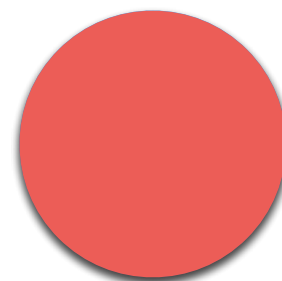
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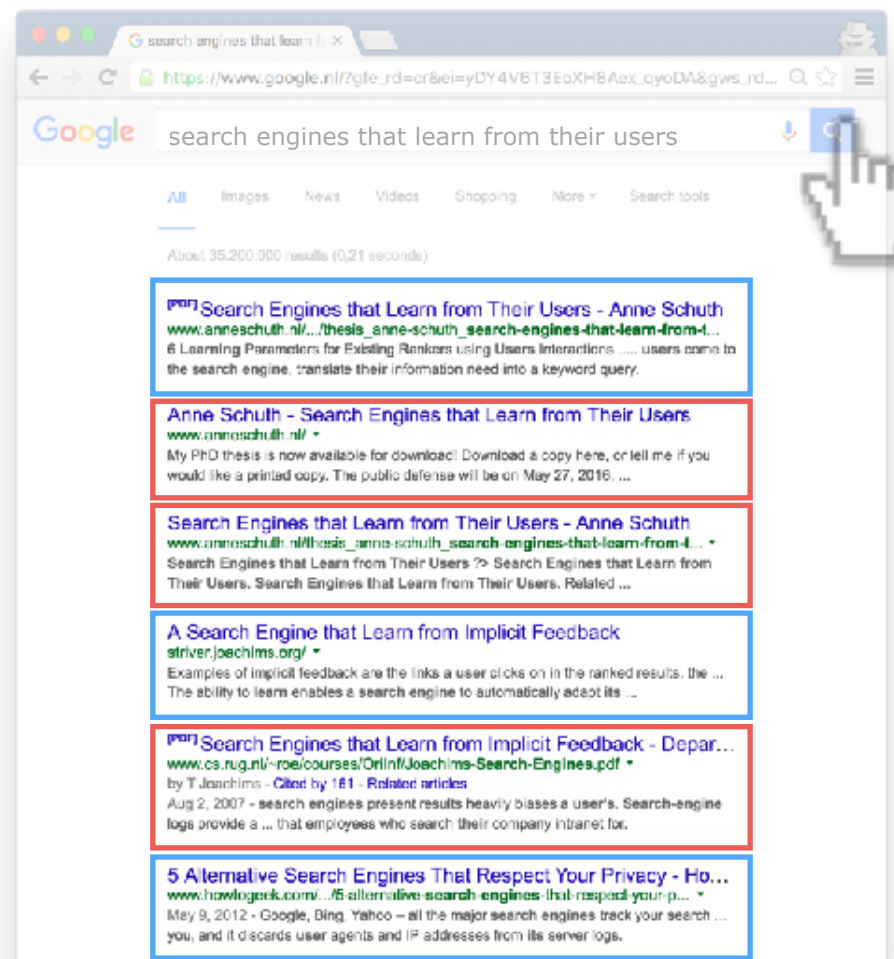
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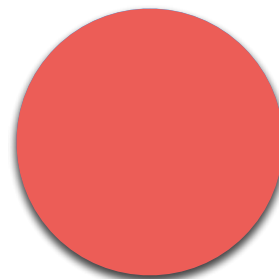


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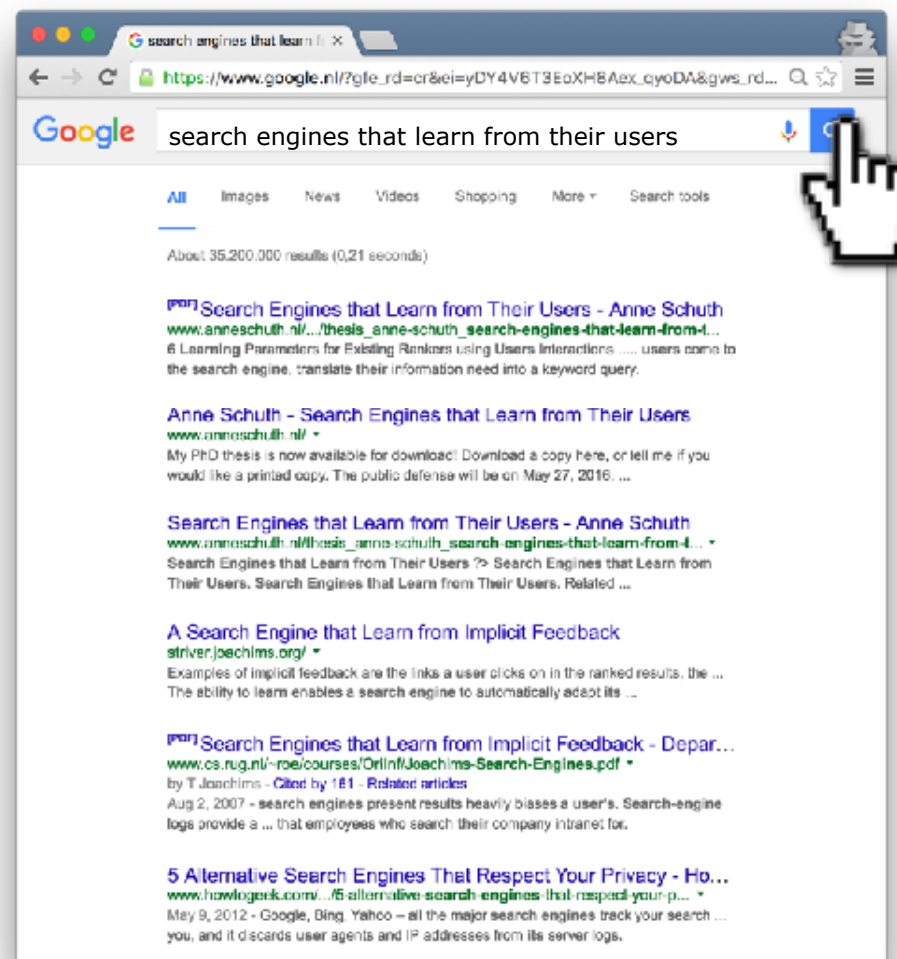


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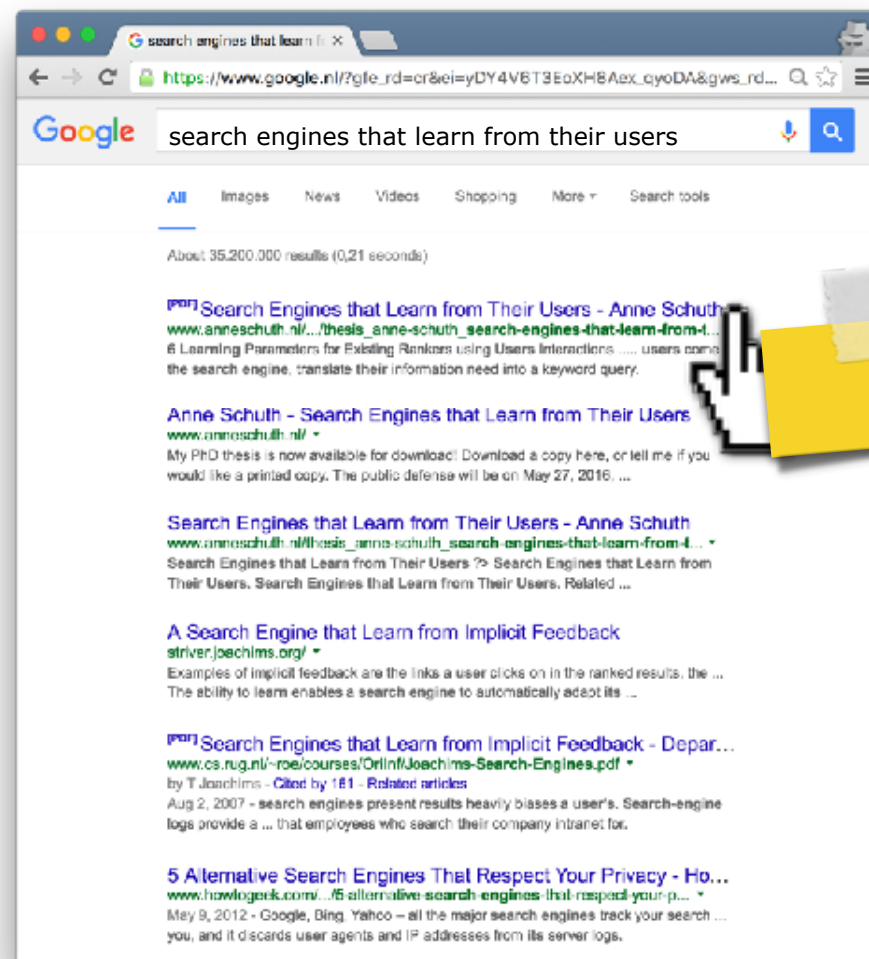
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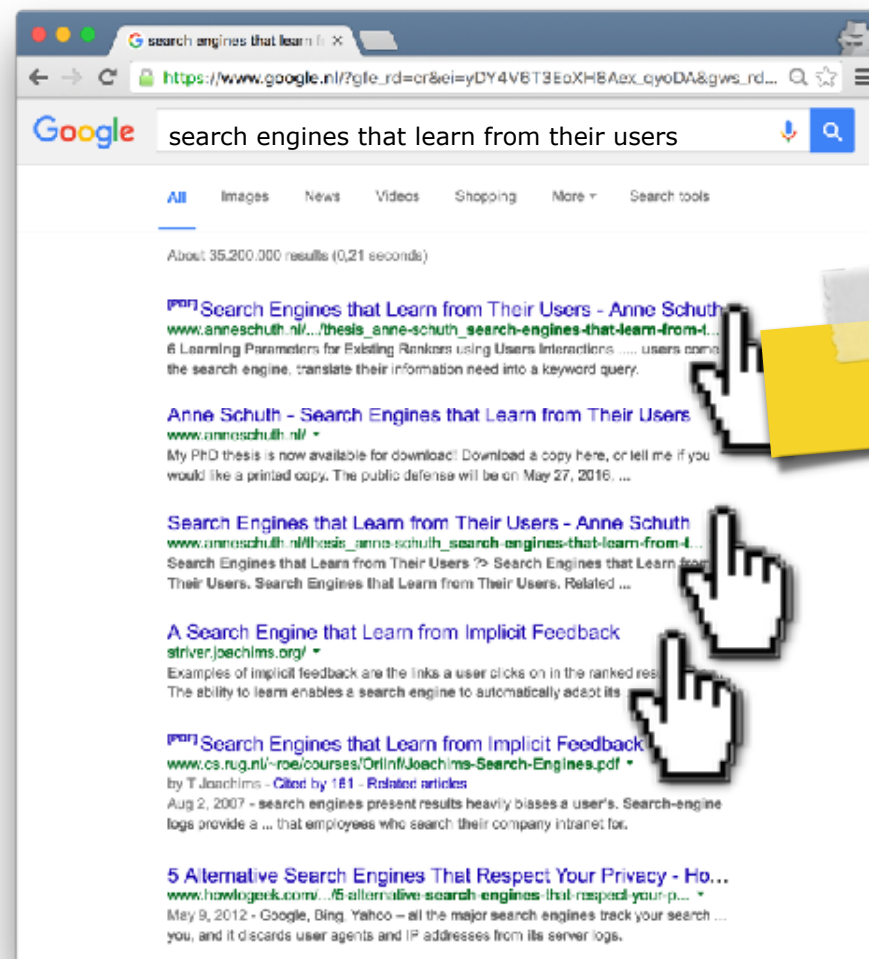
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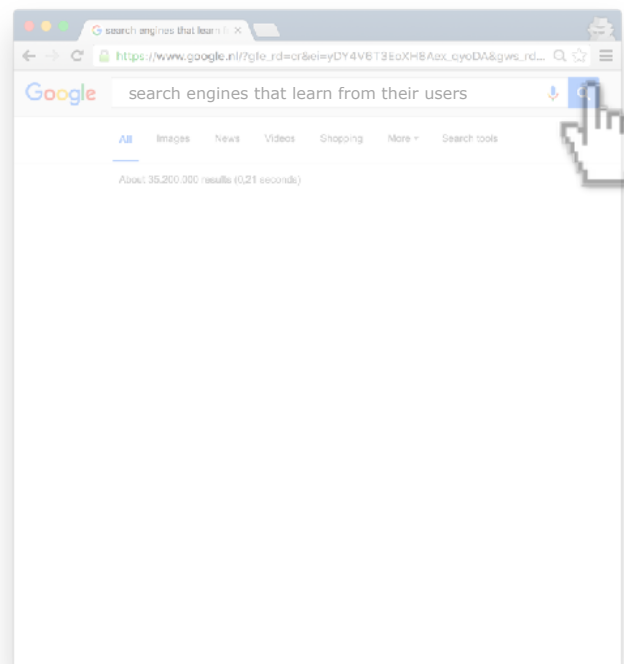
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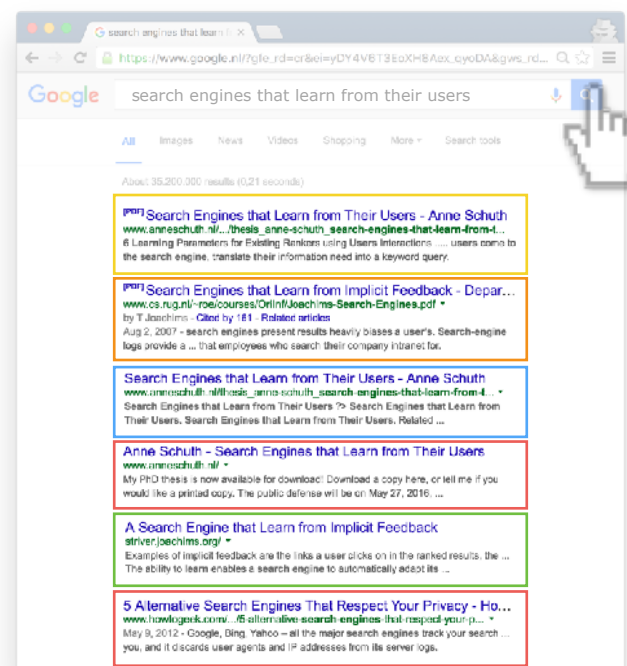
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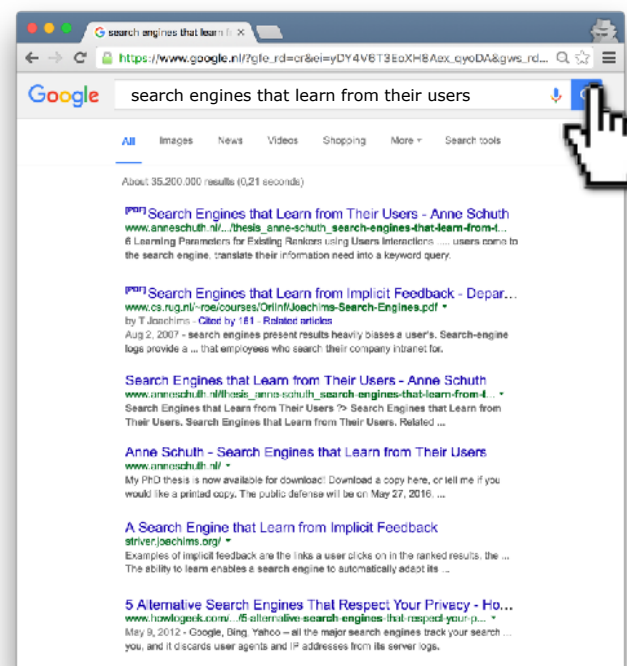
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MULTILEAVING

Google **A**

Google **B**

Google **C**

Google **D**

Google **E**

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Google **A**



Google **B**



Google **C**



Google **D**



Google **E**



Struggling and Success in Web Search

Daan Odijk, University of Amsterdam, The Netherlands

Ryen W. White, Ahmed Hassan Awadallah & Susan T. Dumais
Microsoft Research, Redmond, WA, USA

Motivation

- Long web search sessions are common

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 - Half of web search sessions contain multiple queries [Shokouhi et al., SIGIR'13]
 - 40% of sessions take 3+ minutes [Dumais, NSF'13]
 - Account for most of search time

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Motivation

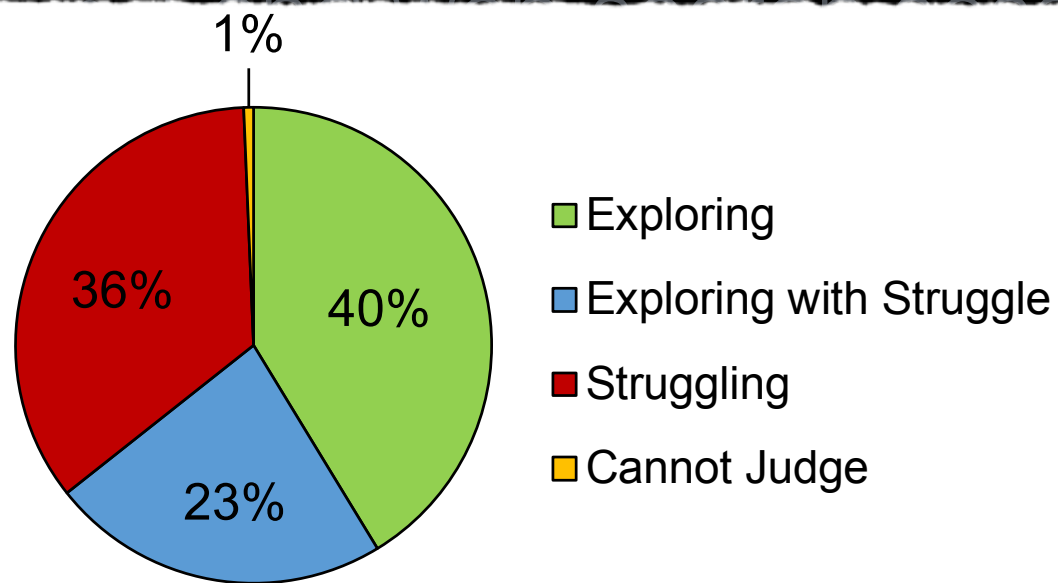


Figure 2. Session type distribution as labeled by judges.

- What are searchers doing? Struggling or Exploring. [Hassan et al., WSDM'14]

Motivation

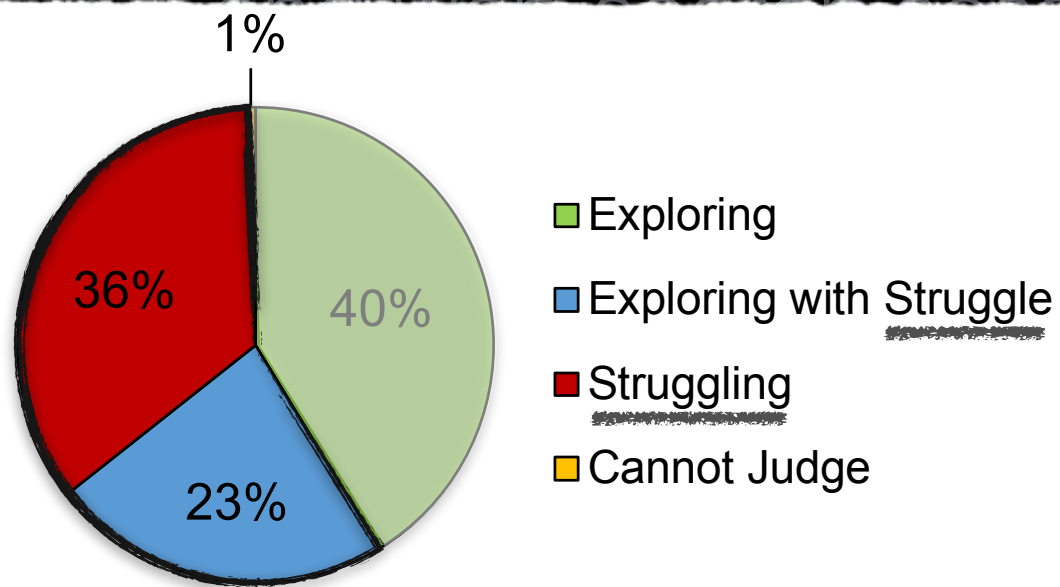


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- Struggling in 60% of long sessions

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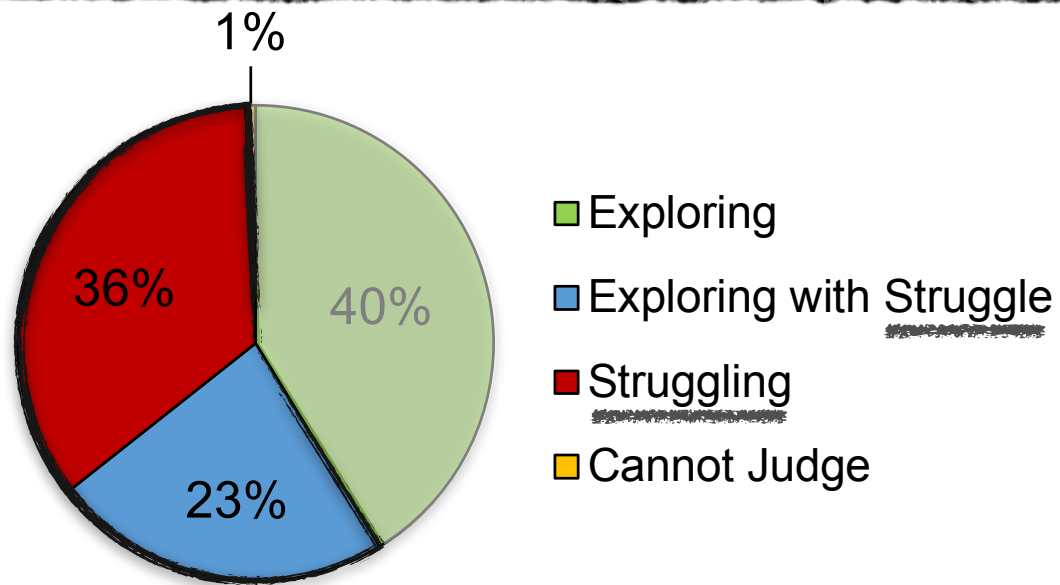


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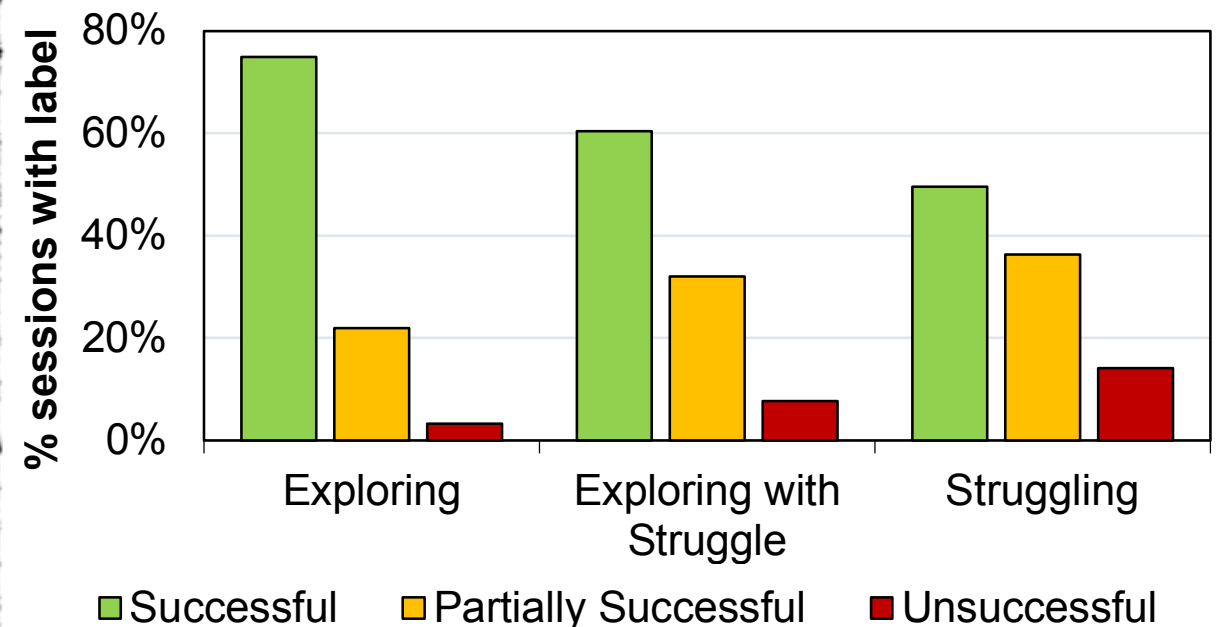


Figure 3. Session success distribution as labeled by judges.

- What are searchers doing? Struggling or Exploring. [Hassan et al., WSDM'14]
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Motivation

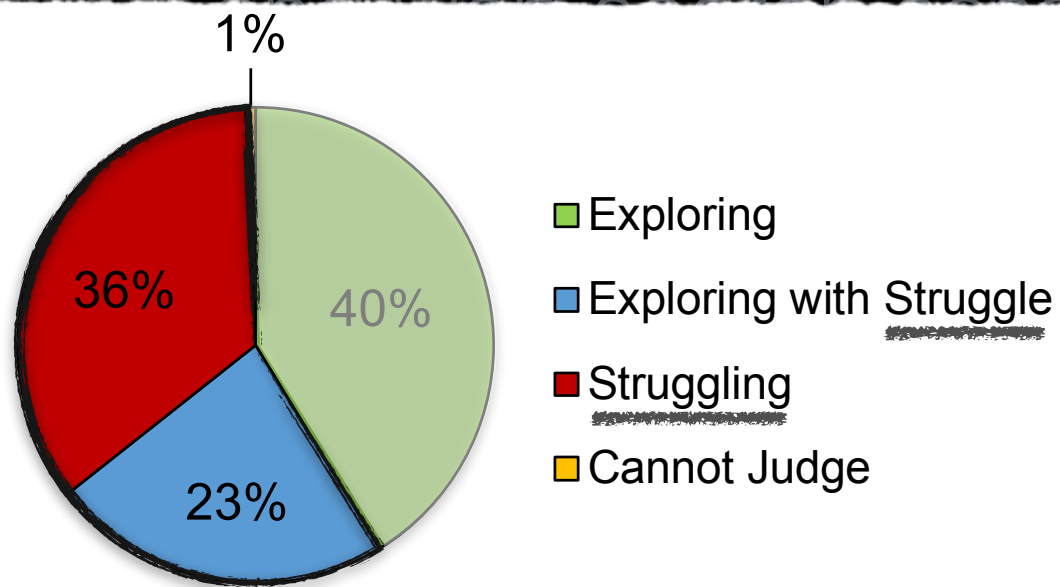


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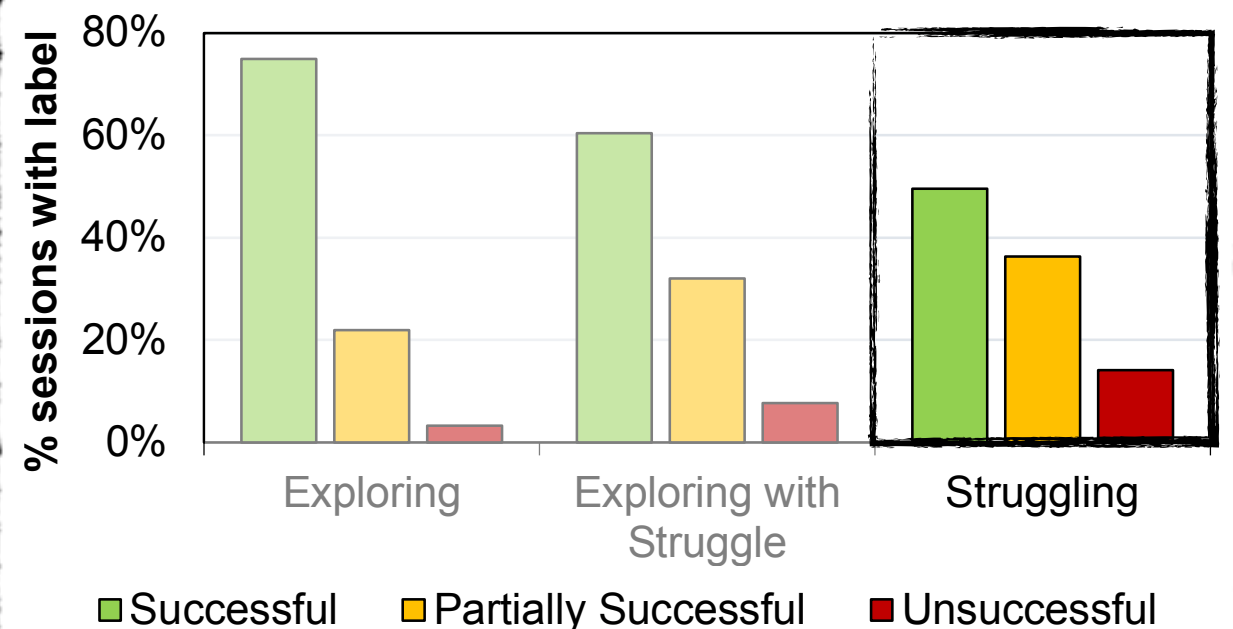


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Example of Struggling

Logged session from June 2014

Example of Struggling

Logged session from June 2014

| | | |
|------------|--|---|
| 9:13:11 AM |  Query | us open |
| 9:13:24 AM |  Query | us open golf |
| 9:13:36 AM |  Query | us open golf 2013 live |
| 9:13:59 AM |  Query | watch us open live streaming |
| 9:14:02 AM |  Click | http://inquisitr.com/1300340/watch-2014-u-s-open-live-online-final-round-free-streaming-video |
| 9:31:55 AM | END | |

Example of Struggling

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How & why do searchers struggle?

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How & why do searchers struggle?

How do searchers go from struggle to success?

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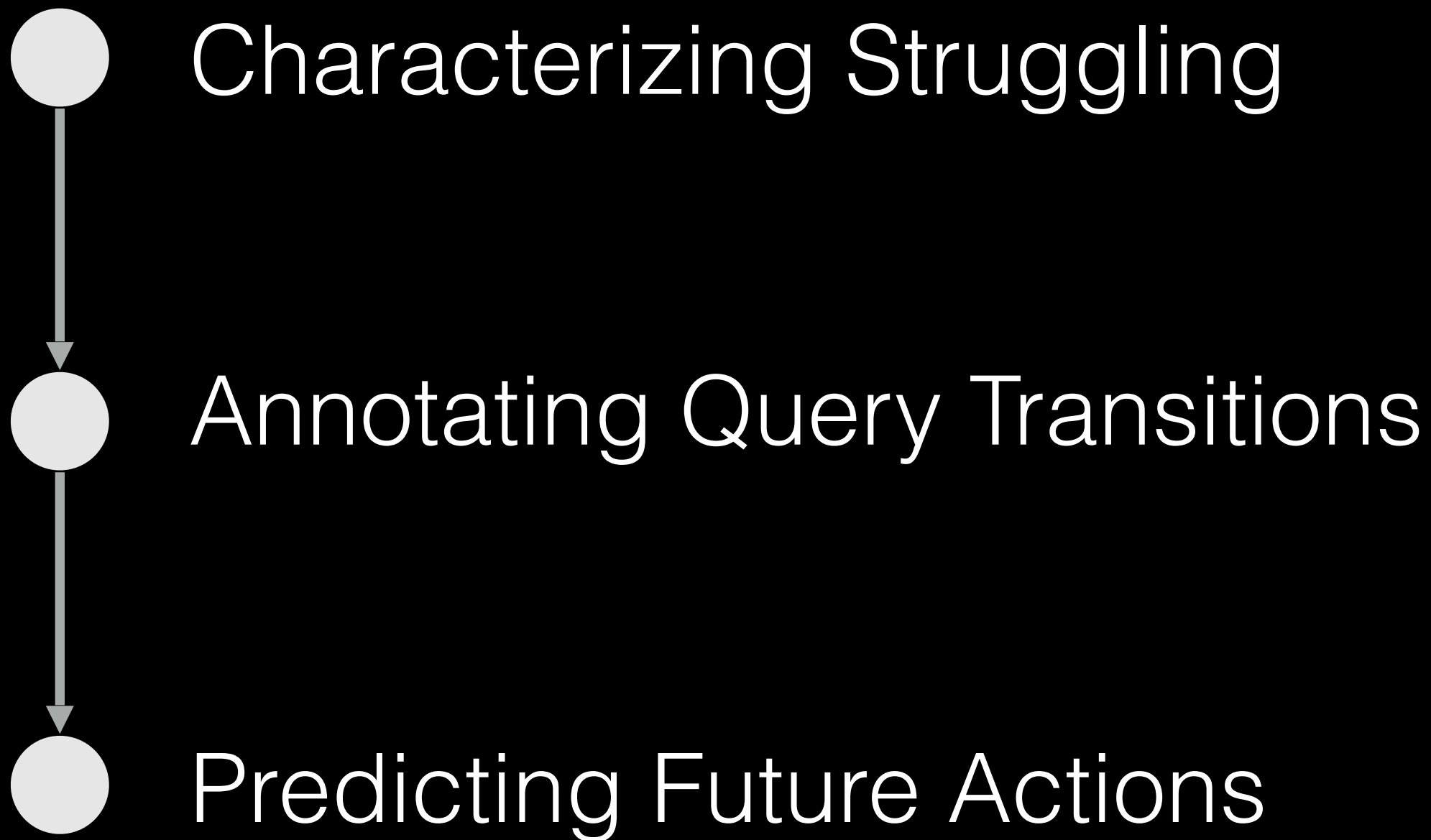
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How & why do searchers struggle?

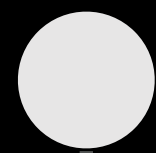
How do searchers go from struggle to success?

Can we help them struggle less?

Outline

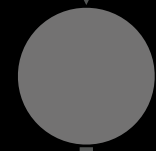


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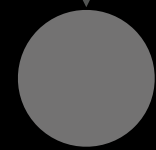


Characterizing Struggling

Struggling searchers behave differently given different outcomes on many search aspects, including: queries, reformulations, clicks, dwell time & topic.



Annotating Query Transitions



Predicting Future Actions

Identifying Struggling Sessions



June 1–7, 2014

1. **Filter sessions:** US & English, start with a typed query
2. **Segment into tasks:** Topically coherent sub-sessions with at least 3 queries
3. **Filter struggling tasks**

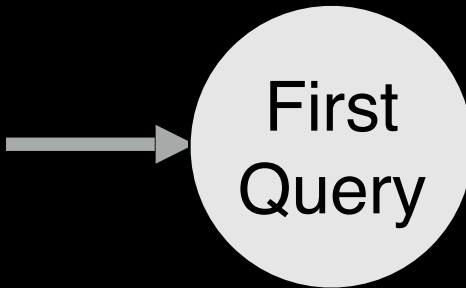
[Hassan et al., WSDM'14]

Identifying Struggling Sessions



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First
Query

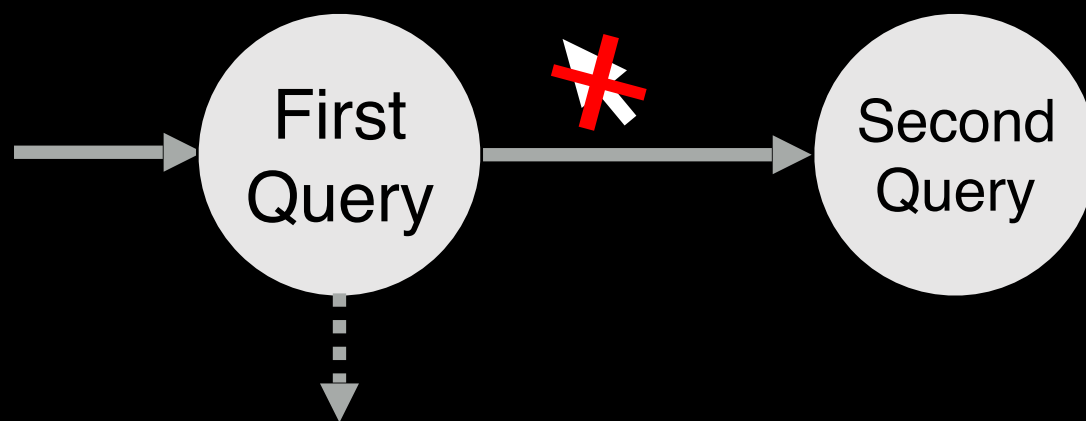
A diagram showing a grey arrow pointing from the left to a light blue circle. Inside the circle, the text 'First Query' is written in two lines.

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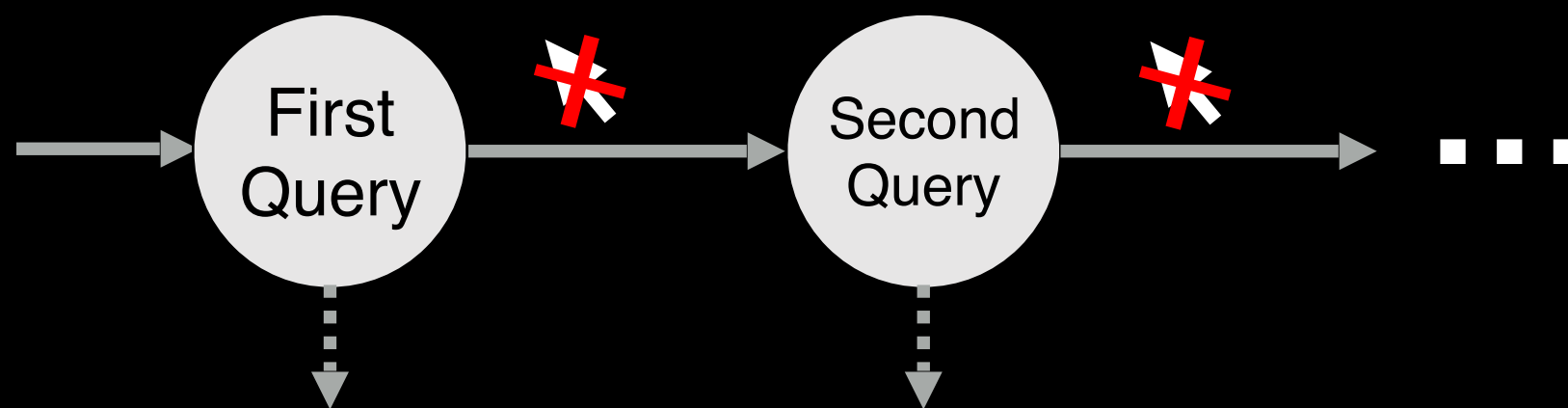
No click or dwell time < 10s

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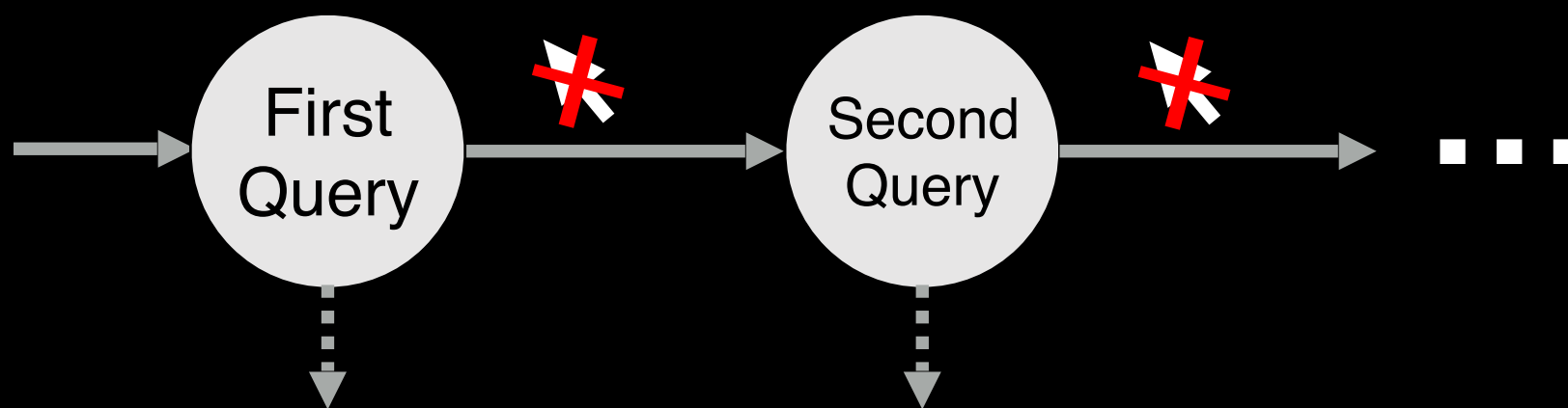
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Commonly used proxy for success.



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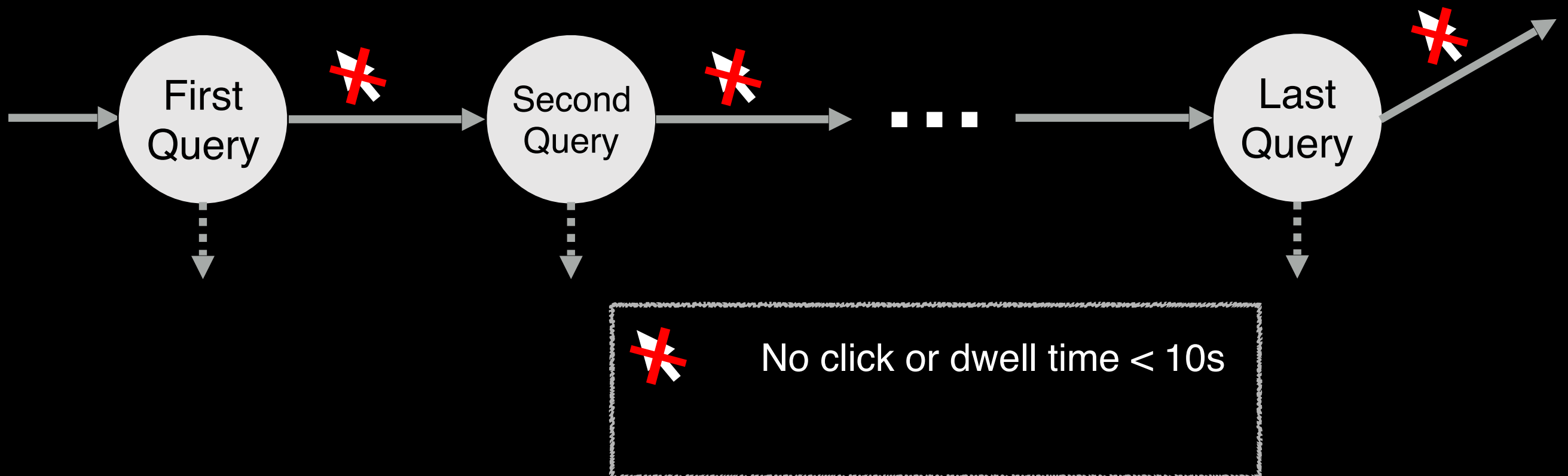


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4,508,821
Unsuccessful



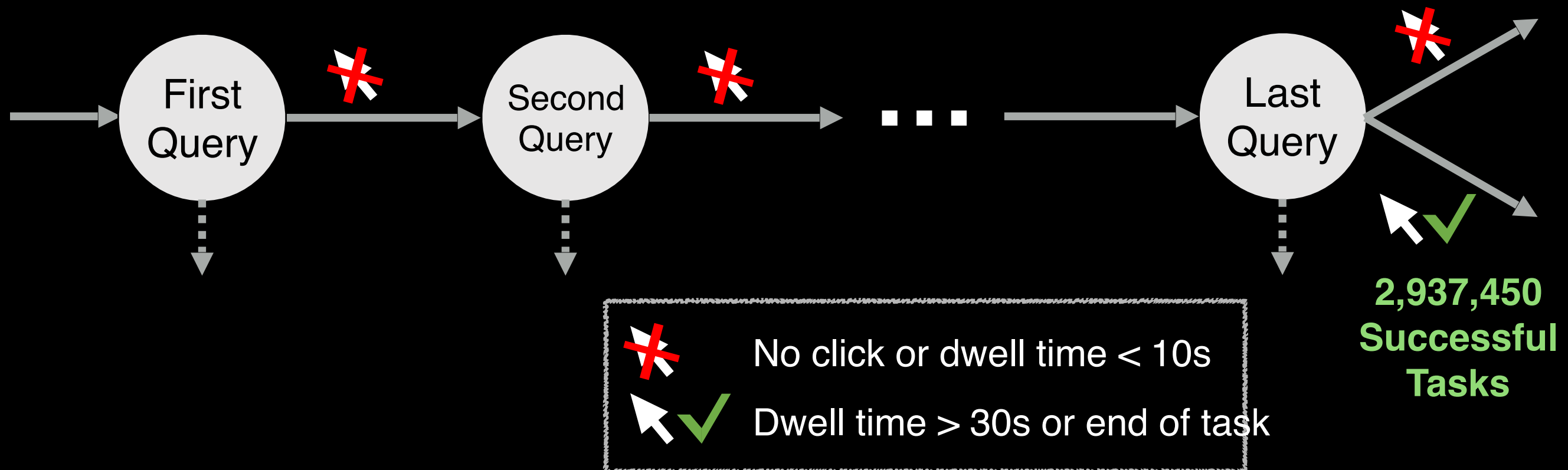
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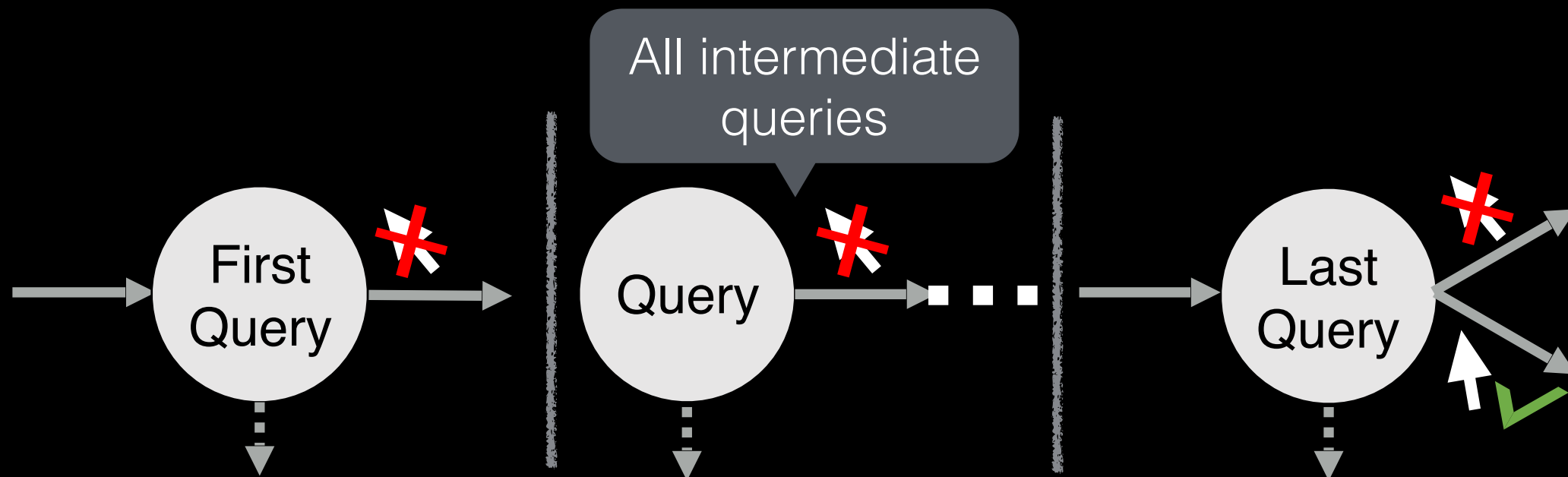
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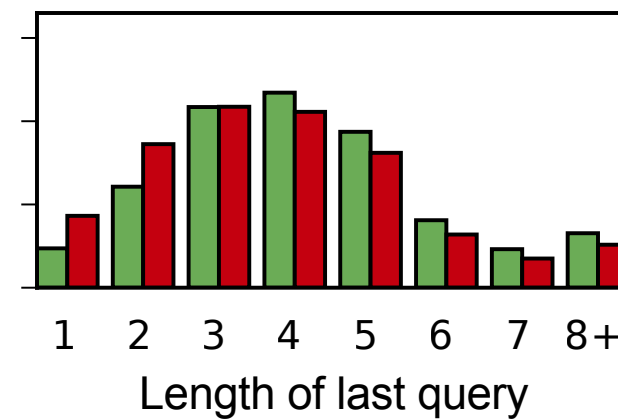
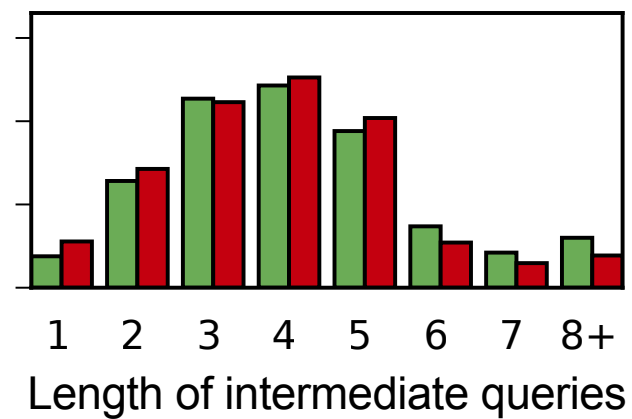
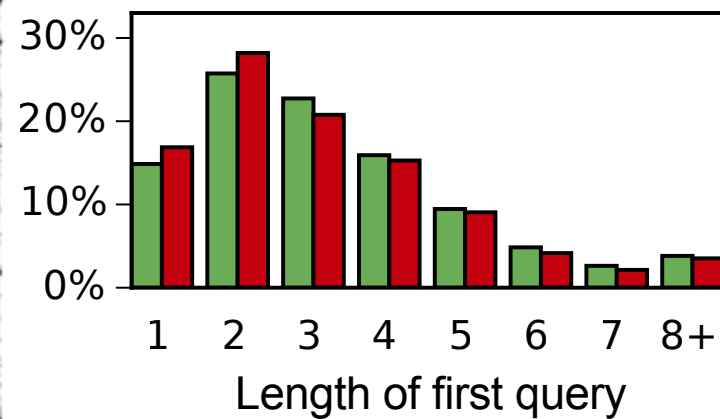
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Query Grouping



Queries become longer

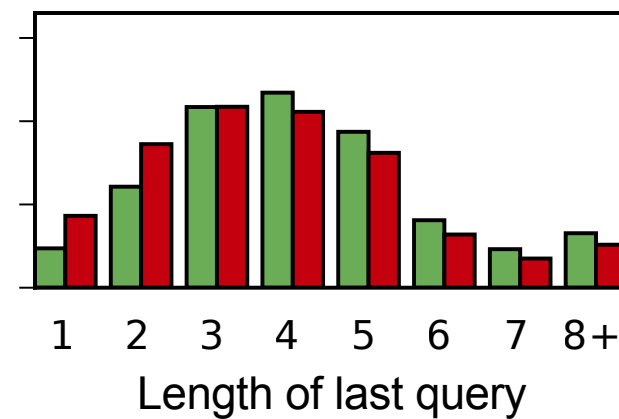
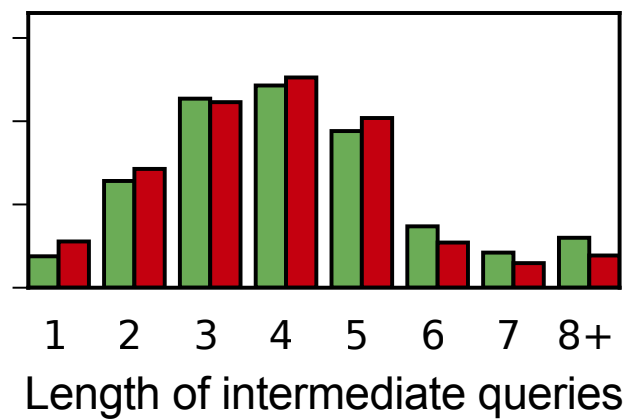
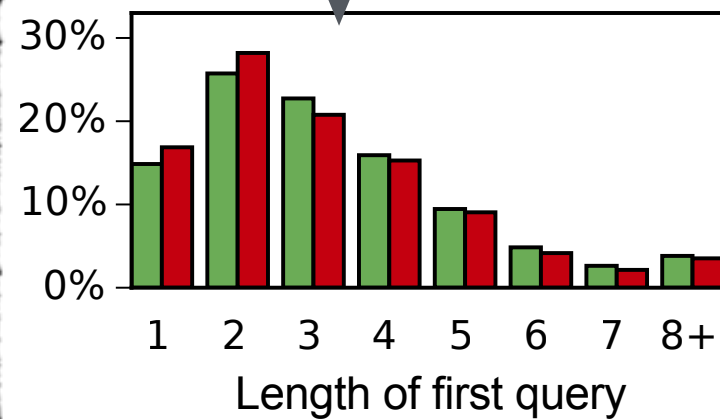


Successful

Unsuccessful

Queries become longer

First query short:
3.35 vs 3.23 terms

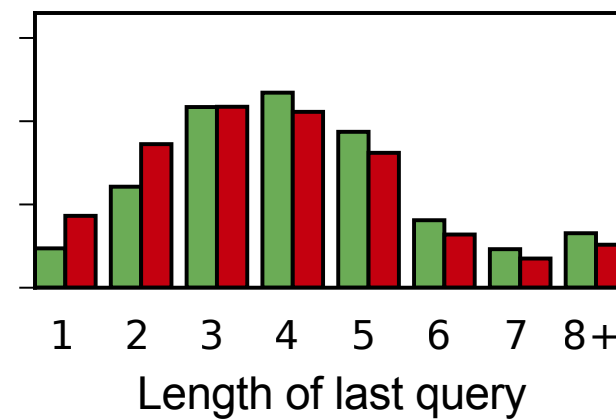
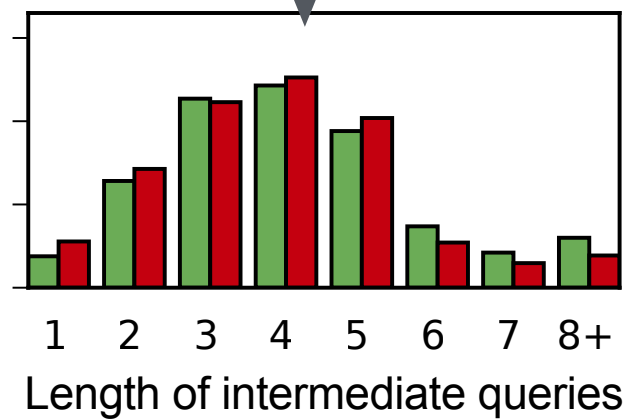
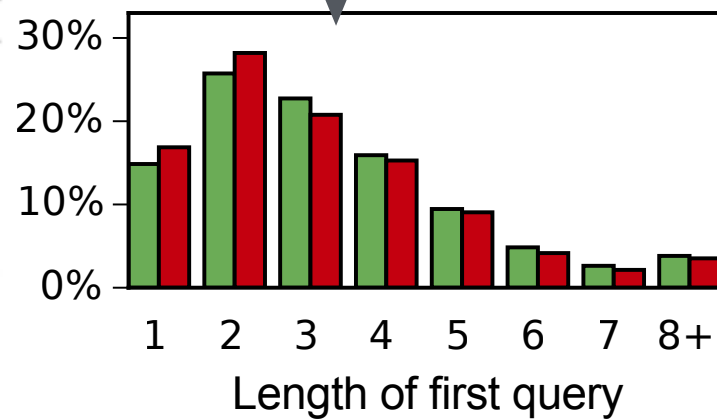


Successful
Unsuccessful

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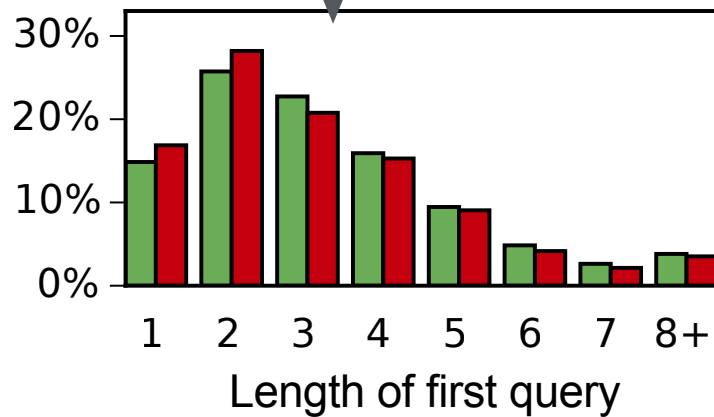
Longer queries:
4.29 vs 4.04 terms



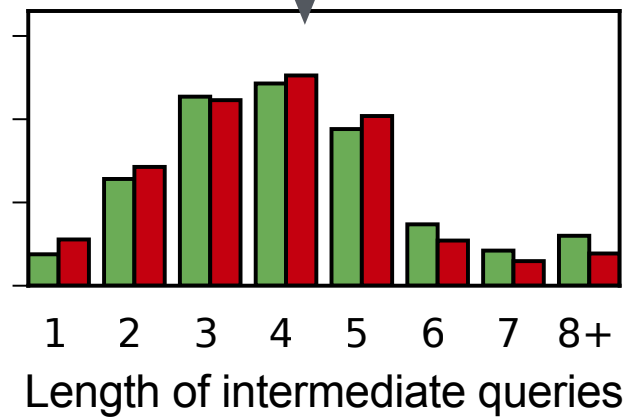
Successful
Unsuccessful

Queries become longer

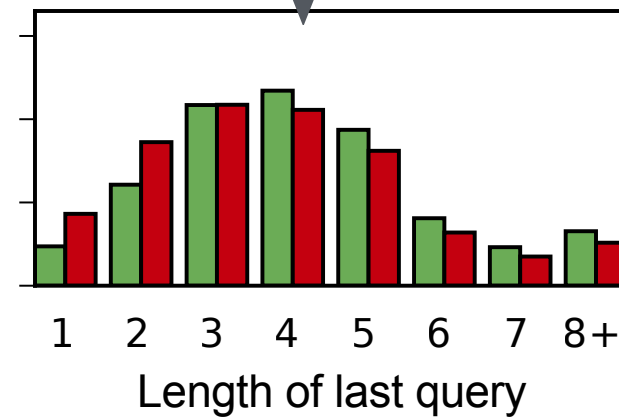
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4.29 vs 4.04 terms



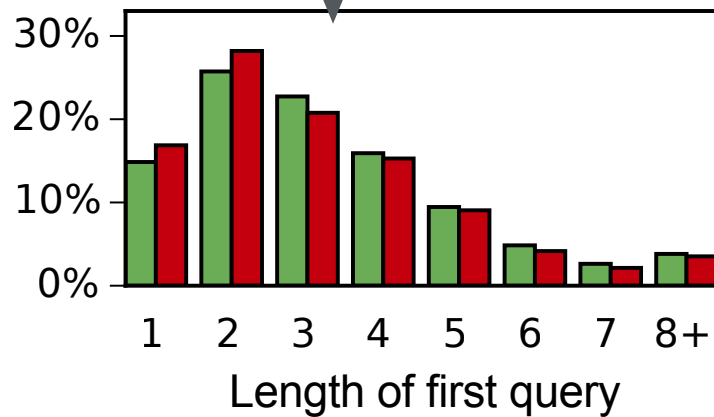
Larger difference:
4.29 vs 3.93 terms



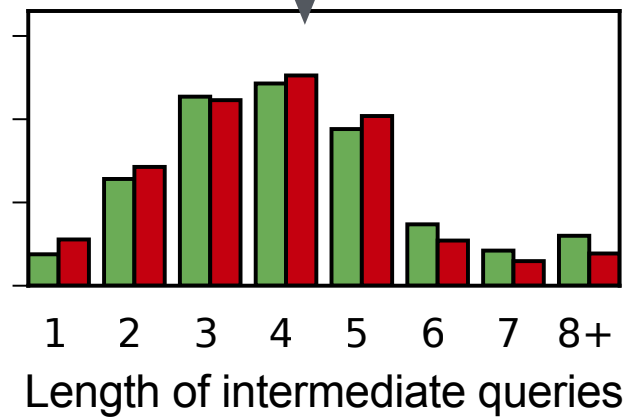
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Unsuccessful

Queries become longer

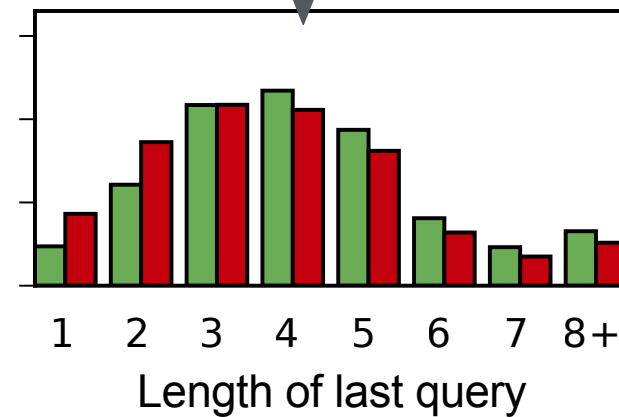
First query short:
3.35 vs 3.23 terms



Longer queries:
4.29 vs 4.04 terms



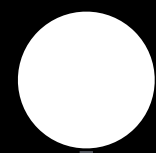
Larger difference:
4.29 vs 3.93 terms



Successful
Unsuccessful

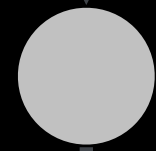
Shorter

Outline

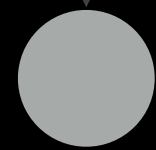


Characterizing Struggling

Struggling searchers in successful vs unsuccessful tasks issue fewer and shorter queries. Query reformulations indicate more trouble choosing correct vocabulary.



Annotating Query Transitions



Predicting Future Actions

Outline



Characterizing Struggling

Struggling searchers in successful vs unsuccessful tasks issue fewer and shorter queries. Query reformulations indicate more trouble choosing correct vocabulary.

Annotating Query Transitions

Crowd-sourcing to better understand: connection between struggling and success & query transitions.
First an exploratory pilot, then main annotations.

Predicting Future Actions

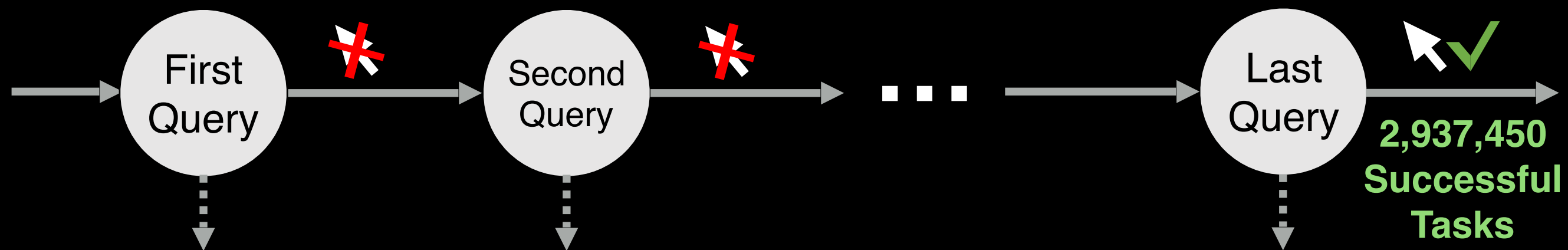
Intent-based query reformulation taxonomy

Based on the answers to the open-ended questions

- Added, removed** ☐ an **action** (e.g., download, contact)
- or substituted** ☐ an **attribute** (e.g., printable, free,)
- Specified** ☐ a **particular instance**
(e.g. added a brand name or version number)
- Rephrased** ☐ Corrected a spelling error or **typo**
☐ Used a **synonym** or related term
- Switched** ☐ to a **related** task (changed main focus)
☐ to a **new task**

Main Annotations:

Transitions in 659 successful tasks



- Annotated 659 new successful tasks
 - Single tasks, no pairs
 - Annotated transitions between each query pair

Understanding Struggling Behavior

Struggling describes a situation whereby a user experiences difficulty in finding the information they are looking for.

Below is a session in which we believe that a Bing user could not immediately find the information they were looking for. The session is presented as a series of Bing Queries (🔍) and Result Clicks (👉) with their timestamps. You can click on a query to repeat a search or click on a result click to inspect the page that the user viewed (the page will open in a new window).

Please examine the session shown below and then answer the questions about it.

| Timestamp | Query/URL |
|--------------|--|
| 9:13:24 AM 🔍 | us open golf |
| 9:13:36 AM 🔍 | us open golf 2013 live |
| 9:13:59 AM 🔍 | watch us open live streaming |
| 9:14:02 AM 👉 | inquisitr.com/1300340/watch-2014-u-s-open-live-online-final-round-free-streaming-video |
| 9:31:55 AM | END |

How successful do you think the user was in this session?

☐ Not at all successful ☐ Somewhat successful ☐ Mostly successful ☐ Completely successful

Understanding Struggling Behavior

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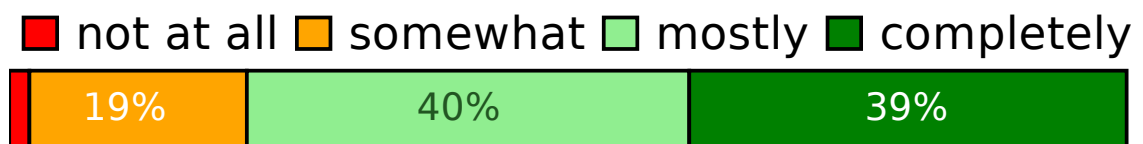
How successful do you think the user was in this session?

☐ Not at all successful ☐ Somewhat successful ☐ Mostly successful ☐ Completely successful

Success & Pivotal Query

Made at least
some progress

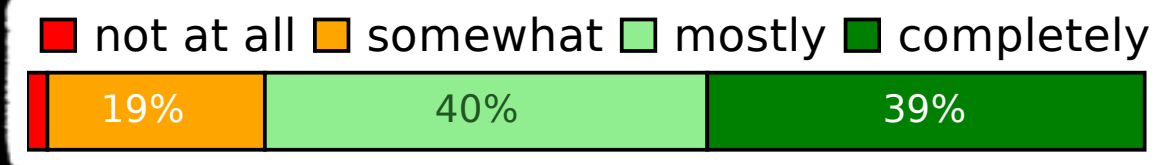
Task Success



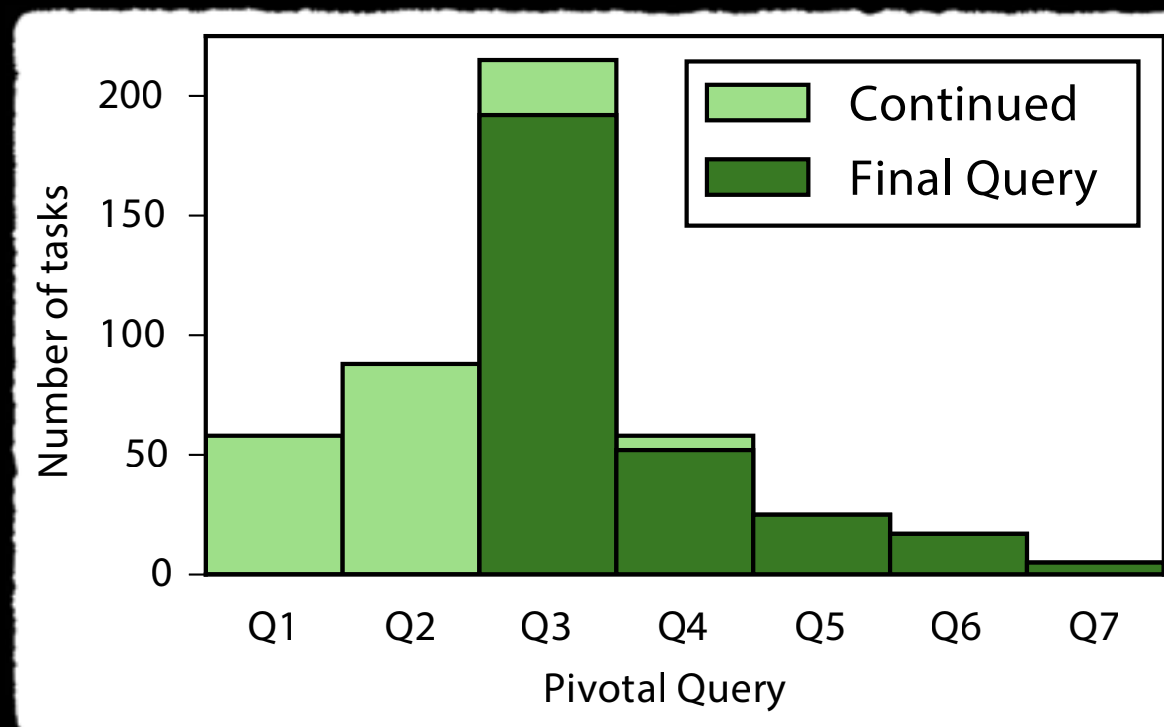
Success & Pivotal Query

Made at least
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Task Success



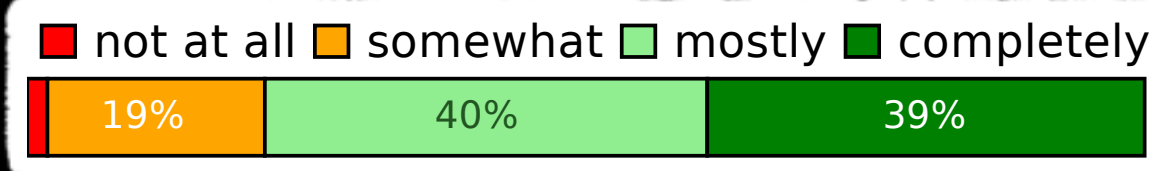
Location of the pivotal query



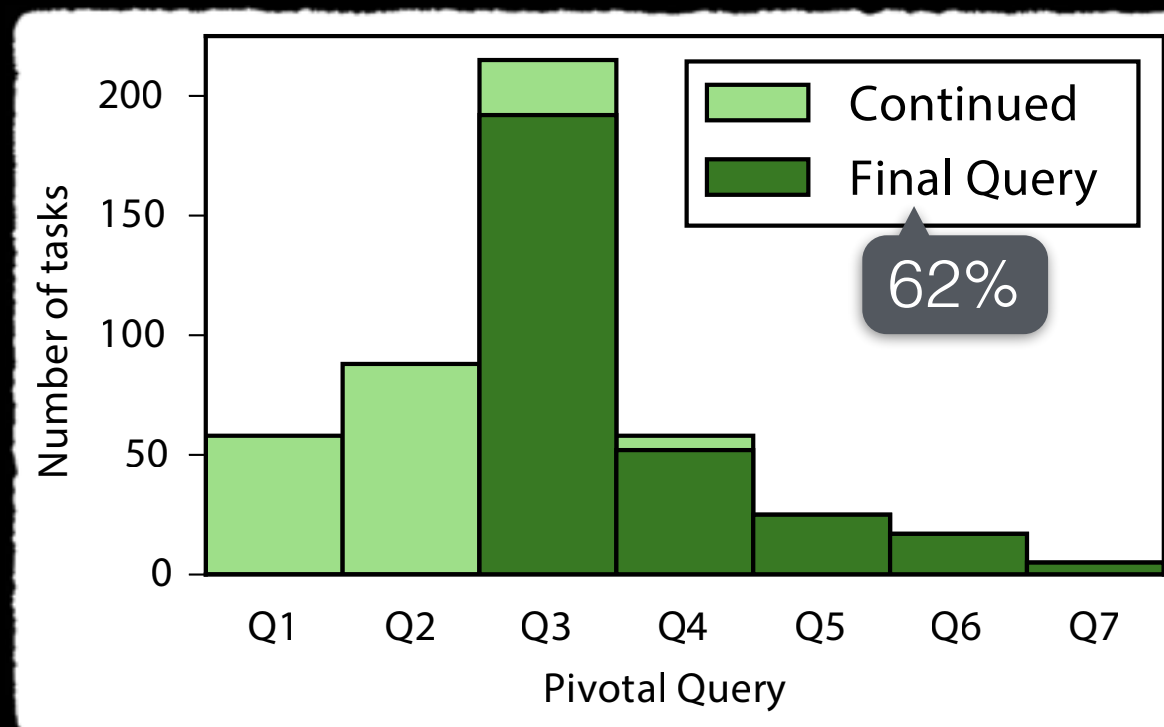
Success & Pivotal Query

Made at least
some progress

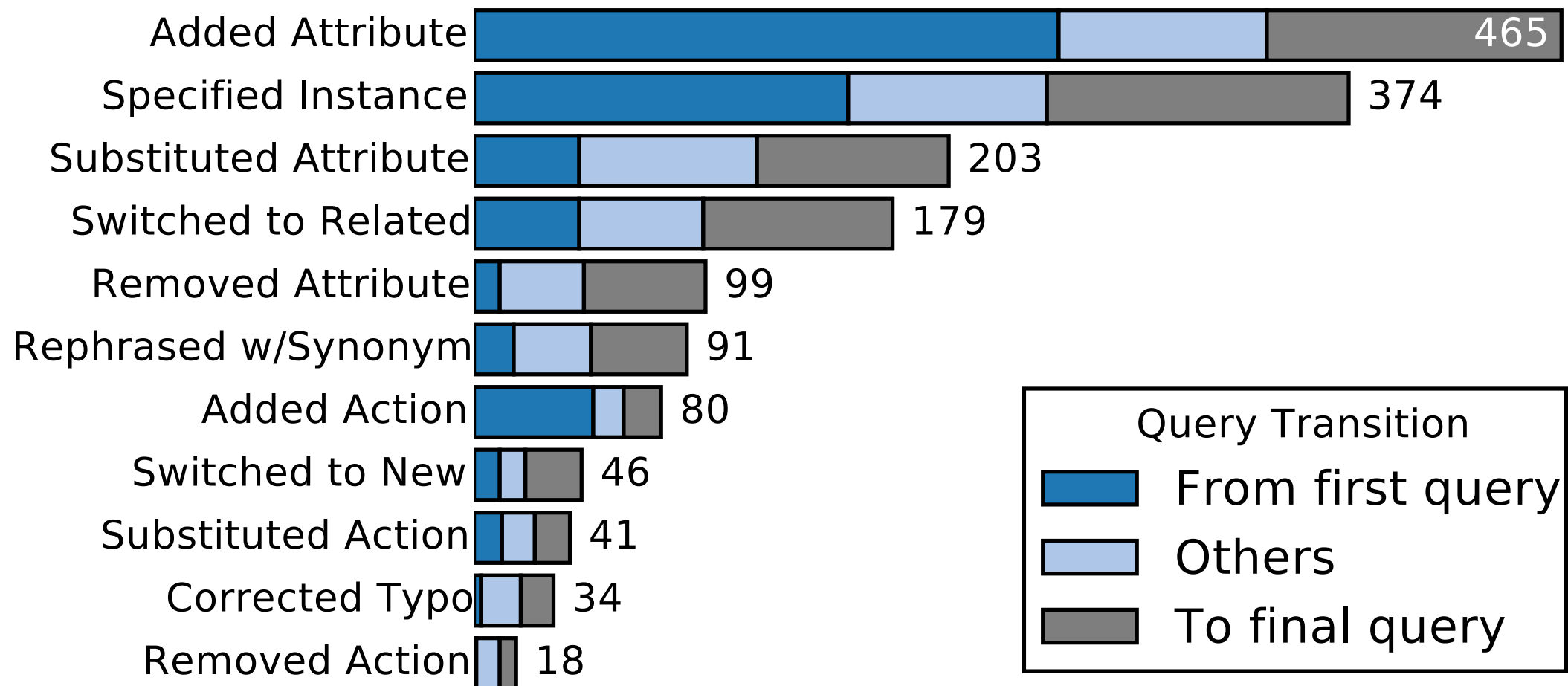
Task Success



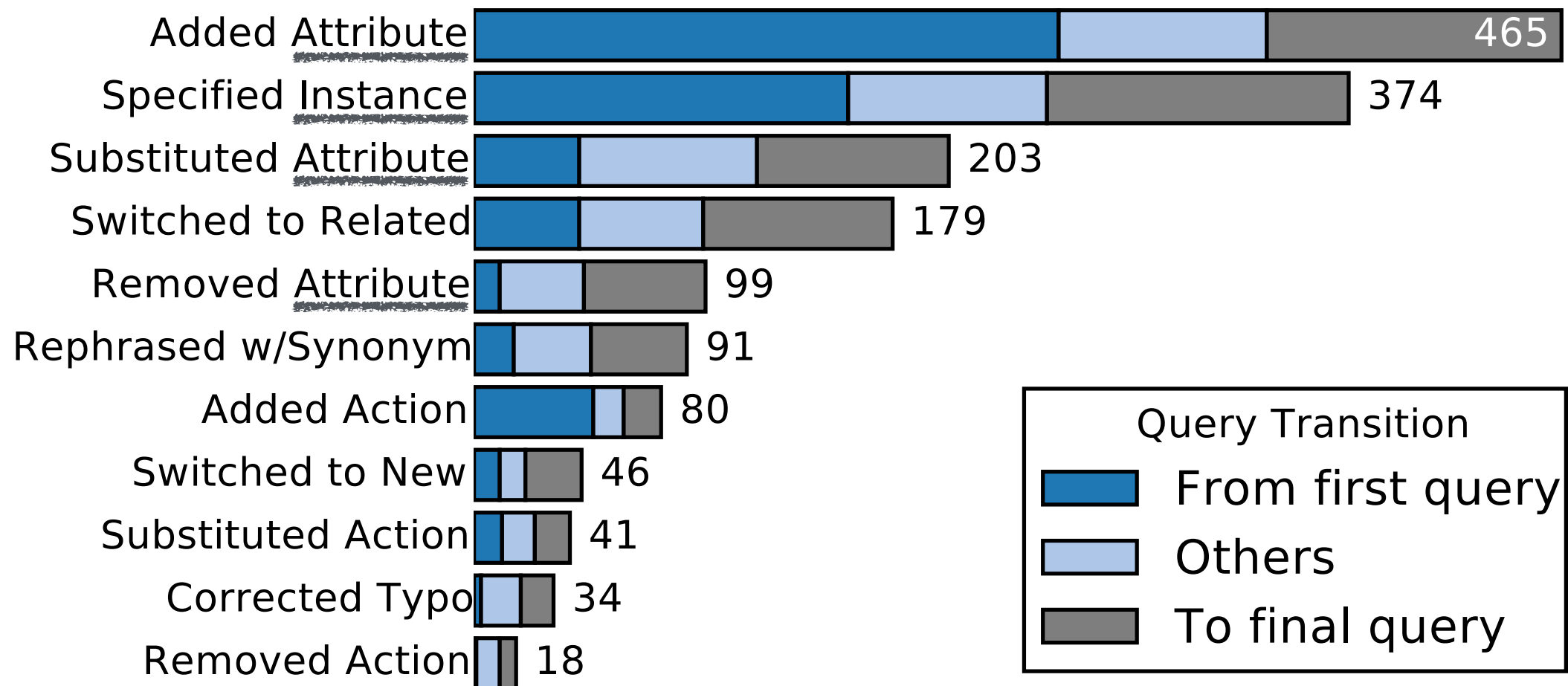
Location of the pivotal query



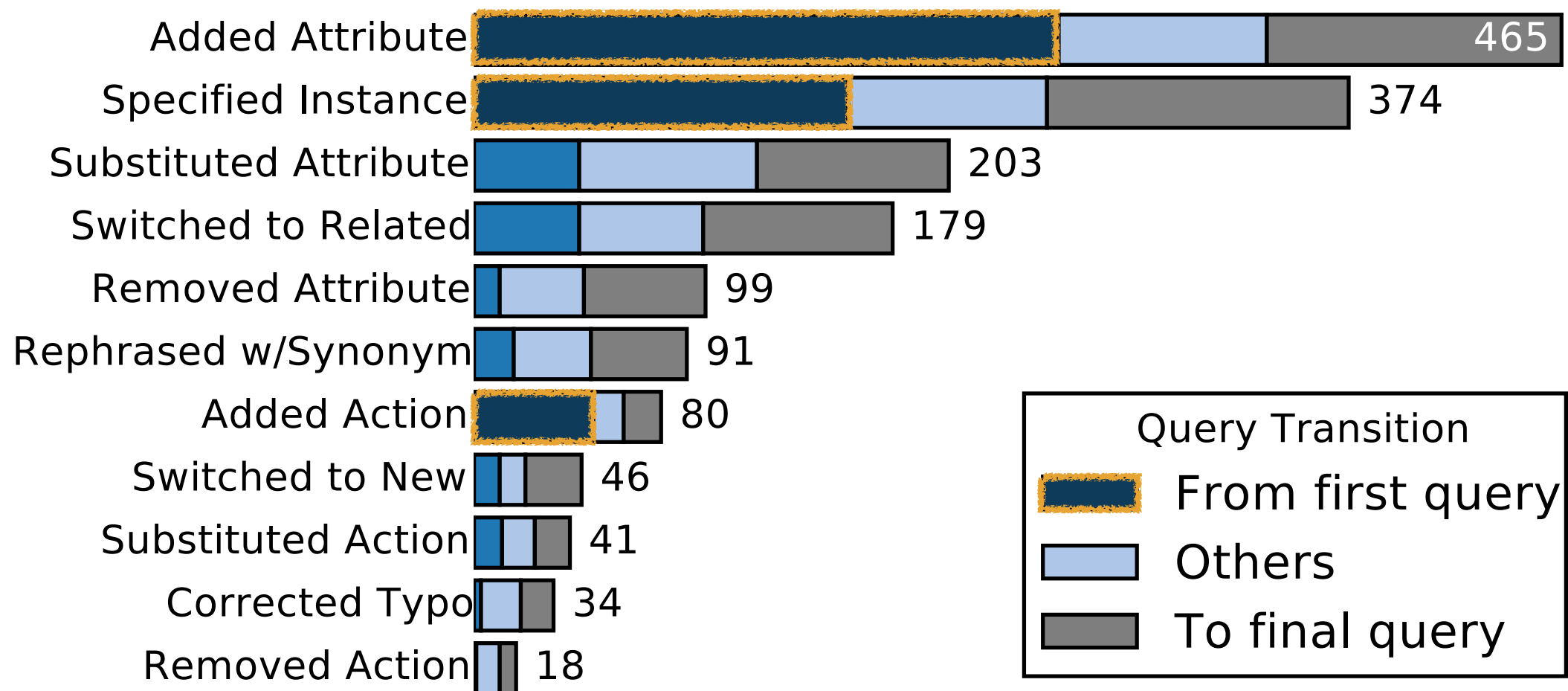
Query Transitions



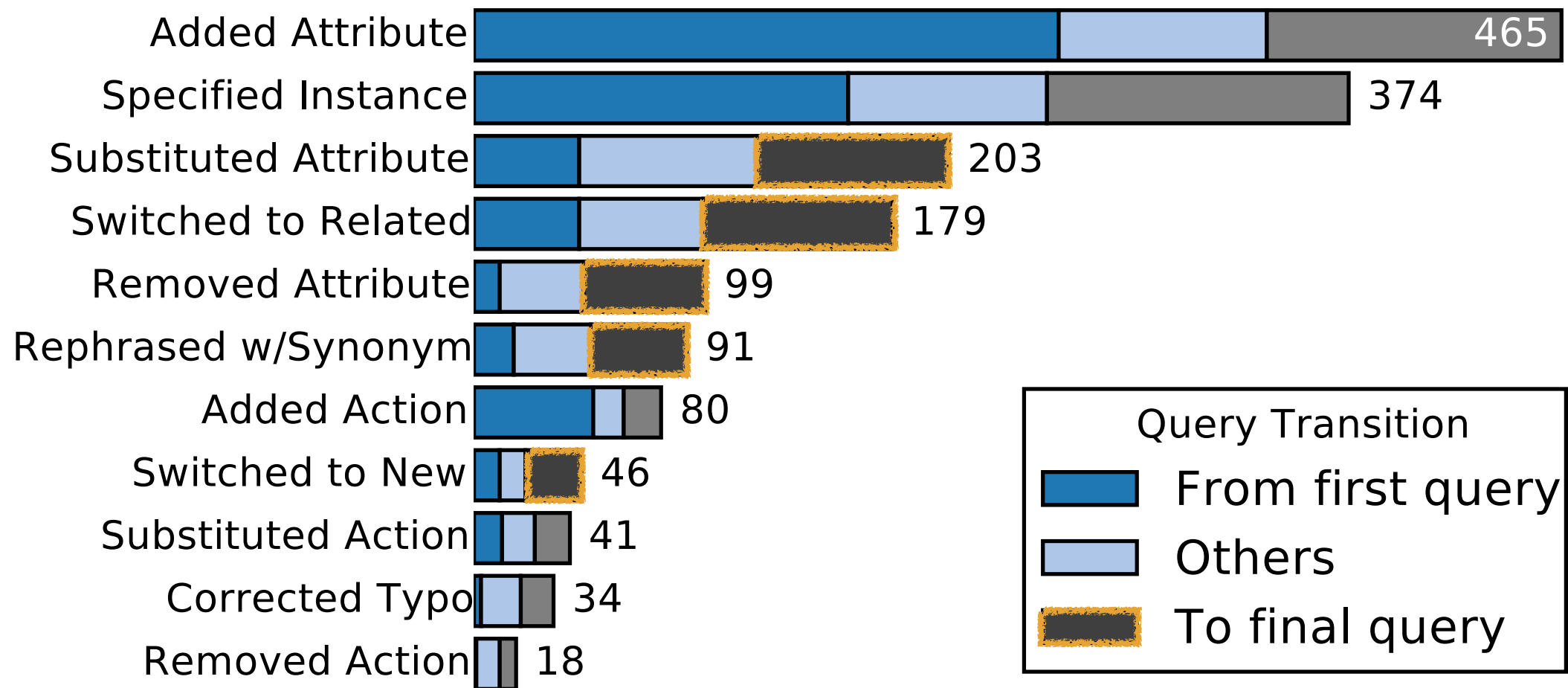
Query Transitions



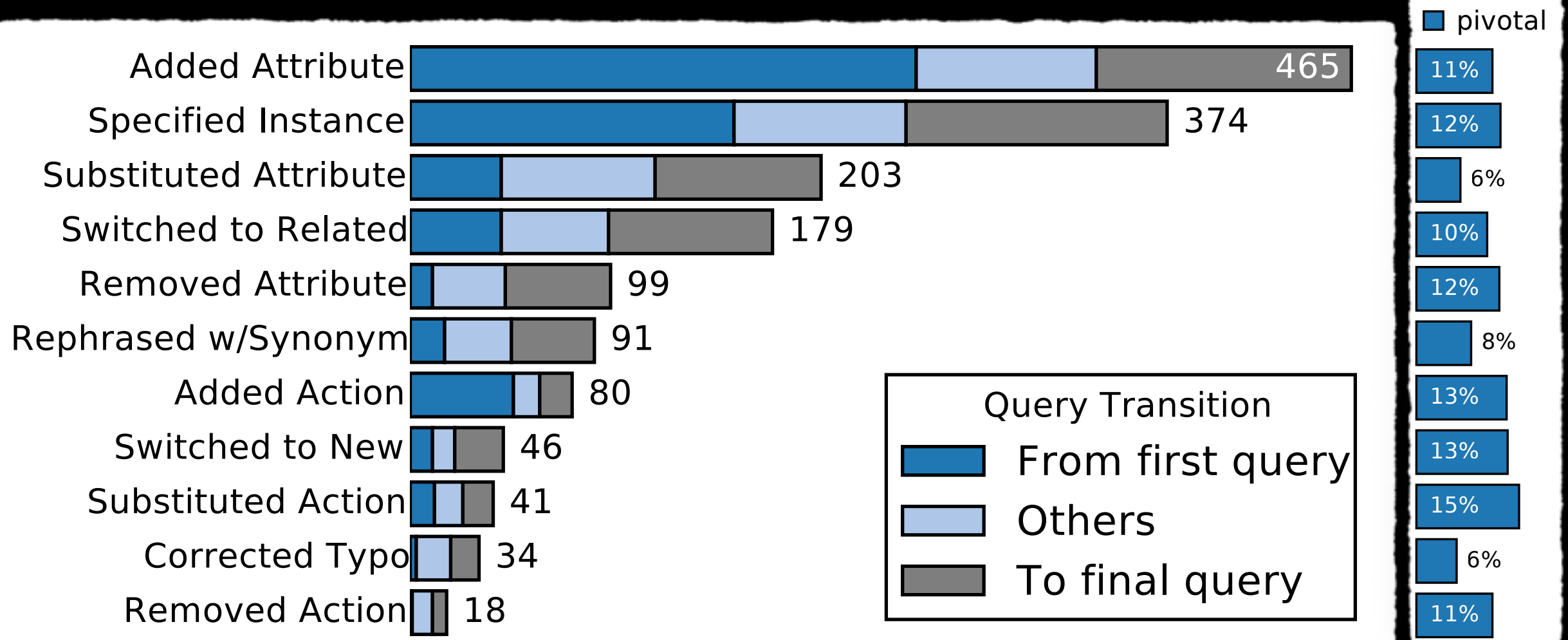
Query Transitions



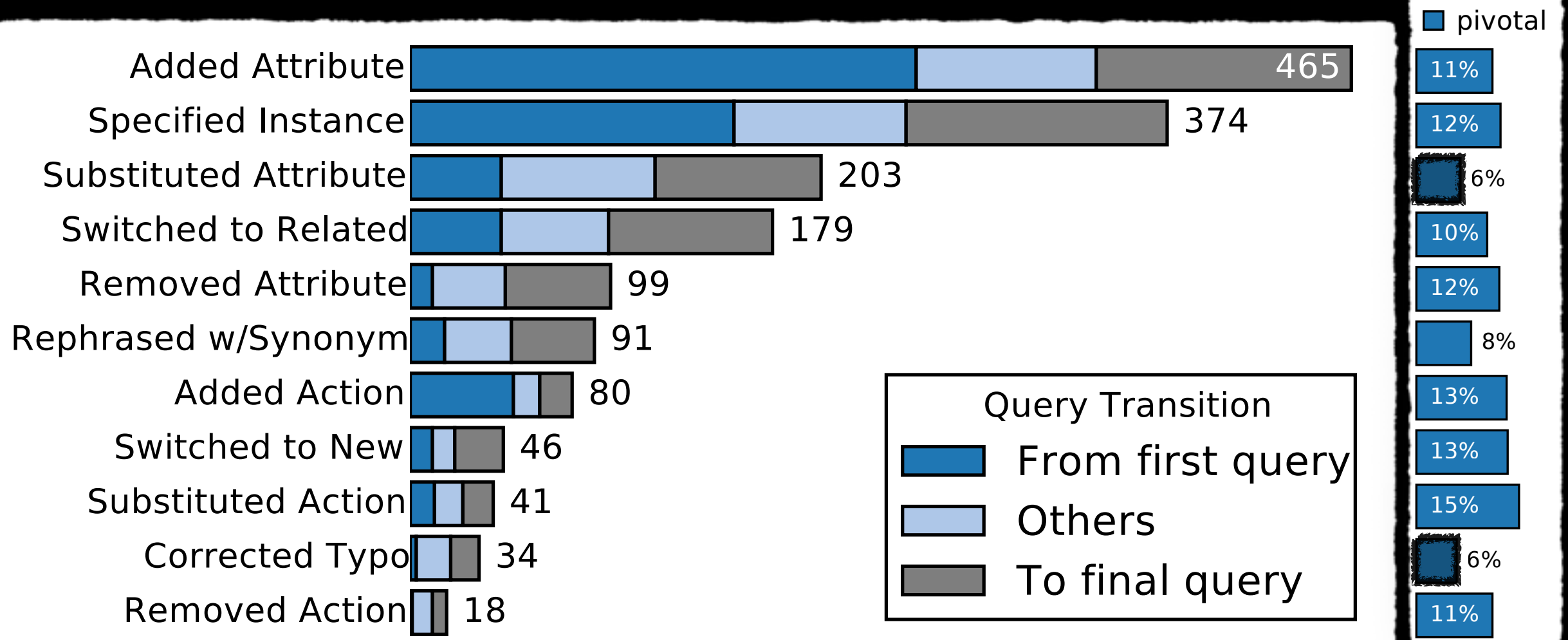
Query Transitions



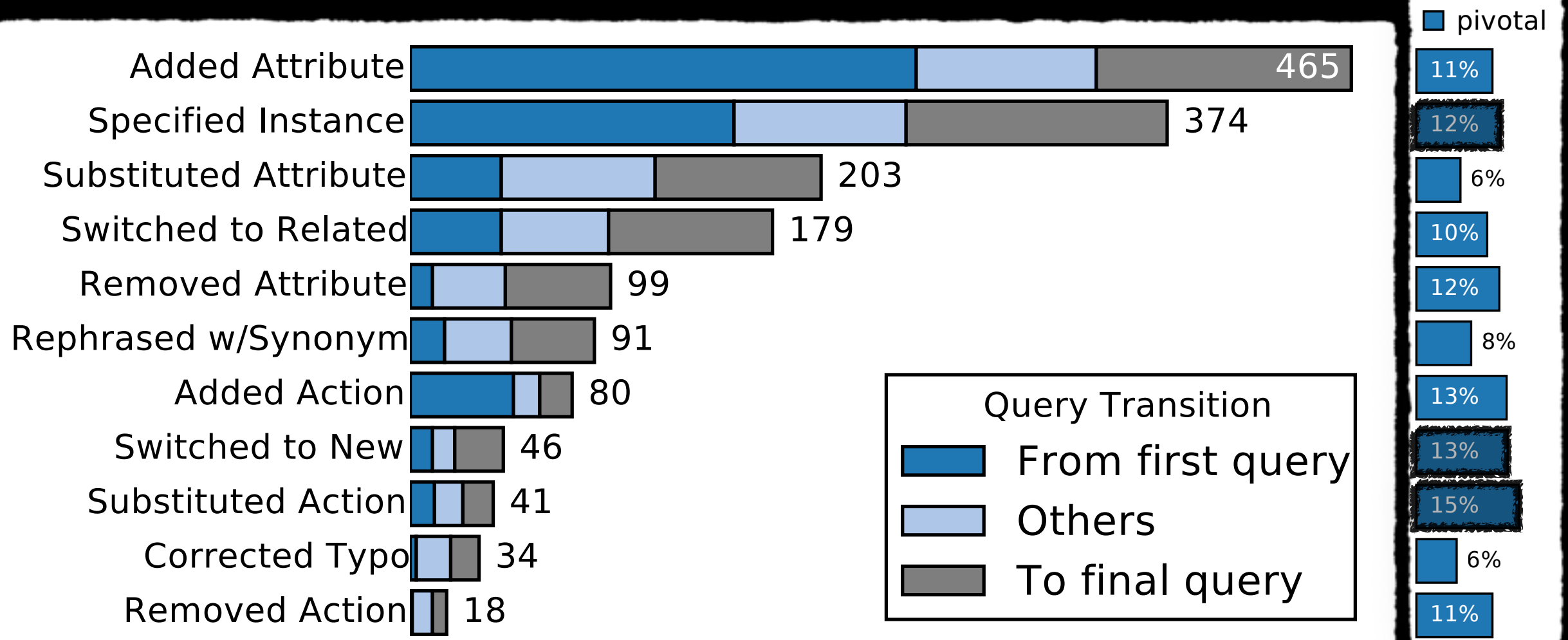
Query Transitions



Query Transitions



Query Transitions



Outline



Characterizing Struggling

Struggling searchers, successful or not, behave differently on many search aspects, including: queries, reformulations, clicks, dwell time & topic.

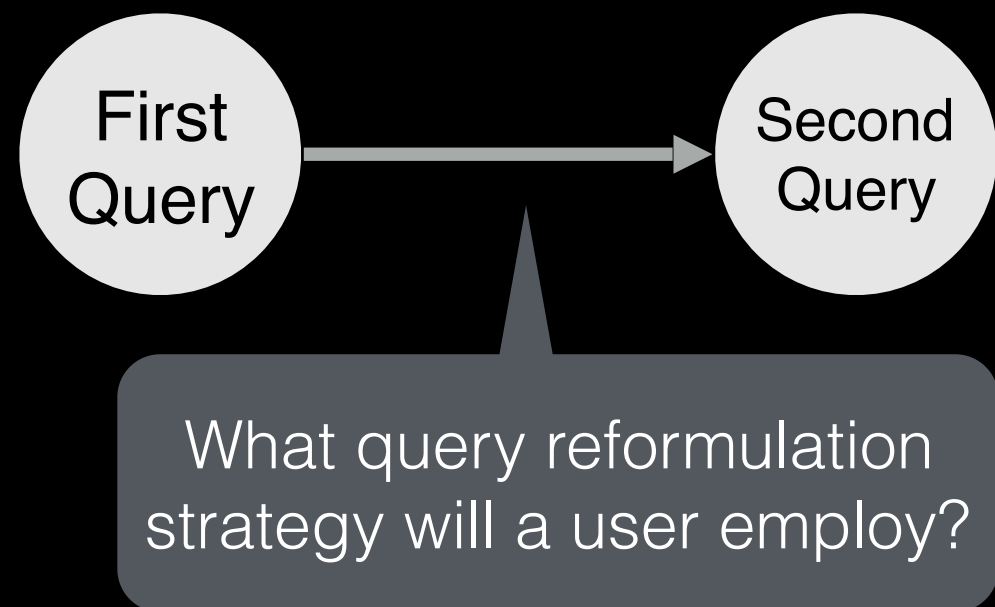
Annotating Query Transitions

Substantial differences in how searchers refine queries in different stages in a struggling task. Strong connections with task outcomes, and particular pivotal queries.

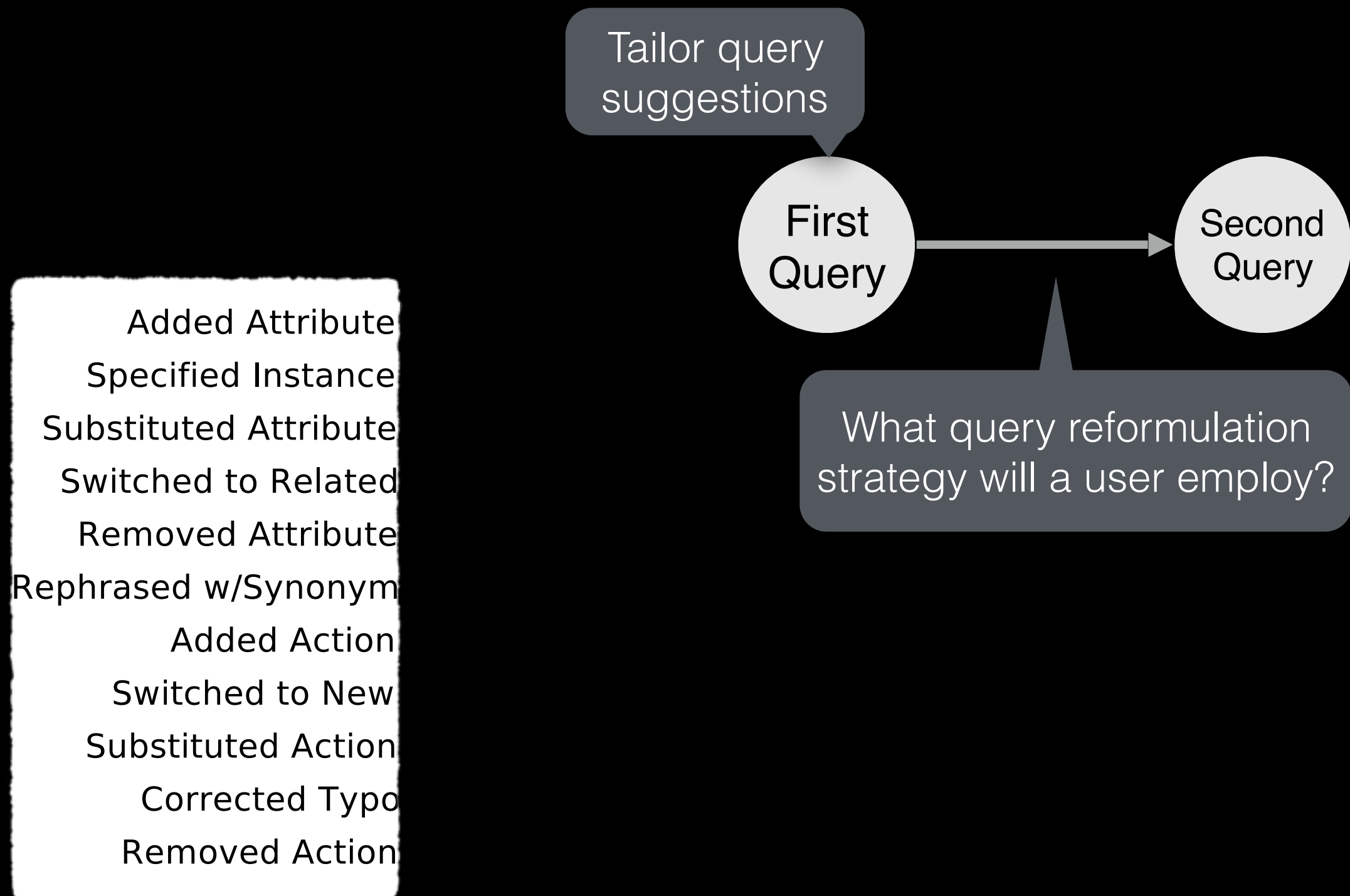
Predicting Future Actions

Predicting Reformulation

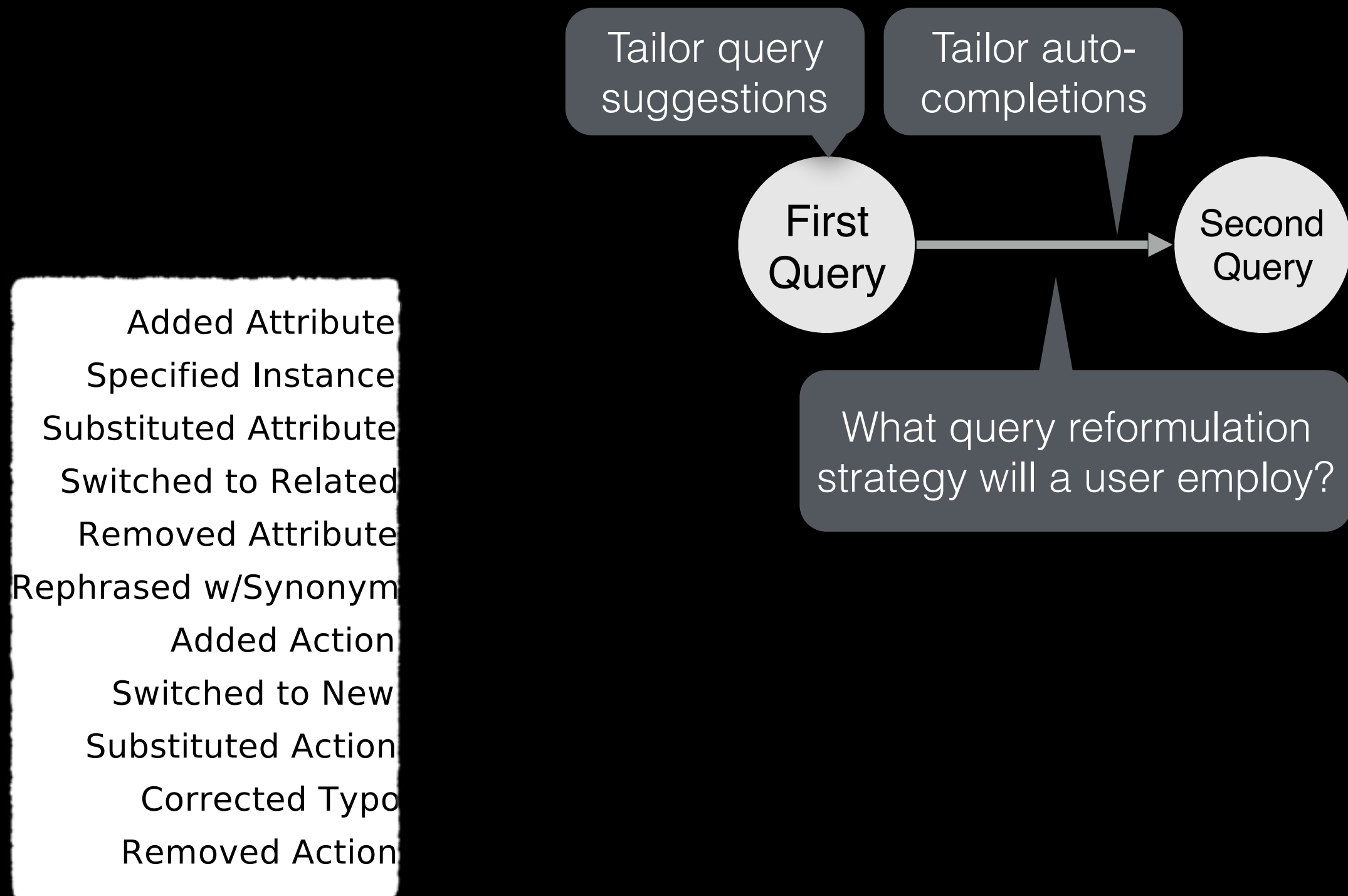
Added Attribute
Specified Instance
Substituted Attribute
Switched to Related
Removed Attribute
Rephrased w/Synonym
Added Action
Switched to New
Substituted Action
Corrected Type
Removed Action



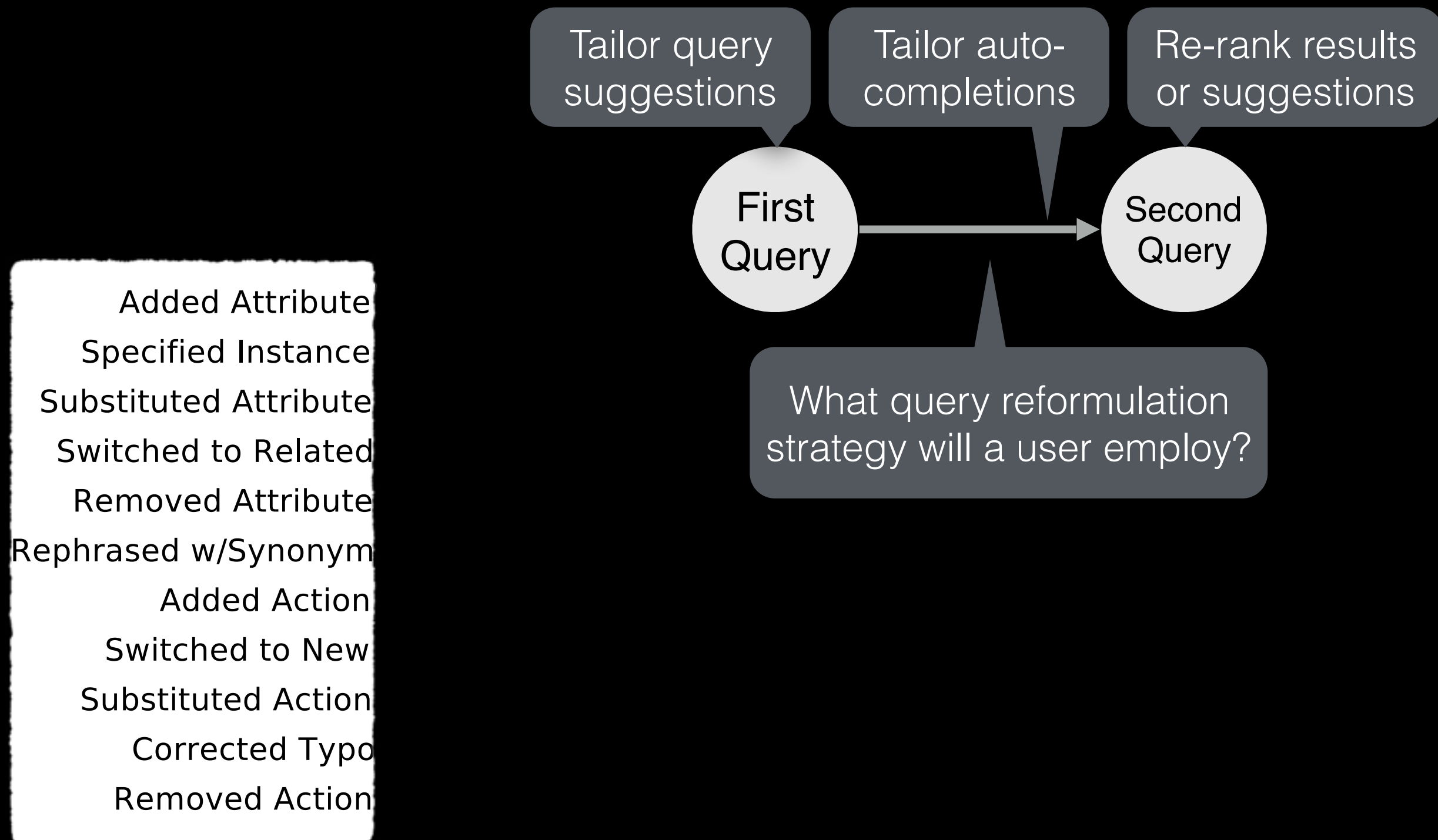
Predicting Reformulation



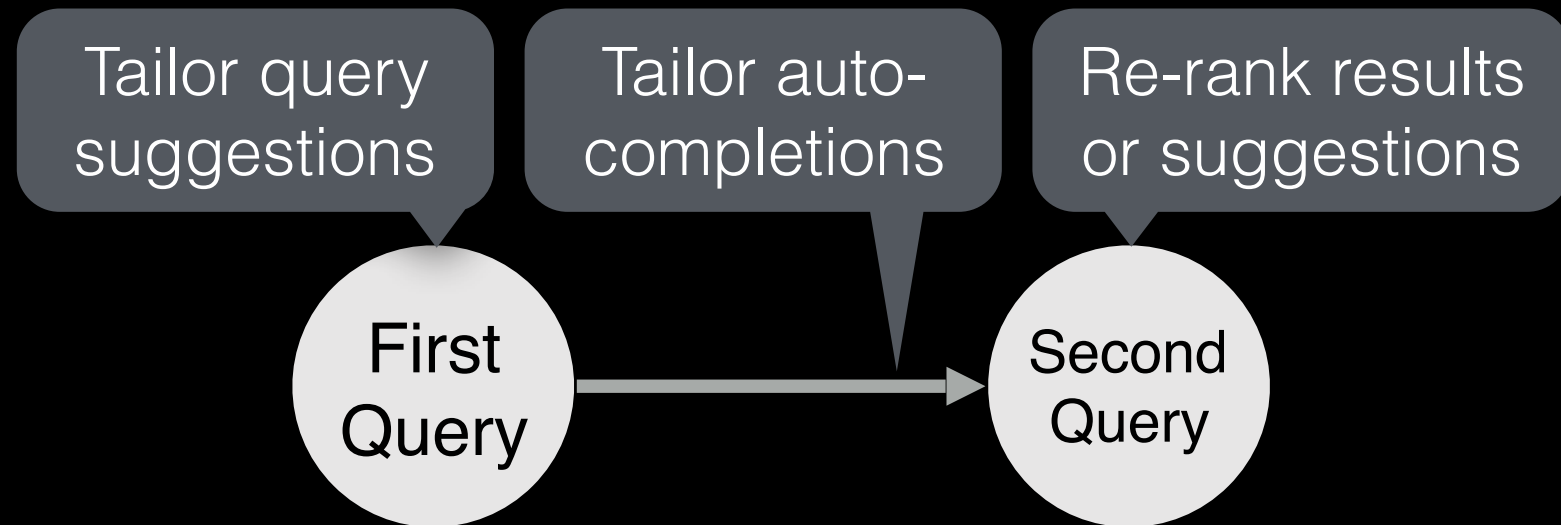
Predicting Reformulation



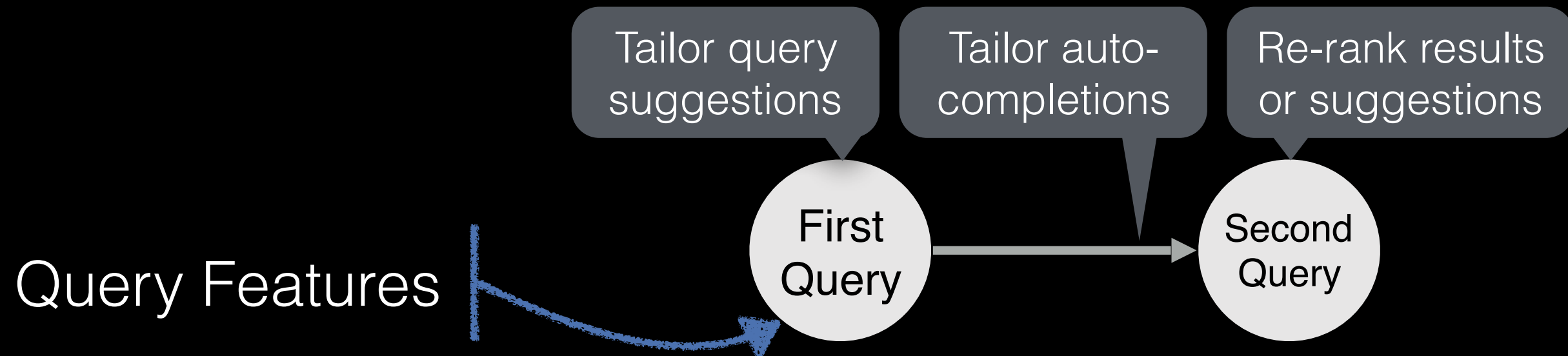
Predicting Reformulation



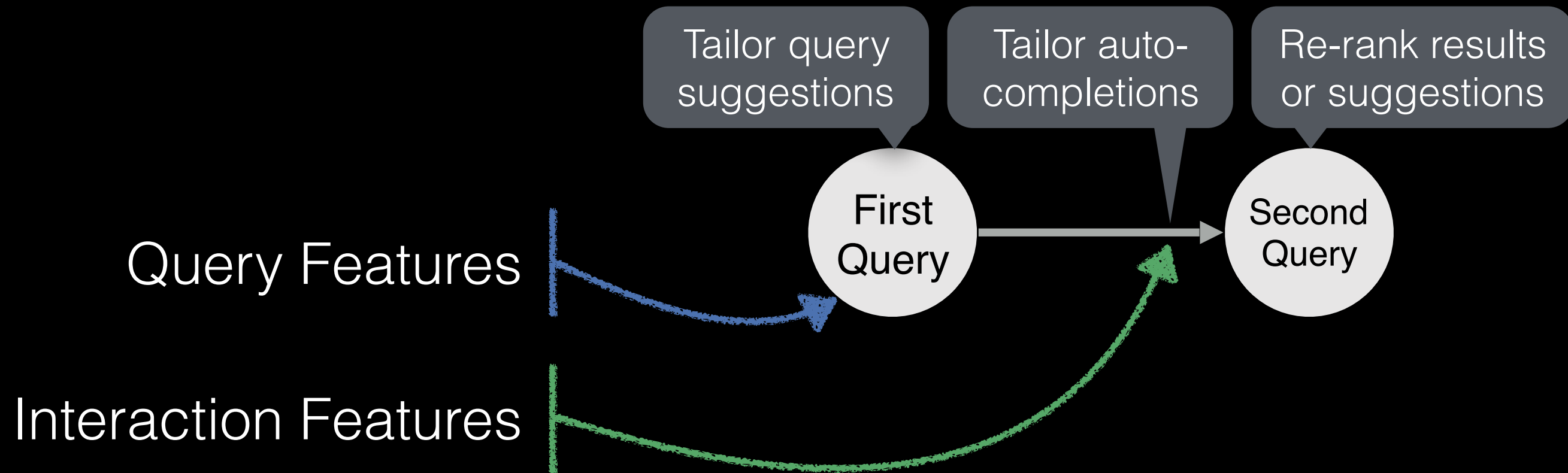
Feature Sets



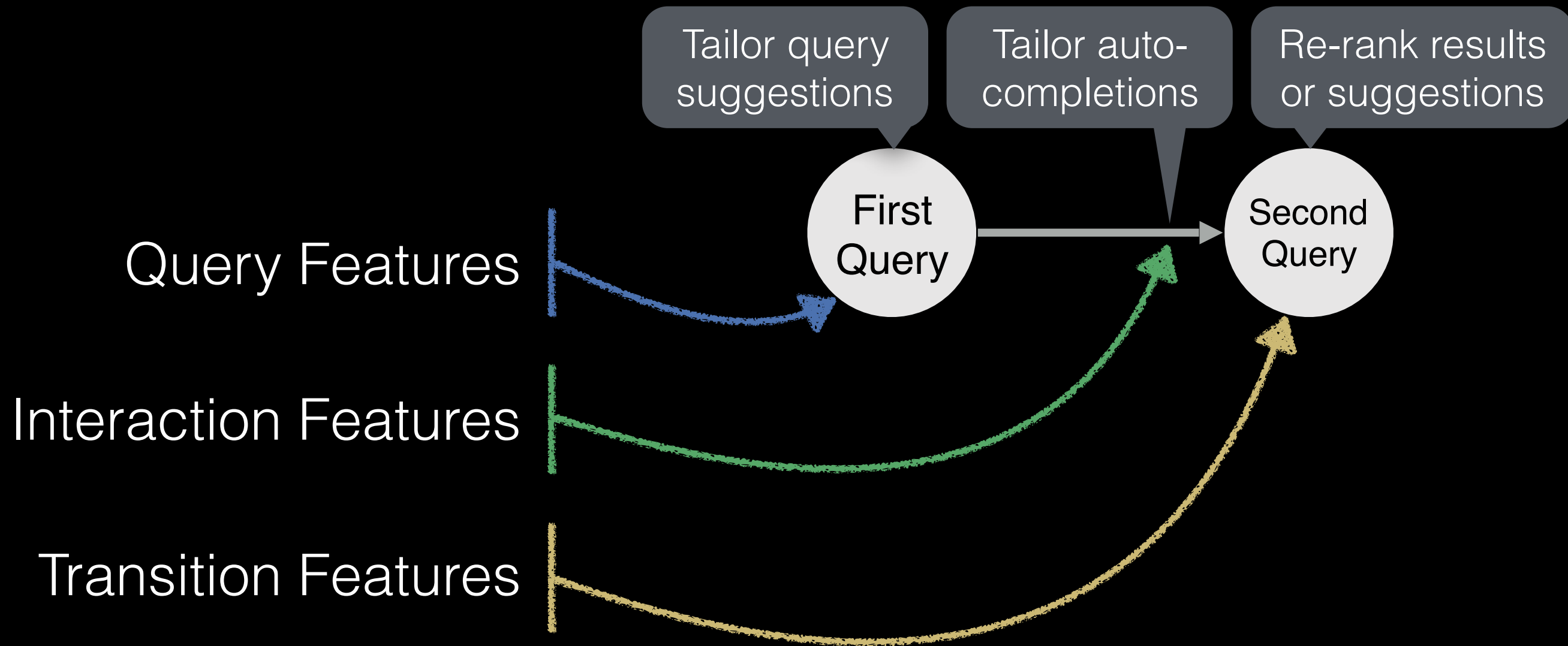
Feature Sets



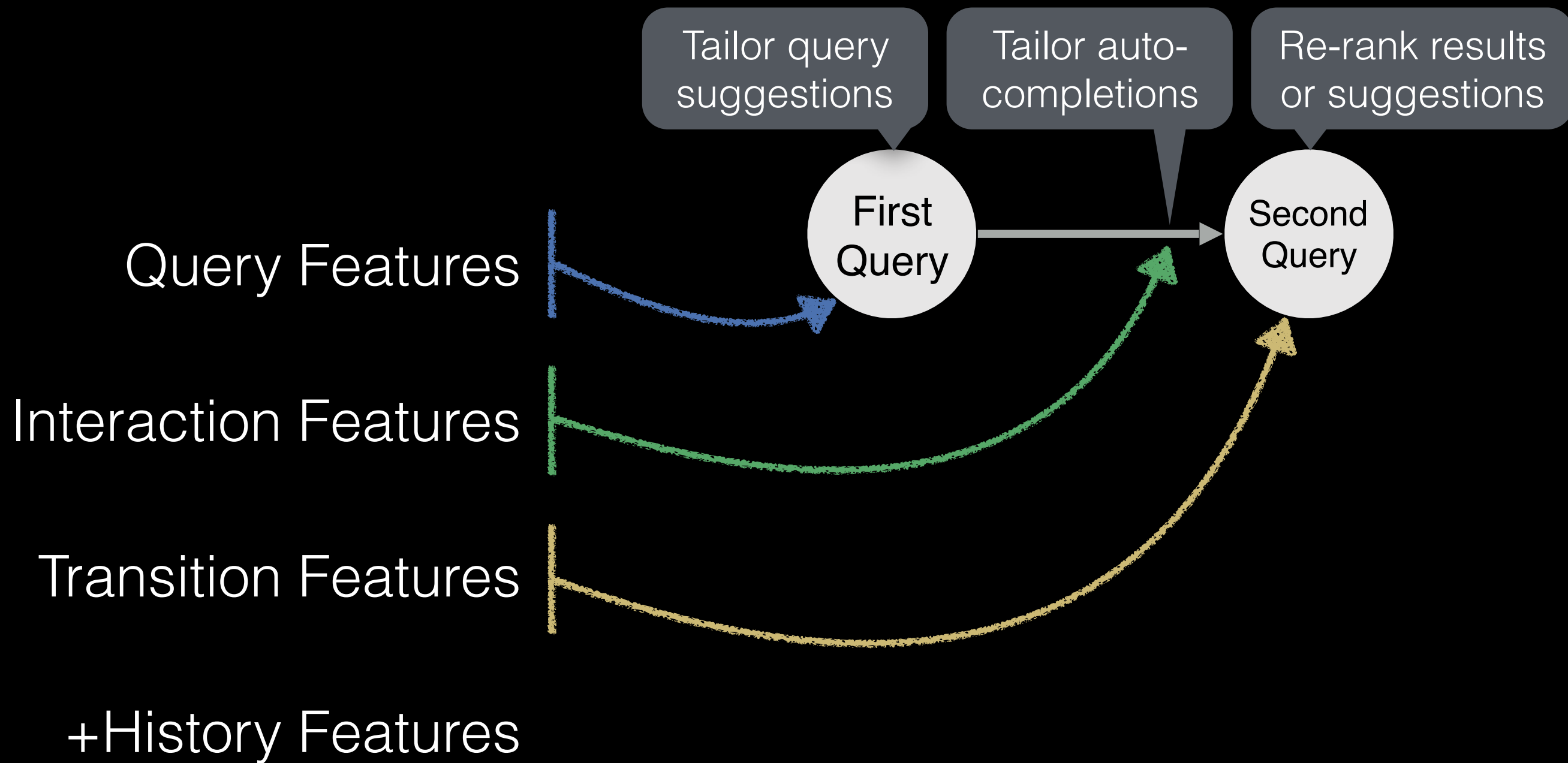
Feature Sets



Feature Sets



Feature Sets



Prediction Results

F1

60%

45%

30%

15%

0%



Q1 to Q2



Q2 to Q3

20%

10%

Baseline

Q1

+Interaction

Q2

Baseline

Q2

+Interaction

Q3

Majority

Q1

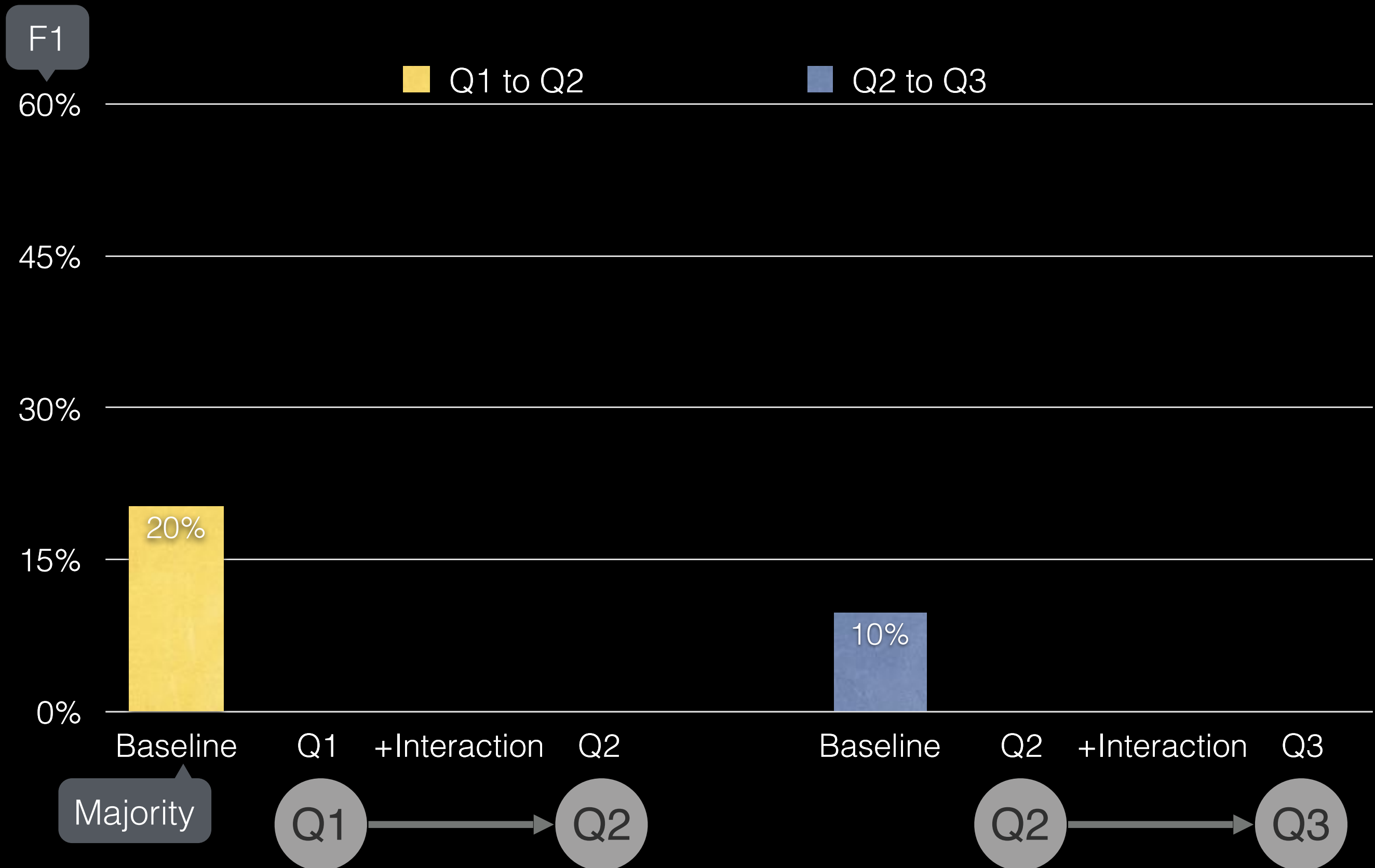
Q2

Q2

Q3



Prediction Results



Prediction Results

F1

60%

■ Q1 to Q2

■ Q2 to Q3

45%

30%

15%

0%

Baseline

Q1

+Interaction

Q2

Baseline

Q2

+Interaction

Q3

Majority

Q1

Q2

Q2

Q3

20%

30%

34%

39%

10%

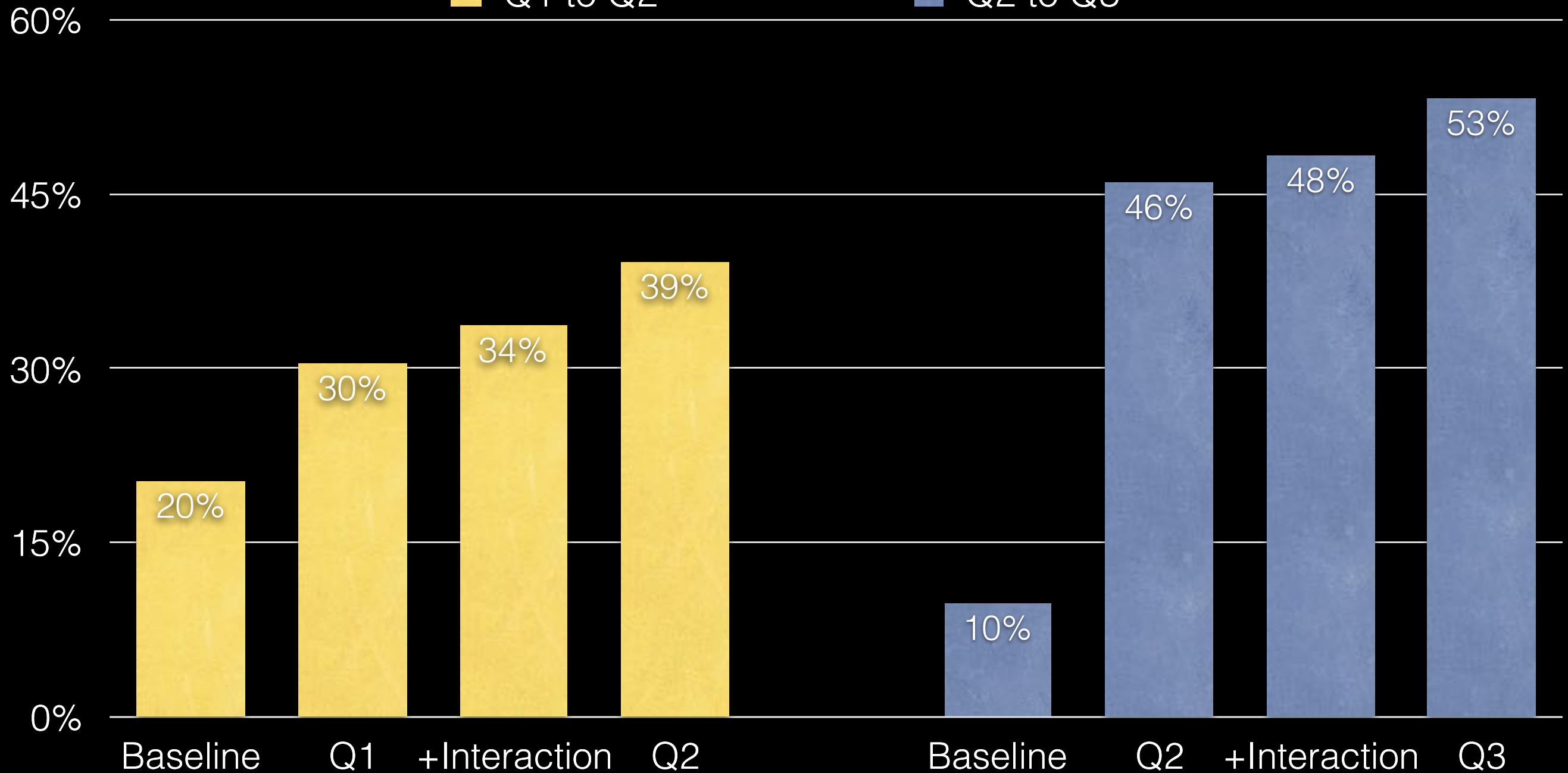
Prediction Results

F1

60%

■ Q1 to Q2

■ Q2 to Q3



Majority

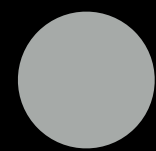
Q1

Q2

Q2

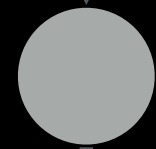
Q3

Outline



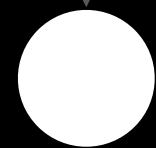
Characterizing Struggling

Substantial differences in how searchers behave in a struggling task, depending on task outcomes.



Annotating Query Transitions

Accurately predict reformulation strategy to provide situation-specific support at a higher level.



Predicting Future Actions

Limitations

- Very specific and apparent type of struggling

Limitations

- Very specific and apparent type of struggling
- Determination of search success
 - Final click as a proxy
 - Judgements by third-party, not by searchers themselves

Future Work

- Directly applying reformulation strategies
 - Query suggestions & auto-completions

Future Work

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 - Query suggestions & auto-completions
 - Mining query \rhd pivotal query pairs

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 - Can identify automatically: F1 59%
(final query baseline: 51%)

Future Work

- Directly applying reformulation strategies
 - Query suggestions & auto-completions
 - Mining query \rhd pivotal query pairs
 - Can identify automatically: F1 59%
(final query baseline: 51%)
- Hints and tips on reformulation strategies

Real-time Recommendations at Blendle

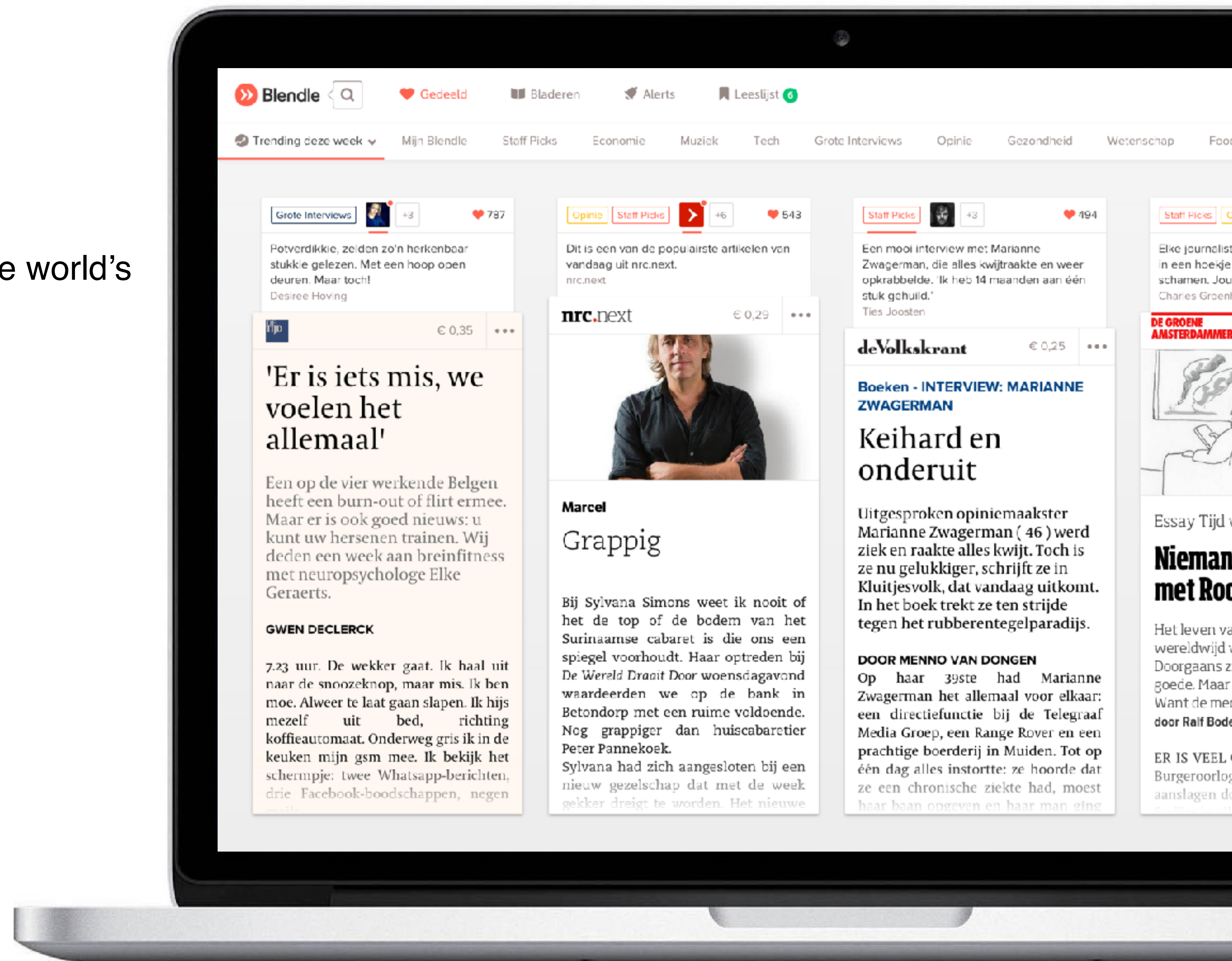
Daan Odijk & Anne Schuth
data scientists



Blendle

✓ Mission

Help you discover and support the world's best journalism



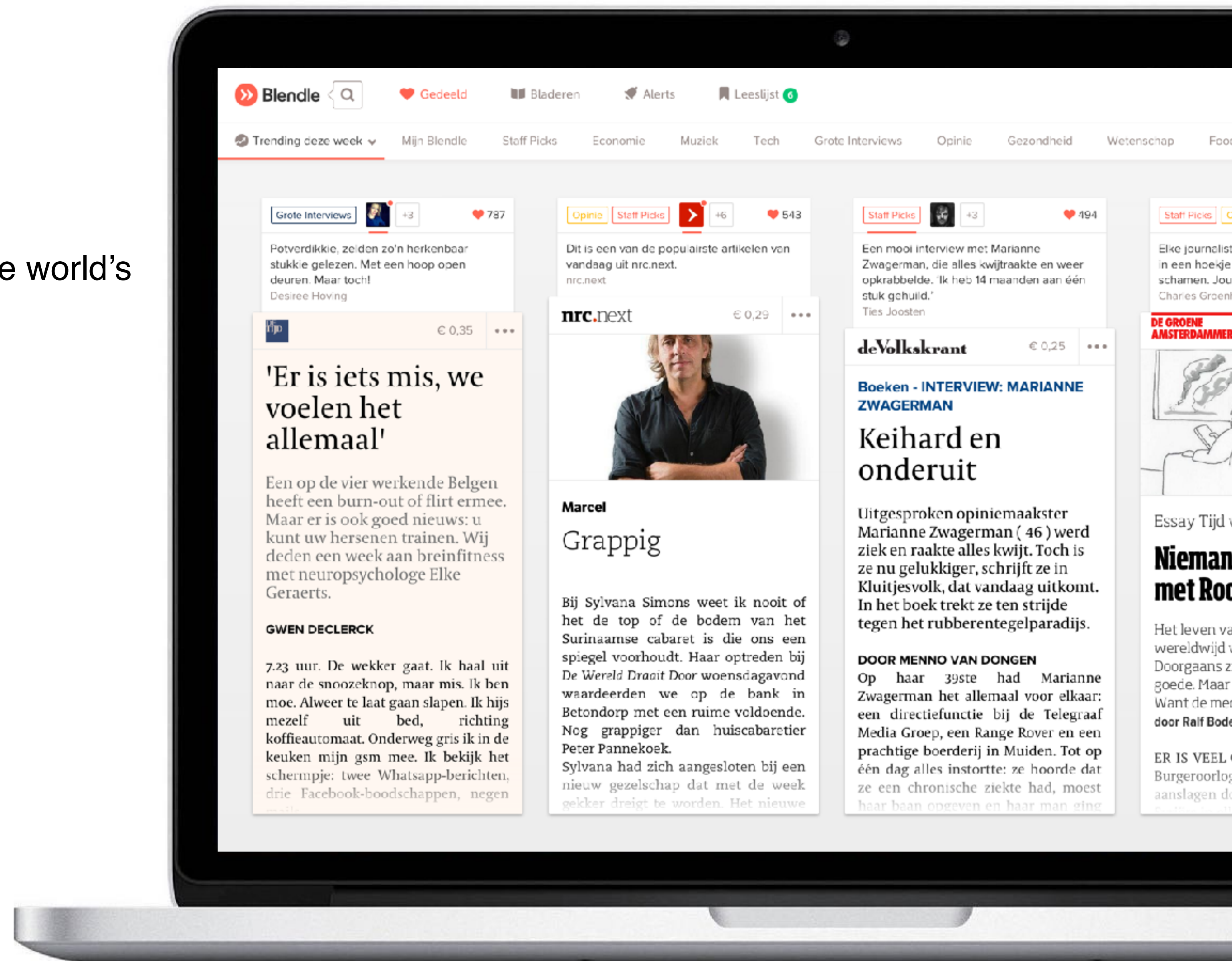
Blendle

✓ Mission

Help you discover and support the world's best journalism

✓ Micropayment platform

articles, issues, subscriptions



Blendle

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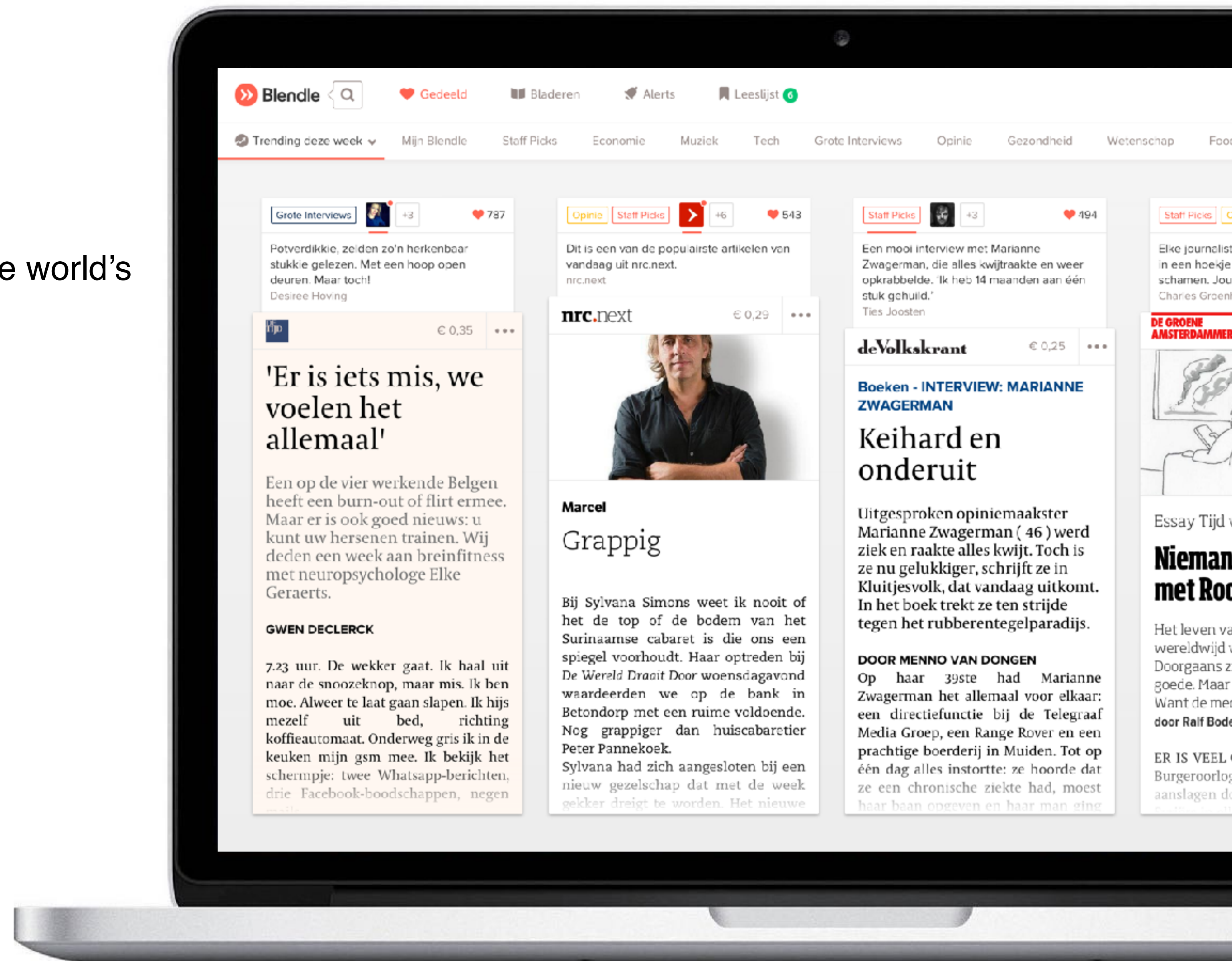
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✓ International

May 2014 : The Netherlands

Sept 2015 : Germany

March 2016 : United States



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May 2014 : The Netherlands

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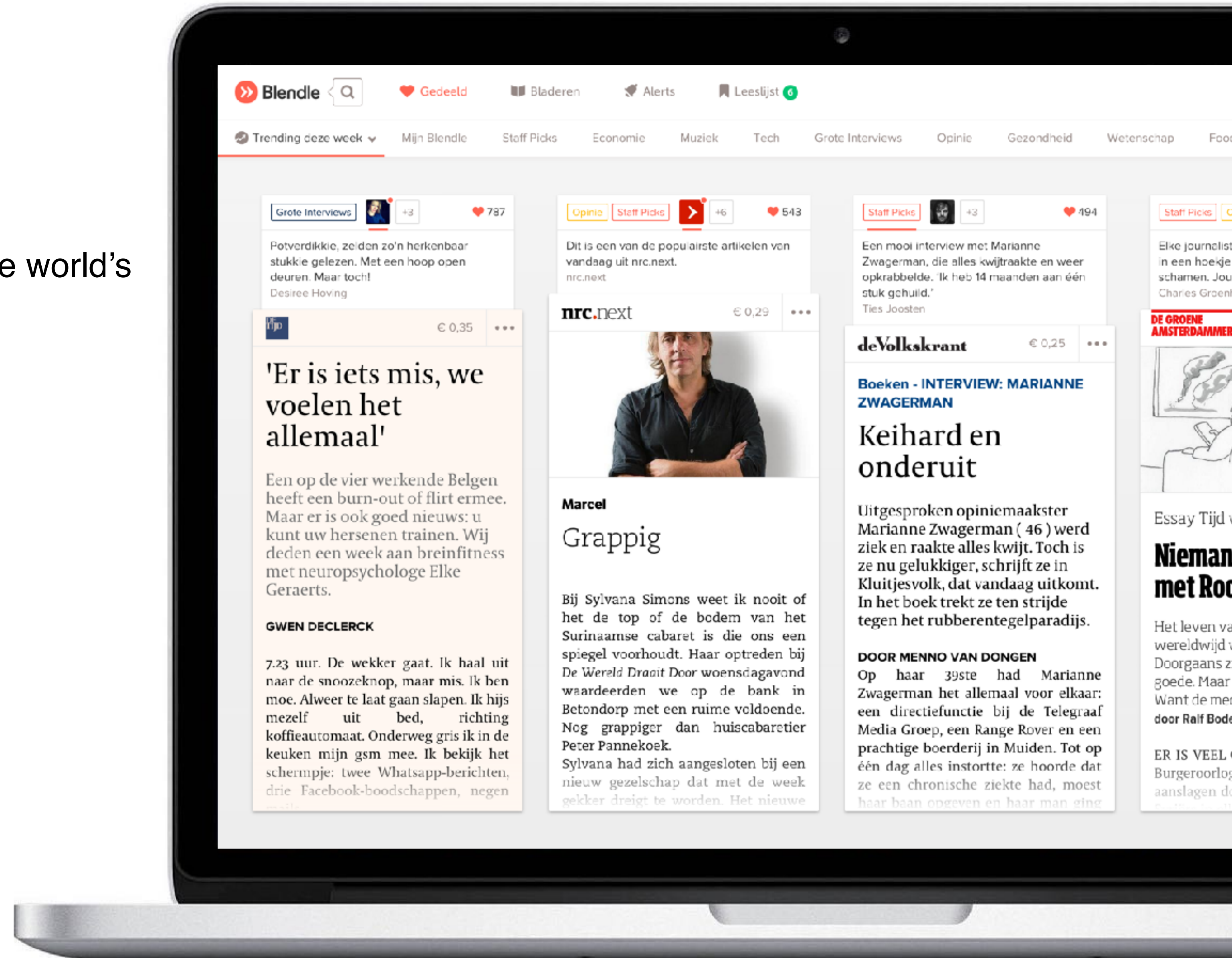
✓ Numbers

> 1M users

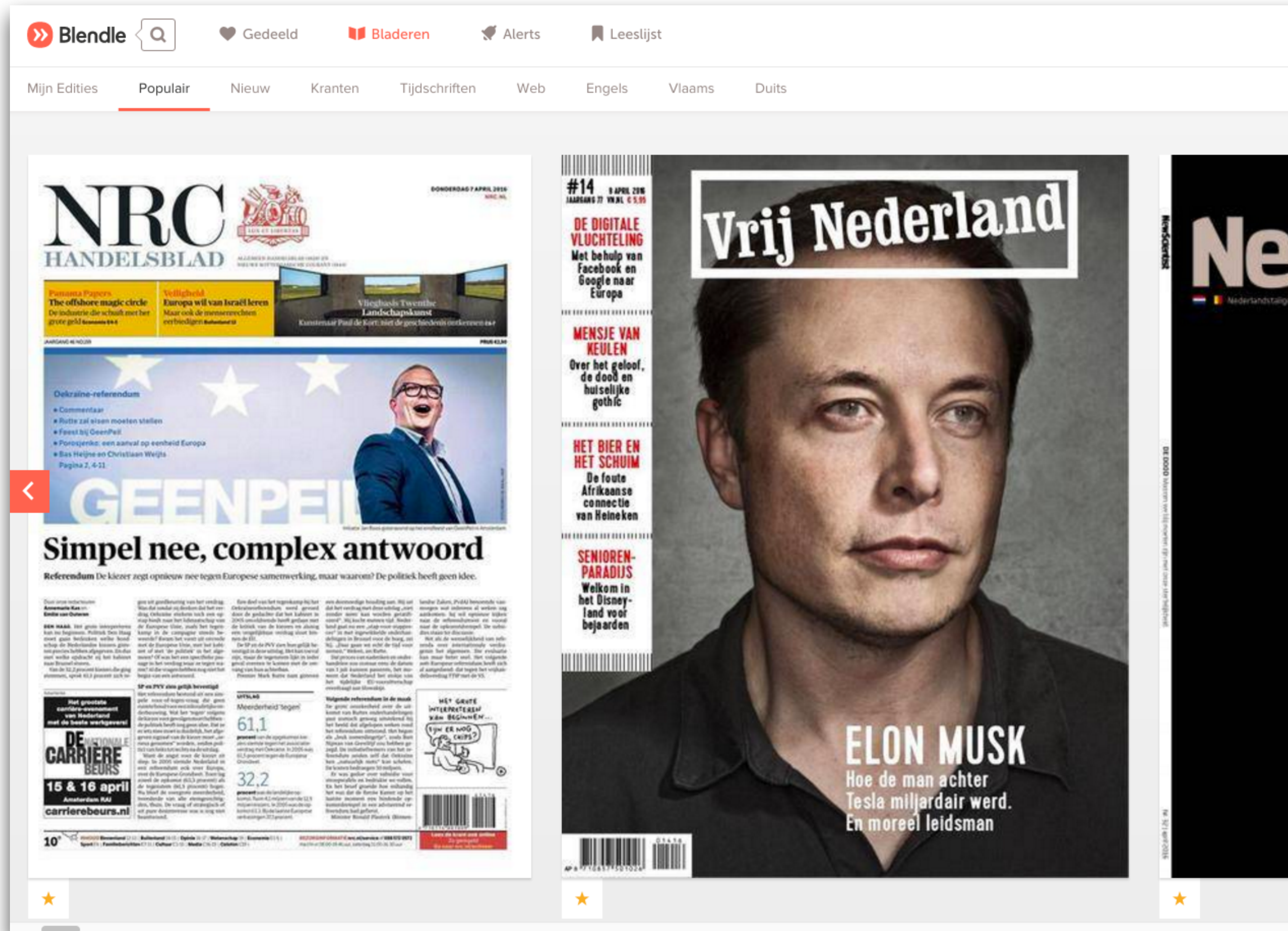
1 in 5 is paying

70 employees

(15 journalists, 50 developers,
+ 30 clippers)



In Blendle you can browse through all quality newspapers and magazines



You only pay for what you read, with a **single click**

» Blendle

Gedeeld


Bladeren

Alerts

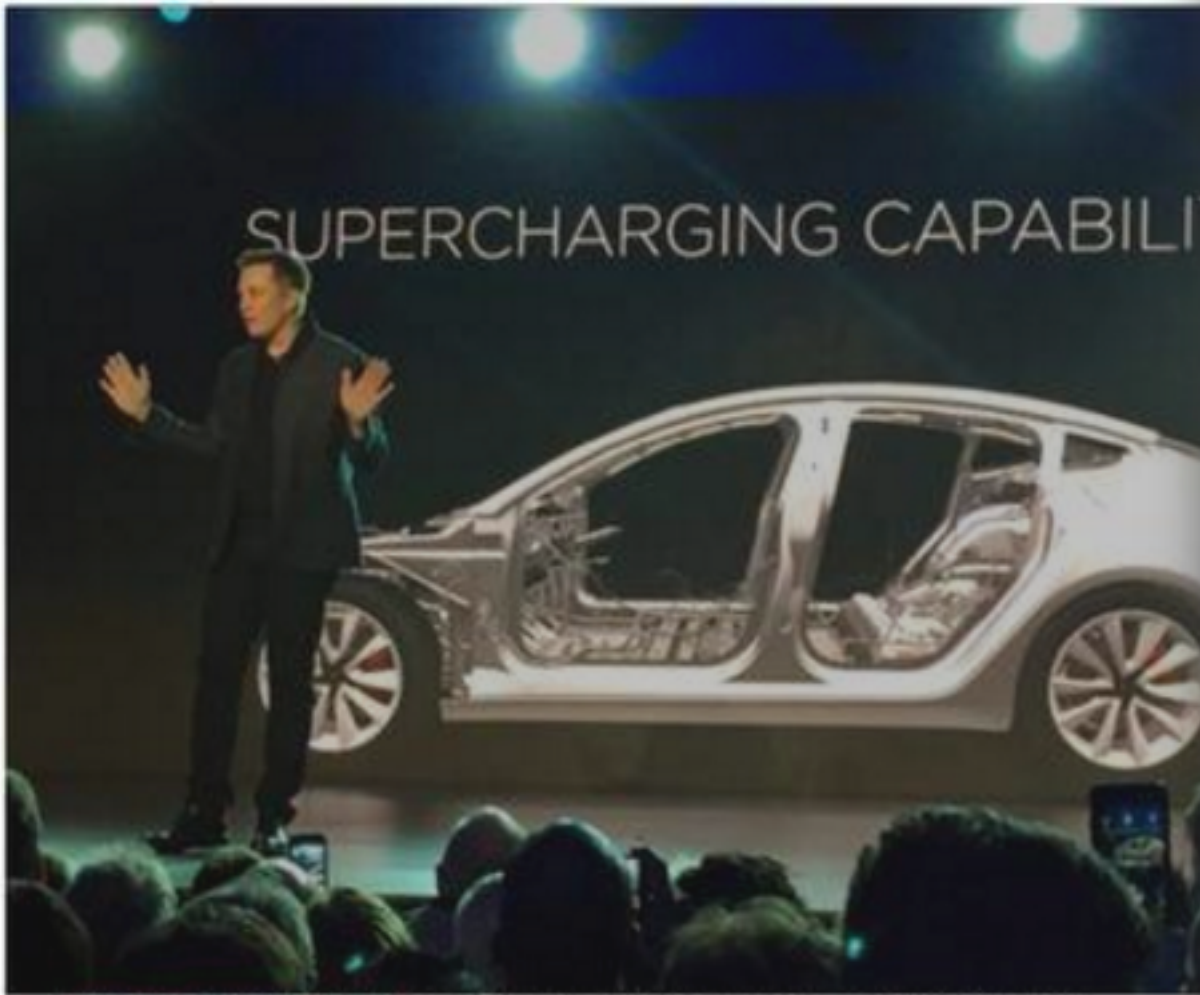
Leeslijst

Populair


Vrij Nederland van gisteren



DE GIGA-FACTORY
in Wallasey, Warrington, is de grootste fabriek ter wereld.



DUURZAMER VERVOER De onthulling van Model 3 van de Tesla. Binnen een dag waren er 100.000 reserveringen



8 APRIL 2016 Vrij Nederland 88

» Vrij Nederland

€ 0,89

ELON MUSK

PORTRET
DE ONDERNEMER ALS
MOREEL LEIDER

Ja, er zit geld in moraal. Elon Musk presenteerde de Tesla Model 3, de coole en betaalbare elektrische auto die de wereld moet veranderen, en hij wil de mensheid redden door Mars te koloniseren. Het heeft hem geen windeieren gelegd, dat redden van de mensheid.

SANDER PLEIJ | PORTRET DAN WINTERS

Hoeveel tijd kost een vrouw? Zo luidde de vraag van Elon Musk, directeur van Tesla (iPhone onder de elektrische auto's) en SpaceX (rakettenfabriek die de mensheid naar Mars wil emigreren); een rijke vent die het beste met de mensheid voor heeft.

Hij zat met een probleem, zo vertrouwde hij zijn biograaf toe, hij was net voor de tweede keer gescheiden en zocht nu een nieuwe vriendin, maar hij vreesde dat een object van het verleden

Hij gebruikt anderen en zichzelf als middel: hing hij rond met paters, met andere inter- nairs, met filmsterren, hij ging wonen in Bel-



EXCENTRIEKE CELEBRITY Musk met zijn tweede echtgenote, filmster

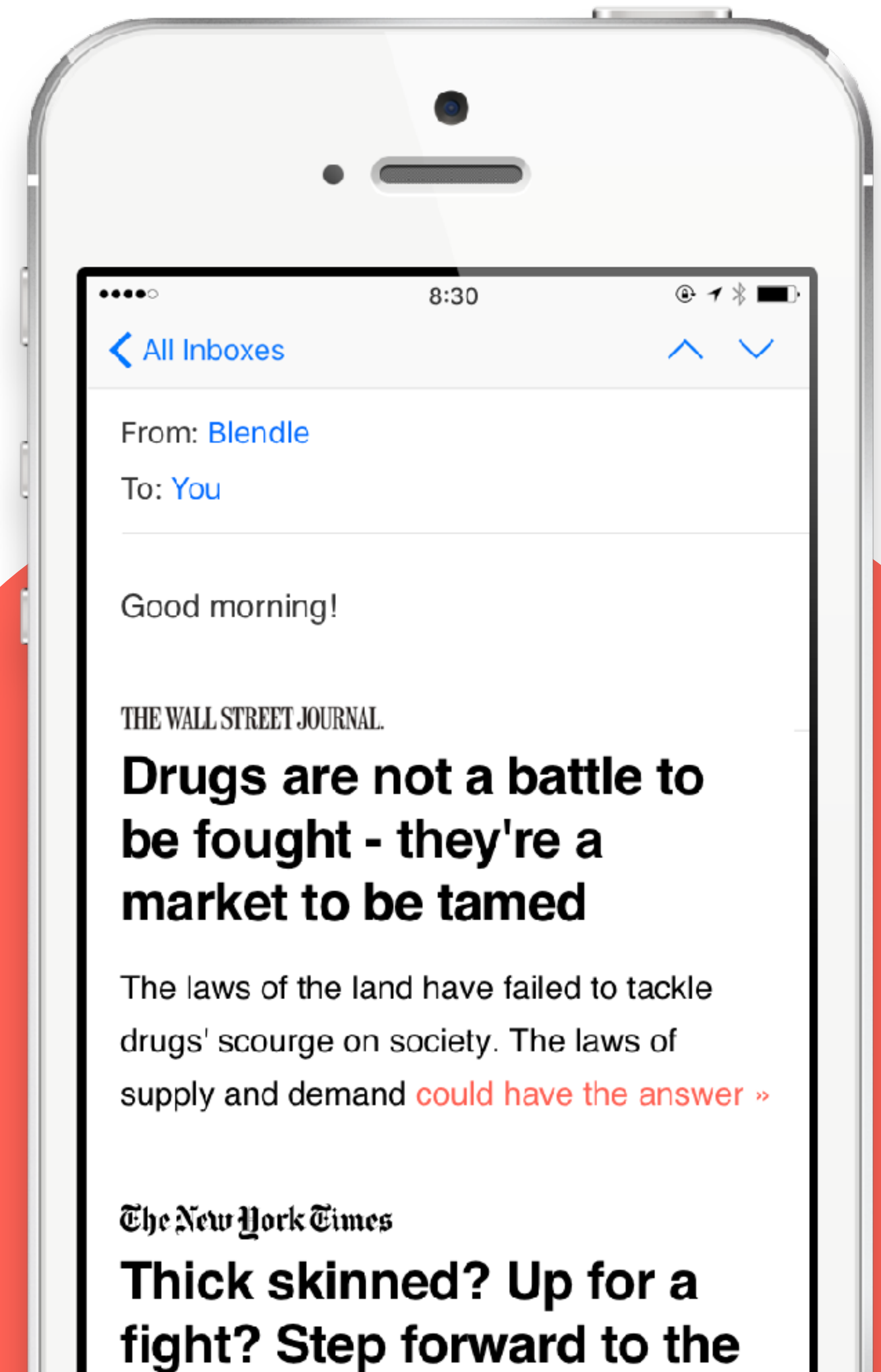
onderdelen zelf te maken. Niks aanmerklijk: lever heel grote fabrieken met alles en ieden- een vlak bij elkaar want dat betekent: niet wachten, geen tijdverlies, directe communica- tie. Binnenkort opent hij de Gigafactory, een nieuwe batterijfabriek met de grootste om- trek ter wereld en nul giftige uitstoot. Alles lijkt onnos vertoonde: geen reclame ma- ken - met de ideologische reden dat reclame manipuleert en overmatig is. Auto's moeten niet jaarlijks met een nieuw model komen, nee, het huidige model wordt constant beter - ah je wilt wachten op een nieuw model kun je voor altijd wachten. Bovendien ondergaat je Tesla continu software-updates. Iets als au- tomatisch van rijbaan veranderen is een nachtelijke download. Over vijf jaar, denkt Musk, zijn die zover dat de Tesla's zichzelf kunnen rijden.

Ook onconventioneel: raketten maken en lan- cereen vanaf het afgelegen atol Kwajalein in de Grote Oceaan. Alles kan hij ook en onde moekt hij zelf. De technische handboeken over ruim- tevervoer leest hij zelf. Dat de werkdruk gigan- tisch is, mage duidelijk zijn, maar hij blijft

vrienden en vrienden w respect. Als je tachtig u baas werkt, blijft je dat ee er zelf hondt werkt. M ze doen het niet voor de mensheid. Het doel is zo zeuren over vijf jaar alheid op spel staat? Het o futiel, heiligt alle midde Musk stelt simpel: 'Je g re auto's of raketten cre week, het koloniseren v beuren in voortig uur p Opofferen, allemaal.

Musk schijnt zichzelf e soort computers te bes over leren als het 'dow algoritmen in je brein kin doen met een b downloadre belef. Me noemt hij een bodap:

Our **editors** select the best articles for our email newsletter **every day**



Data at Blendle

- **Articles**

- > 3.5M in total

- > 6K new every day

- > 30% is read

Data at Blendle

- **Articles**

- > 3.5M in total

- > 6K new every day

- > 30% is read

- **Users**

- > 1M users

- ~ 1 in 5 converts to paying user

Data at Blendle

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- **Users**

- > 1M users

- ~ 1 in 5 converts to paying user

- **Events**

- > 1B in total

- > 2M new every day

Data at Blendle

• Articles

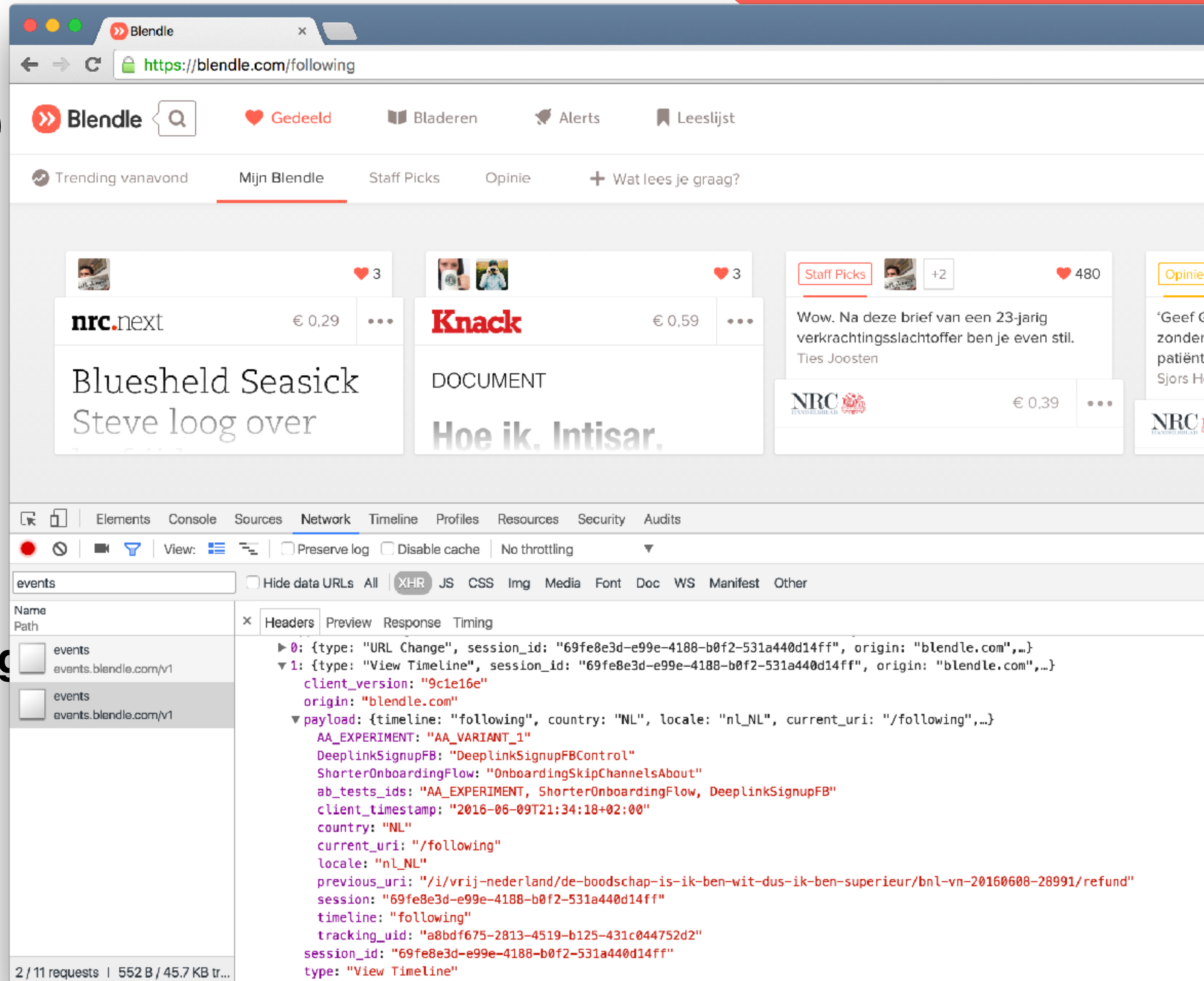
- > 3.5M in total
- > 6K new every day
- > 30% is read

• Users

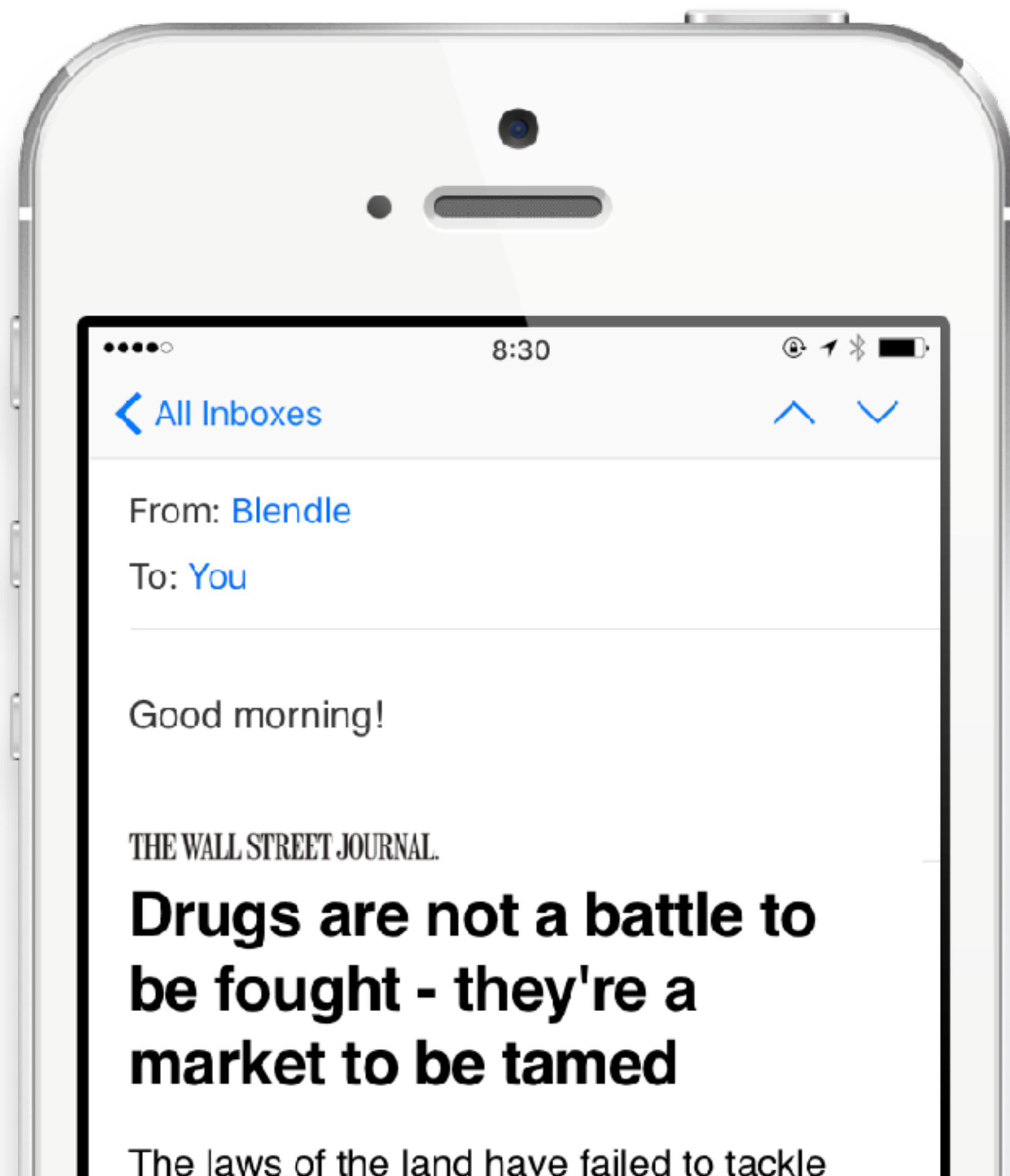
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• Events

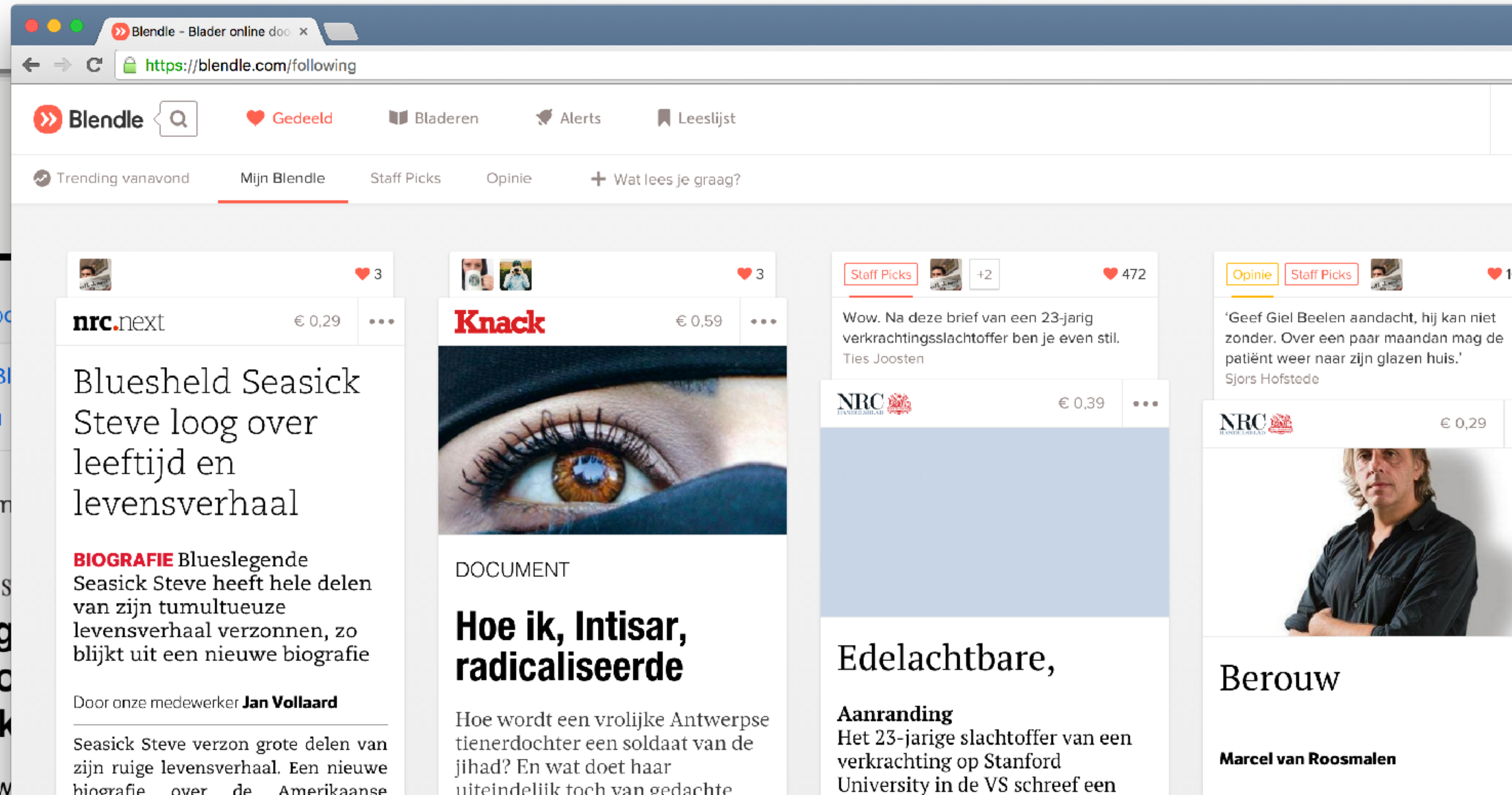
- > 1B in total
- > 2M new every day



Rankings at Blendle



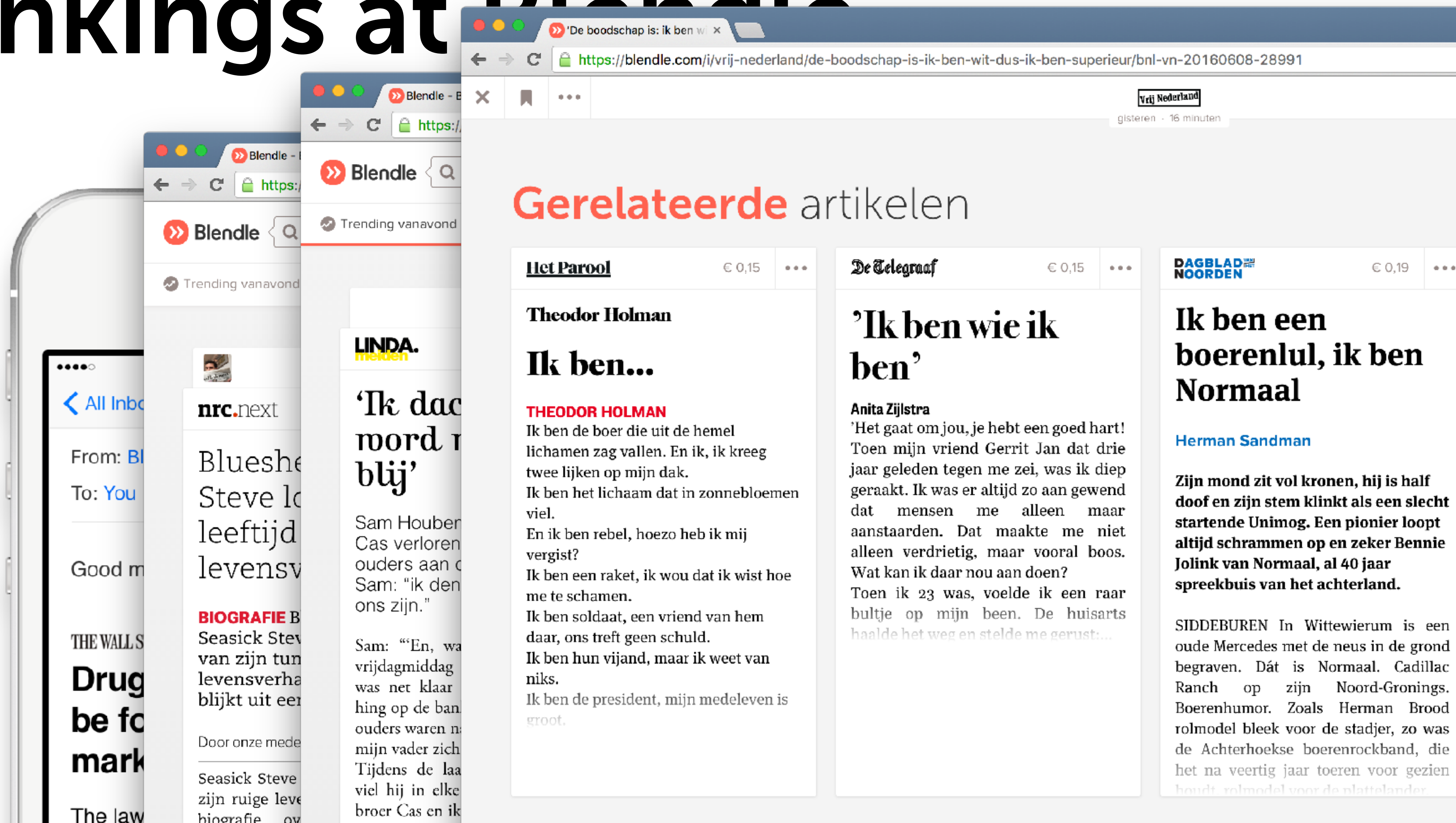
Rankings at Blendle



Rankings at Blendle



Rankings at Blendle



Gerelateerde artikelen

Het Parool

€ 0,15

Theodor Holman

Ik ben...

THEODOR HOLMAN

Ik ben de boer die uit de hemel
lichamen zag vallen. En ik, ik kreeg
twee lijken op mijn dak.
Ik ben het lichaam dat in zonnebloemen
viel.
En ik ben rebel, hoezo heb ik mij
vergist?
Ik ben een raket, ik wou dat ik wist hoe
me te schamen.
Ik ben soldaat, een vriend van hem
daar, ons treft geen schuld.
Ik ben hun vijand, maar ik weet van
niks.
Ik ben de president, mijn medeleven is
groot.

De Telegraaf

€ 0,15

'Ik ben wie ik ben'

Anita Zijlstra

'Het gaat om jou, je hebt een goed hart!
Toen mijn vriend Gerrit Jan dat drie
jaar geleden tegen me zei, was ik diep
geraakt. Ik was er altijd zo aan gewend
dat mensen me alleen maar
aanstaarden. Dat maakte me niet
alleen verdrietig, maar vooral boos.
Wat kan ik daar nou aan doen?
Toen ik 23 was, voelde ik een raar
bultje op mijn been. De huisarts
haalde het weg en stelde me gerust:...

**DAGBLAD
NOORDEN**

€ 0,19

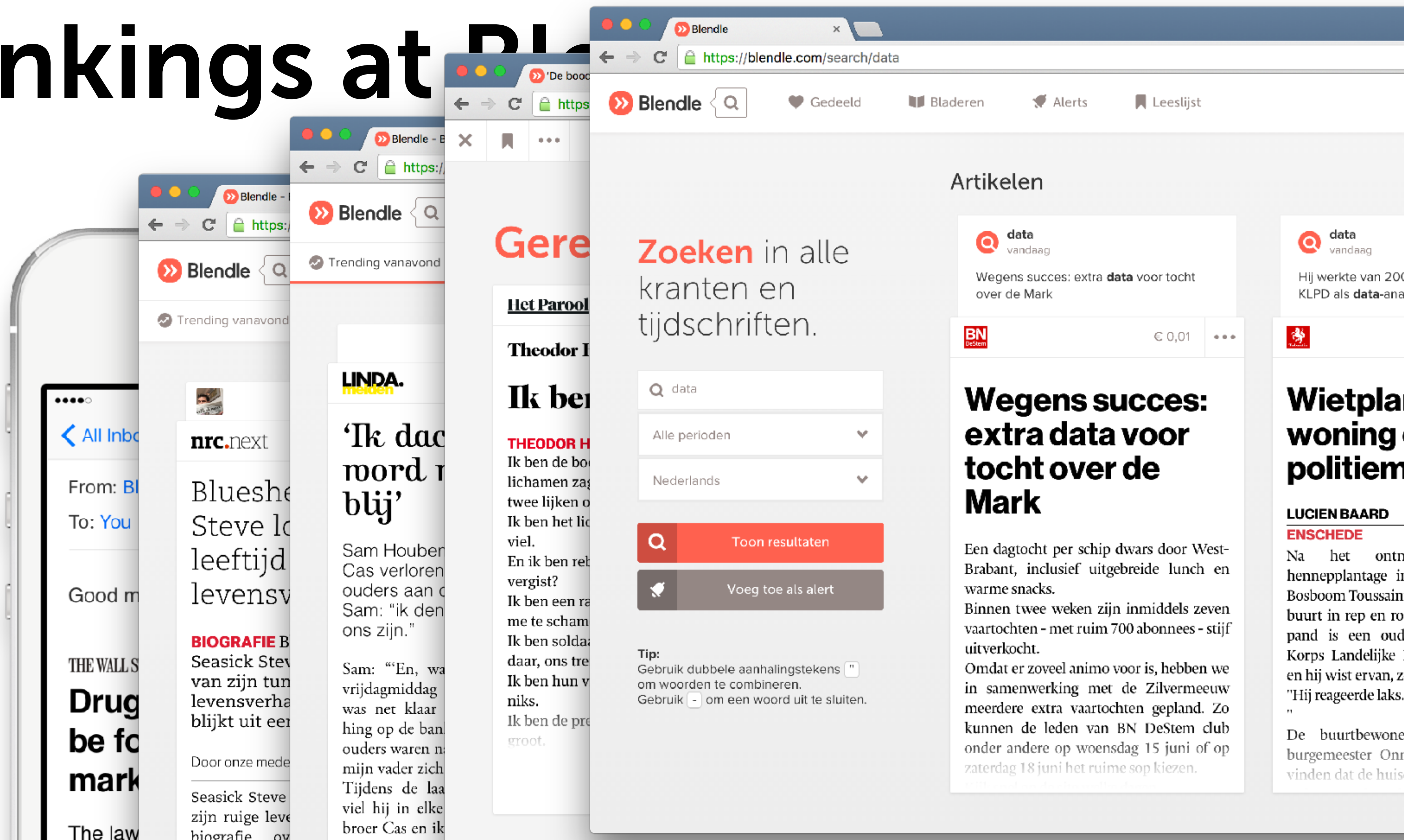
Ik ben een boerenlul, ik ben Normaal

Herman Sandman

**Zijn mond zit vol kronen, hij is half
doof en zijn stem klinkt als een slecht
startende Unimog. Een pionier loopt
altijd schrammen op en zeker Bennie
Jolink van Normaal, al 40 jaar
spreekbuis van het achterland.**

SIDDEBUREN In Wittewierum is een
oude Mercedes met de neus in de grond
begraven. Dát is Normaal. Cadillac
Ranch op zijn Noord-Gronings.
Boerenhumor. Zoals Herman Brood
rolmodel bleek voor de stadjer, zo was
de Achterhoekse boerenrockband, die
het na veertig jaar toeren voor gezien
houdt, rolmodel voor de plattelanders.

Rankings at Blendle



Rankings at Blendle

Rankings at Blendle

- Should be personalised

Rankings at Blendle

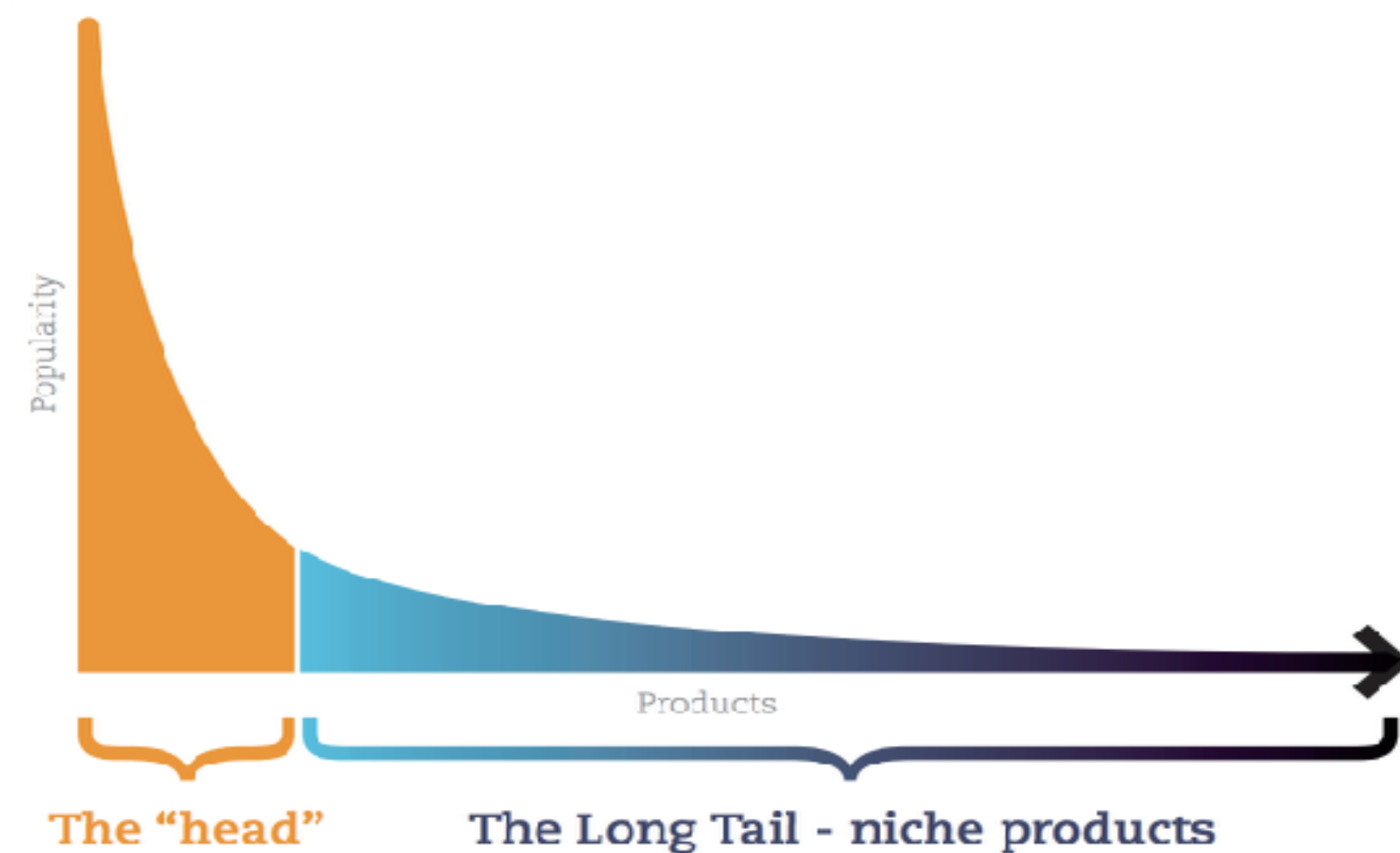
- Should be personalised
 - Lots of content

Rankings at Blendle

- Should be personalised
 - Lots of content
 - Lots of different tastes

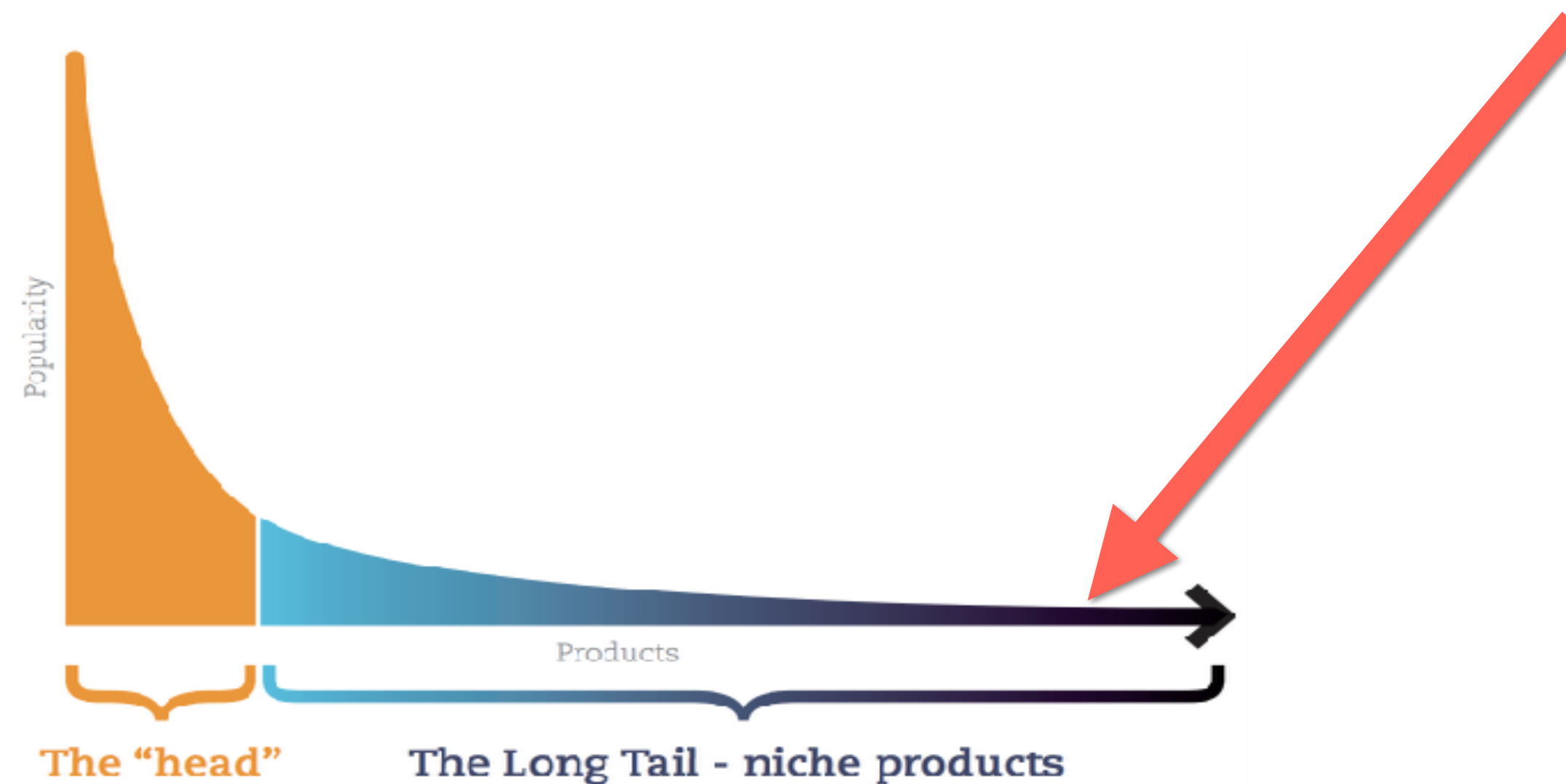
Rankings at Blendle

- Should be personalised
 - Lots of content
 - Lots of different tastes



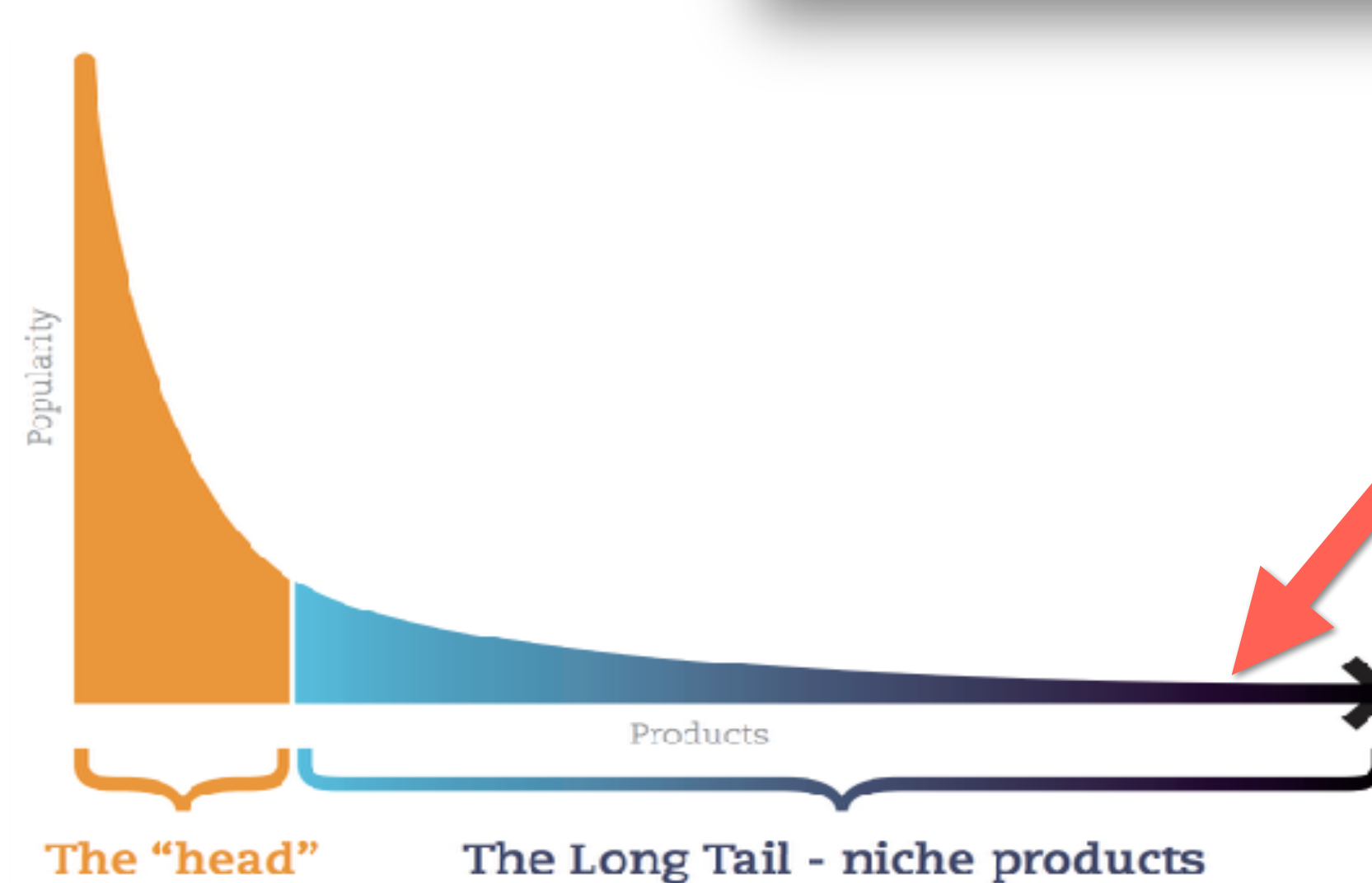
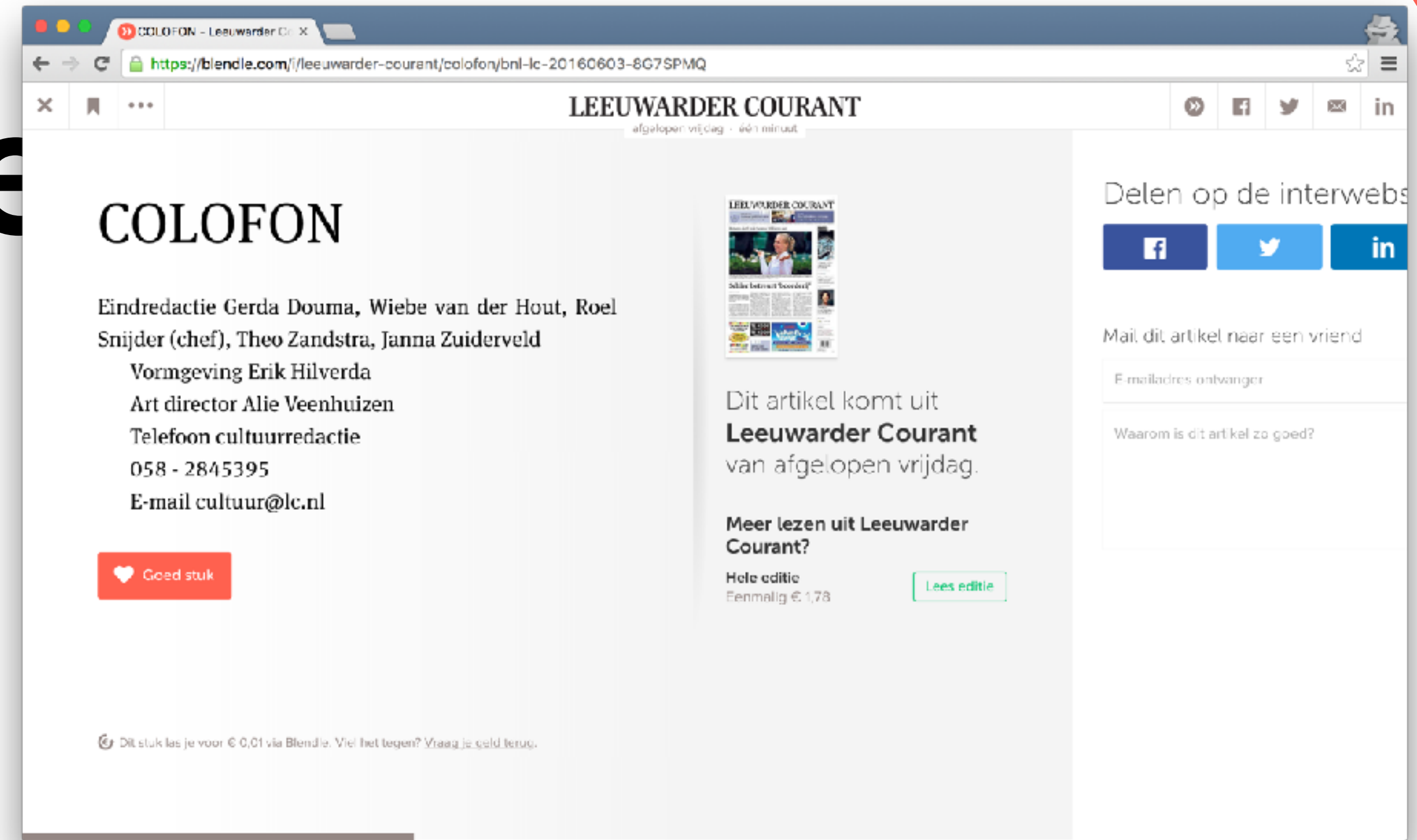
Rankings at Blendle

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 - Lots of content
 - Lots of different tastes



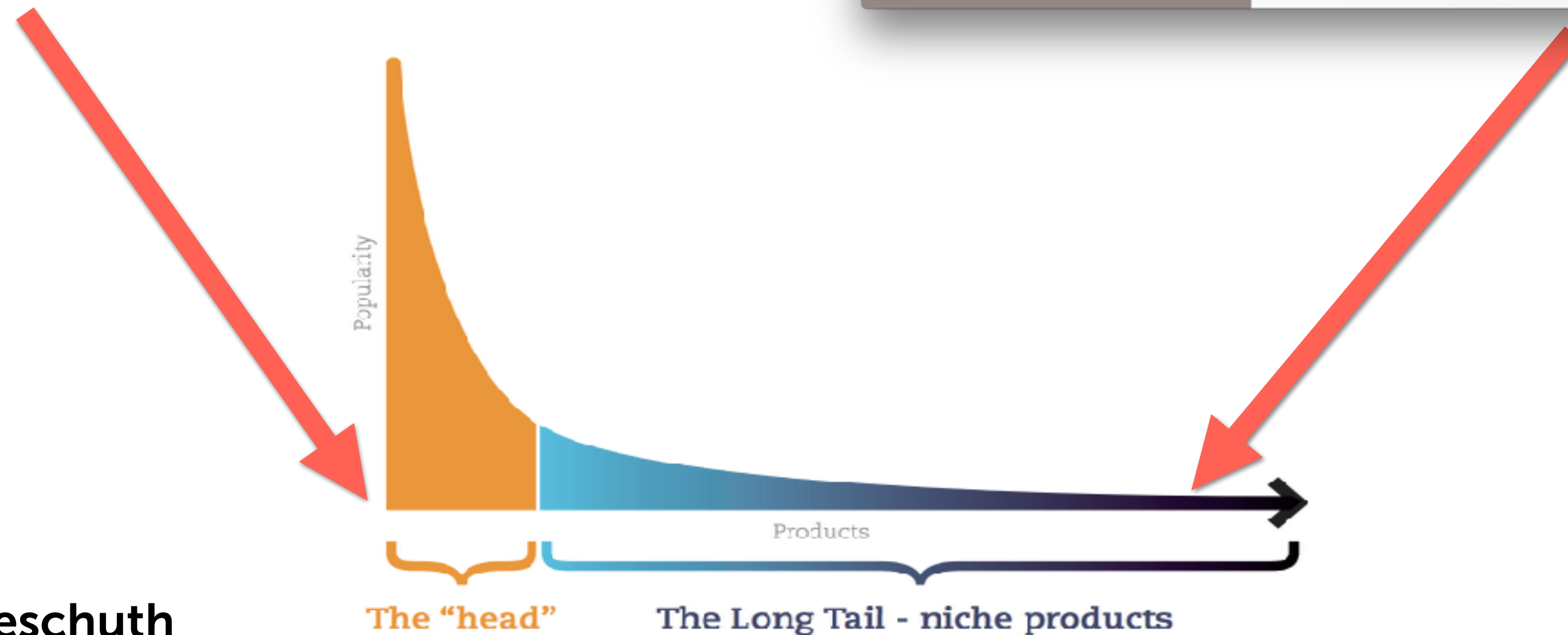
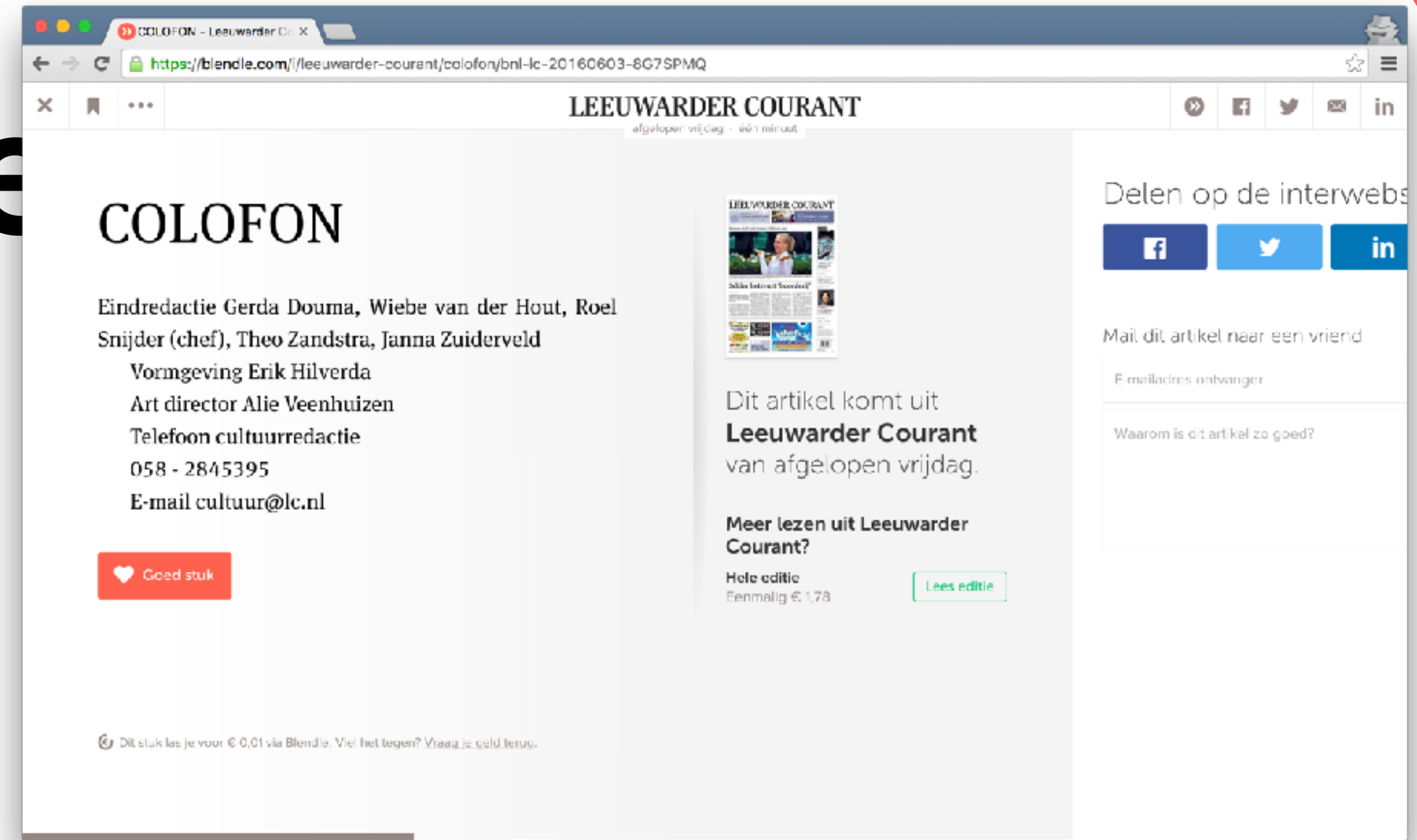
Rankings at Blendle

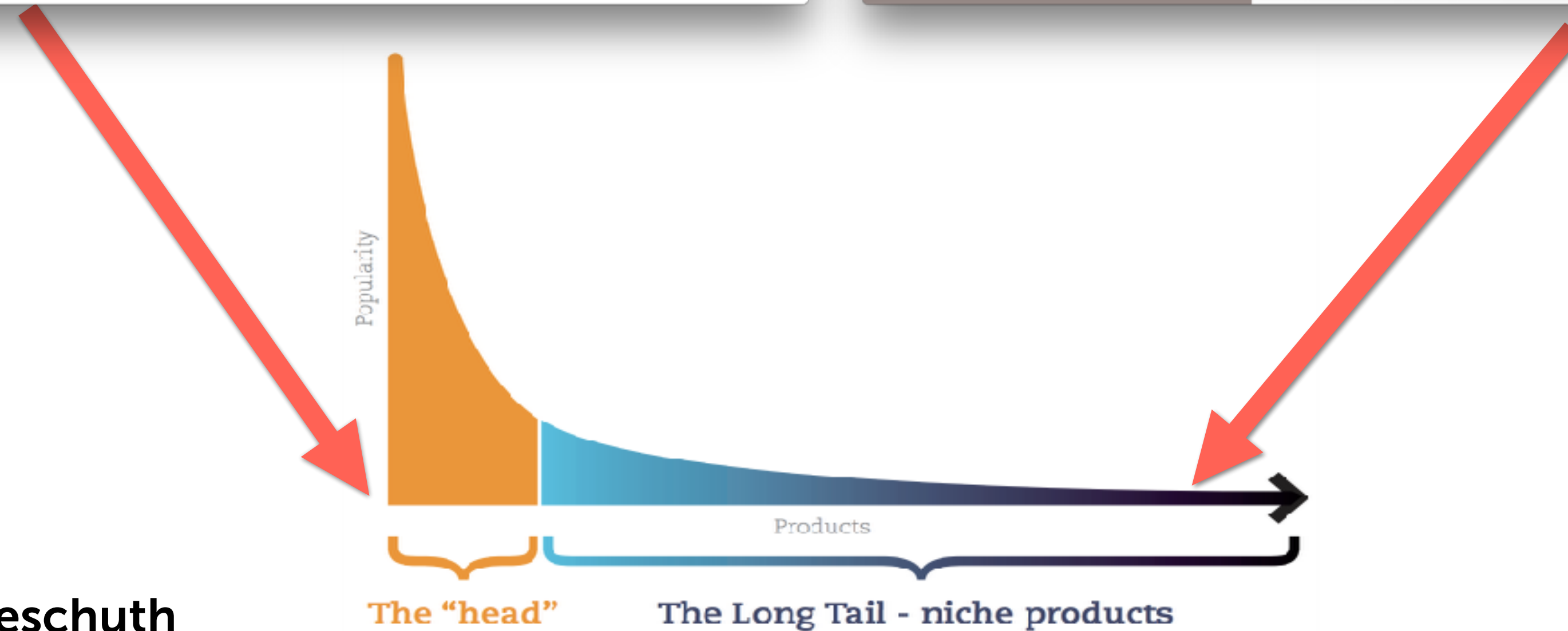
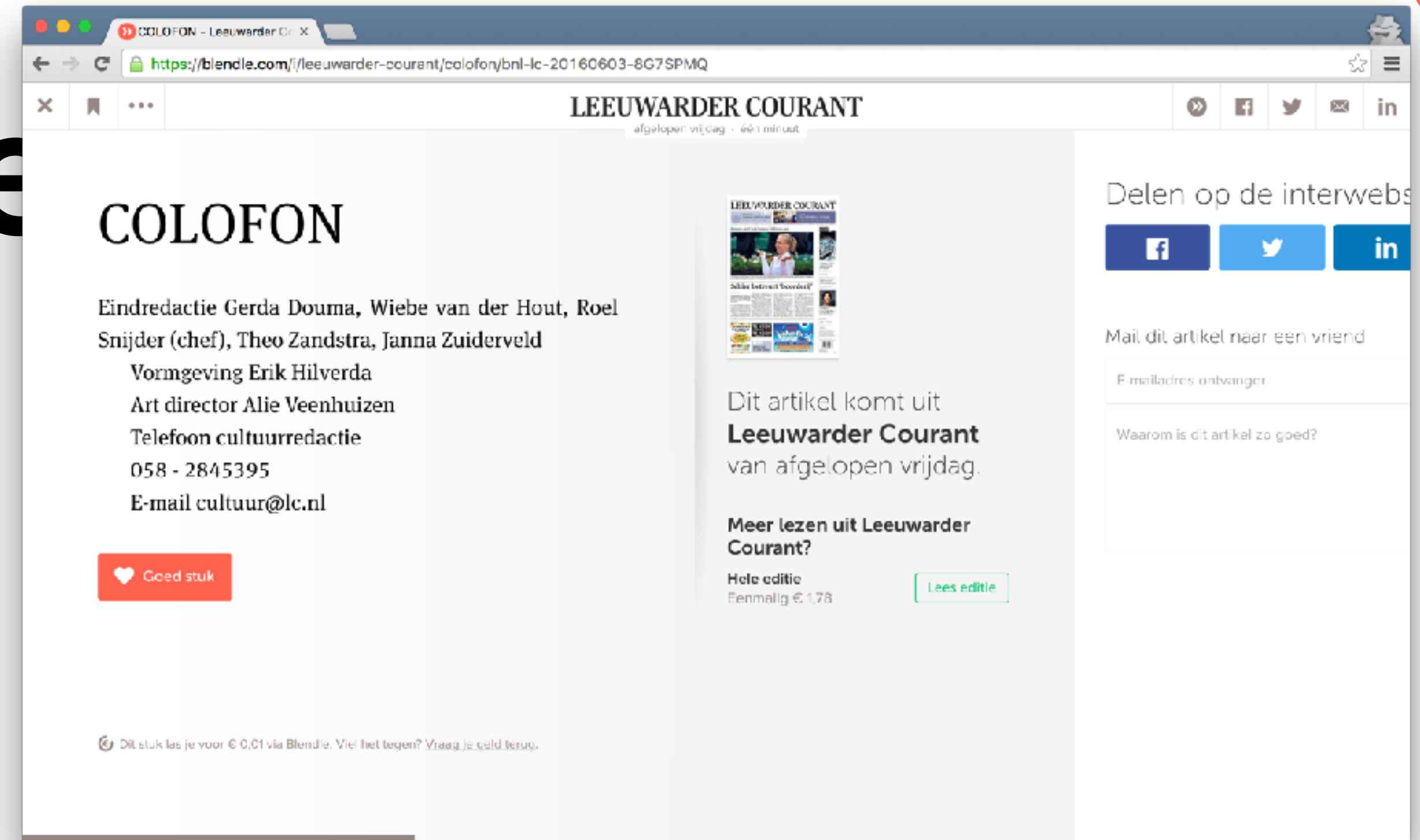
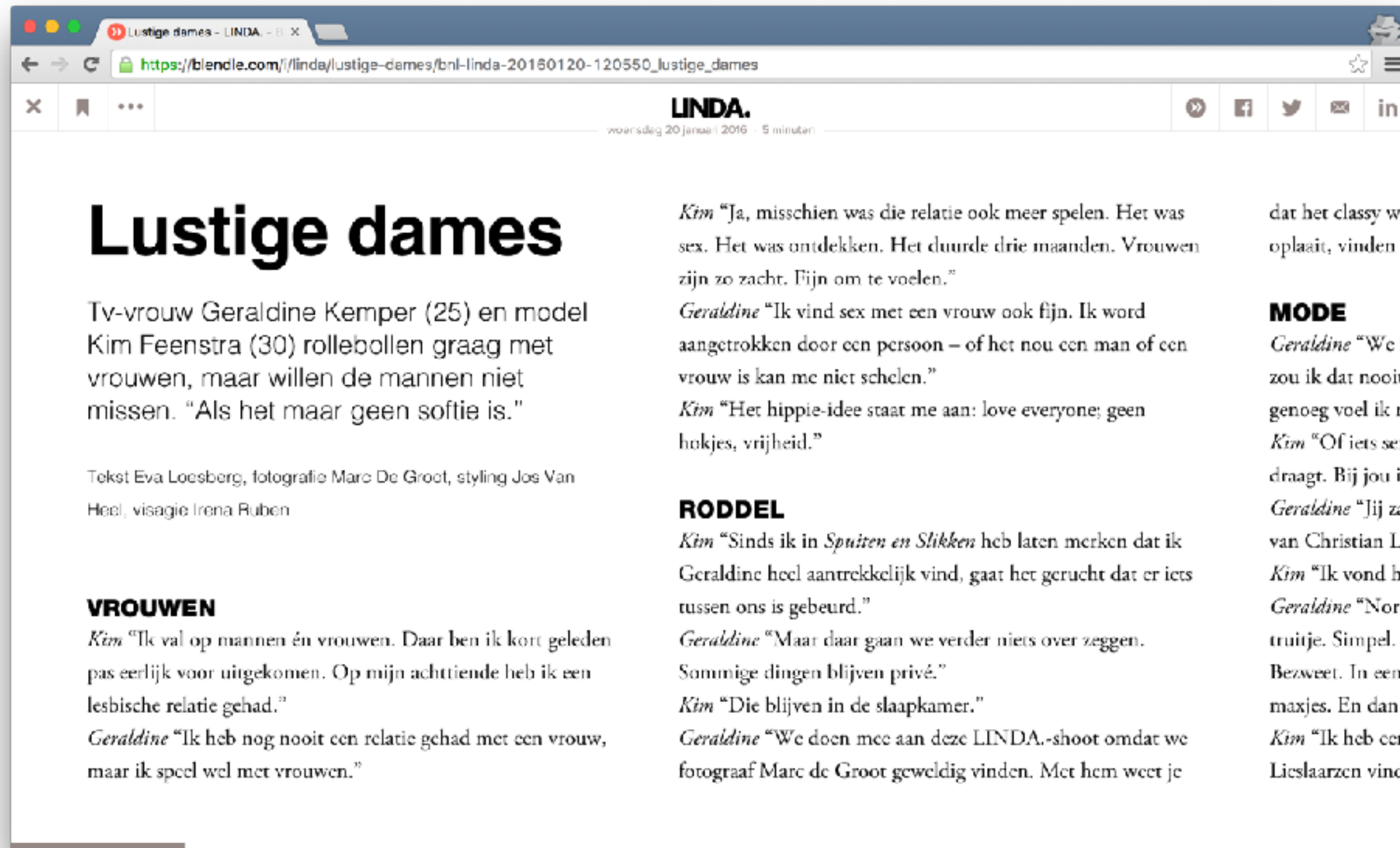
- Should be personalised
 - Lots of content
 - Lots of different tastes

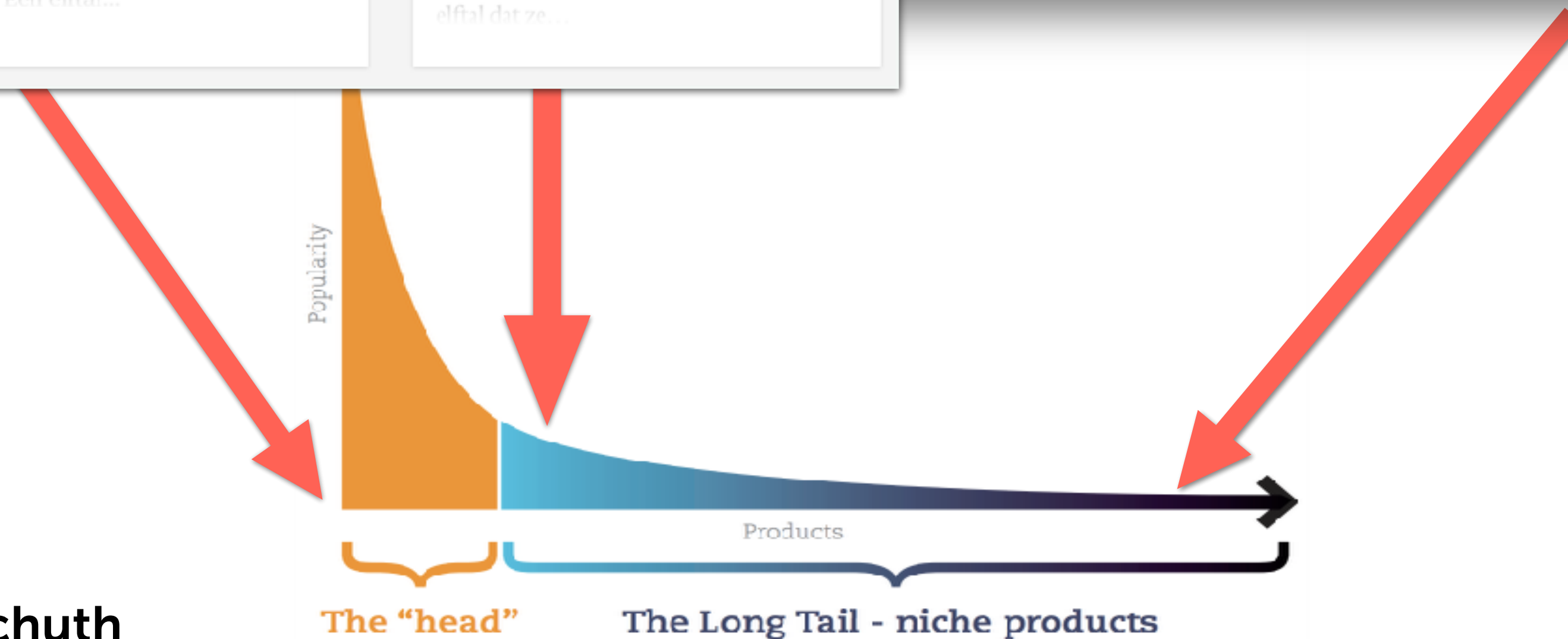


Rankings at Blendle

- Should be personalised
 - Lots of content
 - Lots of different tastes







Lustige dames - LINDA - B X
<https://blendle.com/linda/lustige-dames/bnl-linda-20>

Lustige dame

Tv-vrouw Geraldine Kemper (25) en m Kim Feenstra (30) rollebollen graag m vrouwen, maar willen de mannen niet missen. "Als het maar geen softie is."

Tekst Eva Loesberg, fotografie Marc De Groot, styling Jo Heel, visagie Irena Ruben

VROUWEN

Kim "Ik val op mannen én vrouwen. Daar ben ik ko pas eerlijk voor uitgekomen. Op mijn achttiende heb lesbische relatie gehad."

Geraldine "Ik heb nog nooit een relatie gehad met ee maar ik speel wel met vrouwen."

Ajax gisteren

Mét Tete, Bazoer, Riedewald en El Ghazi, het kwartet op een zijspoor bij Ajax.

DAGBLAD NOORDEN € 0,09

Grote jongens, nu in Jong Oranje

zeist Jong Oranje speelt binnen een week cruciale interlands tegen Turkije en Cyprus om het jeugd-EK van 2017 nog te halen.

Mét Tete, Bazoer, Riedewald en El Ghazi, het kwartet op een zijspoor bij Ajax.

Een gek gezicht? Ja, toch wel. Riechedly Bazoer, Jairo Riedewald, Kenny Tete en Anwar El Ghazi stonden gistermiddag gebroederlijk naast elkaar op het veld van het trainingscomplex in Zeist. Niet bij het grote Oranje, maar bij Jong Oranje. Een elftal...

Ajax gisteren

Prima voor Ajax, zou je zeggen.

AD € 0,15

Jaar geleden nog bij grote jongens, nu in Jong Oranje

DANIËL DWARSWAARD

ZEIST

Jong Oranje speelt binnen een week cruciale interlands tegen Turkije en Cyprus om het jeugd-EK van 2017 nog te halen. Mét Tete, Bazoer, Riedewald en El Ghazi, het kwartet op een zijspoor bij Ajax.

Een gek gezicht? Ja, toch wel. Riechedly Bazner, Jairo Riedewald, Kenny Tete en Anwar El Ghazi stonden gistermiddag gebroederlijk naast elkaar op veld van het trainingscomplex in Zeist. Niet bij het grote Oranje, maar bij Jong Oranje. Een elftal dat ze...

deVolkskrant vandeeg · 2 minuten

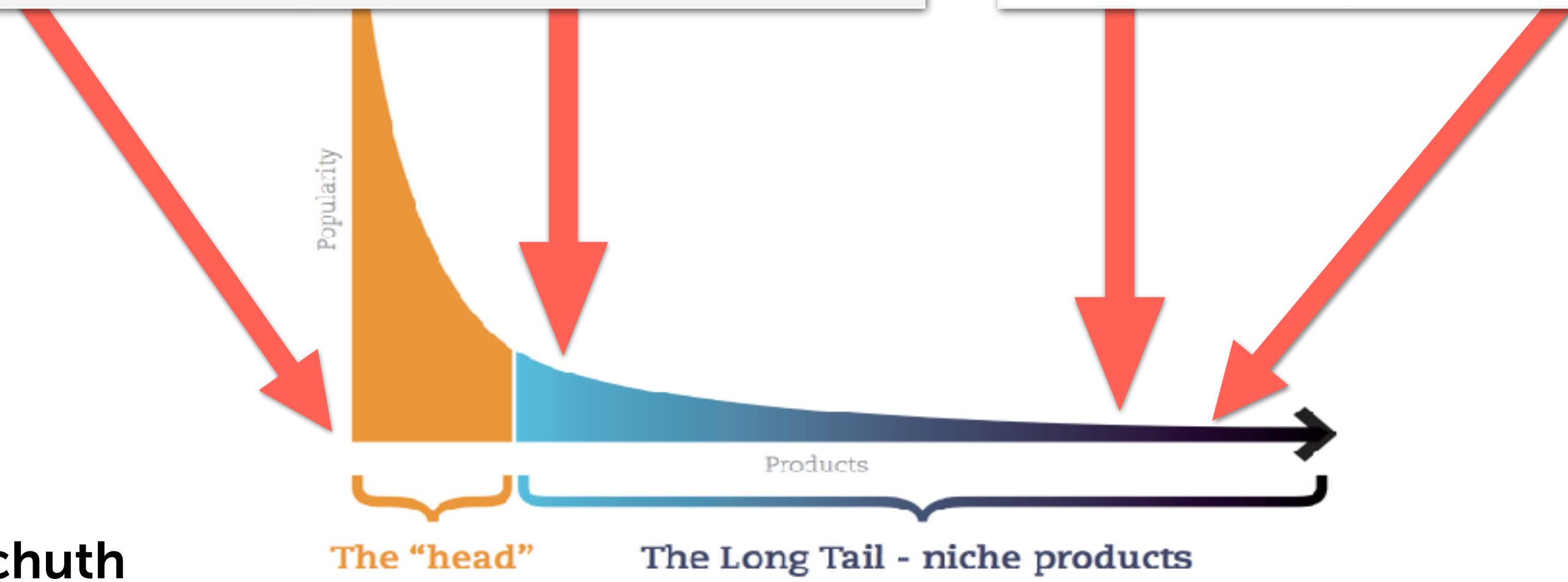
Mysterieuze migratie van paling in kaart gebracht

Met behulp van zenders zijn wetenschappers erin geslaagd de paling te volgen op zijn route van geboorte naar volwassenheid.

VAN ONZE VERSLAGGEVER JENTE OTTENBURGHS AMSTERDAM

Europese palingen zwemmen meer dan 5.000 kilometer - twee keer de afstand tussen Amsterdam en Moskou - naar hun voortplantingsgebied in de Atlantische Oceaan. Een internationaal team van wetenschappers heeft deze migratieroute nu in detail gereconstrueerd. Vanuit diverse Europese rivieren zwemmen de palingen naar de Azoren vanwaar ze koers zetten richting hun eindbestemming. Dat

schrijven de o tijdschrift Scienc
 De route biologisch vraa
 bescherming v
 ging het niet
 Europese kust
 stichting Duur
 niet betrokken
 is het Europese
 huidige maatr
 harde gegeve
 onderzoek b
 beschermingsr
 Tijdens zijn
 zoute oceanen
 worden gebore
 de Atlantische
 golfstroom vo
 vasteland, een
 zwemmen de j



Rankings at Blendle

- Should be personalised
 - Lots of content
 - Lots of different tastes

Rankings at Blendle

- Should be personalised
 - Lots of content
 - Lots of different tastes
- Can be personalised

Rankings at Blendle

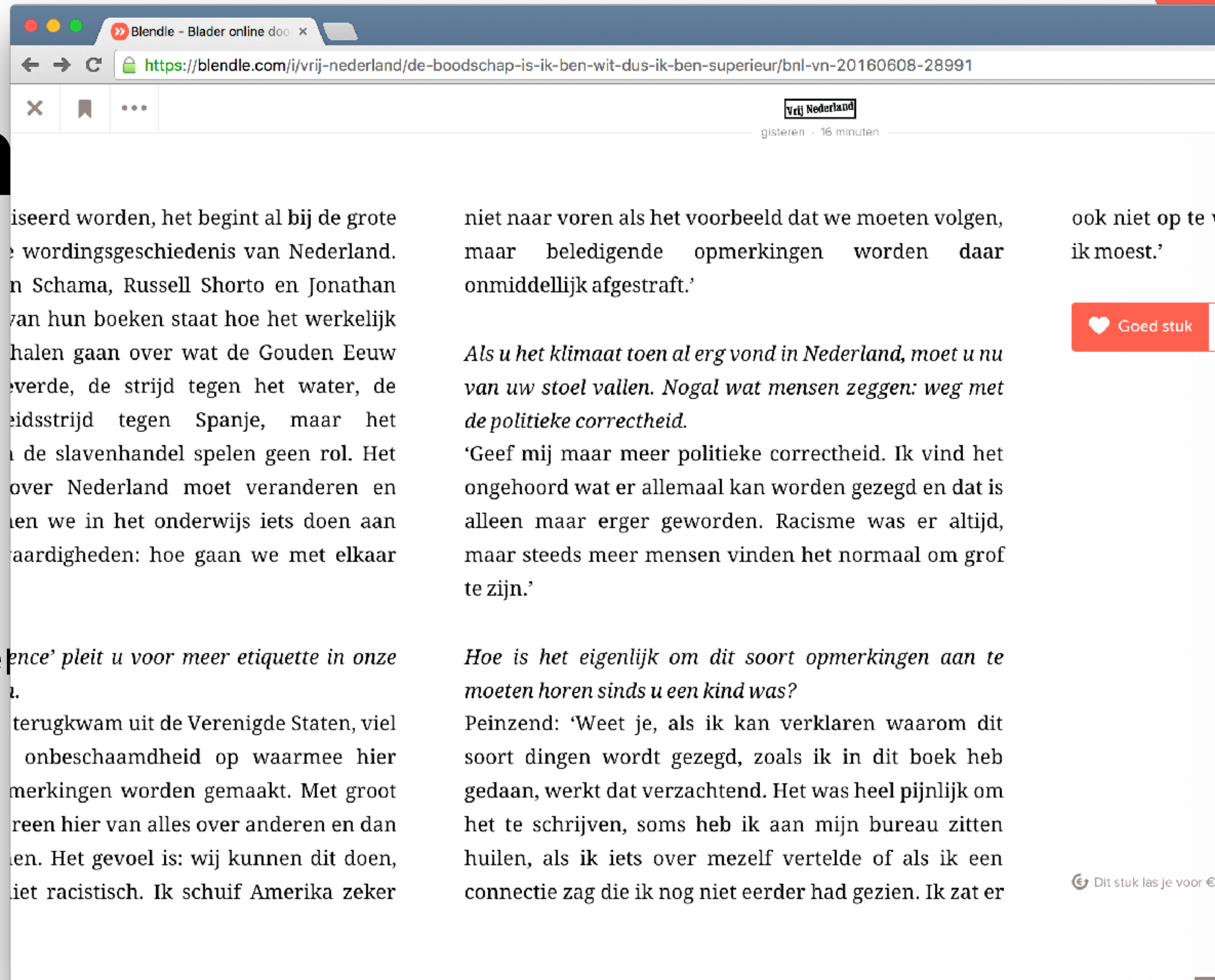
- Should be personalised
 - Lots of content
 - Lots of different tastes
- Can be personalised
 - We know what our users read

Rankings at Blendle

- Should be personalised
 - Lots of content
 - Lots of different tastes
- Can be personalised
 - We know what our users read
 - What they didn't like

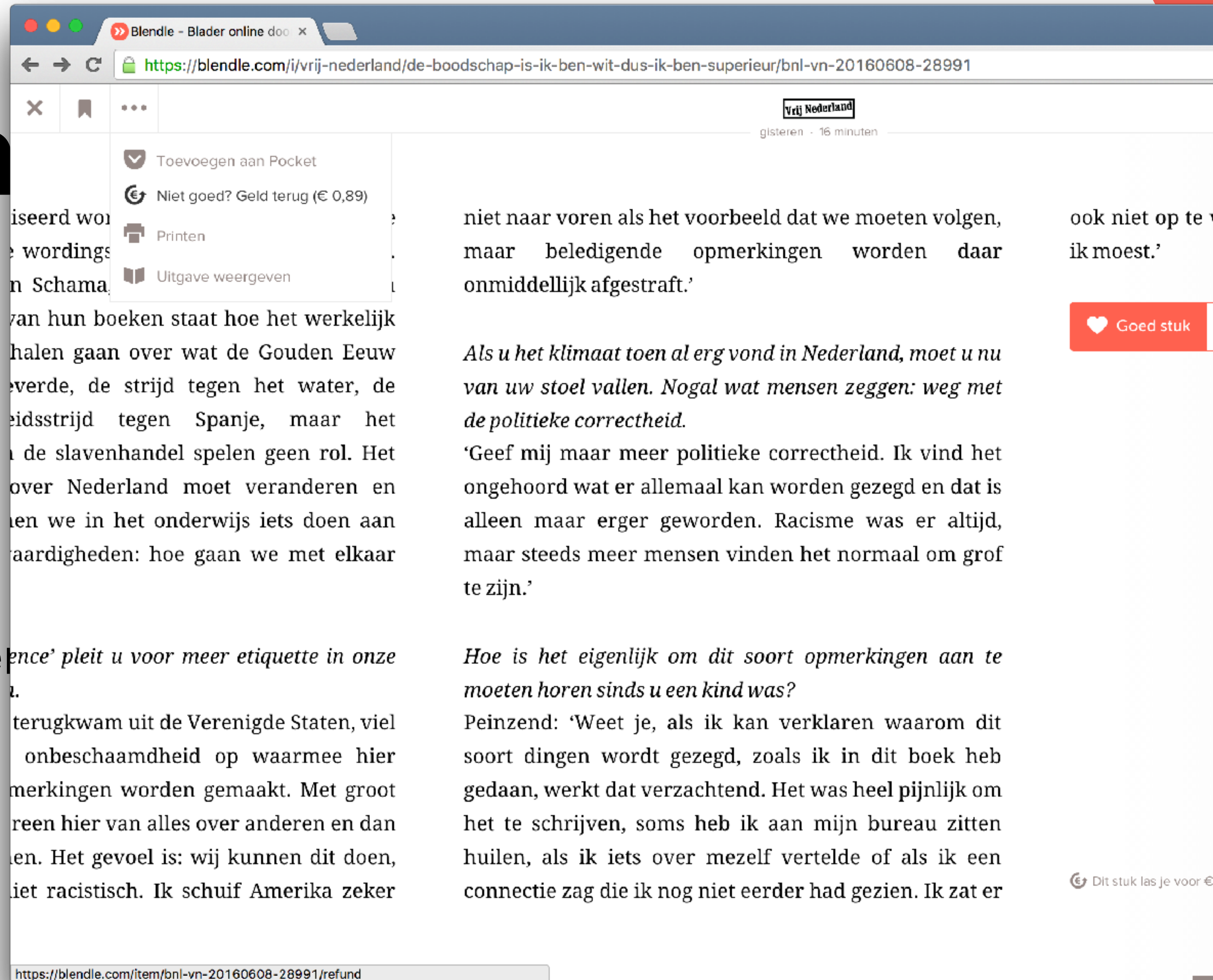
Rankings a

- Should be personalised
 - Lots of content
 - Lots of different tastes
- Can be personalised
 - We know what our users like
 - What they didn't like



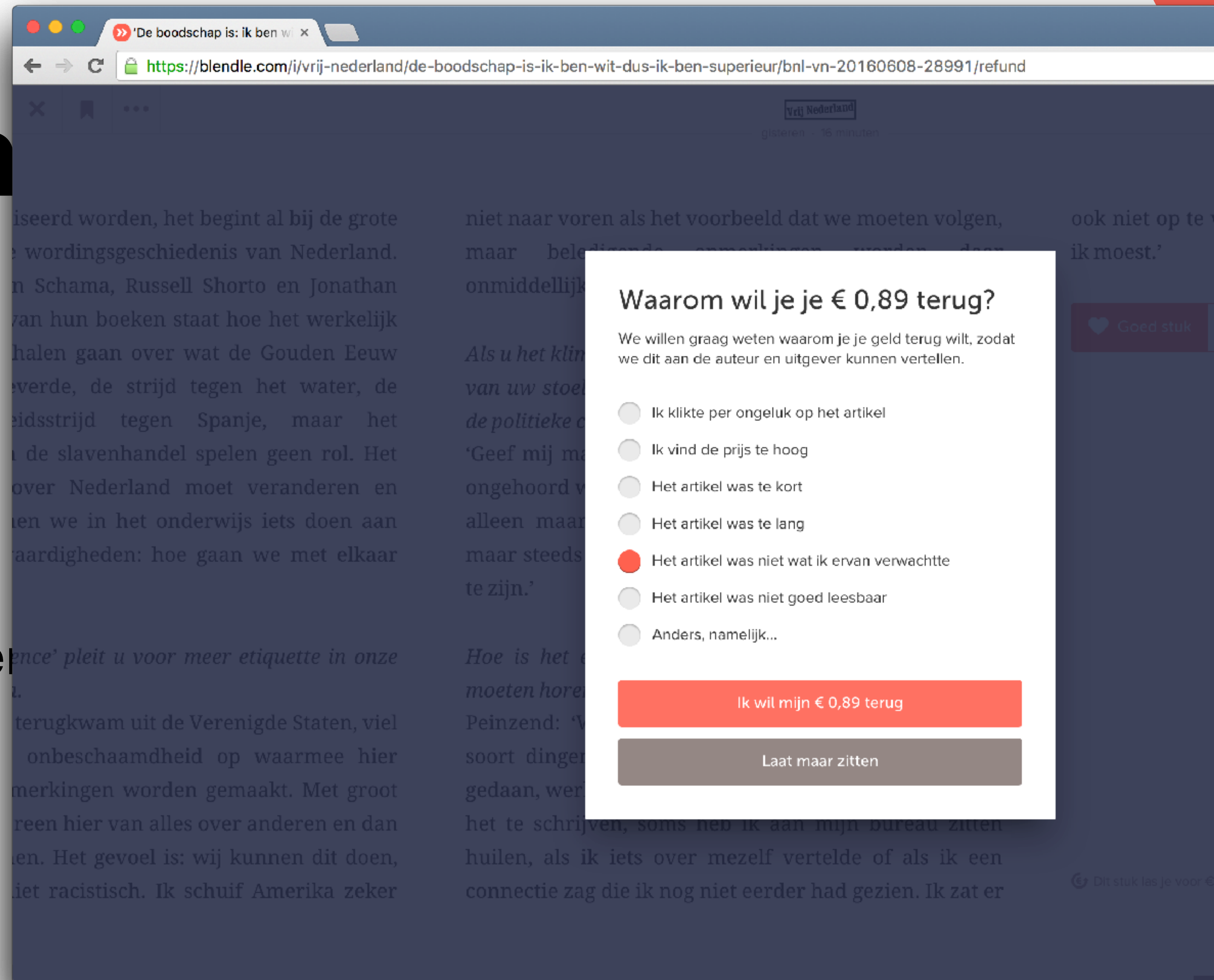
Rankings a

- Should be personalised
 - Lots of content
 - Lots of different tastes
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 - We know what our users like
 - What they didn't like



Rankings a

- Should be personalised
 - Lots of content
 - Lots of different tastes
- Can be personalised
 - We know what our users like
 - What they didn't like



Rankings at Blendle

- Should be personalised
 - Lots of content
 - Lots of different tastes
- Can be personalised
 - We know what our users read
 - What they didn't like

Rankings at Blendle

- Should be personalised
 - Lots of content
 - Lots of different tastes
- Can be personalised
 - We know what our users read
 - What they didn't like
 - When they read

Rankings at Blendle

- Should be personalised
 - Lots of content
 - Lots of different tastes
- Can be personalised
 - We know what our users read
 - What they didn't like
 - When they read
 - ...

Personalised recommendations



Music

- **Repeated** consumption
- More **niche** than movies/series
- **Tens of millions** of songs and users
- **Long** (often unlimited) shelf life
- Feedback: implicit (listening behaviour)

Personalised recommendations



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- More **niche** than movies/series
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Movies and series

- **Single** consumption
- Less niche than music
- 75.000.000 users
- **Long** shelf life
- Feedback: explicit ratings

Personalised recommendations



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Articles

- **Single** consumption

Personalised recommendations



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Articles

- **Single** consumption
- Very **short** shelf-life
 - **Cold start problem, Collaborative Filtering won't work**

Personalised recommendations



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Articles

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 - **Cold start problem, Collaborative Filtering won't work**
- **Diversity** of suggestions very important
 - **Content Based Recommendation won't work**

Personalised recommendations



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Personalised recommendations



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- More **niche** than movies/series
- **Tens of millions** of songs and users
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Movies and series

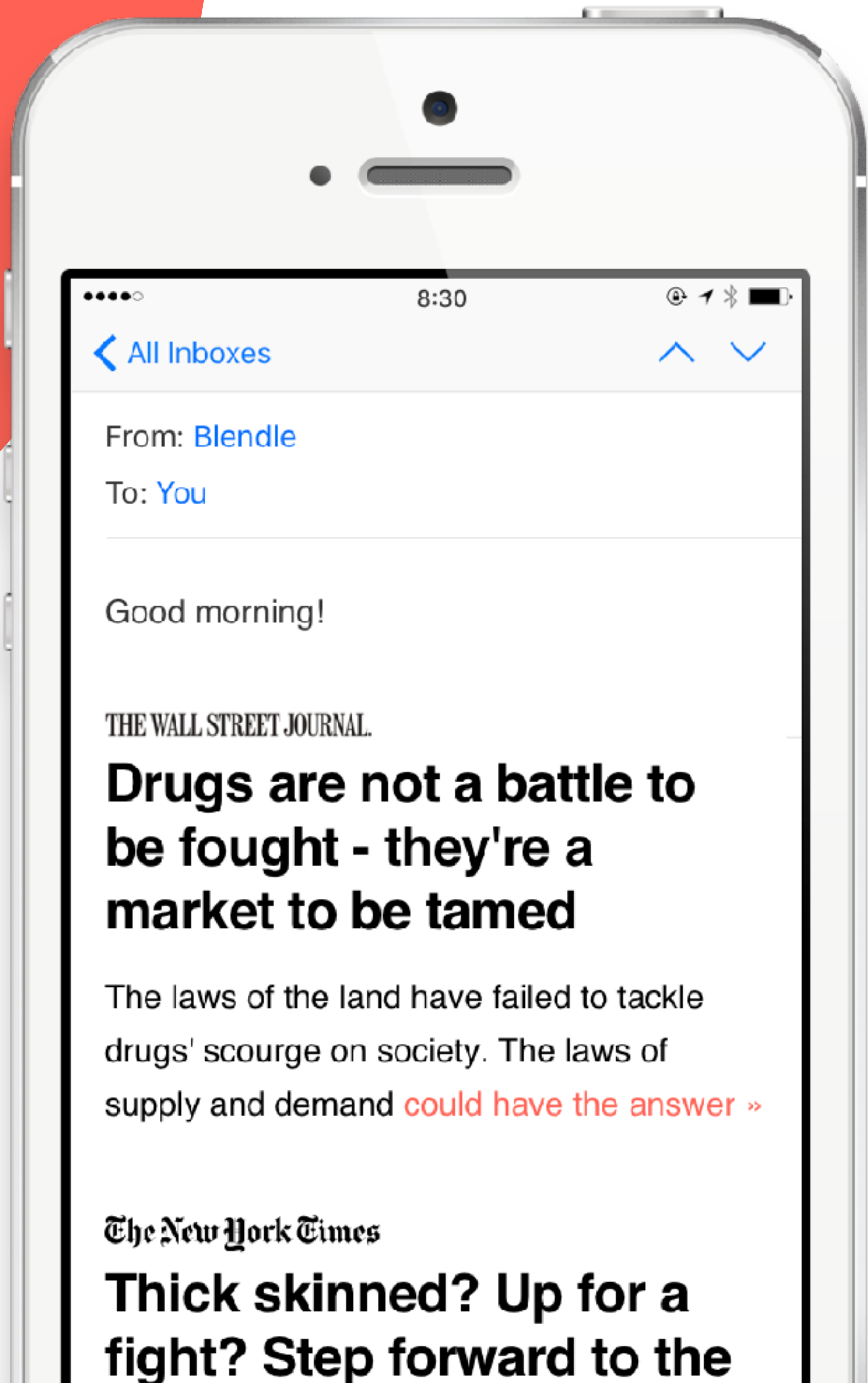
- **Single** consumption
- Less niche than music
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Articles

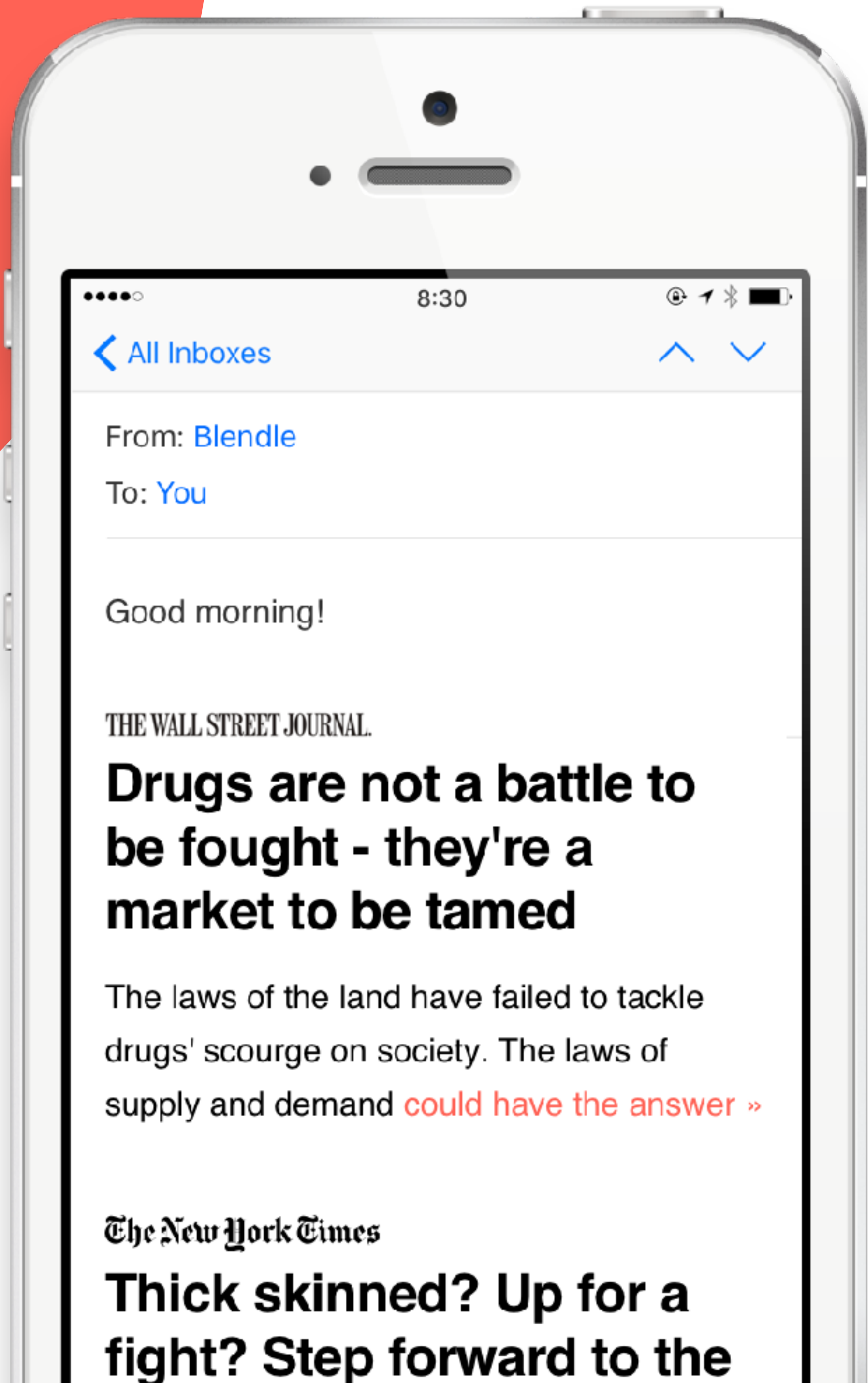
- **Single** consumption
- Very **short** shelf-life
 - **Cold start problem, Collaborative Filtering won't work**
- **Diversity** of suggestions very important
 - **Content Based Recommendation won't work**
- A lot of information **overlap**
- Feedback: implicit through reading behaviour, refunds, also 'like' option

Cold start problem



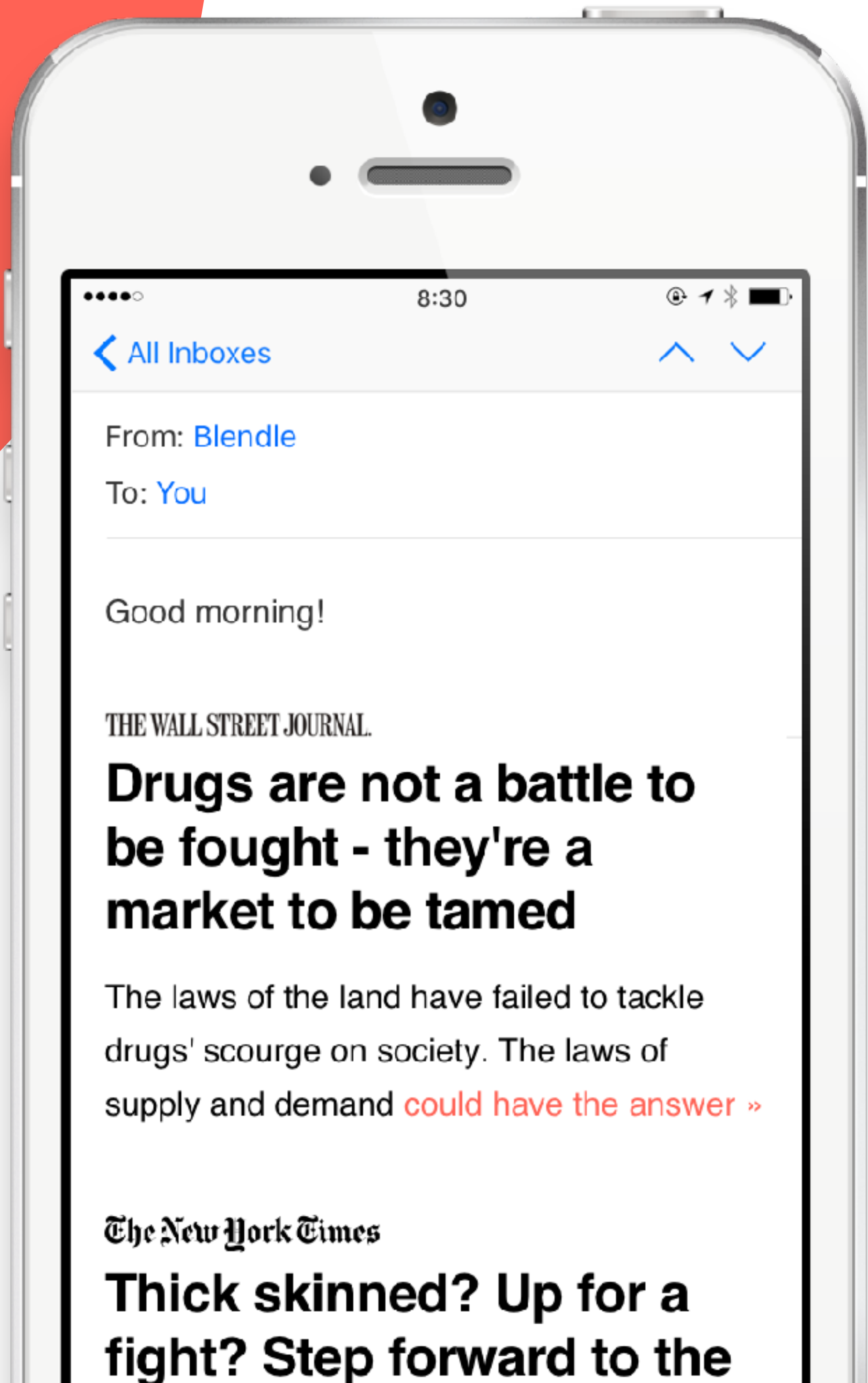
Cold start problem

- >6K new articles every night



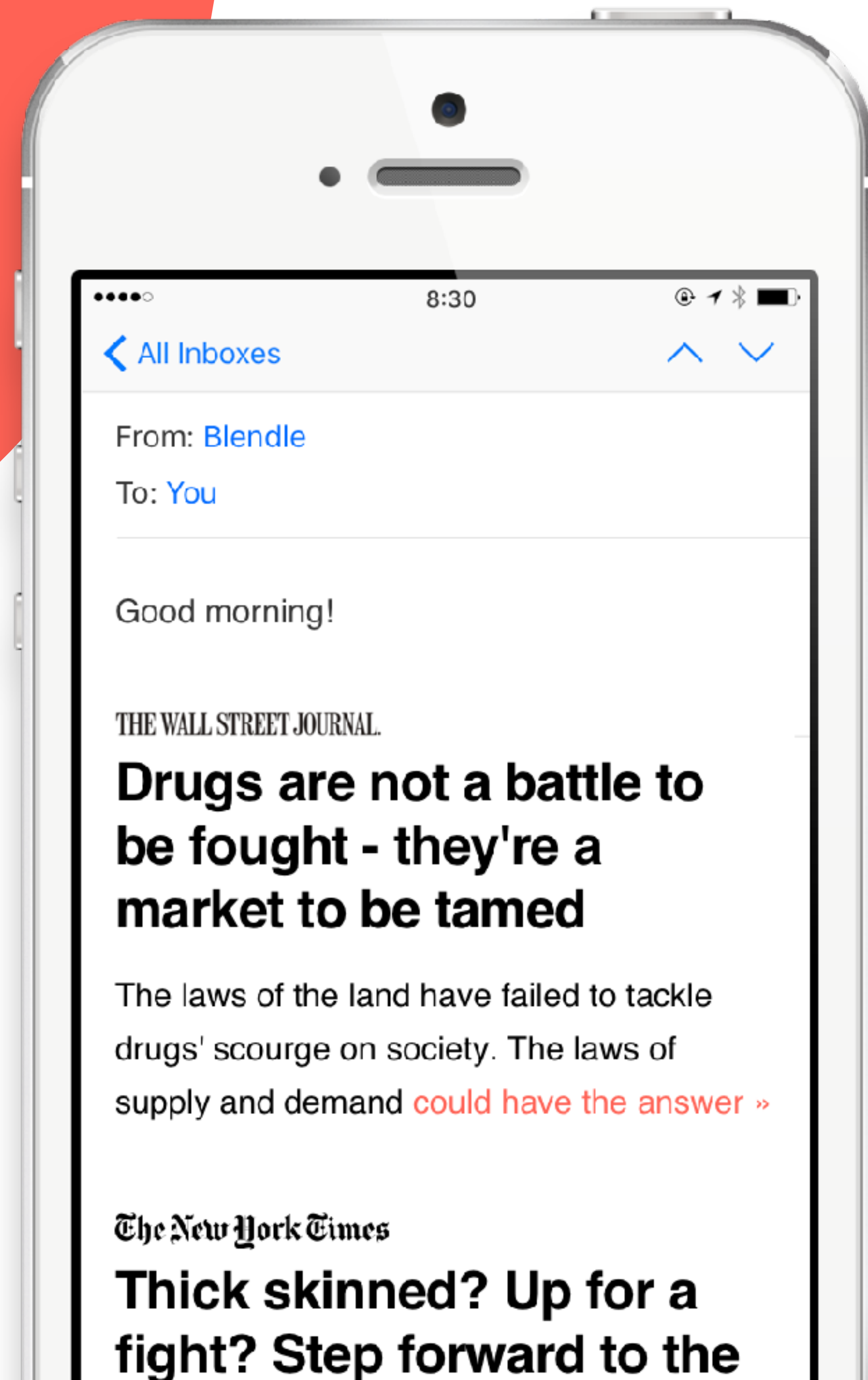
Cold start problem

- >6K new articles every night
- Our newsletter is an important traffic driver

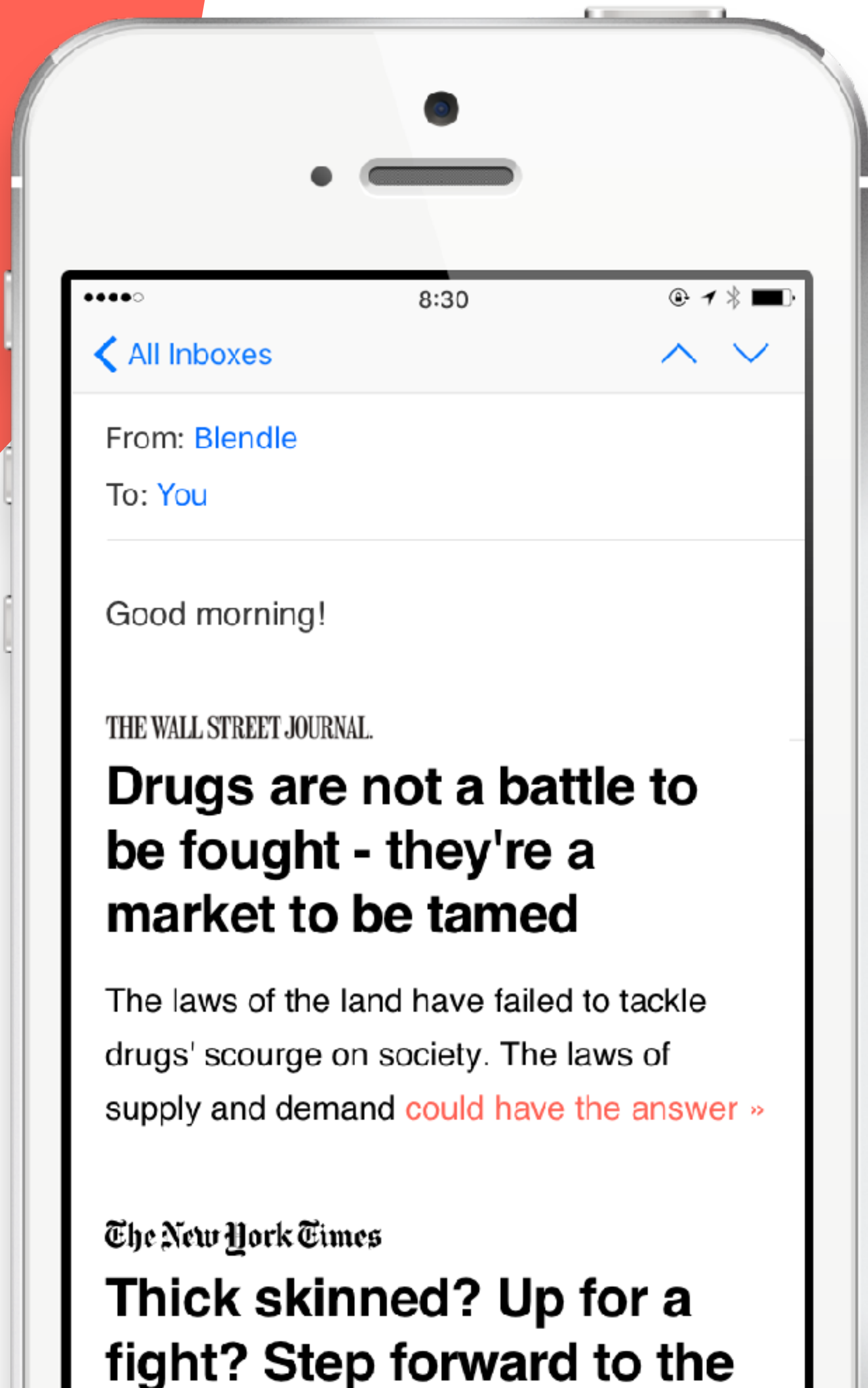


Cold start problem

- >6K new articles every night
- Our newsletter is an important traffic driver
- No usage info to *rank* the newsletter before we *send* the newsletter

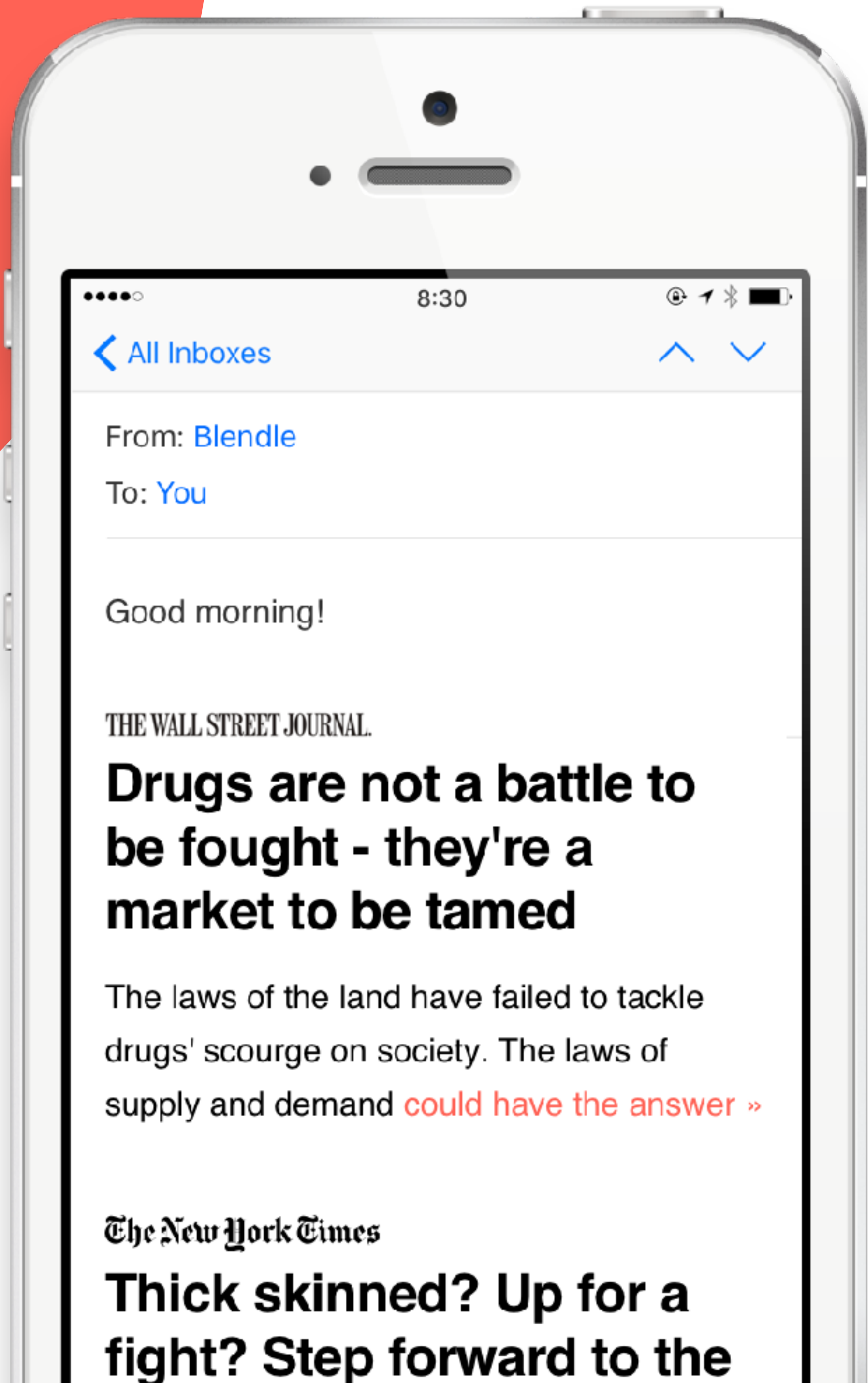


Timing problem



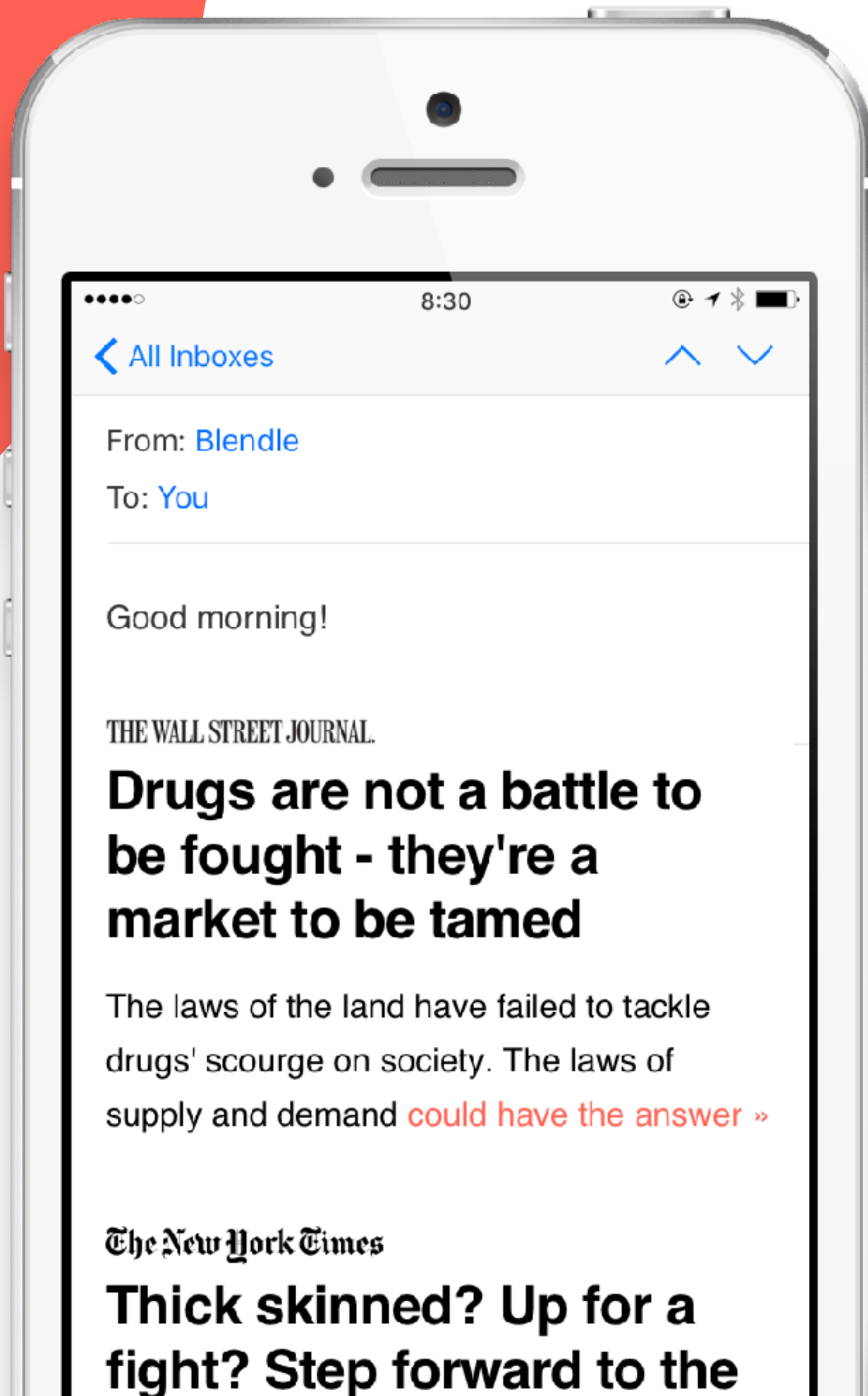
Timing problem

- Our editors wake up at 5am and are done reading at 8am



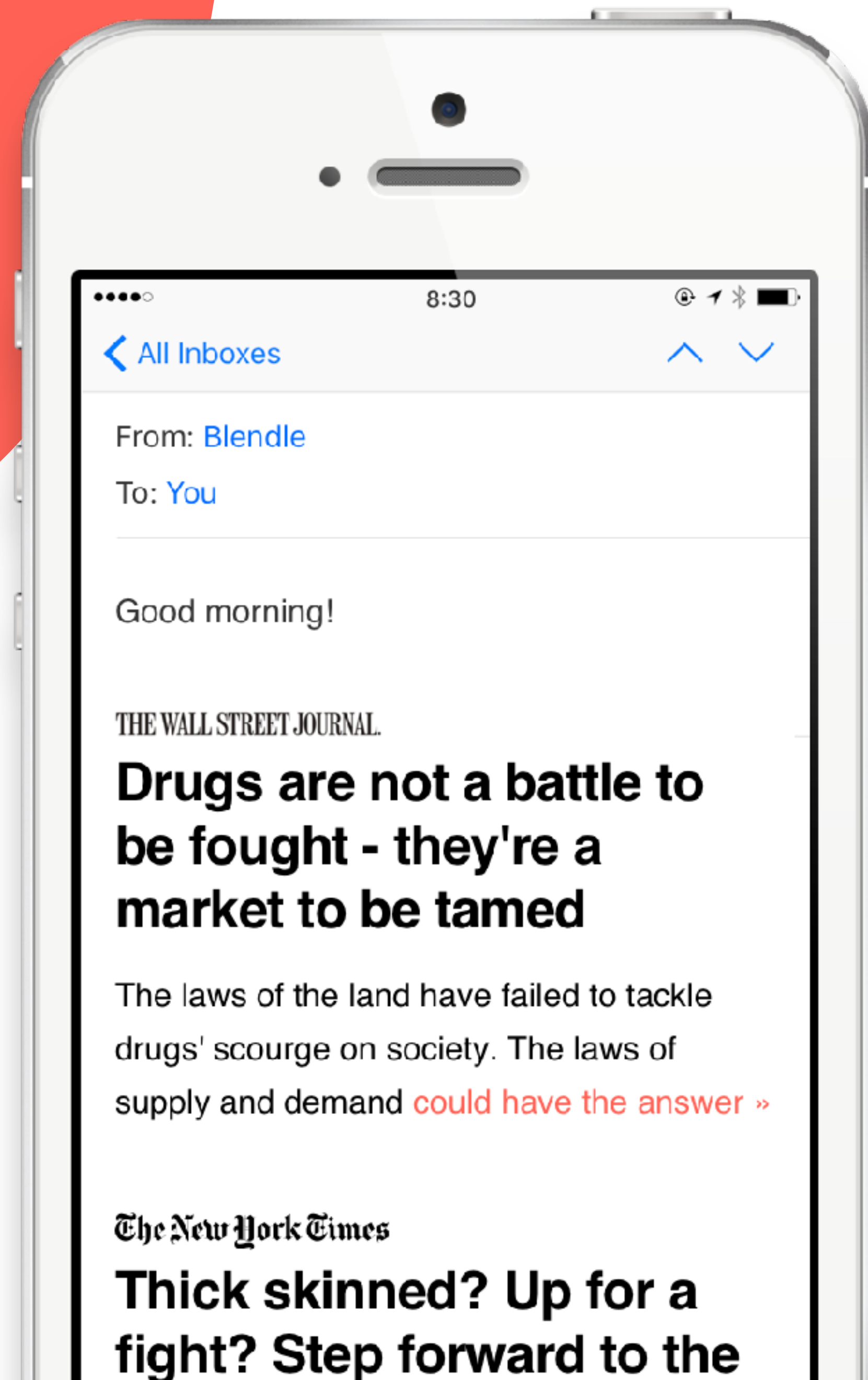
Timing problem

- Our editors wake up at 5am and are done reading at 8am
- Which is also when we want to send our newsletter



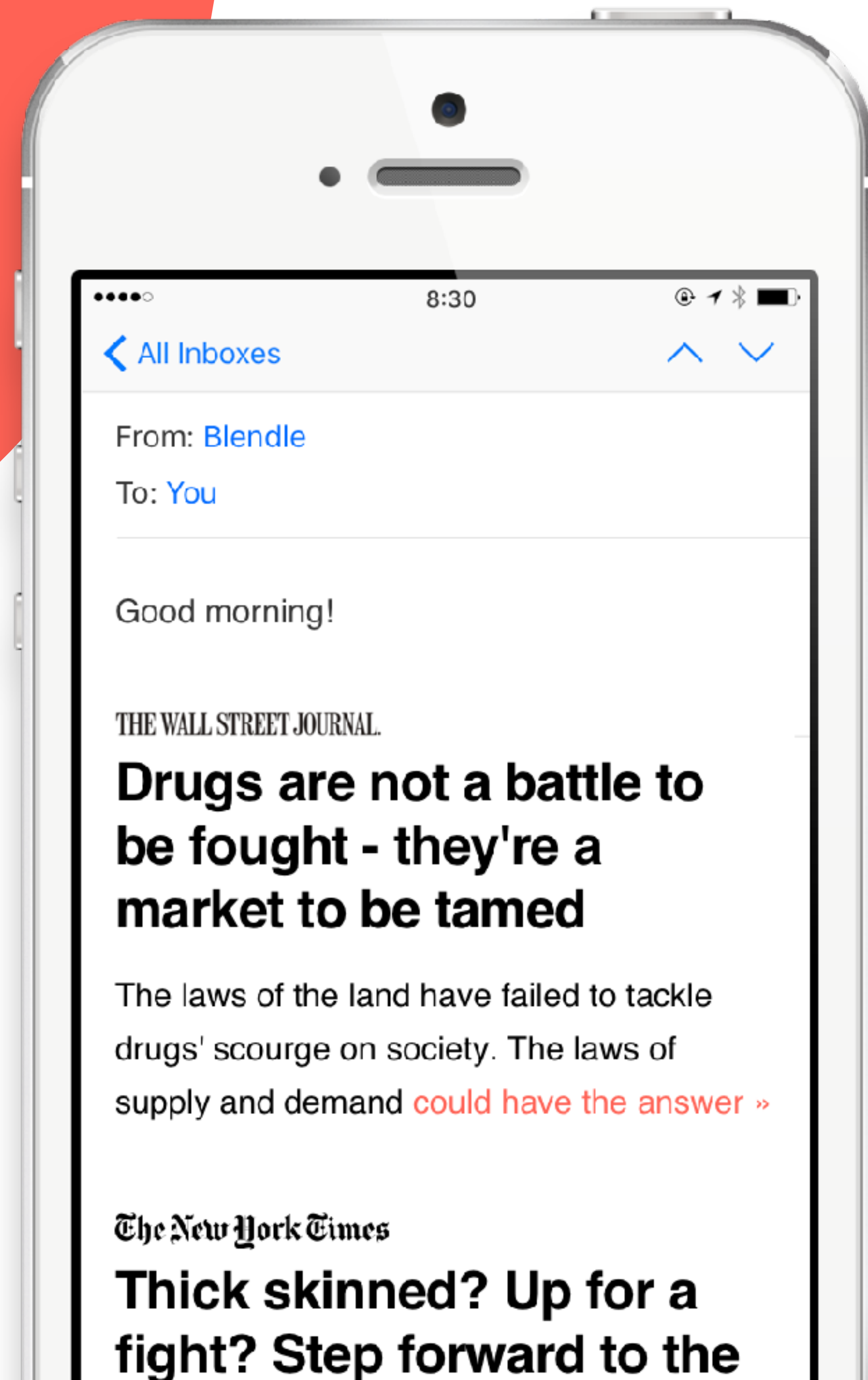
Timing problem

- Our editors wake up at 5am and are done reading at 8am
- Which is also when we want to send our newsletter
- We simply can't wait for a batch process

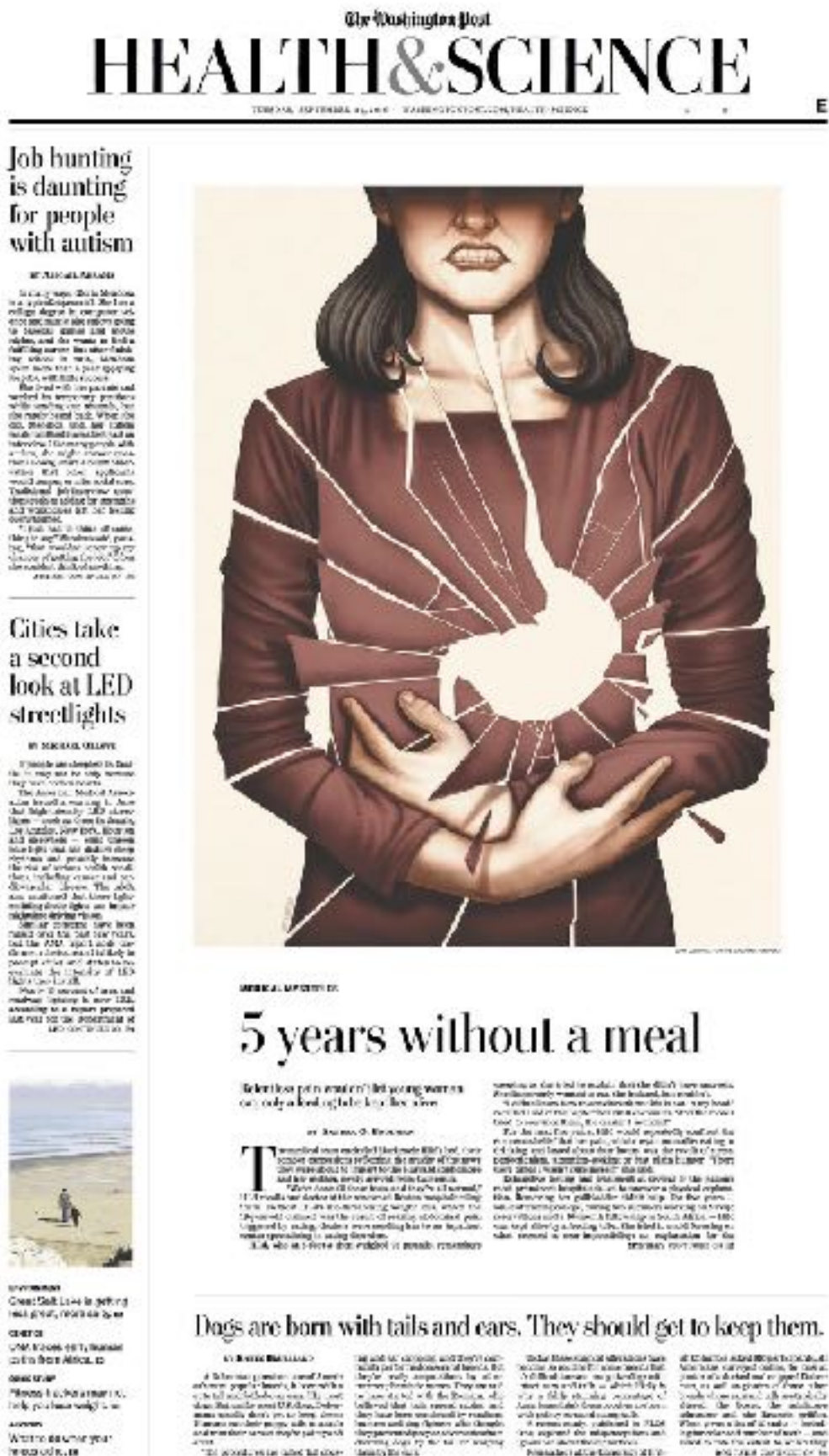


Cold start problem

- >6K new articles every night
- Our newsletter is an important traffic driver
- No usage info to *rank* the newsletter before we *send* the newsletter



Birth of a Blendle article



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2 <!DOCTYPE html PUBLIC "-//W3C//DTD XHTML 1.1//EN" "http://www.w3.org/TR/xhtml11/DTD/xhtml11.d
3 <html xmlns:saxon="http://saxon.sf.net/" xmlns="http://www.w3.org/1999/xhtml" xmlns:nitf="htt
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7 </head>
8 <body>
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11 <div class="masthead-text">
12 <div id="header_title" class="masthead-section">
13 <a href="section_14.xml">HEALTH &#38; SCIENCE</a>
14 </div>
15 </div>
16 </div>
17 <h2 id="headline" class="article-full-headline">5 years without a meal</h2>
18 <div id="subheadline" class="article-full-subhead">Relentless pain wouldn't let young woman eat; only a
19 <div id="byline" class="article-full-byline">BY SANDRA G. BOODMAN</div>
20 <div>
21 <div class="article-full-body"><span class="ld_bold">MEDICAL MYSTERIES</span></div>
22 <div id="image_1" class="article-in-image">
23 
24 <div id="image_1_credit" class="articleImageCredit">CAM COTTRILL FOR THE WASHINGTON P
25 </div>
26 <div class="article-full-body"><span class="ld_bold">The medical team encircled Mackenzie Hild's bed, the
27 <div id="image_2" class="article-in-image">
28 
29 <div id="image_2_caption" class="articleImageCaption">Mackenzie Hild, a medical stud
30 <div id="image_2_credit" class="articleImageCredit">COURTESY OF MACKENZIE HILD</div>
31 </div>
32 <div class="article-full-body"><span class="ld_bold">Drug reaction?</span></div>
33 <div class="article-full-body">Since childhood, Hild, now 26 and a second-year medical st
34 <div class="article-full-body">Back home in rural Nevada City, Calif., and off the drug,
35 <div class="article-full-body">When she got off the plane in August 2010, Hild's fa
36 <div class="article-full-body">As well as serious digestive disorders, including Crohn's disease. All tests were neg
37 <div class="article-full-body">At school, her health worsened. A few weeks into her sopho
38 <div class="article-full-body">After her confrontation with the medical team, Hild spent
39 <div class="article-full-body">diaphragm, which was accompanied by bouts of nausea.</div>
40 <div class="article-full-body">In the spring of 2011, the pain was so debilitating that H
41 <div class="article-full-body">When her weight dropped 105 pounds, doctors approved her a
```

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    "content": "Relentless pain wouldn't let young woman eat; only a feeding tube kept her alive"
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]
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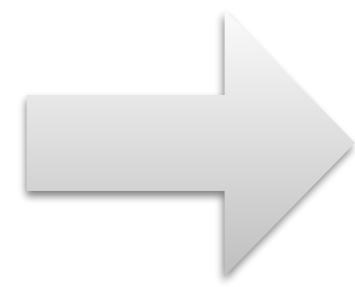
Delivered as PDF

Processed as epub

To the Blendle format



Article enrichment pipeline

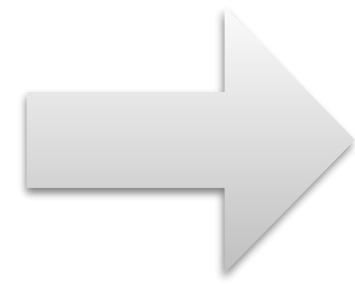


Language
detection



Tokenization

Article enrichment pipeline



Language
detection



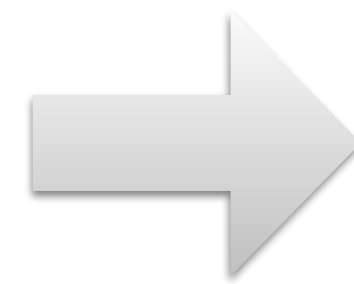
Tokenization



Stylometry

*Length, word
variation, vocabulary
richness, ...*

Article enrichment pipeline



Language
detection



Tokenization



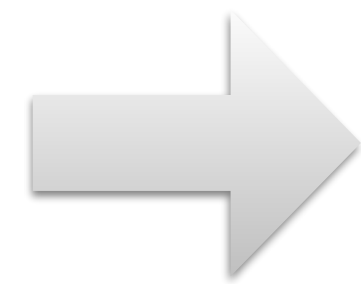
Stylometry

Sentiment
analysis

*Length, word
variation, vocabulary
richness, ...*

*Polarity scores
(negative, positive)*

Article enrichment pipeline



Language
detection



Tokenization



PoS-tagging



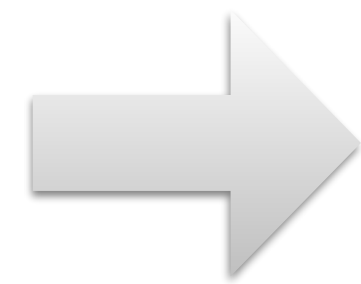
Stylometry

Sentiment
analysis

*Length, word
variation, vocabulary
richness, ...*

*Polarity scores
(negative, positive)*

Article enrichment pipeline



Language
detection



Tokenization



PoS-tagging



Named Entity
Recognition



Stylometry

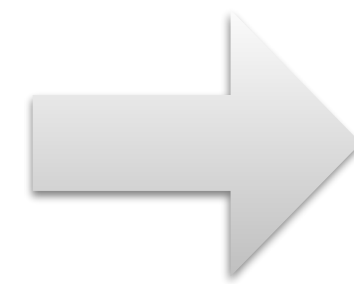
Sentiment
analysis

*Length, word
variation, vocabulary
richness, ...*

*Polarity scores
(negative, positive)*

*Locations,
persons,
organizations*

Article enrichment pipeline



Language
detection

Tokenization

PoS-tagging

Named Entity
Recognition

Stylometry

Sentiment
analysis

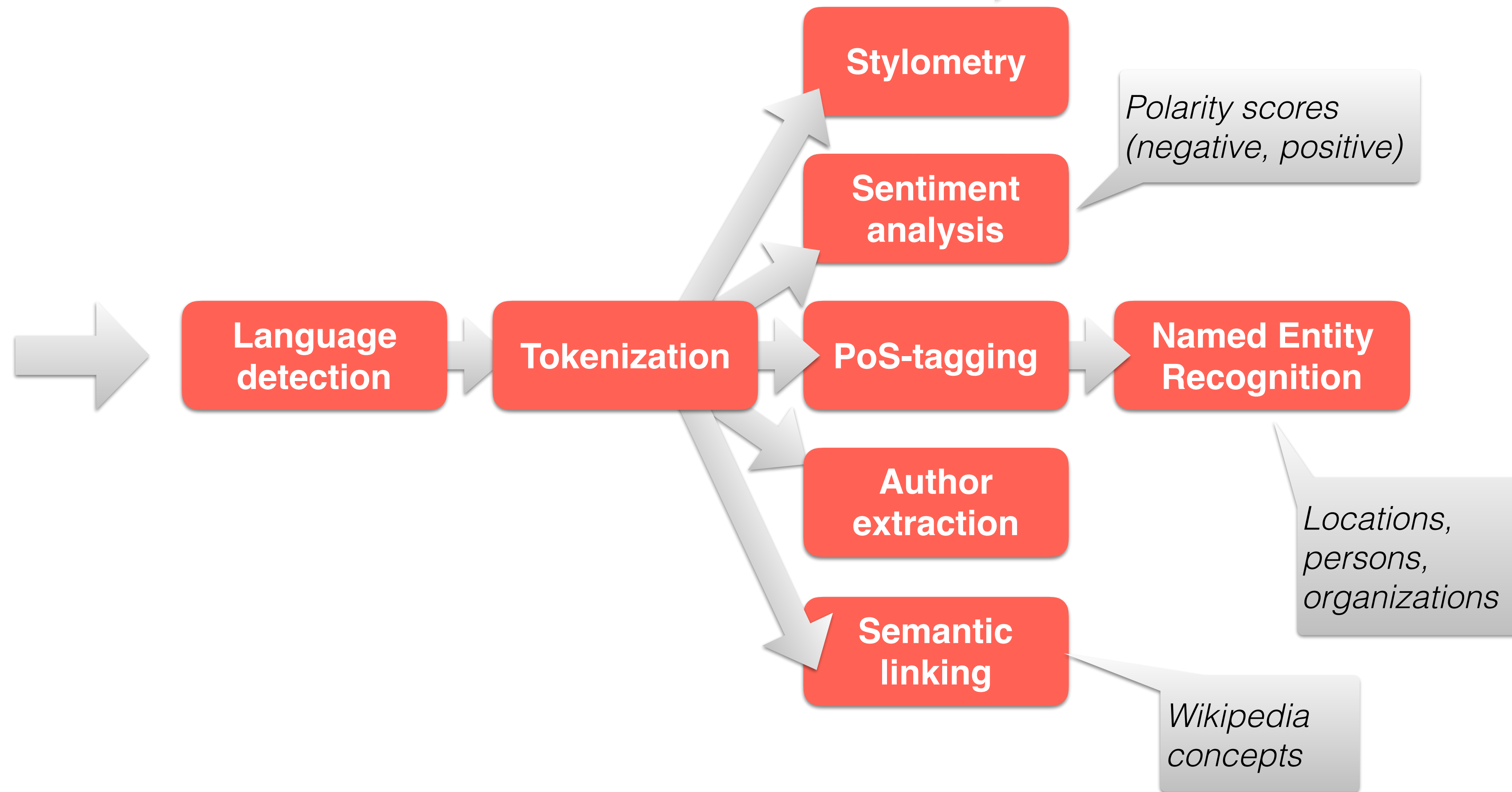
Author
extraction

*Length, word
variation, vocabulary
richness, ...*

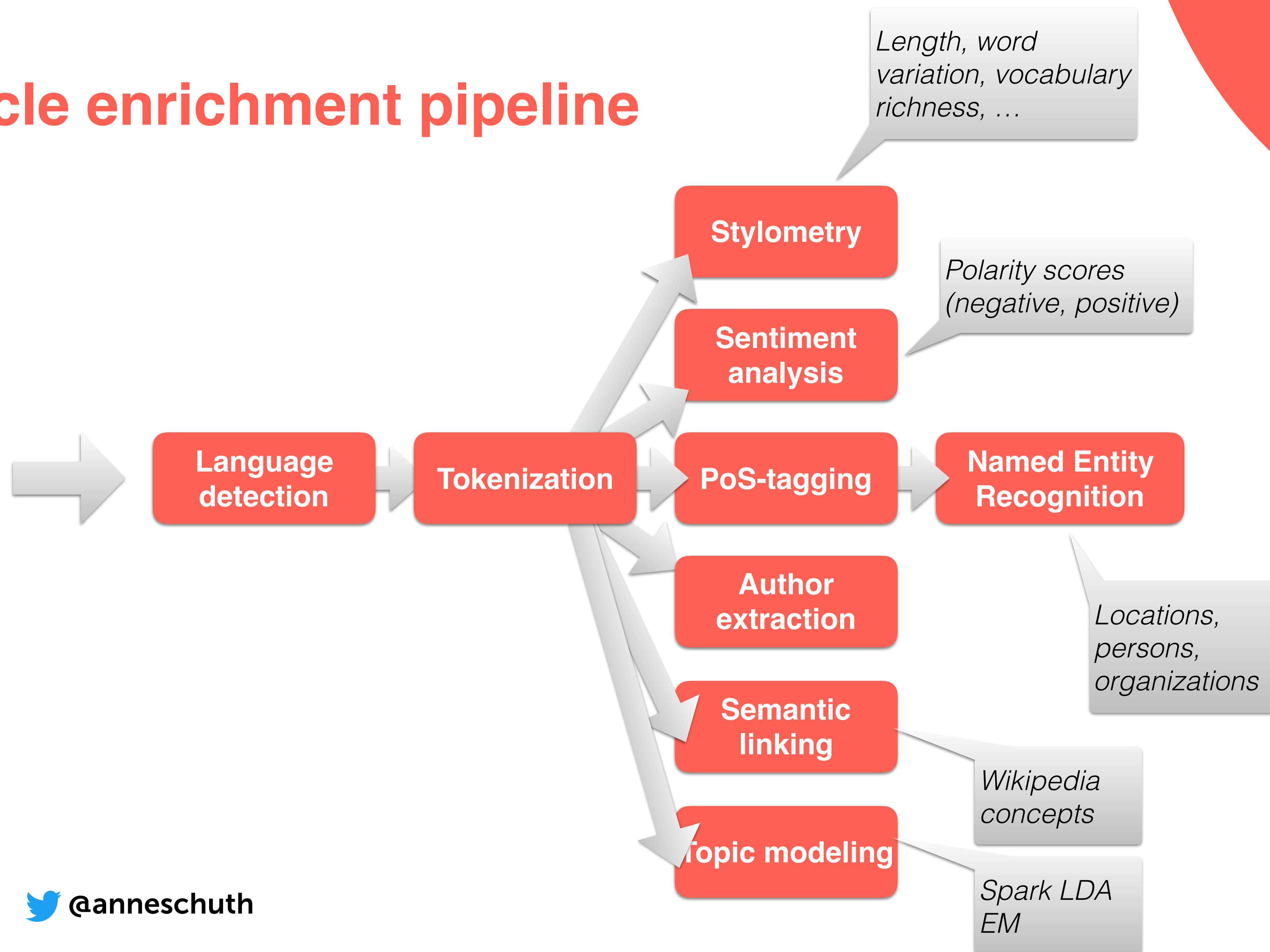
*Polarity scores
(negative, positive)*

*Locations,
persons,
organizations*

Article enrichment pipeline



Article enrichment pipeline



Article enrichment pipeline

Feature: Enrich item pipeline

Scenario: Enrich an item

Given I have the following item data

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"body":[{"content":"Smulpapen","type":"kicker"},
{"content":"Tom Kellerhuis stoomt uit allerhande keukens bedrieglijk simpele gerechten klaar.","type":"intro"},
{"content":"Dronken vegetariër","type":"h1"}, {"content":"TOM KELLERHUIS","type":"byline"},
{"content":"Ik ken een flink aantal restaurateurs dat growt bij het woord vegetariër. Ik ken er zelfs een paar die hem bewust uit hun zaak weren. \"U eet geen vlees of vis? Wat doet u hier dan?\" hoorde ik ooit als pissig antwoord op de vraag of er soms ook gerechten zónder vis of vlees op de kaart stonden.","type":"p"}, {"content":"Een goeie kok wil nu eenmaal laten zien wat hij in huis heeft. Dat zit hem vooral in de vlees- en visbereidingen, of in de sauzen, waarin vaak ook vlees- en visproducten zijn verwerkt. Vanuit dat oogpunt snap ik de kok wel. Maar steeds meer mensen kiezen ervoor om minder vlees of vis te consumeren, om hen moverende redenen. De één denkt aan het milieu en de consumptiemaatschappij, de ander aan het dierenwelzijn, weer een ander louter aan zijn eigen gezondheid.","type":"p"}, {"content":"Hoewel er aan het woord vegetariër nog steeds een sektarisch randje kleeft, mogen we toch wel stellen dat hij tegenwoordig lang zo suf niet meer is als het aloude stereotype beeld: het op sandalen – waarin platvoeten in geitenwollensokken – sjokkende en van elke humor gespeende tiepje, met linnen draagtas op zoek naar gedroogde sojabonen en tempé voor de avondmaaltijd.","type":"p"}, {"content":"Ik kreeg laatst het receptenboek De dronken vegetariër van Floor Overgoor, Hanny Roskamp en Yannick Slagter toegezonden, dat gehakt maakt van dat oude cliché. Allemaal vegagerechten met een tic (en soms flink wat, zoals in bijgaand recept. Roskamp schrijft in haar voorwoord: 'We zijn gaan beseffen dat die dronken vegetariër een betere ambassadeur is voor een diervriendelijke wereld dan een vegetariër die zichzelf opsluit achter een muur van morele superioriteit.'","type":"p"}, {"content":"Welaan, het beeld is dus aan het kantelen. Ik hoop snel eens zo'n dronken vegetariër tegen te komen!","type":"p"}, {"content":"Reageren? t.kellerhuis@parool.nl","type":"p"}, {"content":"Wijnfondue","type":"ph"}, {"content":"(voor 2 personen)","type":"p"}, {"content":"1/2 liter vega-bouillon, 1/2 fles pinot noir, 1/2 aubergine in plakken, 200 g oesterzwammen, 200 g bospaddenstoelen, 1 courgette in plakken, 200 g tofoe in repen.","type":"p"}, {"content":"Simpeler en romantischer dan dit wordt het niet. Maak de bouillon, breng aan de kook, giet de wijn erbij en breng opnieuw aan de kook (maar laat niet doorkoken: zonde van de wijn!).","type":"p"}, {"content":"Zet dit heerlijke vocht op een fonduestel, warmhoudplaatje of theelicht. Gooi een paar flinke handen groentes en tofoe in het hete vocht en haal de stukken er na een minuut of 5 weer uit; liefst met zo'n Chinees fonduemandje, maar een vork werkt ook prima.","type":"p"}, {"content":"Laat de volgende portie groente en tofoe garen in het vocht, terwijl je de eerste portie opeet.","type":"p"}, {"content":"Eet de stukjes groente met brood en knoflookboter. Dippen in knoflooksaus kan uiteraard ook.","type":"p"}],
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"provider":{"id":"par"}}
"""
```


Feature: Enrich item pipeline

Scenario: Enrich an item

Given I have the following item data

```
"""json
{"_links":{"self":{"href":"s3://static.blendle.nl/publication/par/2015/01/27/item/3895280/version/1/private/content.json"}}
"body":[{"content":{"content":"Tom Kellerhuis stoomt uit allerlei keukens bedrieglijk simpele gerechten klaar."
{"content":"Recepten voor vegetariërs (vrij naar Floor Overgoor, Hanny Roskamp en Yannick Slagter toegezonden, dat gehakt maakt van dat oude cliché. Allemaal vegagerechten met een tic (en soms flink wat, zoals in bijgaand recept. Roskamp schrijft in haar voorwoord: 'We zijn gaan beseffen dat die dronken vegetariër een betere ambassadeur is voor
en visproducten zijn verwerkt. Vanuit dat oogpunt snap ik de kok wel. Maar steeds meer mensen kiezen ervoor om minder vlees of vis te consumeren, om hen moverende redenen. De één denkt aan het milieu en de consumptiemaatschappij, de ander aan het dierenwelzijn, weer een ander louter aan zijn eigen gezondheid.
Hoewel er aan het woord vegetariër nog steeds een sektarisch randje kleeft, mogen we toch wel stellen dat hij tegenwoordig lang zo suf niet meer is als het aloude stereotype beeld: het op sandalen - waarin platvoeten in geitenwollensokken - sjokkende en van elke humor gespeende tiepje, met linnen draagtas op zoek naar gedroogde sojabonen en tempé voor de avondmaaltijd.
Ik kreeg laatst het receptenboek De dronken vegetariër van Floor Overgoor, Hanny Roskamp en Yannick Slagter toegezonden, dat gehakt maakt van dat oude cliché. Allemaal vegagerechten met een tic (en soms flink wat, zoals in bijgaand recept. Roskamp schrijft in haar voorwoord: 'We zijn gaan beseffen dat die dronken vegetariër een betere ambassadeur is voor
een diervriendelijke wereld dat zichzelf opsluit achter een superioriteit.'
Welaan, het beeld is dus aan het veranderen. Het is niet meer zo'n dronken vegetariër die in geitenwollen sokken en platvoeten op sandalen loopt. Het is een vegetariër die in geitenwollen sokken en platvoeten op sandalen loopt. Het is een vegetariër die in geitenwollen sokken en platvoeten op sandalen loopt.
Reageren? t.kellerhuis@parool.nl
"""
```

Smulpapen

Dronken vegetariër

Tom Kellerhuis stoomt uit allerlei keukens bedrieglijk simpele gerechten klaar.

TOM KELLERHUIS

Ik ken een flink aantal restaurateurs dat gruwet bij het woord vegetariër. Ik ken er zelfs een paar die hem bewust uit hun zaak weren. "U eet geen vlees of vis? Wat doet u hier dan?" hoorde ik ooit als pissig antwoord op de vraag of er soms ook gerechten zonder vis of vlees op de kaart stonden.

Een goeie kok wil nu eenmaal laten zien wat hij in huis heeft. Dat zit hem vooral in de vlees- en visbereidingen, of in de sauzen, waarin vaak ook vlees-

en visproducten zijn verwerkt. Vanuit dat oogpunt snap ik de kok wel. Maar steeds meer mensen kiezen ervoor om minder vlees of vis te consumeren, om hen moverende redenen. De één denkt aan het milieu en de consumptiemaatschappij, de ander aan het dierenwelzijn, weer een ander louter aan zijn eigen gezondheid.

Hoewel er aan het woord vegetariër nog steeds een sektarisch randje kleeft, mogen we toch wel stellen dat hij tegenwoordig lang zo suf niet meer is als het aloude stereotype beeld: het op sandalen - waarin platvoeten in geitenwollensokken - sjokkende en van elke humor gespeende tiepje, met linnen draagtas op zoek naar gedroogde sojabonen en tempé voor de avondmaaltijd.

Ik kreeg laatst het receptenboek De dronken vegetariër van Floor Overgoor, Hanny Roskamp en Yannick Slagter toegezonden, dat gehakt maakt van dat oude cliché. Allemaal vegagerechten met een tic (en soms flink wat, zoals in bijgaand recept. Roskamp schrijft in haar voorwoord: 'We zijn gaan beseffen dat die dronken vegetariër een betere ambassadeur is voor

een diervriendelijke wereld dat zichzelf opsluit achter een superioriteit.'

Welaan, het beeld is dus aan het veranderen. Het is niet meer zo'n dronken vegetariër

Reageren? t.kellerhuis@parool.nl

Wijnfondue

(voor 2 personen)

1/2 liter vega-bouillon, 1/2 aubergine in plakken, 200 g oerbospaddenstoelen, 1 courgette in plakjes, 1 ui in repen.

Simpeler en romantischer dan de klassieke fondue. Maak de bouillon, breng aan de kook en breng opnieuw aan de kook. Doe de groenten erin en doorkoken: zonde van de wijn!).

Zet dit heerlijke vocht in een warmhoudplaatje of theelicht. Doe de handen groentes en tofoe in het vocht en laat ze erin staan. Na een minuut of 5 w

Feature: Enrich item pipeline

Scenario: Enrich an item

Given I have the following item data

```
"""json
{"_links":{"self":{"href":"s3://static.blendle.nl/publication/par/2015/01/27/item/3895280/version/1/private/content.json"}}},
"body":[{"content":"Smulpapen","type":"kicker"},
{"content":"Tom Kellerhuis stoomt uit allerhande keukens bedrieglijk simpele gerechten klaar.","type":"intro"},
{"content":"Dronken vegetariër","type":"h1"}, {"content":"TOM KELLERHUIS","type":"byline"},
{"content":"Ik ken een flink aantal restaurateurs dat gruwet bij het woord vegetariër. Ik ken er zelfs een paar die hem bewust uit hun zaak weren. \"U eet geen vlees of vis? Wat doet u hier dan?\" hoorde ik ooit als pissig antwoord op de vraag of er soms ook gerechten zónder vis of vlees op de kaart stonden.","type":"p"}, {"content":"Een goeie kok wil nu eenmaal laten zien wat hij in huis heeft. Dat zit hem vooral in de vlees- en visbereidingen, of in de sauzen, waarin vaak ook vlees- en visproducten zijn verwerkt. Vanuit dat oogpunt snap ik de kok wel. Maar steeds meer mensen kiezen ervoor om minder vlees of vis te consumeren, om hen moverende redenen. De één denkt aan het milieu en de consumptiemaatschappij, de ander aan het dierenwelzijn, weer een ander louter aan zijn eigen gezondheid.","type":"p"}, {"content":"Hoewel er aan het woord vegetariër nog steeds een sektarisch randje kleeft, mogen we toch wel stellen dat hij tegenwoordig lang zo suf niet meer is als het aloude stereotype beeld: het op sandalen – waarin platvoeten in geitenwollensokken – sjokkende en van elke humor gespeende tiepje, met linnen draagtas op zoek naar gedroogde sojabonen en tempé voor de avondmaaltijd.","type":"p"}, {"content":"Ik kreeg laatst het receptenboek De dronken vegetariër van Floor Overgoor, Hanny Roskamp en Yannick Slagter toegezonden, dat gehakt maakt van dat oude cliché. Allemaal vegagerechten met een tic (en soms flink wat, zoals in bijgaand recept. Roskamp schrijft in haar voorwoord: 'We zijn gaan beseffen dat die dronken vegetariër een betere ambassadeur is voor een diervriendelijke wereld dan een vegetariër die zichzelf opsluit achter een muur van morele superioriteit.'","type":"p"}, {"content":"Welaan, het beeld is dus aan het kantelen. Ik hoop snel eens zo'n dronken vegetariër tegen te komen!","type":"p"}, {"content":"Reageren? t.kellerhuis@parool.nl","type":"p"}, {"content":"Wijnfondue","type":"ph"}, {"content":"(voor 2 personen)","type":"p"}, {"content":"1/2 liter vega-bouillon, 1/2 fles pinot noir, 1/2 aubergine in plakken, 200 g oesterzwammen, 200 g bospaddenstoelen, 1 courgette in plakken, 200 g tofoe in repen.","type":"p"}, {"content":"Simpeler en romantischer dan dit wordt het niet. Maak de bouillon, breng aan de kook, giet de wijn erbij en breng opnieuw aan de kook (maar laat niet doorkoken: zonde van de wijn!).","type":"p"}, {"content":"Zet dit heerlijke vocht op een fonduestel, warmhoudplaatje of theelicht. Gooi een paar flinke handen groentes en tofoe in het hete vocht en haal de stukken er na een minuut of 5 weer uit; liefst met zo'n Chinees fonduemandje, maar een vork werkt ook prima.","type":"p"}, {"content":"Laat de volgende portie groente en tofoe garen in het vocht, terwijl je de eerste portie opeet.","type":"p"}, {"content":"Eet de stukjes groente met brood en knoflookboter. Dippen in knoflooksaus kan uiteraard ook.","type":"p"}],
"date":"2015-01-27T00:00:00+00:00",
"format_version":4,
"id":"bnl-par-20150127-3895280",
"issue":{"id":"bnl-par-20150127"},
"item_index":70,
"provider":{"id":"par"}}
"""
```


When I send it through the enrichment pipeline language|tokenizer|postagger|ner|stylometry|author|semanticizer|sentiment

Then I should have the following enrichments in the result

| enrichment | value |
|------------|----------------|
| language | nl |
| author | TOM KELLERHUIS |

And I should have the following stylometry enrichments in the result

| enrichment | value |
|----------------------|-----------------|
| number_of_paragraphs | 12 |
| number_of_words | 432 |
| article_length | 2542 |
| vocab_richness | 40.5376820773 |
| word_variation | 0.585648148148 |
| avg_word_length | 4.98611111111 |
| word_size_short | 0.553240740741 |
| word_size_medium | 0.391203703704 |
| word_size_long | 0.0555555555556 |
| hapax_legomena | 0.4375 |
| hapax_dislegomena | 0.0763888888889 |
| number_of_images | 1 |

And I should have the following semantic links in the result

| url | title | text | senseProbability | count | norm |
|---|------------------------|------------------------|---------------------|-------|---|
| http://nl.wikipedia.org/wiki/Avondmaaltijd | Avondmaaltijd | avondmaaltijd | 0.36666666666666664 | 1 | http://dbpedia.org/resource/Supper |
| http://nl.wikipedia.org/wiki/Tic | Tic | tic | 1.0416666666666667 | 1 | http://dbpedia.org/resource/Tic |
| http://nl.wikipedia.org/wiki/Platvoeten | Platvoeten | platvoeten | 0.47058823529411764 | 1 | http://dbpedia.org/resource/Flat_feet |
| http://nl.wikipedia.org/wiki/Groente | Groente | groente | 0.41304347826086957 | 2 | http://dbpedia.org/resource/Vegetable |
| http://nl.wikipedia.org/wiki/Sojaboon | Sojaboon | sojabonen | 0.6206896551724138 | 1 | http://dbpedia.org/resource/Soybean |
| http://nl.wikipedia.org/wiki/Vegetarisme | Vegetarisme | vegetariër | 2.6956521739130435 | 6 | http://dbpedia.org/resource/Vegetarianism |
| http://nl.wikipedia.org/wiki/Pinot%20noir | Pinot noir | pinot noir | 0.8827586206896552 | 1 | http://dbpedia.org/resource/Pinot_noir |
| http://nl.wikipedia.org/wiki/Knoflooksaus | Knoflooksaus | knoflooksaus | 0.35294117647058826 | 1 | |
| http://nl.wikipedia.org/wiki/Consumptiemaatschappij | Consumptiemaatschappij | consumptiemaatschappij | 0.5121951219512195 | 1 | |
| http://nl.wikipedia.org/wiki/Courgette | Courgette | courgette | 0.8421052631578947 | 1 | http://dbpedia.org/resource/Zucchini |
| http://nl.wikipedia.org/wiki/Tofoe | Tofoe | tofoe | 0.8275862068965517 | 3 | http://dbpedia.org/resource/Tofu |
| http://nl.wikipedia.org/wiki/Bouillon%20%28voedsel%29 | Bouillon (voedsel) | - bouillon | 0.5752212389380531 | 1 | http://dbpedia.org/resource/Broth |
| http://nl.wikipedia.org/wiki/Bouillon%20%28voedsel%29 | Bouillon (voedsel) | bouillon | 0.5752212389380531 | 2 | http://dbpedia.org/resource/Broth |
| http://nl.wikipedia.org/wiki/Aubergine%20%28plant%29 | Aubergine (plant) | aubergine | 0.8666666666666667 | 1 | http://dbpedia.org/resource/Eggplant |
| http://nl.wikipedia.org/wiki/Kensoort | Kensoort | ken | 0.8787878787878788 | 2 | |

And I should have the following named entities in the result

| entity | tag | count |
|-----------------|-----|-------|
| TOM KELLERHUIS | PER | 1 |
| FLOOR OVERGOOR | PER | 1 |
| HANNY ROSKAMP | PER | 2 |
| YANNICK SLAGTER | PER | 1 |
| WIJNFONDUE | LOC | 1 |
| SIMPELER | PER | 1 |

When I send it through the enrichment pipeline language|tokenizer|postagger|ner|stylometry|author|semanticizer|sentiment
Then I should have the following enrichments in the result

| enrichment | value |
|------------|----------------|
| language | nl |
| author | TOM KELLERHUIS |

And I should have the following numerical averages in the result

| | |
|-------------------|-----------------|
| avg_word_length | 4.98611111111 |
| word_size_short | 0.553240740741 |
| word_size_medium | 0.391203703704 |
| word_size_long | 0.0555555555556 |
| hapax_legomena | 0.4375 |
| hapax_dislegomena | 0.0763888888889 |
| number_of_images | 1 |

And I should have the following semantic links in the result

| url | title | text | senseProbability | count | norm |
|---|------------------------|------------------------|---------------------|-------|---|
| http://nl.wikipedia.org/wiki/Avondmaaltijd | Avondmaaltijd | avondmaaltijd | 0.36666666666666664 | 1 | http://dbpedia.org/resource/Supper |
| http://nl.wikipedia.org/wiki/Tic | Tic | tic | 1.0416666666666667 | 1 | http://dbpedia.org/resource/Tic |
| http://nl.wikipedia.org/wiki/Platvoeten | Platvoeten | platvoeten | 0.47058823529411764 | 1 | http://dbpedia.org/resource/Flat_feet |
| http://nl.wikipedia.org/wiki/Groente | Groente | groente | 0.41304347826086957 | 2 | http://dbpedia.org/resource/Vegetable |
| http://nl.wikipedia.org/wiki/Sojaboon | Sojaboon | sojabonen | 0.6206896551724138 | 1 | http://dbpedia.org/resource/Soybean |
| http://nl.wikipedia.org/wiki/Vegetarisme | Vegetarisme | vegetariër | 2.6956521739130435 | 6 | http://dbpedia.org/resource/Vegetarianism |
| http://nl.wikipedia.org/wiki/Pinot%20noir | Pinot noir | pinot noir | 0.8827586206896552 | 1 | http://dbpedia.org/resource/Pinot_noir |
| http://nl.wikipedia.org/wiki/Knoflooksaus | Knoflooksaus | knoflooksaus | 0.35294117647058826 | 1 | |
| http://nl.wikipedia.org/wiki/Consumptiemaatschappij | Consumptiemaatschappij | consumptiemaatschappij | 0.5121951219512195 | 1 | |
| http://nl.wikipedia.org/wiki/Courgette | Courgette | courgette | 0.8421052631578947 | 1 | http://dbpedia.org/resource/Zucchini |
| http://nl.wikipedia.org/wiki/Tofoe | Tofoe | tofoe | 0.8275862068965517 | 3 | http://dbpedia.org/resource/Tofu |
| http://nl.wikipedia.org/wiki/Bouillon%20%28voedsel%29 | Bouillon (voedsel) | - bouillon | 0.5752212389380531 | 1 | http://dbpedia.org/resource/Broth |
| http://nl.wikipedia.org/wiki/Bouillon%20%28voedsel%29 | Bouillon (voedsel) | bouillon | 0.5752212389380531 | 2 | http://dbpedia.org/resource/Broth |
| http://nl.wikipedia.org/wiki/Aubergine%20%28plant%29 | Aubergine (plant) | aubergine | 0.8666666666666667 | 1 | http://dbpedia.org/resource/Eggplant |
| http://nl.wikipedia.org/wiki/Kensoort | Kensoort | ken | 0.8787878787878788 | 2 | |

And I should have the following named entities in the result

| entity | tag | count |
|-----------------|-----|-------|
| TOM KELLERHUIS | PER | 1 |
| FLOOR OVERGOOR | PER | 1 |
| HANNY ROSKAMP | PER | 2 |
| YANNICK SLAGTER | PER | 1 |
| WIJNFONDUE | LOC | 1 |
| SIMPELER | PER | 1 |

When I send it through the enrichment pipeline language|tokenizer|postagger|ner|stylometry|author|semanticizer|sentiment

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| | |
|----------------------|------------------|
| enrichment | value |
| number_of_paragraphs | 12 |
| number_of_words | 432 |
| article_length | 2542 |
| vocab_richness | 40.5376820773 |
| word_variation | 0.585648148148 |
| avg_word_length | 4.986111111111 |
| word_size_short | 0.553240740741 |
| word_size_medium | 0.391203703704 |
| word_size_long | 0.05555555555556 |
| hapax_legomena | 0.4375 |
| hapax_dislegomena | 0.07638888888889 |
| number_of_images | 1 |

| | | |
|-----|-------|---|
| | count | norm |
| 564 | 1 | http://dbpedia.org/resource/Supper |
| 57 | 1 | http://dbpedia.org/resource/Tic |
| 764 | 1 | http://dbpedia.org/resource/Flat_feet |
| 957 | 2 | http://dbpedia.org/resource/Vegetable |
| 38 | 1 | http://dbpedia.org/resource/Soybean |
| 35 | 6 | http://dbpedia.org/resource/Vegetarianism |
| 52 | 1 | http://dbpedia.org/resource/Pinot_noir |
| 326 | 1 | |
| 95 | 1 | |
| 47 | 1 | http://dbpedia.org/resource/Zucchini |
| 17 | 3 | http://dbpedia.org/resource/Tofu |
| 31 | 1 | http://dbpedia.org/resource/Broth |
| 31 | 2 | http://dbpedia.org/resource/Broth |
| 57 | 1 | http://dbpedia.org/resource/Eggplant |
| 38 | 2 | |

| | | |
|-----------------|-----|-------|
| entity | tag | count |
| TOM KELLERHUIS | PER | 1 |
| FLOOR OVERGOOR | PER | 1 |
| HANNY ROSKAMP | PER | 2 |
| YANNICK SLAGTER | PER | 1 |
| WIJNFONDUE | LOC | 1 |
| SIMPELER | PER | 1 |

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| <http://nl.wikipedia.org/wiki/Avondmaaltijd>

| <http://nl.wikipedia.org/wiki/Tic>

| <http://nl.wikipedia.org/wiki/Platvoeten>

| <http://nl.wikipedia.org/wiki/Groente>

| <http://nl.wikipedia.org/wiki/Sojaboon>

| <http://nl.wikipedia.org/wiki/Vegetarisme>

| <http://nl.wikipedia.org/wiki/Pinot%20noir>

| <http://nl.wikipedia.org/wiki/Knoflooksaus>

| <http://nl.wikipedia.org/wiki/Consumptiemaatschappij>

| <http://nl.wikipedia.org/wiki/Courgette>

| <http://nl.wikipedia.org/wiki/Tofoe>

| <http://nl.wikipedia.org/wiki/Bouillon%20%28voedsel%29>

| <http://nl.wikipedia.org/wiki/Bouillon%20%28voedsel%29>

| <http://nl.wikipedia.org/wiki/Aubergine%20%28plant%29>

| <http://nl.wikipedia.org/wiki/Kensoort>

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| [e/Vegetarianism](#)
| [e/Pinot_noir](#)

| [e/Zucchini](#)
| [e/Tofu](#)
| [e/Broth](#)
| [e/Broth](#)
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Hoofdgerecht - Wikipedia



<https://nl.wikipedia.org/wiki/Hoofdgerecht>



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Een **hoofdgerecht** wordt in de klassieke keuken als het belangrijkste deel van een [diner](#) gezien. Het kan als [gang](#) op een [menukaart](#) te vinden zijn.

Kenmerk van een hoofdgerecht is dat er nadruk op wordt gelegd door deze uitgebreider dan de andere gangen te serveren. In het [Frans](#) wordt het wel uitgelegd als "pièce de resistance".^[1] Het zwaarste deel van de maaltijd, meestal rondom [vlees](#), [gebraad](#) of [gevogelte](#). Tezamen met het vlees kunnen [groenten](#), [sauzen](#) en [bijgerechten](#) worden geserveerd.

In de zin van "belangrijkste onderdeel van de maaltijd" kan een hoofdgerecht in de moderne keuken evengoed rondom bijvoorbeeld [vis](#) of een groenteschotel zijn gecreëerd.

Referenties [[bewerken](#)]



Hoofdgerecht van een [kerstdiner](#) in [schalen](#) op tafel.



<https://nl.wikipedia.org/wiki/Avondmaaltijd>

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| <http://nl.wikipedia.org/wiki/Knoflooksaus>

| <http://nl.wikipedia.org/wiki/Consumptiemaatschappij>

| <http://nl.wikipedia.org/wiki/Courgette>

| <http://nl.wikipedia.org/wiki/Tofoe>

| <http://nl.wikipedia.org/wiki/Bouillon%20%28voedsel%29>

| <http://nl.wikipedia.org/wiki/Bouillon%20%28voedsel%29>

| <http://nl.wikipedia.org/wiki/Aubergine%20%28plant%29>

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| [e/Flat_feet](#)
| [e/Vegetable](#)
| [e/Soybean](#)
| [e/Vegetarianism](#)
| [e/Pinot_noir](#)

| [e/Zucchini](#)
| [e/Tofu](#)
| [e/Broth](#)
| [e/Broth](#)
| [e/Eggplant](#)

url

<http://nl.wikipedia.org/wiki/Avondmaaltijd>

Avondmaaltijd - Wikipedia

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Чăвашла

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English

Esperanto

Español

Euskara

Suomi

Français

Galego

עברית

Bahasa Indonesia

Íslenska

Italiano

日本語

한국어


steeds gebruikt om de middagmaaltijd aan te duiden.^[1] In Parijs ontstond de gewoonte om de belangrijkste maaltijd van de dag 's avonds te eten.^[1]

Vandaag betekent diner in België en Nederland een vaste maaltijd die met meerdere personen wordt genuttigd. In praktijk gebeurt dit vaak 's avonds. Al begint een diner soms al in de middaguren. Er wordt doorgaans meer tijd besteed om het maal te nuttigen. De locatie kan ook buitenshuis plaatsvinden. Wordt er tijdens het diner de gelegenheid geboden om te dansen, dan spreekt men van een *diner dansant*. Een officieel diner dat door een [staatshoofd](#) wordt gegeven, noemt men een *staatsdiner* of *staatsbanket*; alleen genodigden mogen hieraan deelnemen. Vaak wordt bij een [staatsbezoek](#) een staatsdiner aangeboden.

Een ander woord voor het avondmaal is het 'souper'. De oorsprong hiervan ligt bij het eten van de inhoud van een ketel (stoverij of soep), die een tijdlang had staan garen.^[1]

Kerstdiner [\[bewerken \]](#)

<https://en.wikipedia.org/wiki/Supper>



Avondmaal, door Lucas Cranach

<http://nl.wikipedia.org/wiki/Aubergine%20%28plant%29>

<http://nl.wikipedia.org/wiki/Kensoort>

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| <http://nl.wikipedia.org/wiki/Avondmaaltijd>

| <http://nl.wikipedia.org/wiki/Tic>

| <http://nl.wikipedia.org/wiki/Platvoeten>

| <http://nl.wikipedia.org/wiki/Groente>

| <http://nl.wikipedia.org/wiki/Sojaboon>

| <http://nl.wikipedia.org/wiki/Vegetarisme>

| <http://nl.wikipedia.org/wiki/Pinot%20noir>

| <http://nl.wikipedia.org/wiki/Knoflooksaus>

| <http://nl.wikipedia.org/wiki/Consumptiemaatschappij>

| <http://nl.wikipedia.org/wiki/Courgette>

| <http://nl.wikipedia.org/wiki/Tofoe>

| <http://nl.wikipedia.org/wiki/Bouillon%20%28voedsel%29>

| <http://nl.wikipedia.org/wiki/Bouillon%20%28voedsel%29>

| <http://nl.wikipedia.org/wiki/Aubergine%20%28plant%29>

| <http://nl.wikipedia.org/wiki/Kensoort>

| [e/Supper](#)
| [e/Tic](#)
| [e/Flat_feet](#)
| [e/Vegetable](#)
| [e/Soybean](#)
| [e/Vegetarianism](#)
| [e/Pinot_noir](#)

| [e/Zucchini](#)
| [e/Tofu](#)
| [e/Broth](#)
| [e/Broth](#)
| [e/Eggplant](#)

W
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norm

<http://dbpedia.org/resource/Supper>

<http://dbpedia.org/resource/Tic>

http://dbpedia.org/resource/Flat_feet

<http://dbpedia.org/resource/Vegetable>

<http://dbpedia.org/resource/Soybean>

<http://dbpedia.org/resource/Vegetarianism>

http://dbpedia.org/resource/Pinot_noir

<http://dbpedia.org/resource/Zucchini>

<http://dbpedia.org/resource/Tofu>

<http://dbpedia.org/resource/Broth>

<http://dbpedia.org/resource/Broth>

<http://dbpedia.org/resource/Eggplant>

nt

norm

<http://dbpedia.org/resource/Supper>

<http://dbpedia.org/resource/Tic>

http://dbpedia.org/resource/Flat_feet

<http://dbpedia.org/resource/Vegetable>

<http://dbpedia.org/resource/Soybean>

<http://dbpedia.org/resource/Vegetarianism>

http://dbpedia.org/resource/Pinot_noir

<http://dbpedia.org/resource/Zucchini>

<http://dbpedia.org/resource/Tofu>

<http://dbpedia.org/resource/Broth>

<http://dbpedia.org/resource/Broth>

<http://dbpedia.org/resource/Eggplant>

When I send it through the enrichment pipeline language|tokenizer|postagger|ner|stylometry|author|semanticizer|sentiment

Then I should have the following enrichments in the result

| | |
|------------|----------------|
| enrichment | value |
| language | nl |
| author | TOM KELLERHUIS |

And I should have the following stylometry enrichments in the result

| | |
|----------------------|------------------|
| enrichment | value |
| number_of_paragraphs | 12 |
| number_of_words | 432 |
| article_length | 2542 |
| vocab_richness | 40.5376820773 |
| word_variation | 0.585648148148 |
| avg_word_length | 4.986111111111 |
| word_size_short | 0.553240740741 |
| word_size_medium | 0.391203703704 |
| word_size_long | 0.05555555555556 |
| hapax_legomena | 0.4375 |
| hapax_dislegomena | 0.07638888888889 |
| number_of_images | 1 |

And I should have the following semantic links in the result

| | | | | | |
|---|------------------------|------------------------|---------------------|-------|---|
| url | title | text | senseProbability | count | norm |
| http://nl.wikipedia.org/wiki/Avondmaaltijd | Avondmaaltijd | avondmaaltijd | 0.36666666666666664 | 1 | http://dbpedia.org/resource/Supper |
| http://nl.wikipedia.org/wiki/Tic | Tic | tic | 1.0416666666666667 | 1 | http://dbpedia.org/resource/Tic |
| http://nl.wikipedia.org/wiki/Platvoeten | Platvoeten | platvoeten | 0.47058823529411764 | 1 | http://dbpedia.org/resource/Flat_feet |
| http://nl.wikipedia.org/wiki/Groente | Groente | groente | 0.41304347826086957 | 2 | http://dbpedia.org/resource/Vegetable |
| http://nl.wikipedia.org/wiki/Sojaboon | Sojaboon | sojabonen | 0.6206896551724138 | 1 | http://dbpedia.org/resource/Soybean |
| http://nl.wikipedia.org/wiki/Vegetarisme | Vegetarisme | vegetariër | 2.6956521739130435 | 6 | http://dbpedia.org/resource/Vegetarianism |
| http://nl.wikipedia.org/wiki/Pinot%20noir | Pinot noir | pinot noir | 0.8827586206896552 | 1 | http://dbpedia.org/resource/Pinot_noir |
| http://nl.wikipedia.org/wiki/Knoflooksaus | Knoflooksaus | knoflooksaus | 0.35294117647058826 | 1 | |
| http://nl.wikipedia.org/wiki/Consumptiemaatschappij | Consumptiemaatschappij | consumptiemaatschappij | 0.5121951219512195 | 1 | |
| | | | 0.8421052631578947 | 1 | http://dbpedia.org/resource/Zucchini |
| | | | 0.8275862068965517 | 3 | http://dbpedia.org/resource/Tofu |
| | | | 0.5752212389380531 | 1 | http://dbpedia.org/resource/Broth |
| | | | 0.5752212389380531 | 2 | http://dbpedia.org/resource/Broth |
| | | | 0.8666666666666667 | 1 | http://dbpedia.org/resource/Eggplant |
| | | | 0.8787878787878788 | 2 | |

At

| | | |
|-----------------|-----|-------|
| entity | tag | count |
| TOM KELLERHUIS | PER | 1 |
| FLOOR OVERGOOR | PER | 1 |
| HANNY ROSKAMP | PER | 2 |
| YANNICK SLAGTER | PER | 1 |

When I send it through the enrichment pipeline language|tokenizer|postagger|ner|stylometry|author|semanticizer|sentiment

Then I should have the following enrichments in the result

| enrichment | value |
|------------|----------------|
| language | nl |
| author | TOM KELLERHUIS |

And I should have the following stylometry enrichments in the result

| enrichment | value |
|----------------------|-----------------|
| number_of_paragraphs | 12 |
| number_of_words | 432 |
| article_length | 2542 |
| vocab_richness | 40.5376820773 |
| word_variation | 0.585648148148 |
| avg_word_length | 4.98611111111 |
| word_size_short | 0.553240740741 |
| word_size_medium | 0.391203703704 |
| word_size_long | 0.0555555555556 |
| hapax_legomena | 0.4375 |
| hapax_dislegomena | 0.0763888888889 |
| number_of_images | 1 |

And I should have the following semantic links in the result

| url | title | text | senseProbability | count | norm |
|---|------------------------|------------------------|---------------------|-------|---|
| http://nl.wikipedia.org/wiki/Avondmaaltijd | Avondmaaltijd | avondmaaltijd | 0.36666666666666664 | 1 | http://dbpedia.org/resource/Supper |
| http://nl.wikipedia.org/wiki/Tic | Tic | tic | 1.0416666666666667 | 1 | http://dbpedia.org/resource/Tic |
| http://nl.wikipedia.org/wiki/Platvoeten | Platvoeten | platvoeten | 0.47058823529411764 | 1 | http://dbpedia.org/resource/Flat_feet |
| http://nl.wikipedia.org/wiki/Groente | Groente | groente | 0.41304347826086957 | 2 | http://dbpedia.org/resource/Vegetable |
| http://nl.wikipedia.org/wiki/Sojaboon | Sojaboon | sojabonen | 0.6206896551724138 | 1 | http://dbpedia.org/resource/Soybean |
| http://nl.wikipedia.org/wiki/Vegetarisme | Vegetarisme | vegetariër | 2.6956521739130435 | 6 | http://dbpedia.org/resource/Vegetarianism |
| http://nl.wikipedia.org/wiki/Pinot%20noir | Pinot noir | pinot noir | 0.8827586206896552 | 1 | http://dbpedia.org/resource/Pinot_noir |
| http://nl.wikipedia.org/wiki/Knoflooksaus | Knoflooksaus | knoflooksaus | 0.35294117647058826 | 1 | |
| http://nl.wikipedia.org/wiki/Consumptiemaatschappij | Consumptiemaatschappij | consumptiemaatschappij | 0.5121951219512195 | 1 | |
| http://nl.wikipedia.org/wiki/Courgette | Courgette | courgette | 0.8421052631578947 | 1 | http://dbpedia.org/resource/Zucchini |
| http://nl.wikipedia.org/wiki/Tofoe | Tofoe | tofoe | 0.8275862068965517 | 3 | http://dbpedia.org/resource/Tofu |
| http://nl.wikipedia.org/wiki/Bouillon%20%28voedsel%29 | Bouillon (voedsel) | - bouillon | 0.5752212389380531 | 1 | http://dbpedia.org/resource/Broth |
| http://nl.wikipedia.org/wiki/Bouillon%20%28voedsel%29 | Bouillon (voedsel) | bouillon | 0.5752212389380531 | 2 | http://dbpedia.org/resource/Broth |
| http://nl.wikipedia.org/wiki/Aubergine%20%28plant%29 | Aubergine (plant) | aubergine | 0.8666666666666667 | 1 | http://dbpedia.org/resource/Eggplant |
| http://nl.wikipedia.org/wiki/Kensoort | Kensoort | ken | 0.8787878787878788 | 2 | |

And I should have the following named entities in the result

| entity | tag | count |
|-----------------|-----|-------|
| TOM KELLERHUIS | PER | 1 |
| FLOOR OVERGOOR | PER | 1 |
| HANNY ROSKAMP | PER | 2 |
| YANNICK SLAGTER | PER | 1 |
| WIJNFONDUE | LOC | 1 |
| SIMPELER | PER | 1 |

User enrichment pipeline

Feature: Combine enriched items into a user profile

Scenario combine two enriched items

Given "item1" with these enrichments

| | | |
|------------|----------------|--|
| enrichment | value | |
| language | nl | |
| author | TOM KELLERHUIS | |

And these stylometry enrichments

| | | |
|----------------------|----------------|--|
| enrichment | value | |
| number_of_paragraphs | 12 | |
| number_of_words | 432 | |
| article_length | 2542 | |
| vocab_richness | 40.5376820773 | |
| word_variation | 0.585648148148 | |
| avg_word_length | 4.98611111111 | |

And these named entities

| | | | |
|-----------------|-----|-------|--|
| entity | tag | count | |
| YANNICK SLAGTER | PER | 1 | |
| WIJNFONDUE | LOC | 1 | |
| SIMPELER | PER | 1 | |

Given "item2" with these enrichments

| | | |
|------------|---------------|--|
| enrichment | value | |
| language | de | |
| author | PETER LANDERS | |

And these stylometry enrichments

| | | |
|----------------------|--------------------|--|
| enrichment | value | |
| number_of_paragraphs | 7 | |
| number_of_words | 600 | |
| article_length | 4560 | |
| vocab_richness | 61.62260711030082 | |
| word_variation | 0.6265060240963856 | |
| avg_word_length | 5.578313253012048 | |

And these named entities

| | | | |
|----------------|-----|-------|--|
| entity | tag | count | |
| ANDRÉ SCHÜRRLE | PER | 3 | |
| VFL WOLFSBURG | ORG | 4 | |
| KAA | ORG | 5 | |

Feature: Combine enriched items into a user profile

Scenario combine two enriched items

Given "item1" with these enrichments

| | |
|------------|----------------|
| enrichment | value |
| language | nl |
| author | TOM KELLERHUIS |

And these stylometry enrichments

| | |
|----------------------|----------------|
| enrichment | value |
| number_of_paragraphs | 12 |
| number_of_words | 432 |
| article_length | 2542 |
| vocab_richness | 40.5376820773 |
| word_variation | 0.585648148148 |
| avg_word_length | 4.98611111111 |

And these named entities

| | | |
|-----------------|-----|-------|
| entity | tag | count |
| YANNICK SLAGTER | PER | 1 |
| WIJNFONDUE | LOC | 1 |
| SIMPELER | PER | 1 |

Given "item2" with these enrichments

| | |
|------------|---------------|
| enrichment | value |
| language | de |
| author | PETER LANDERS |

And these stylometry enrichments

| | |
|----------------------|--------------------|
| enrichment | value |
| number_of_paragraphs | 7 |
| number_of_words | 600 |
| article_length | 4560 |
| vocab_richness | 61.62260711030082 |
| word_variation | 0.6265060240963856 |
| avg_word_length | 5.578313253012048 |

And these named entities

| | | |
|----------------|-----|-------|
| entity | tag | count |
| ANDRÉ SCHÜRRLE | PER | 3 |
| VFL WOLFSBURG | ORG | 4 |
| KAA | ORG | 5 |

When I run the `UserEnrichmentTask` task and it's dependencies

Then the user "anne" should have the following profile:

```
"""json
{
  "count": 2,
  "enrichments": {
    "language": [
      {
        "count": 1,
        "name": "nl"
      },
      {
        "count": 1,
        "name": "en"
      }
    ],
    "author": [
      {
        "count": 1,
        "name": "TOM KELLERHUIS"
      },
      {
        "count": 1,
        "name": "PETER LANDERS"
      }
    ]
  },
  "stylometry": [
    {
      "count": 2,
      "mean": 2177.5,
      "stdev": 515.4808434849931,
      "name": "article_length"
    },
    {
      "count": 2,
      "mean": 5.165410504361017,
      "stdev": 0.2535676336592832,
      "name": "avg_word_length"
    }
  ]
}
"last_100_purchased_items": ["item1", "item2"],
"tracking_uid": "anne"
"""
```


Feature: Combine enriched items into a user profile

Scenario combine two enriched items

Given "item1" with these enrichments

| enrichment | value |
|------------|----------------|
| language | nl |
| author | TOM KELLERHUIS |

And these stylometry enrichments

| enrichment | value |
|----------------------|----------------|
| number_of_paragraphs | 12 |
| number_of_words | 432 |
| article_length | 2542 |
| vocab_richness | 40.5376820773 |
| word_variation | 0.585648148148 |
| avg_word_length | 4.98611111111 |

And these named entities

| entity | tag | count |
|-----------------|-----|-------|
| YANNICK SLAGTER | PER | 1 |
| WIJNFONDUE | LOC | 1 |
| SIMPELER | PER | 1 |

Given "item2" with these enrichments

| enrichment | value |
|------------|---------------|
| language | de |
| author | PETER LANDERS |

And these stylometry enrichments

| enrichment | value |
|----------------------|--------------------|
| number_of_paragraphs | 7 |
| number_of_words | 600 |
| article_length | 4560 |
| vocab_richness | 61.62260711030082 |
| word_variation | 0.6265060240963856 |
| avg_word_length | 5.578313253012048 |

And these named entities

| entity | tag | count |
|----------------|-----|-------|
| ANDRÉ SCHÜRRLE | PER | 3 |
| VFL WOLFSBURG | ORG | 4 |
| KAA | ORG | 5 |

When I run the `UserEnrichmentTask` task and it's dependencies
Then the user "anne" should have the following profile:

```
"language": [
  {
    "count": 1,
    "name": "nl"
  },
  {
    "count": 1,
    "name": "en"
  }
]
```

```
"stylometry": [
  {
    "count": 2,
    "mean": 2177.5,
    "stdev": 515.4808434849931,
    "name": "article_length"
  },
  {
    "count": 2,
    "mean": 5.165410504361017,
    "stdev": 0.2535676336592832,
    "name": "avg_word_length"
  }
]
"last_100_purchased_items": ["item1", "item2"],
"tracking_uid": "anne"
}
```

Feature: Combine enriched items into a user profile

Scenario combine two enriched items

Given "item1" with these enrichments

| enrichment | value |
|------------|----------------|
| language | nl |
| author | TOM KELLERHUIS |

And these stylometry enrichments

| enrichment | value |
|----------------------|----------------|
| number_of_paragraphs | 12 |
| number_of_words | 432 |
| article_length | 2542 |
| vocab_richness | 40.5376820773 |
| word_variation | 0.585648148148 |
| avg_word_length | 4.98611111111 |

And these named entities

| entity | tag | count |
|-----------------|-----|-------|
| YANNICK SLAGTER | PER | 1 |
| WIJNFONDUE | LOC | 1 |
| SIMPELER | PER | 1 |

Given "item2" with these enrichments

| enrichment | value |
|------------|---------------|
| language | de |
| author | PETER LANDERS |

And these stylometry enrichments

| enrichment | value |
|----------------------|--------------------|
| number_of_paragraphs | 7 |
| number_of_words | 600 |
| article_length | 4560 |
| vocab_richness | 61.62260711030082 |
| word_variation | 0.6265060240963856 |
| avg_word_length | 5.578313253012048 |

And these named entities

| entity | tag | count |
|----------------|-----|-------|
| ANDRÉ SCHÜRRLE | PER | 3 |
| VFL WOLFSBURG | ORG | 4 |
| KAA | ORG | 5 |

When I run the `UserEnrichmentTask` task and it's dependencies

Then the user "anne" should have the following profile:

```
"language": [  
  "author": [  
    {  
      "count": 1,  
      "name": "TOM KELLERHUIS"  
    },  
    {  
      "count": 1,  
      "name": "PETER LANDERS"  
    }  
  ]  
}
```

```
    "mean": 2177.5,  
    "stdev": 515.4808434849931,  
    "name": "article_length"  
  },  
  {  
    "count": 2,  
    "mean": 5.165410504361017,  
    "stdev": 0.2535676336592832,  
    "name": "avg_word_length"  
  }  
]  
}  
"last_100_purchased_items": ["item1", "item2"],  
"tracking_uid": "anne"  
}  
.....
```


Feature: Combine enriched items into a user profile

Scenario combine two enriched items

Given "item1" with these enrichments

| enrichment | value |
|------------|----------------|
| language | nl |
| author | TOM KELLERHUIS |

And these stylometry enrichments

| enrichment | value |
|----------------------|----------------|
| number_of_paragraphs | 12 |
| number_of_words | 432 |
| article_length | 2542 |
| vocab_richness | 40.5376820773 |
| word_variation | 0.585648148148 |
| avg_word_length | 4.98611111111 |

And these named entities

| entity | tag | count |
|-----------------|-----|-------|
| YANNICK SLAGTER | PER | 1 |
| WIJNFONDUE | LOC | 1 |
| SIMPELER | PER | 1 |

Given "item2" with these enrichments

| enrichment | value |
|------------|---------------|
| language | de |
| author | PETER LANDERS |

And these stylometry enrichments

| enrichment | value |
|----------------------|--------------------|
| number_of_paragraphs | 7 |
| number_of_words | 600 |
| article_length | 4560 |
| vocab_richness | 61.62260711030082 |
| word_variation | 0.6265060240963856 |
| avg_word_length | 5.578313253012048 |

And these named entities

| entity | tag | count |
|----------------|-----|-------|
| ANDRÉ SCHÜRRLE | PER | 3 |
| VFL WOLFSBURG | ORG | 4 |
| KAA | ORG | 5 |

When I run the `UserEnrichmentTask` task and it's dependencies

Then the user "anne" should have the following profile:

```
"language": [
  {
    "author": [
      {
        "stylometry": [
          {
            "count": 2,
            "mean": 2177.5,
            "stdev": 515.4808434849931,
            "name": "article_length"
          },
          {
            "count": 2,
            "mean": 5.165410504361017,
            "stdev": 0.2535676336592832,
            "name": "avg_word_length"
          }
        ]
      }
    ]
  },
  "last_100_purchased_items": ["item1", "item2"],
  "tracking_uid": "anne"
}
"""
```

Learning to rank: preference learning



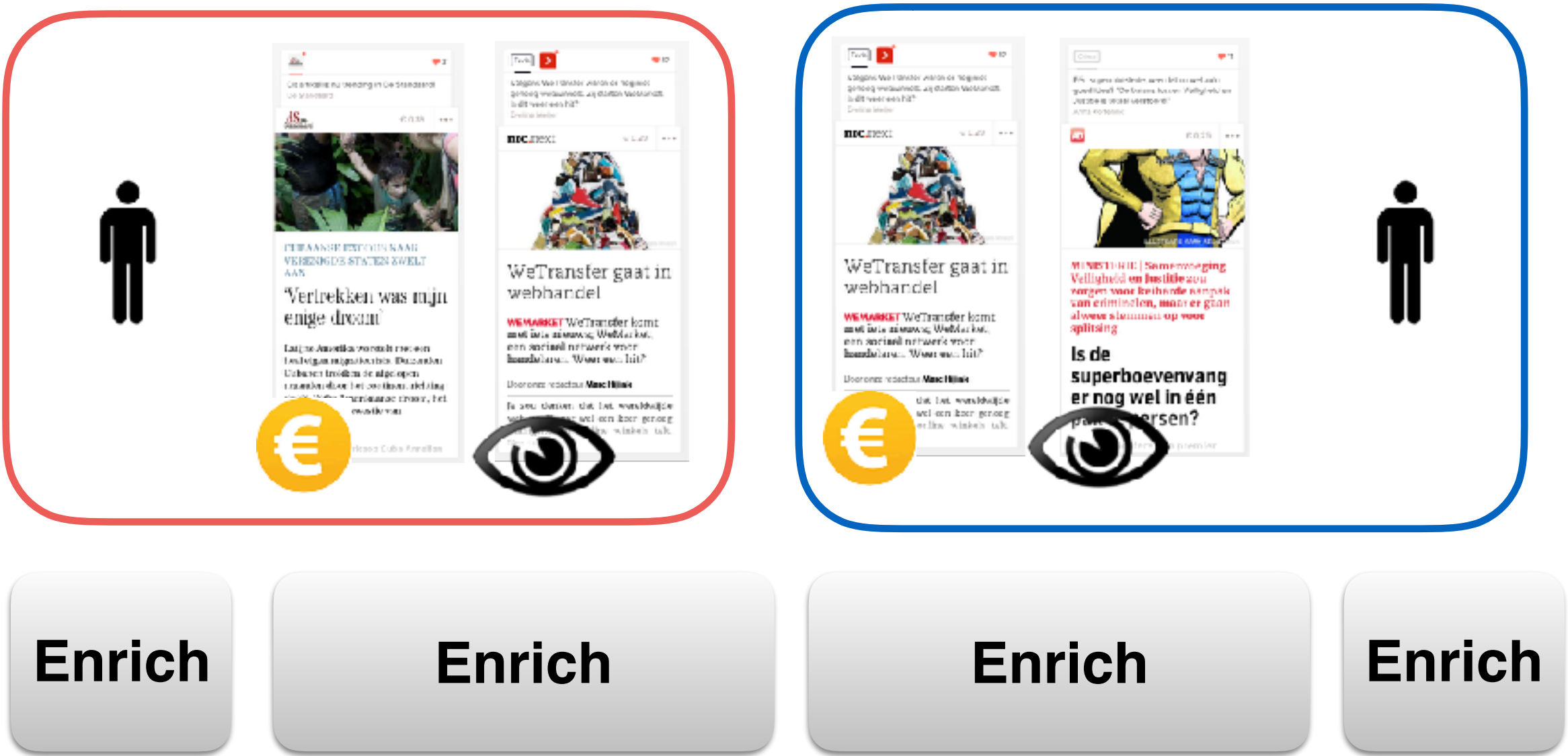
Learning to rank: preference learning



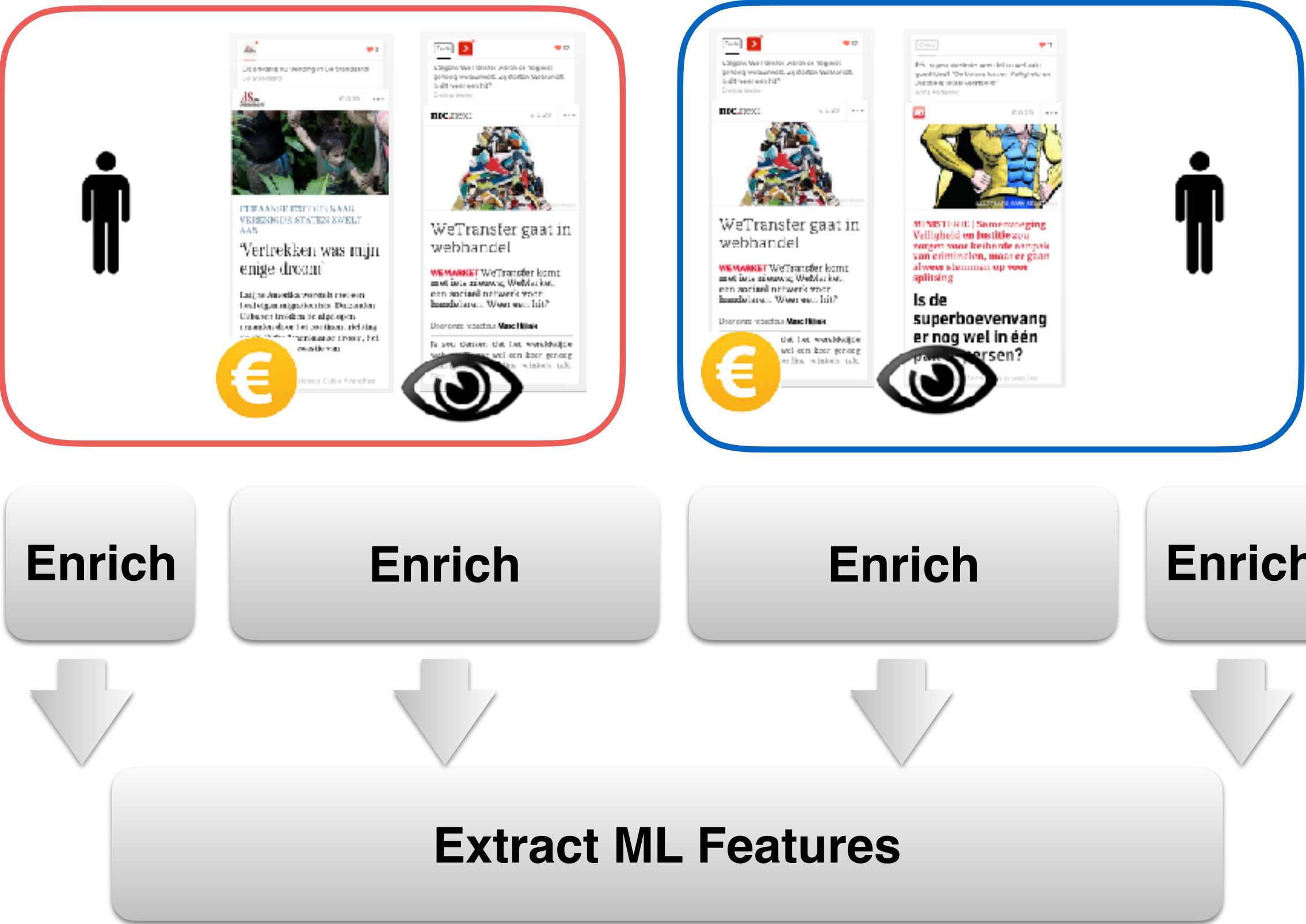
Learning to rank: preference learning



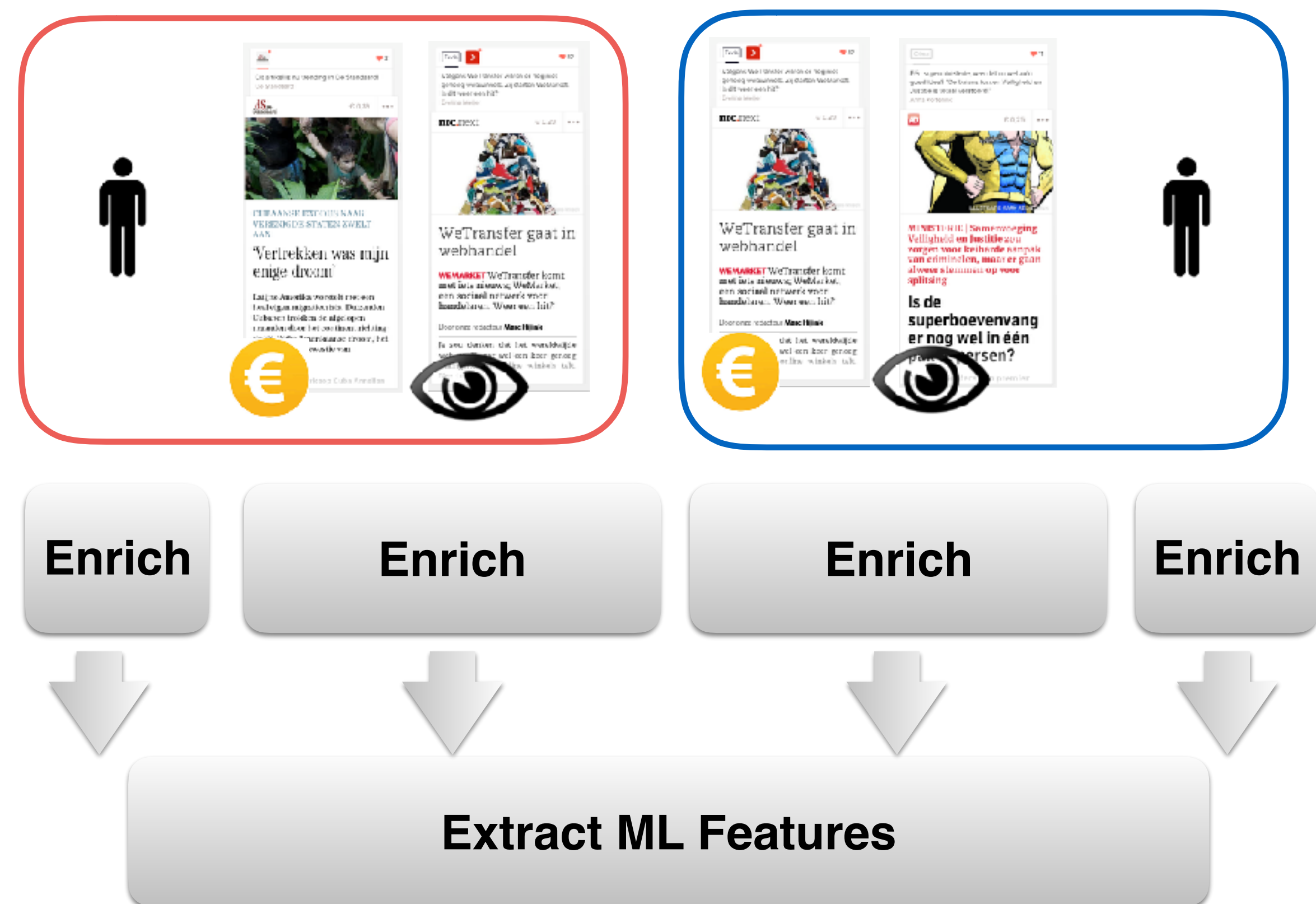
Learning to rank: preference learning



Learning to rank: preference learning



Learning to rank: preference learning

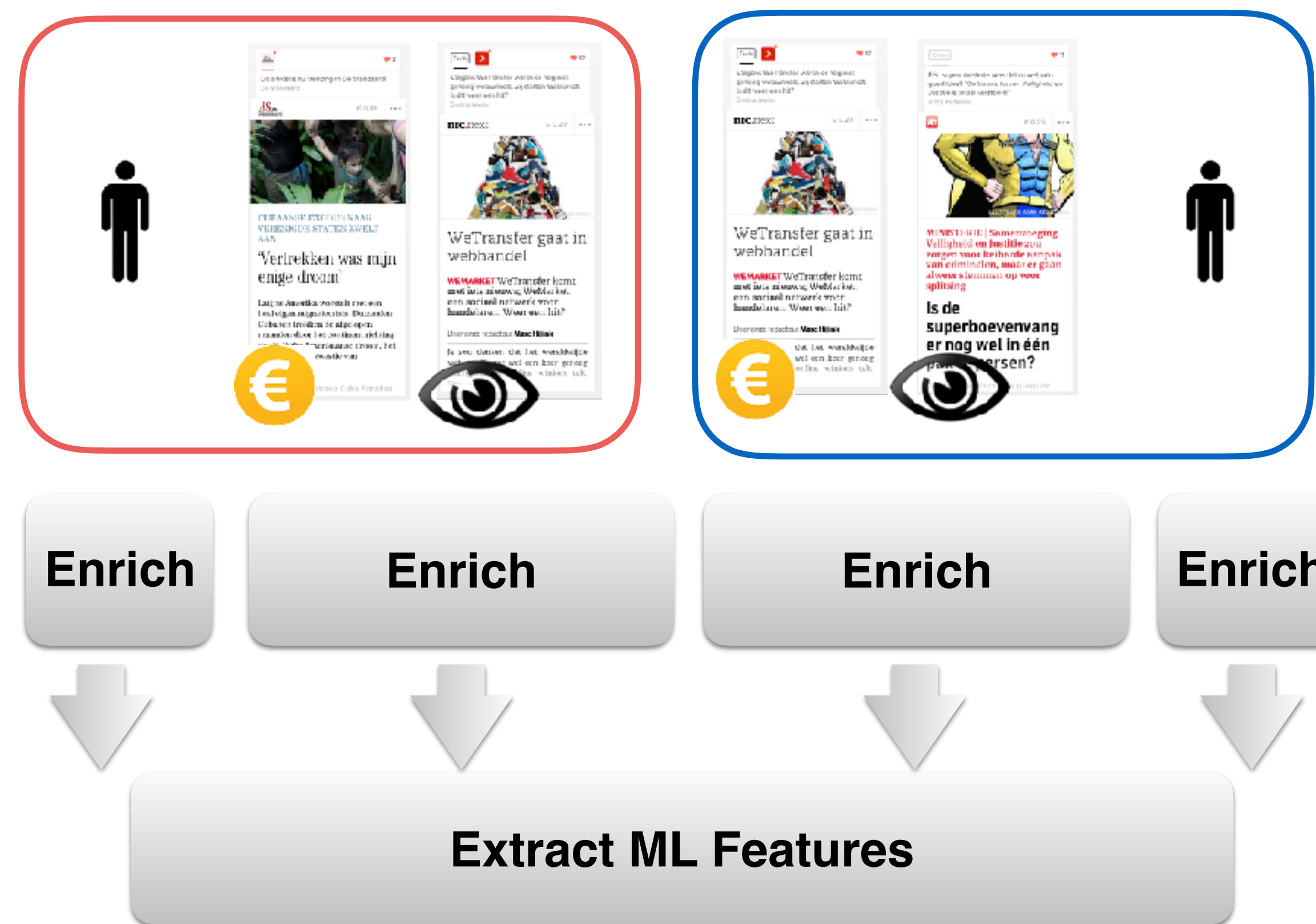


When I compute features

Then I should have the following features and values:

| feature | value |
|-------------------------------------|-------------------|
| user_nr_purchased_items | 5 |
| user_nr_channels | 1 |
| user_nr_subscriptions | 2 |
| user_nr_providers | 1 |
| user_vmoney_almost_spent | 1 |
| user_alerts | 1 |
| user_new_edition | 1 |
| user_digest | 1 |
| user_magazine_digest | 1 |
| user_image_mean | 0.5 |
| user_likes_it_long | 0 |
| purchased_channel_intersect | 1 |
| purchased_channel_intersect_size | 1 |
| newsletter_purchased_channel_score | 0.05 |
| newsletter_purchased_provider_score | 0.025 |
| item_provider_followed_by_user | 0 |
| item_channel_followed_by_user | 0 |
| item_rating_score | 0.9 |
| item_number_of_images | 1 |
| item_length_class | 0 |
| user_item_language_score | 0.5 |
| user_item_author_in_top3 | 1 |
| user_item_semlink_in_top10 | 1 |
| user_item_semantic_overlap | 0.097777777777777 |
| user_item_named_entity_overlap | 0.04081632653061 |
| user_item_length_pdf | 0.00316108841344 |

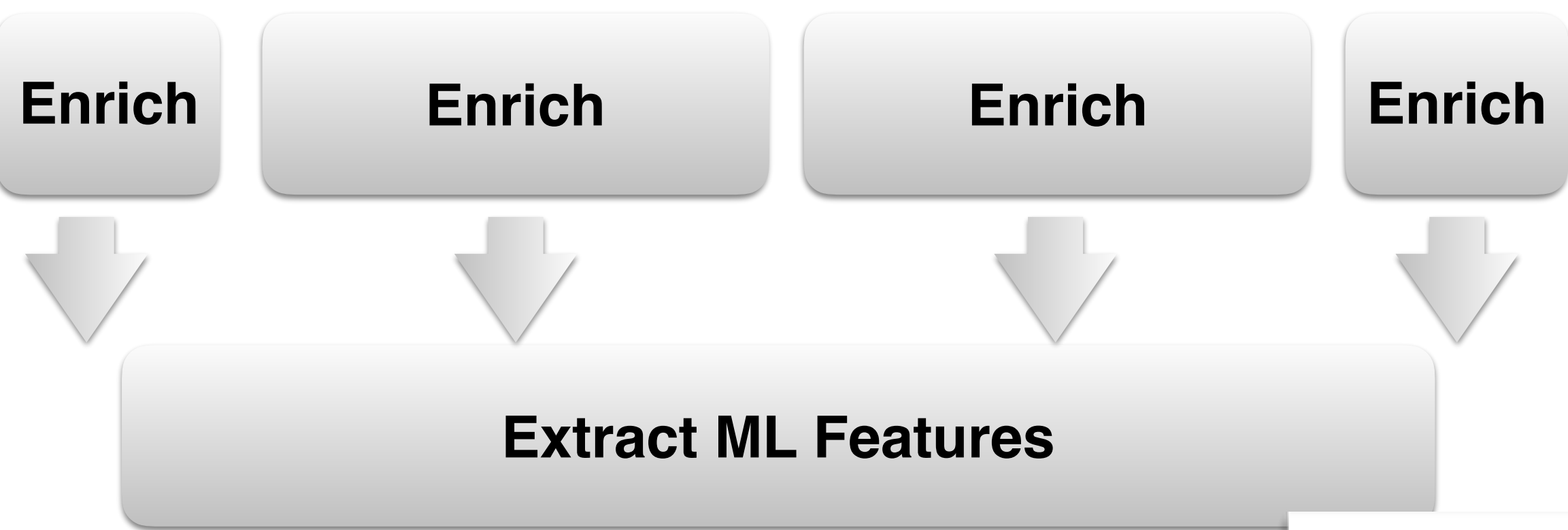
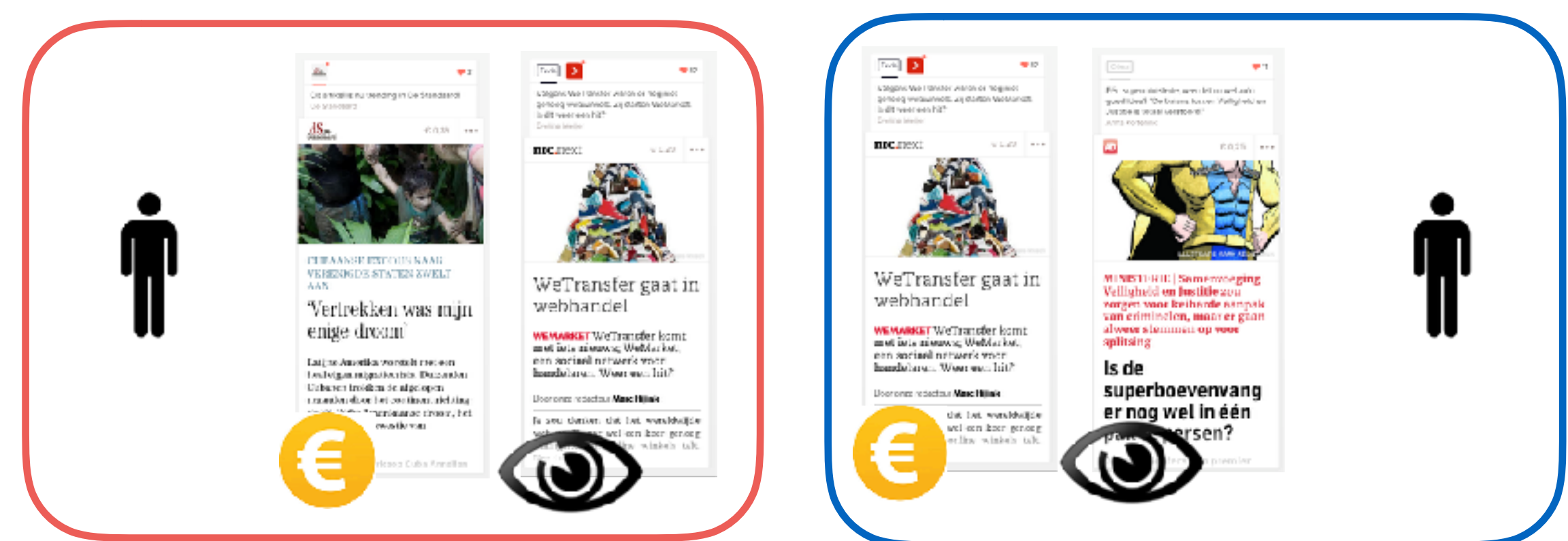
Learning to rank: preference learning



When I compute features
Then I should have the following features and values:

| feature | value |
|-------------------------------------|-------------------|
| user_nr_purchased_items | 5 |
| user_nr_channels | 1 |
| user_nr_subscriptions | 2 |
| user_nr_providers | 1 |
| user_vmoney_almost_spent | 1 |
| user_alerts | 1 |
| user_new_edition | 1 |
| user_digest | 1 |
| user_magazine_digest | 1 |
| user_image_mean | 0.5 |
| user_likes_it_long | 0 |
| purchased_channel_intersect | 1 |
| purchased_channel_intersect_size | 1 |
| newsletter_purchased_channel_score | 0.05 |
| newsletter_purchased_provider_score | 0.025 |
| item_provider_followed_by_user | 0 |
| item_channel_followed_by_user | 0 |
| item_rating_score | 0.9 |
| item_number_of_images | 1 |
| item_length_pdf | 0 |
| user_item_author_in_top3 | 1 |
| user_item_semlink_in_top10 | 1 |
| user_item_semantic_overlap | 0.097777777777777 |
| user_item_named_entity_overlap | 0.04081632653061 |
| user_item_length_pdf | 0.00316108841344 |

Learning to rank: preference learning



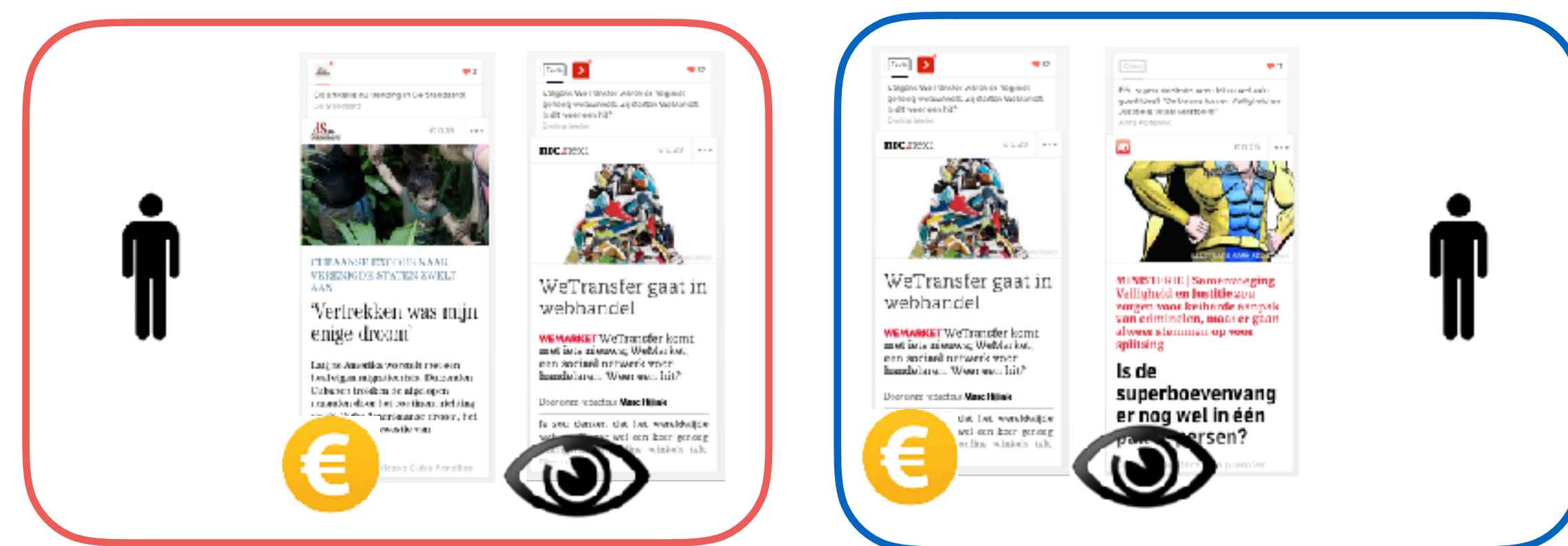
When I compute features
Then I should have the following features and values:

| feature | value |
|-------------------------------------|-------|
| user_nr_purchased_items | 5 |
| user_nr_channels | 1 |
| user_nr_subscriptions | 2 |
| user_nr_providers | 1 |
| user_vmoney_almost_spent | 1 |
| user_alerts | 1 |
| user_new_edition | 1 |
| user_digest | 1 |
| user_magazine_digest | 1 |
| user_image_mean | 0.5 |
| user_likes_it_long | 0 |
| purchased_channel_intersect | 1 |
| purchased_channel_intersect_size | 1 |
| newsletter_purchased_channel_score | 0.05 |
| newsletter_purchased_provider_score | 0.025 |
| item_provider_followed_by_user | 0 |
| item_channel_followed_by_user | 0 |

| user_item_language_score | 0.5

| | |
|--------------------------------|-------------------|
| item_length_class | 0 |
| user_item_language_score | 0.5 |
| user_item_author_in_top3 | 1 |
| user_item_semlink_in_top10 | 1 |
| user_item_semantic_overlap | 0.097777777777777 |
| user_item_named_entity_overlap | 0.04081632653061 |
| user_item_length_pdf | 0.00316108841344 |

Learning to rank: preference learning



When I compute features
Then I should have the following features and values:

| feature | value |
|--------------------------|-------|
| user_nr_purchased_items | 5 |
| user_nr_channels | 1 |
| user_nr_subscriptions | 2 |
| user_nr_providers | 1 |
| user_vmoney_almost_spent | 1 |
| user_alerts | 1 |
| user_new_edition | 1 |
| user_digest | 1 |
| user_magazine_digest | 1 |

Enrich

Enrich

Enrich

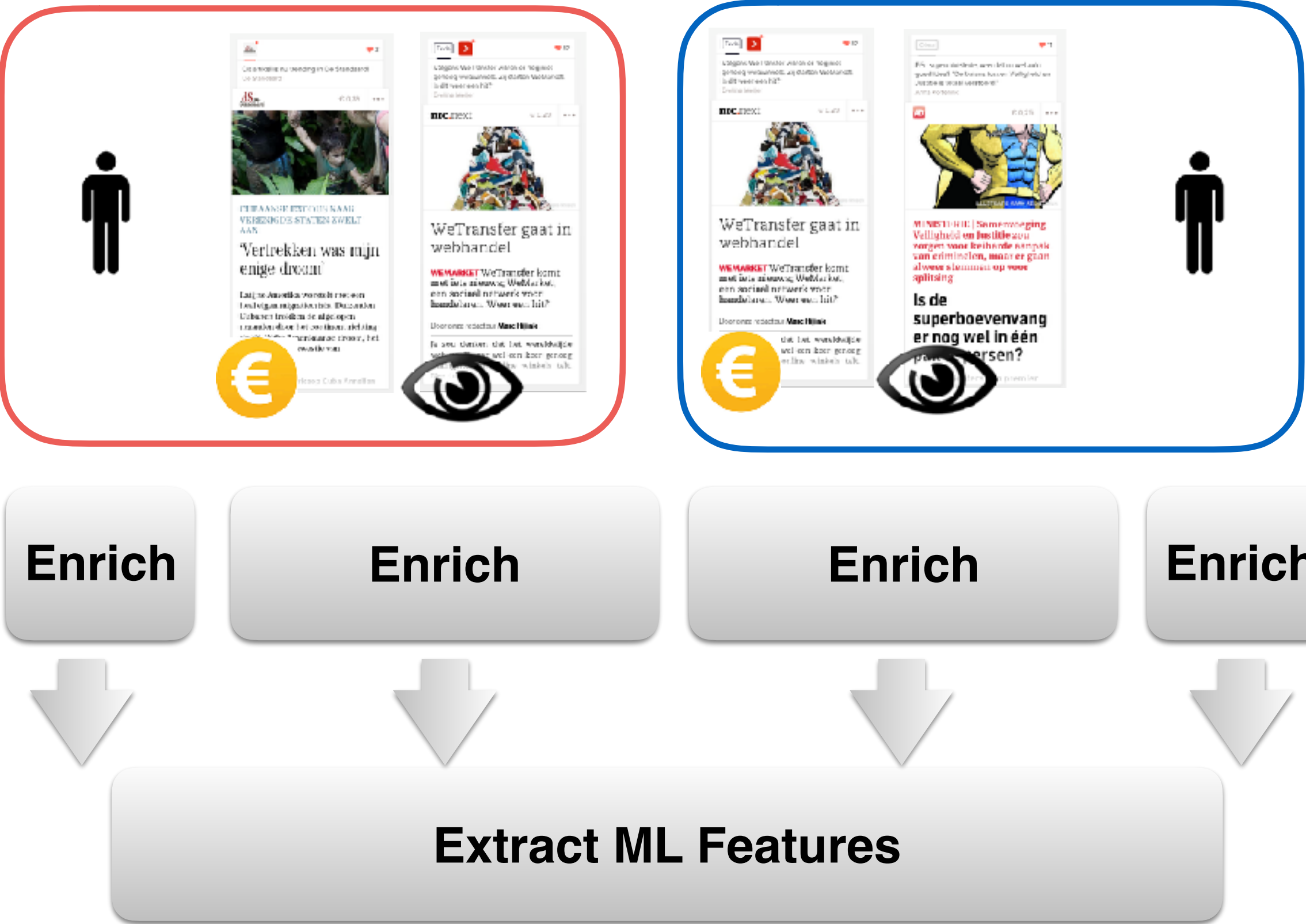
| user_likes_it_long

| 0

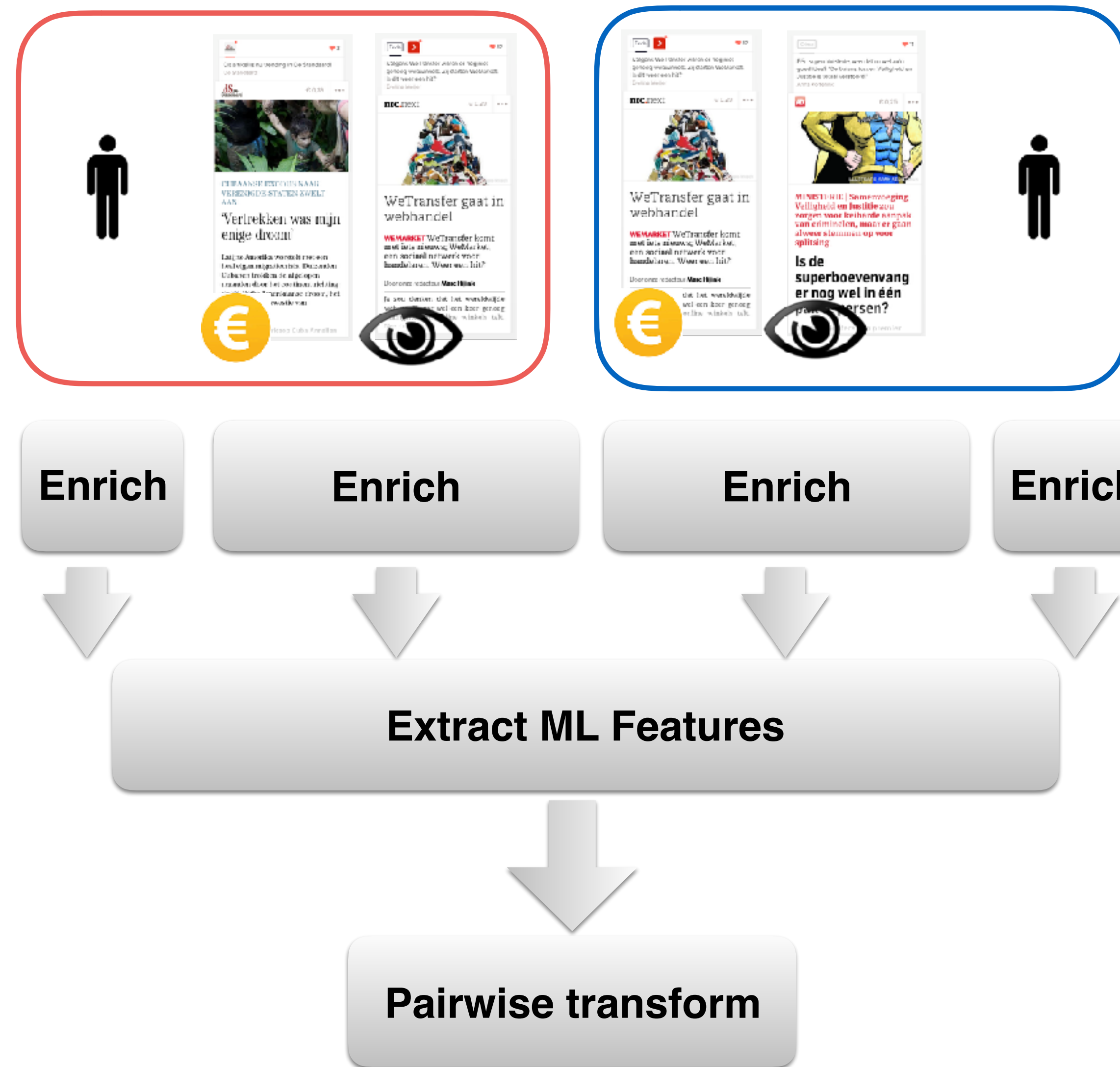
Extract ML Features

| | |
|-------------------------------------|-------------------|
| purchased_channel_intersect | 1 |
| purchased_channel_intersect_size | 1 |
| newsletter_purchased_channel_score | 0.05 |
| newsletter_purchased_provider_score | 0.025 |
| item_provider_followed_by_user | 0 |
| item_channel_followed_by_user | 0 |
| item_rating_score | 0.9 |
| item_number_of_images | 1 |
| item_length_class | 0 |
| user_item_language_score | 0.5 |
| user_item_author_in_top3 | 1 |
| user_item_semlink_in_top10 | 1 |
| user_item_semantic_overlap | 0.097777777777777 |
| user_item_named_entity_overlap | 0.04081632653061 |
| user_item_length_pdf | 0.00316108841344 |

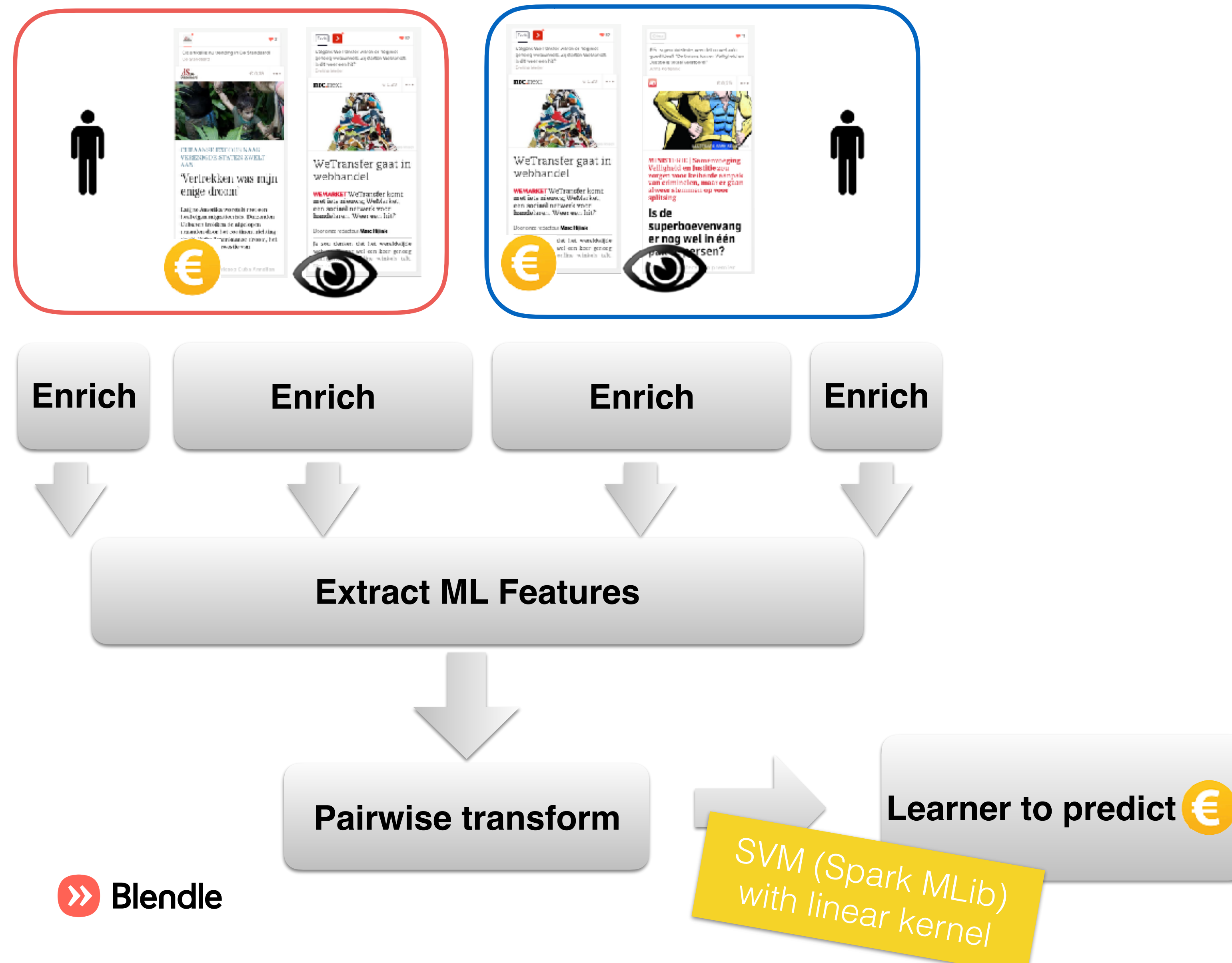
Learning to rank: preference learning



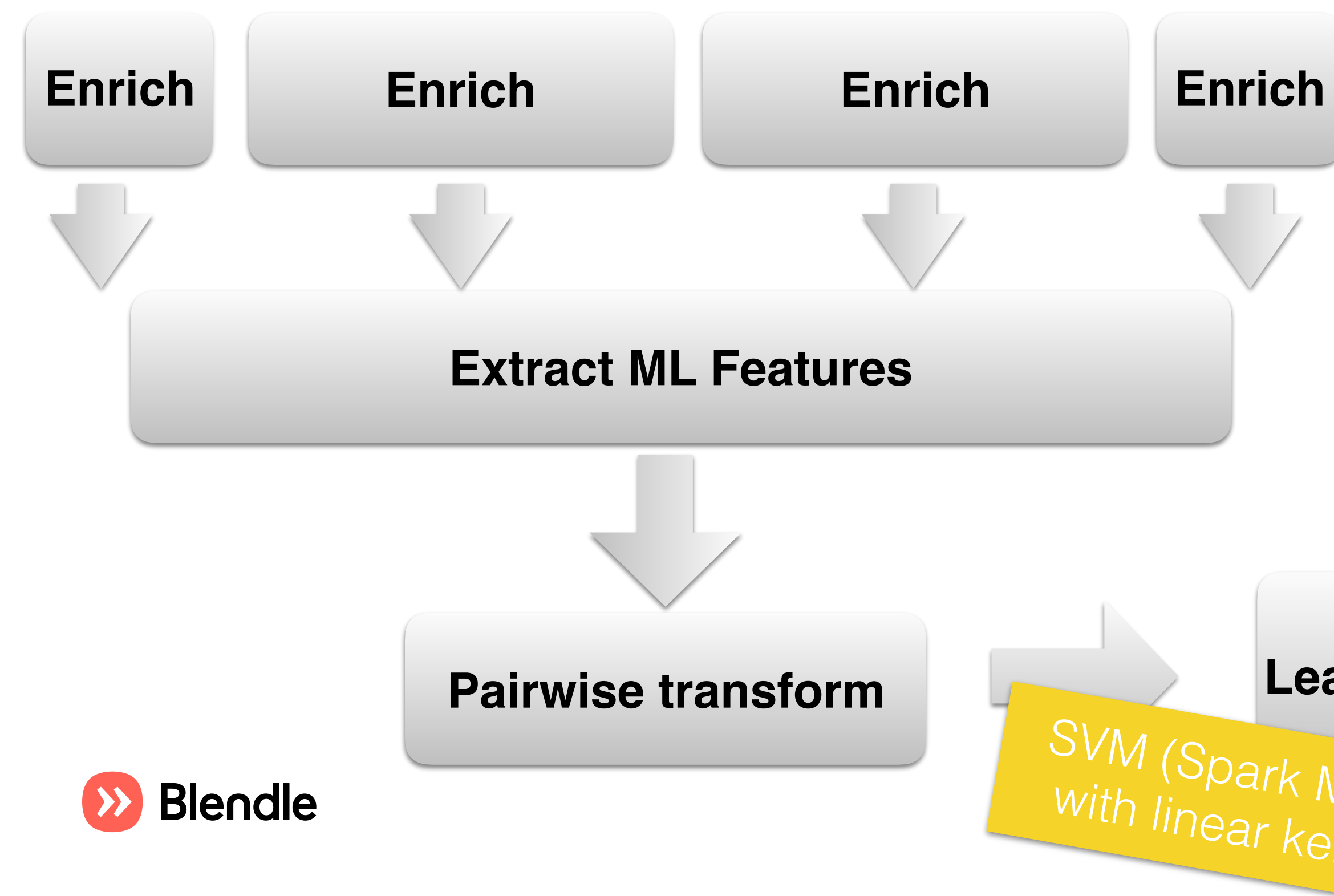
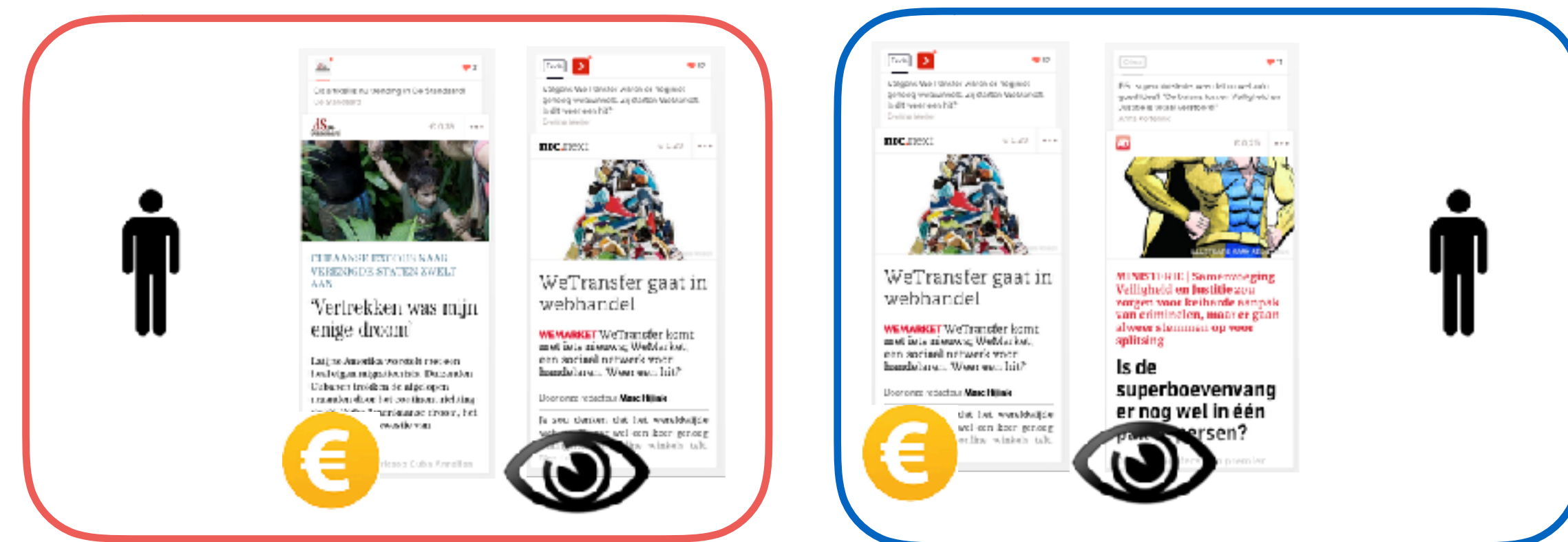
Learning to rank: preference learning



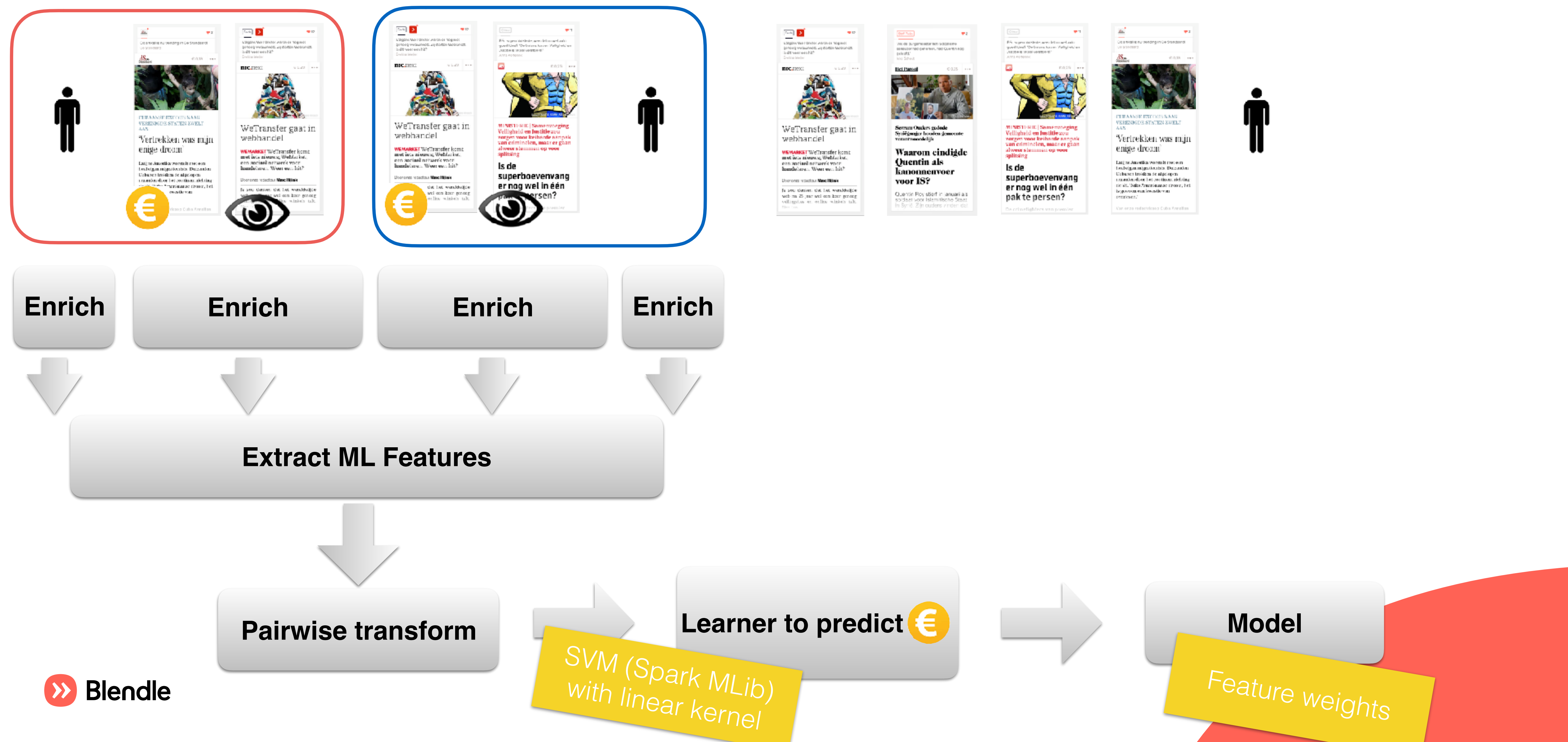
Learning to rank: preference learning



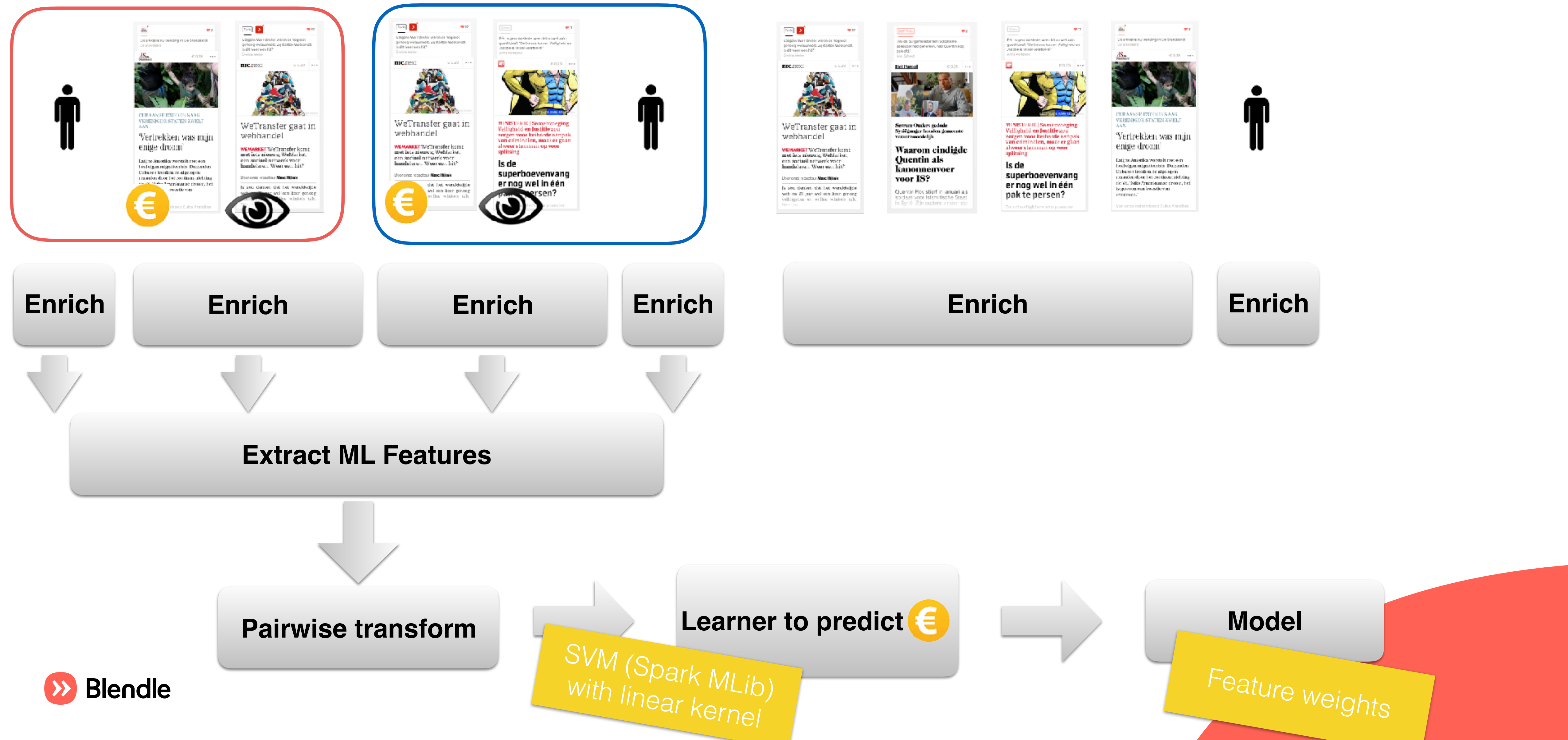
Learning to rank: preference learning



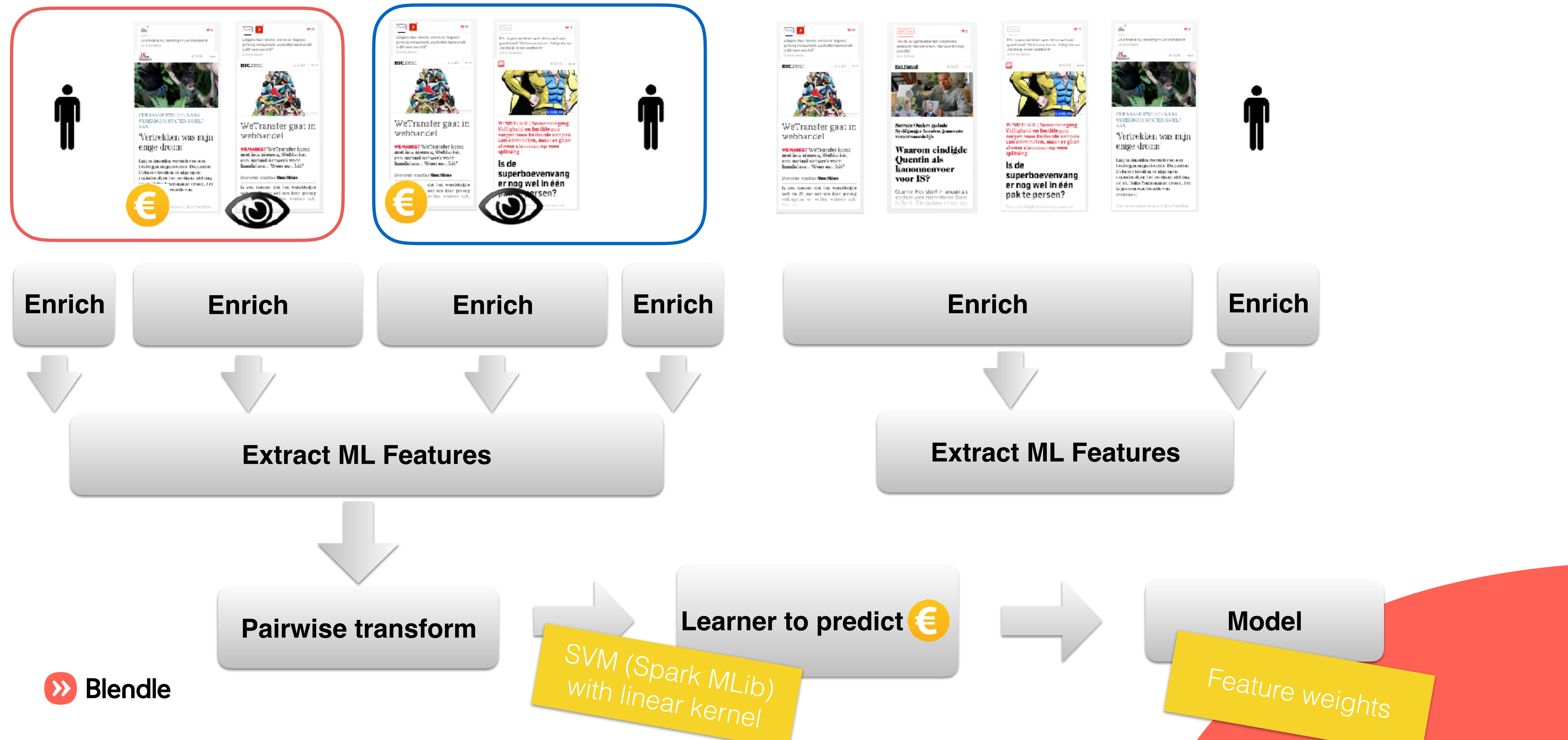
Learning to rank: preference learning



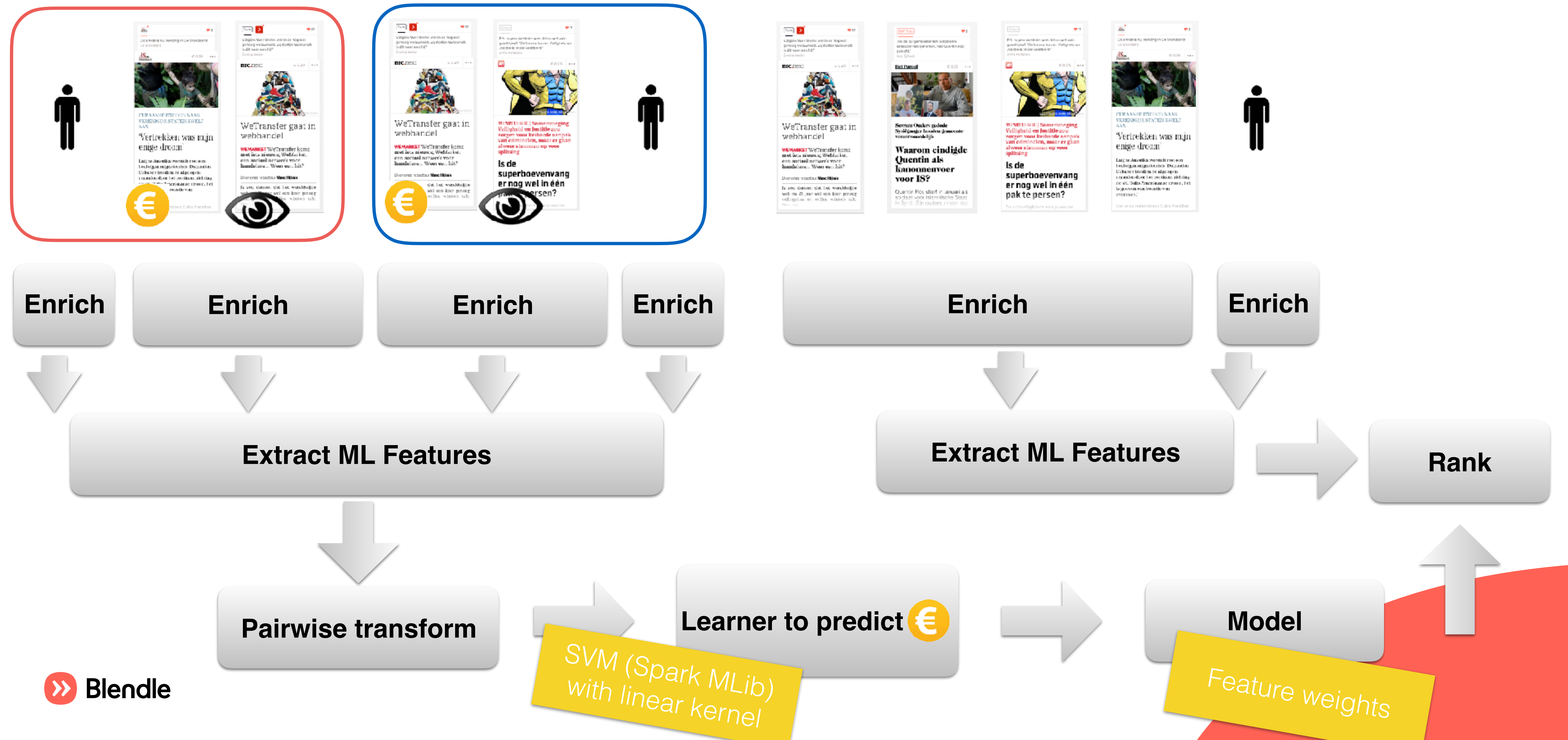
Learning to rank: preference learning



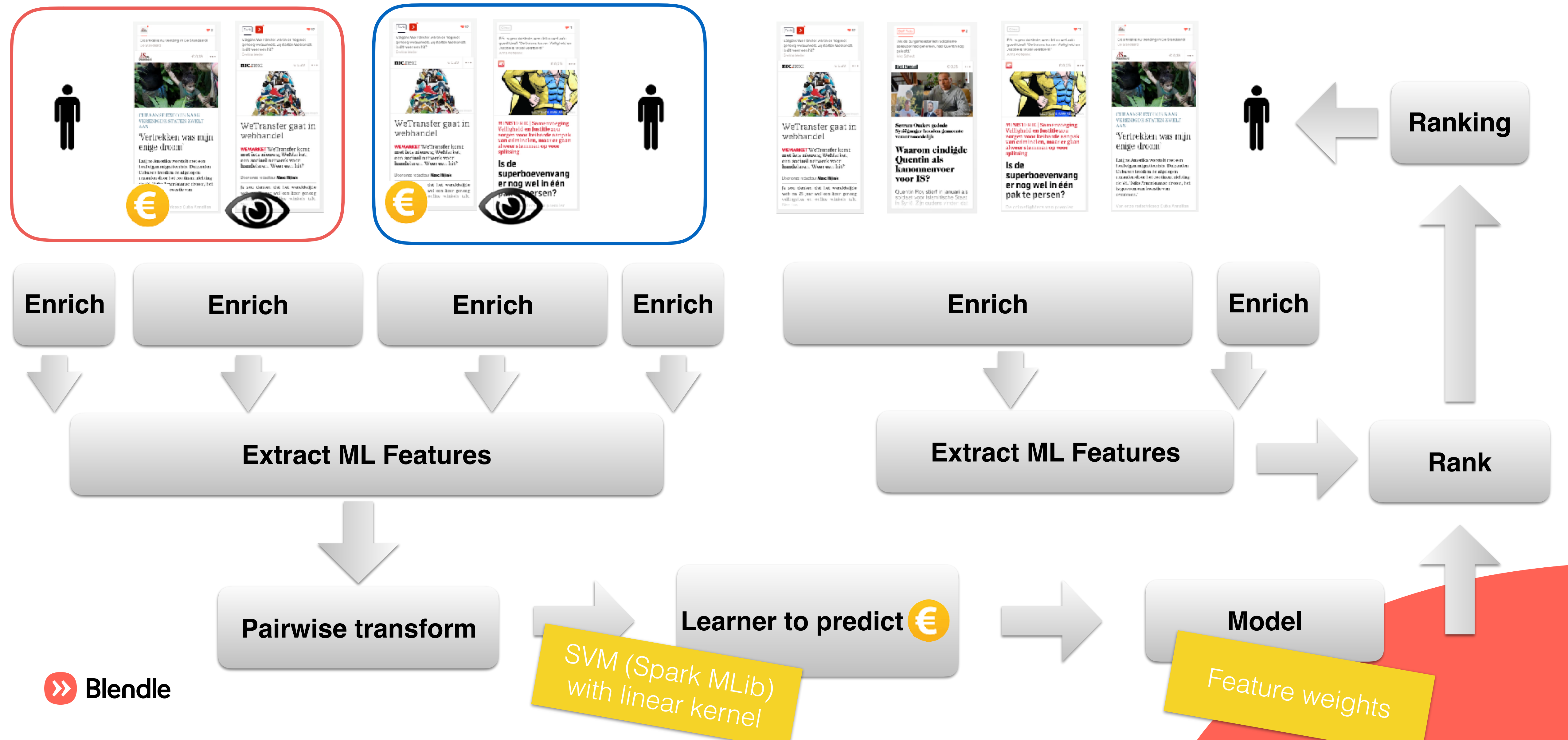
Learning to rank: preference learning



Learning to rank: preference learning



Learning to rank: preference learning





Learning to Rank

- What can possibly go wrong?

Learning to Rank

- What can possibly go wrong?
 - Clicks are biased

Learning to Rank

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 - users won't click on things you didn't show them

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 - user are likely to click on things that appear high

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 - Clicks are biased
 - users won't click on things you didn't show them
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 - it matters how you present documents

Learning to Rank

- What can possibly go wrong?
 - Clicks are biased
 - users won't click on things you didn't show them
 - user are likely to click on things that appear high
 - it matters how you present documents
 - snippets, images, colors, font size, grouped with other documents

Learning

Example: Rich Result Summarization

Idea: Users like to know how dishes look like for recipes.

Let's generate nicer captions by including an image.

[Chicken Marsala | Chicken Recipes | Savory Sweet Life - Easy ...](#)
[savorysweetlife.com/2010/03/chicken-marsala](#)
Mar 09, 2010 · This **chicken marsala recipe** is so quick and easy. Perfect for a weeknight, this **chicken** mushroom dinner can be prepared within 30 minutes.

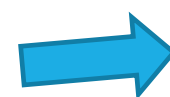
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Feature-specific metric:

- Short-dwell click rate

→ **improves!** 😊

→ Good feature!?

Learning

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 [savorysweetlife.com/2010/03/chicken-marsala](#) is so quick and easy. Perfect for a weeknight, this chicken mushroom dinner can be prepared within 30 minutes.

Feature-specific metric:

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→ Good feature!?

What could have happened?

Learning

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[savorysweetlife.com/2010/03/chicken-marsala](#)
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Learning Lab

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chicken marsala recipe

1,930,000 RESULTS Any time ▾

[Chicken Marsala Recipe](#) · Emeril Lagasse · [Recipes](#) · [Food Network](#)
[www.foodnetwork.com](#) · [Recipes](#)
★★★★★ Rating: 5/5 · 836 reviews · By Emeril Lagasse · Difficulty: Easy
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[Chicken Marsala Recipe](#) - [Allrecipes.com](#) - ...
[allrecipes.com/Recipe/Chicken-Marsala](#)
★★★★★ Rating: 4.5/5 · 2,913 reviews · 118 photos
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[www.food.com](#) · [Main Ingredient](#) · [Meat](#) · [Poultry](#) · [Chicken](#)
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[Chicken Marsala Recipes](#) - [Allrecipes.com](#)
[allrecipes.com/recipes/meat-and-poultry/chicken/chicken-marsala](#)
Find easy and delicious **recipes** for classic **chicken Marsala**.

[Chicken Marsala Recipe Recipe](#) | [Cooking](#) | [How To](#) | [Martha ...](#)
[www.marthastewart.com/353041/chicken-marsala](#)
Make Martha Stewart's **Chicken Marsala Recipe recipe**. How To and Step-by-Step Instructions from Martha Stewart.

Feature-specific metric:

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Learning Lab

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Feature-specific metric:

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- improves! 😊
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More generalizable metrics:

- Whole page click-through rate
- #queries per session

Learning Lab

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Challenge: Design feature-specific metrics in a way that they are aligned with overall goodness.



chicken marsala recipe

1,930,000 RESULTS Any time ▾

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Learning to Rank

- What can possibly go wrong?
 - Clicks are biased

Learning to Rank

- What can possibly go wrong?
 - Clicks are biased
 - Clicks are noisy

Learning to Rank

- What can possibly go wrong?
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 - They don't always mean what you hope

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 - Even with refunds
 - Absence of clicks is not necessarily negative


Learning to Rank

- What can possibly go wrong?
 - Clicks are biased
 - Clicks are noisy
 - They don't always mean what you hope
 - Even with refunds
 - Absence of clicks is not necessarily negative
 - Users might learn enough from snippets


Online Learning to Rank




Online Learning to Rank

- Learning with a user in the loop
- 

Online Learning to Rank

- Learning with a user in the loop
 - Bias is no longer a problem
- 

Online Learning to Rank

- Learning with a user in the loop
 - Bias is no longer a problem
 - Noise remains
- 
- A large, solid red arc is positioned on the right side of the slide, curving from the top towards the bottom.

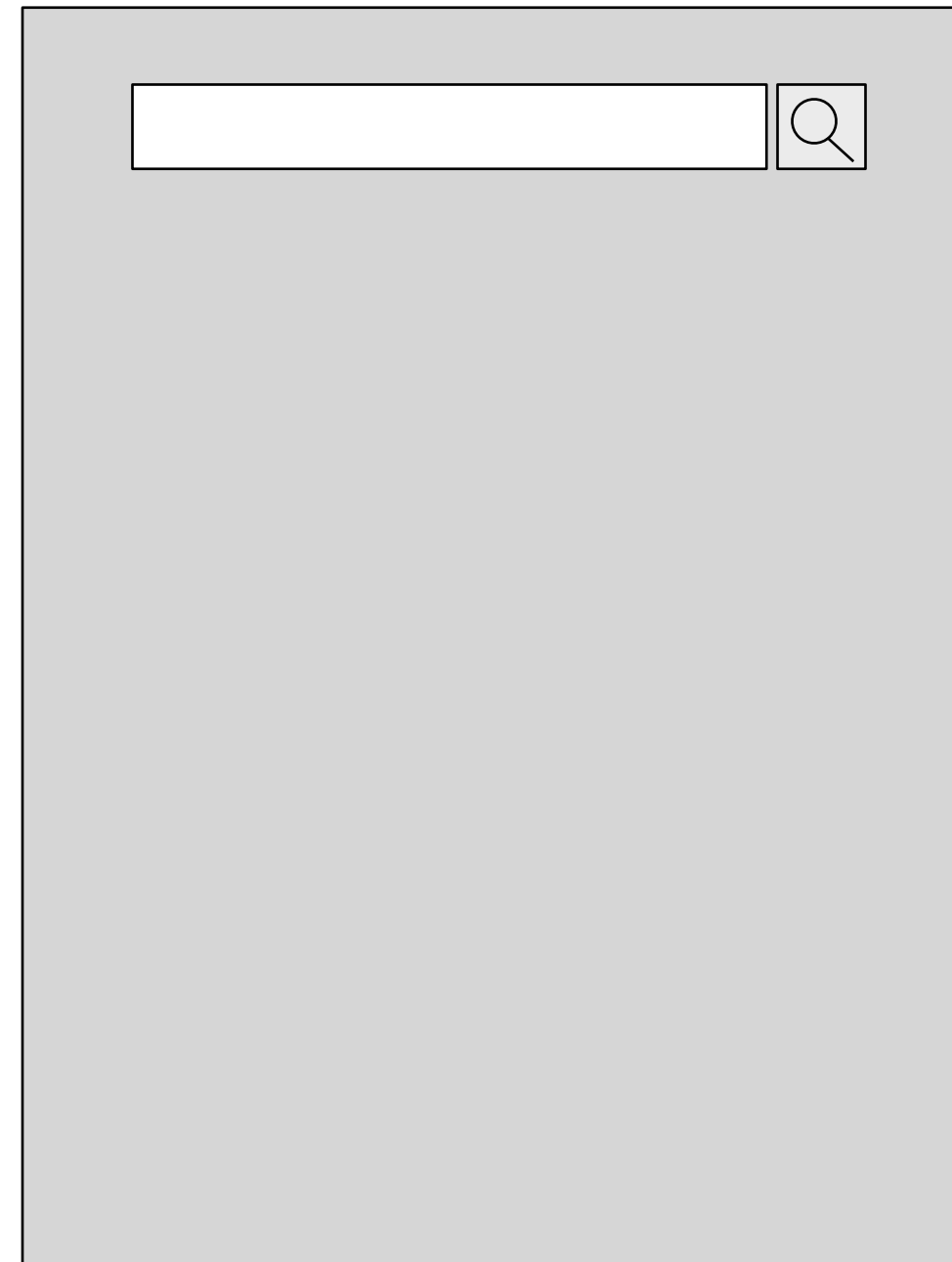
Online Learning to Rank

We are not yet doing
this at Blendle

- Learning with a user in the loop
- Bias is no longer a problem
- Noise remains

Dueling Bandit Gradient Descent

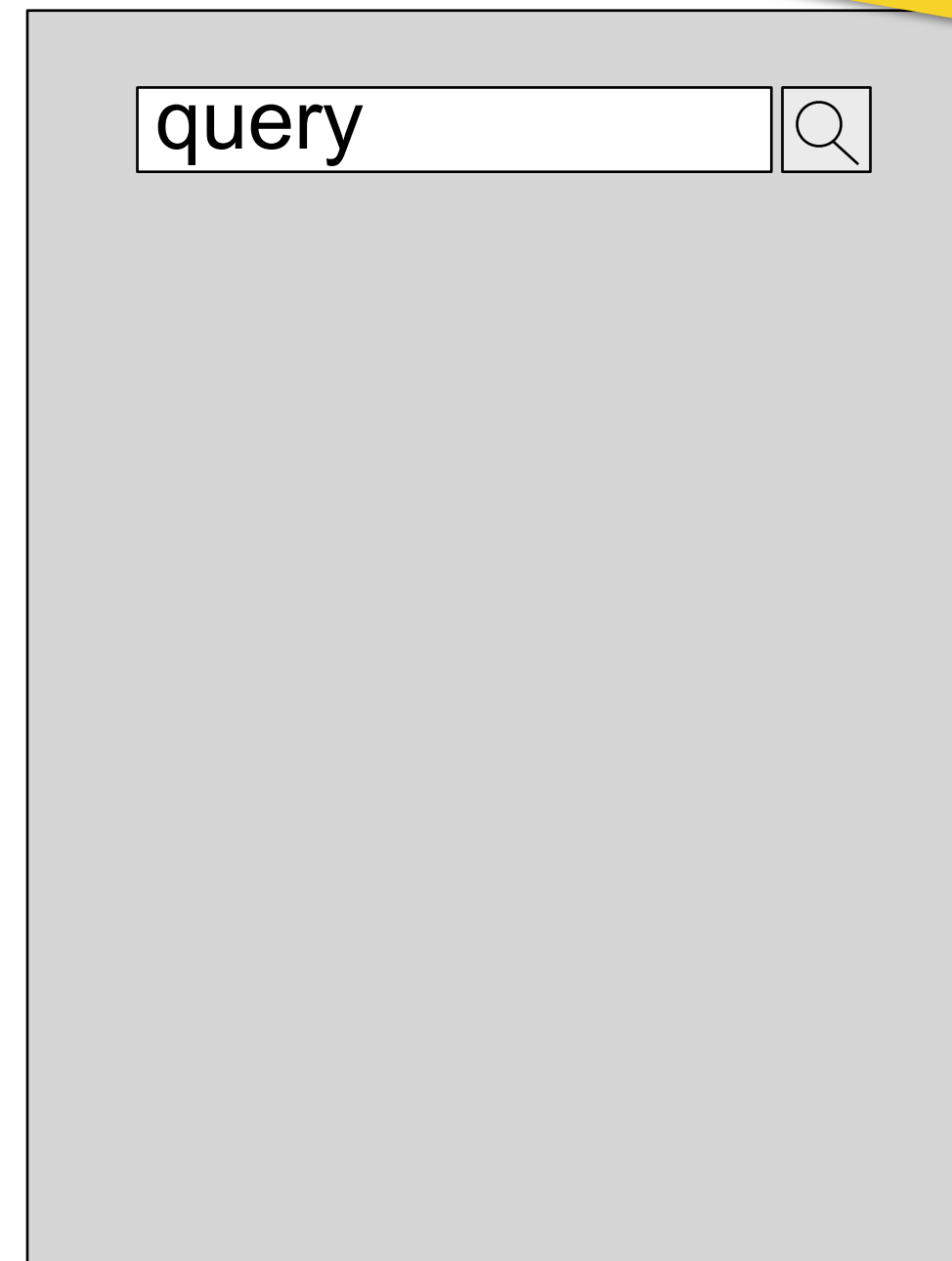
We are not yet doing
this at Blendle



[Yue et al, 2009; Hofmann et al., 2011]

Dueling Bandit Gradient Descent

For Blendle the user
would be the query



query

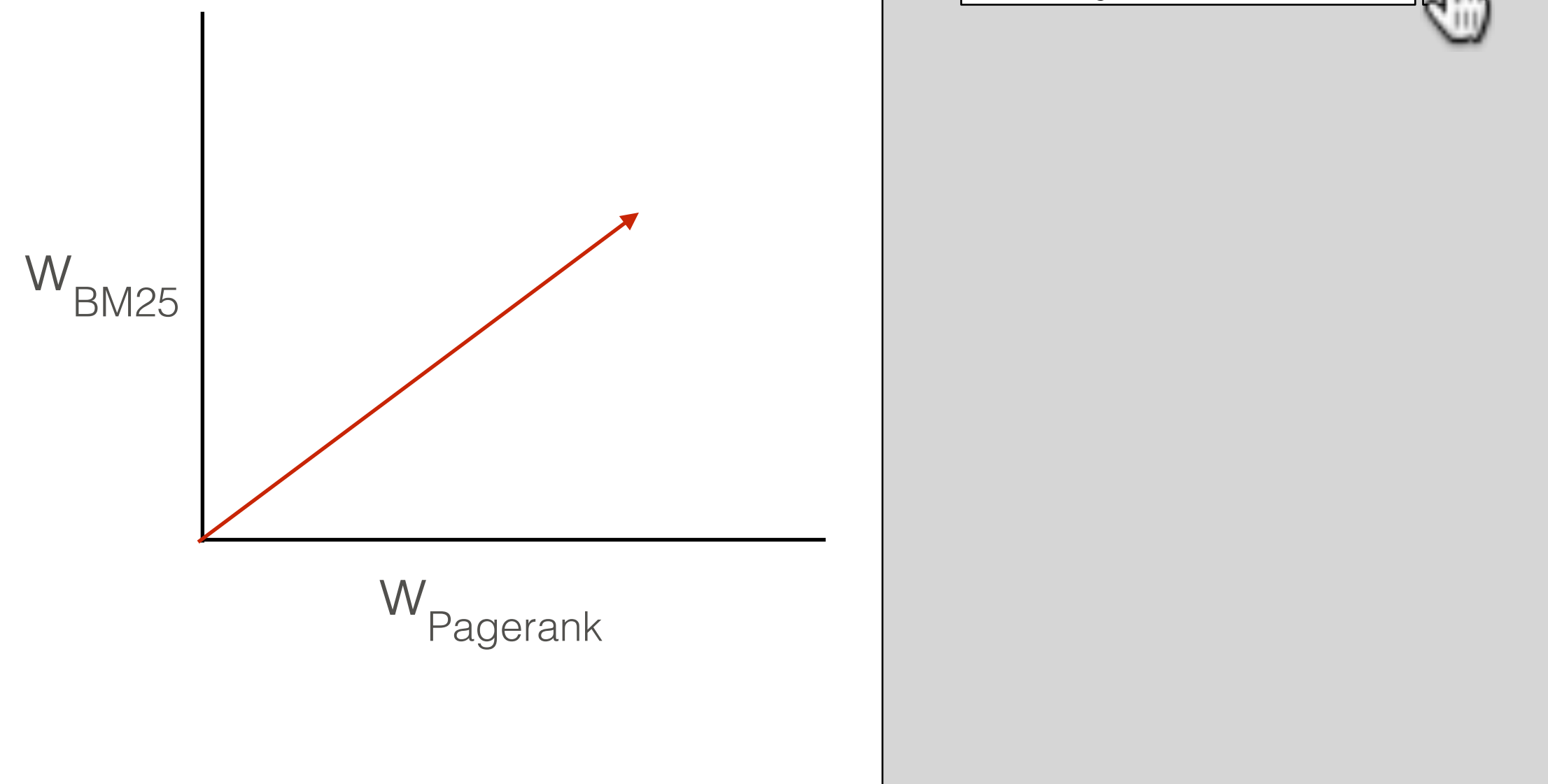
We are not yet doing
this at Blendle

[Yue et al, 2009; Hofmann et al., 2011]

Dueling Bandit Gradient Descent

We are not yet doing
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For Blendle the user
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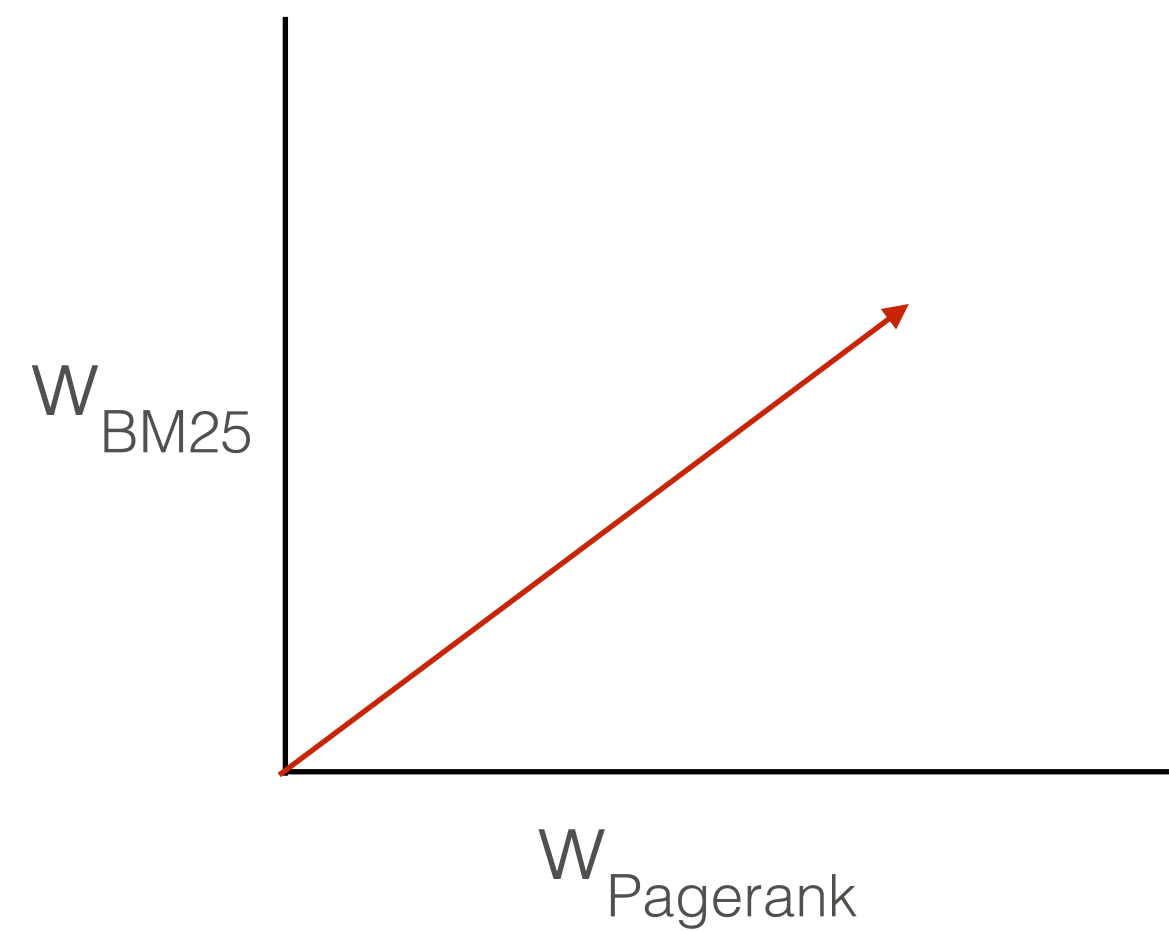


[Yue et al, 2009; Hofmann et al., 2011]

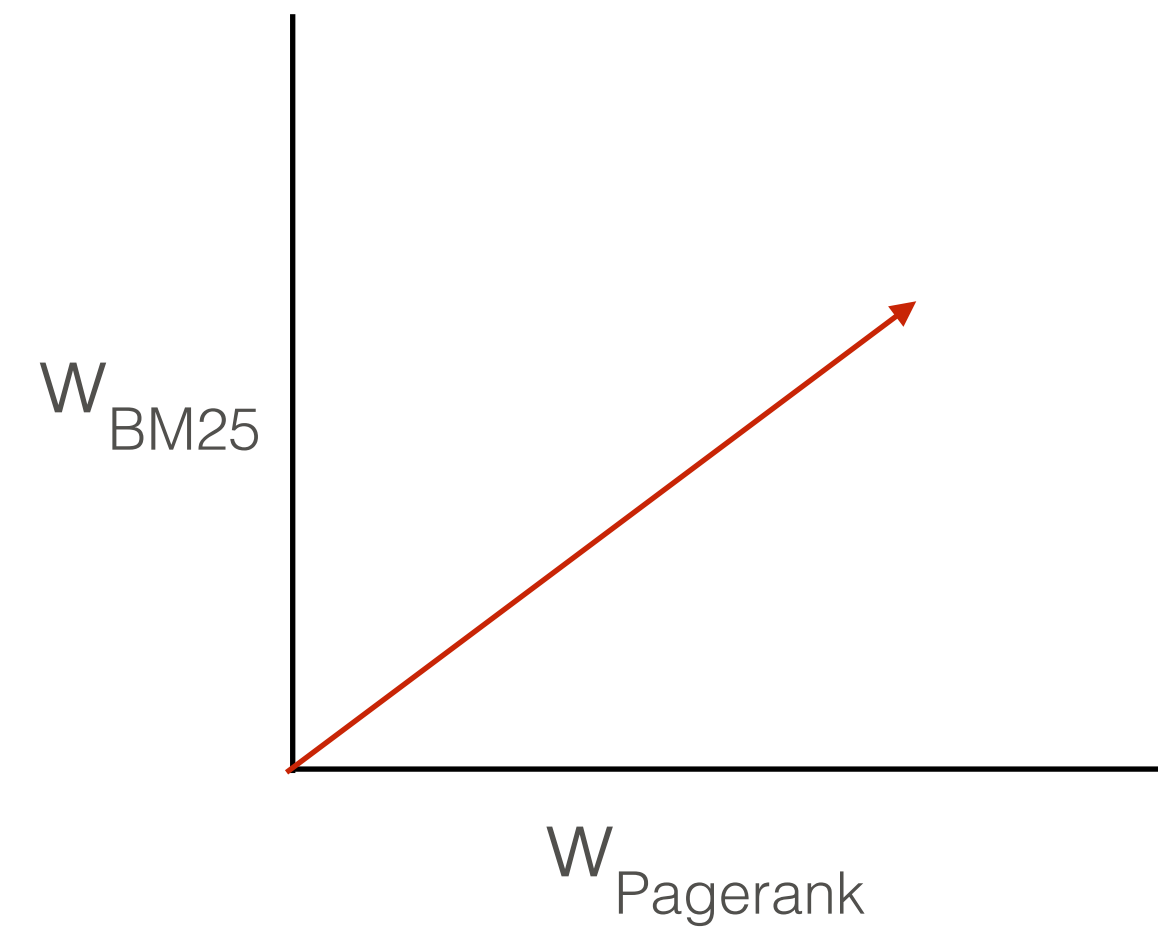
Dueling Bandit Gradient Descent

We are not yet doing this at Blendle

For Blendle the user would be the query



query

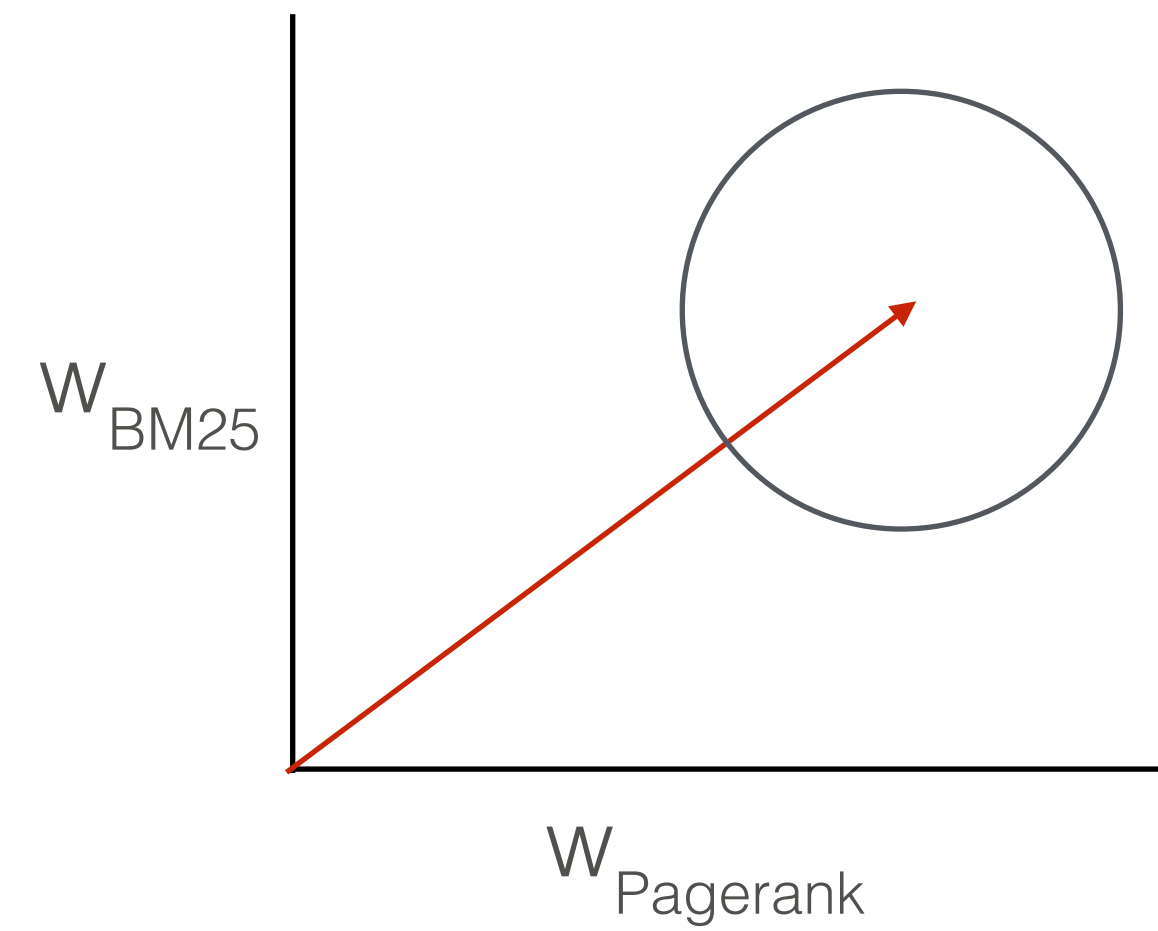
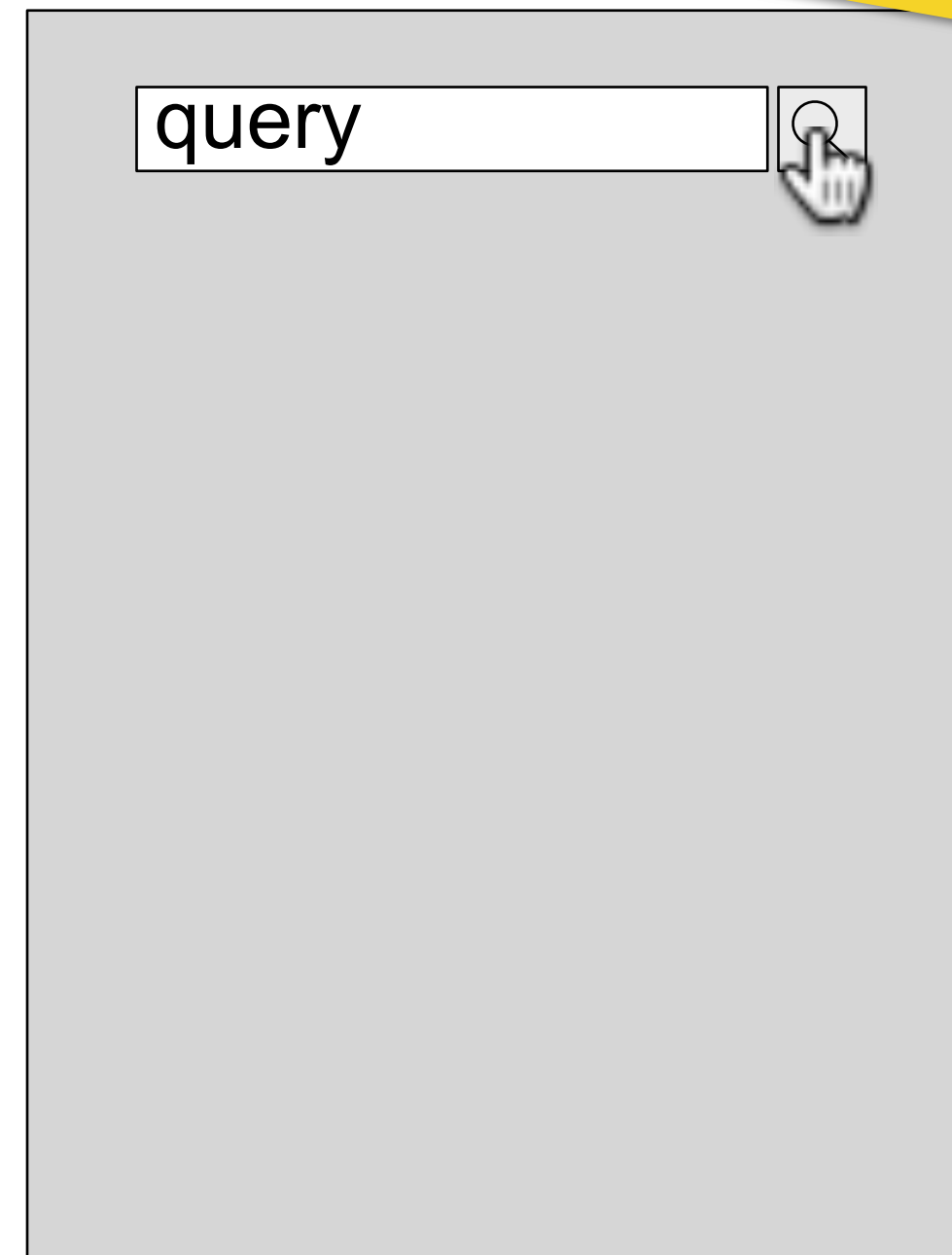
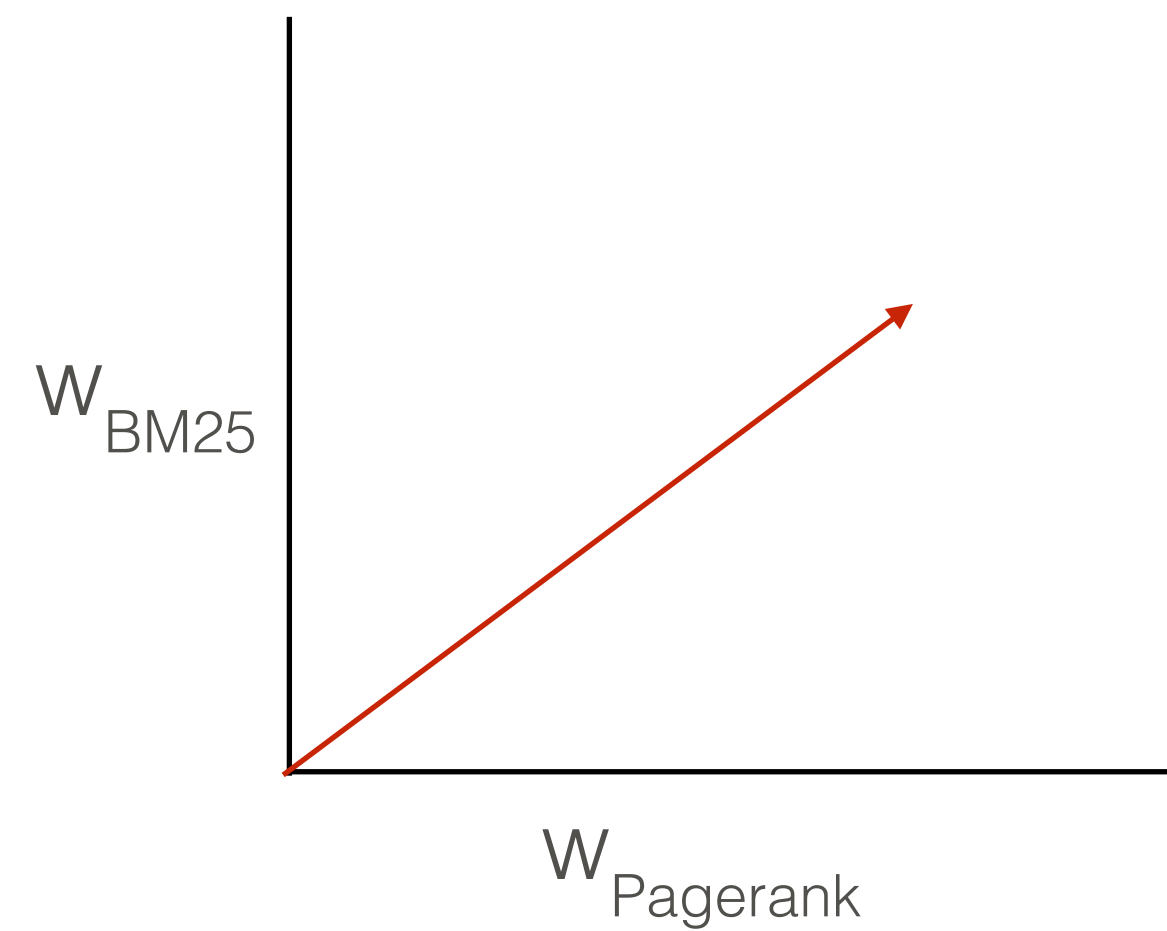


[Yue et al, 2009; Hofmann et al., 2011]

Dueling Bandit Gradient Descent

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For Blendle the user would be the query

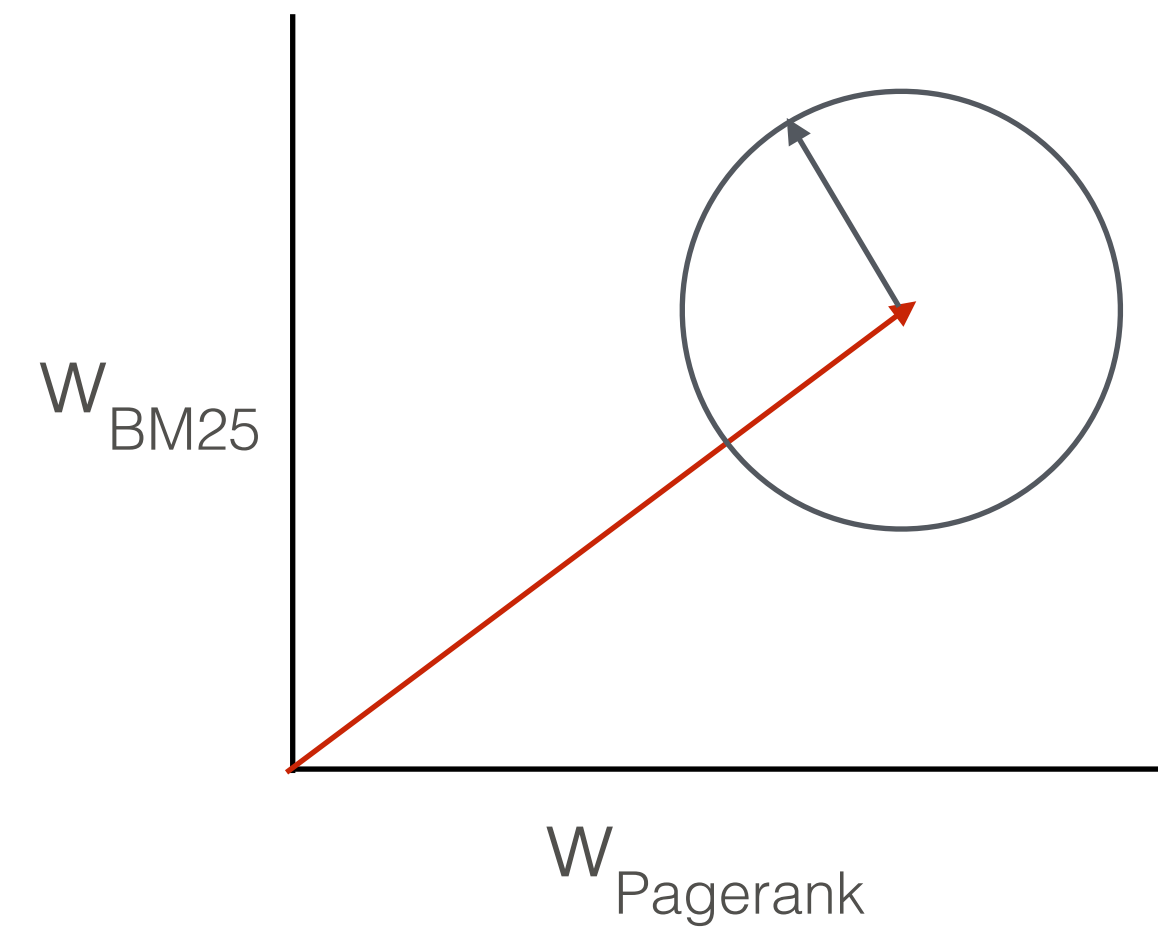
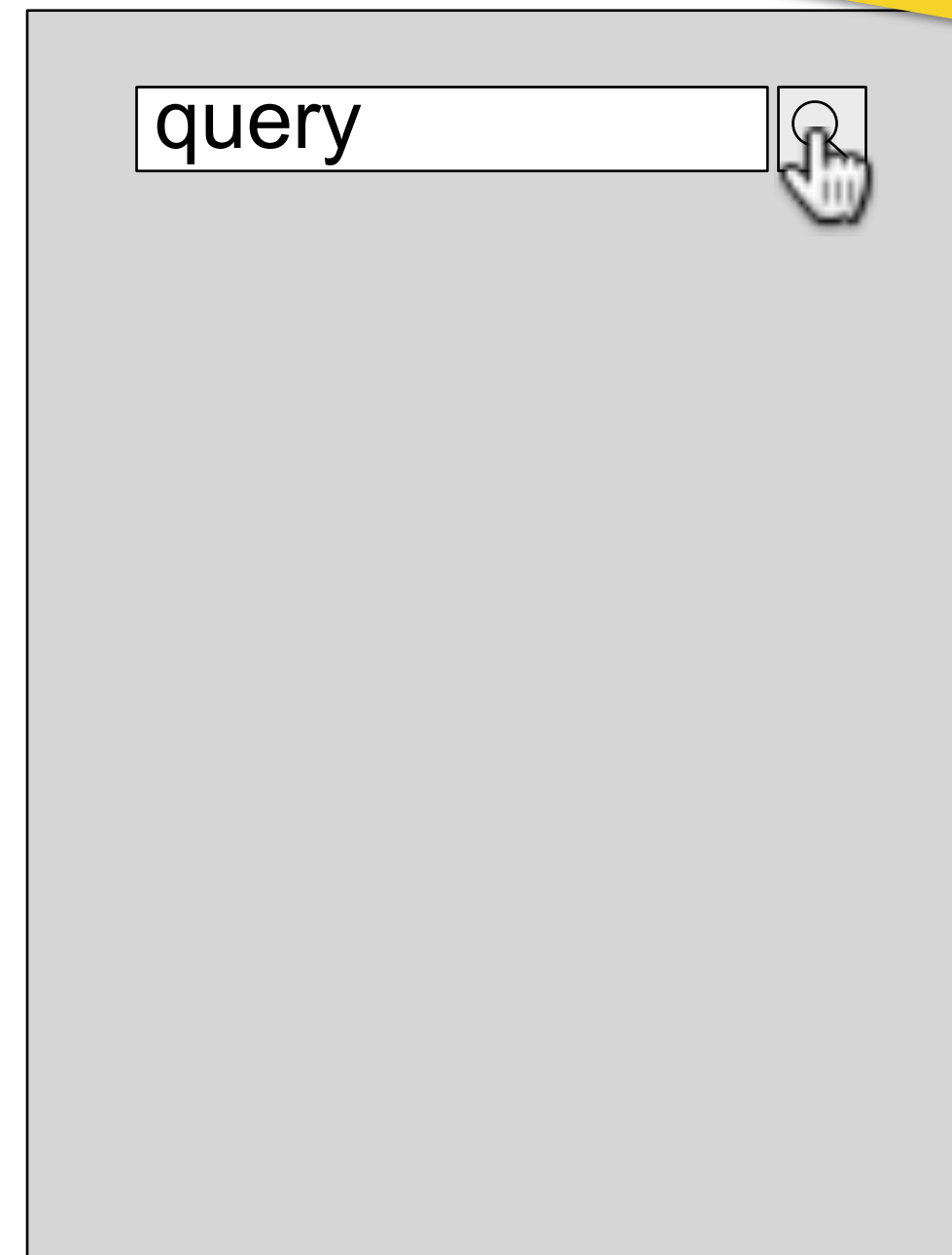
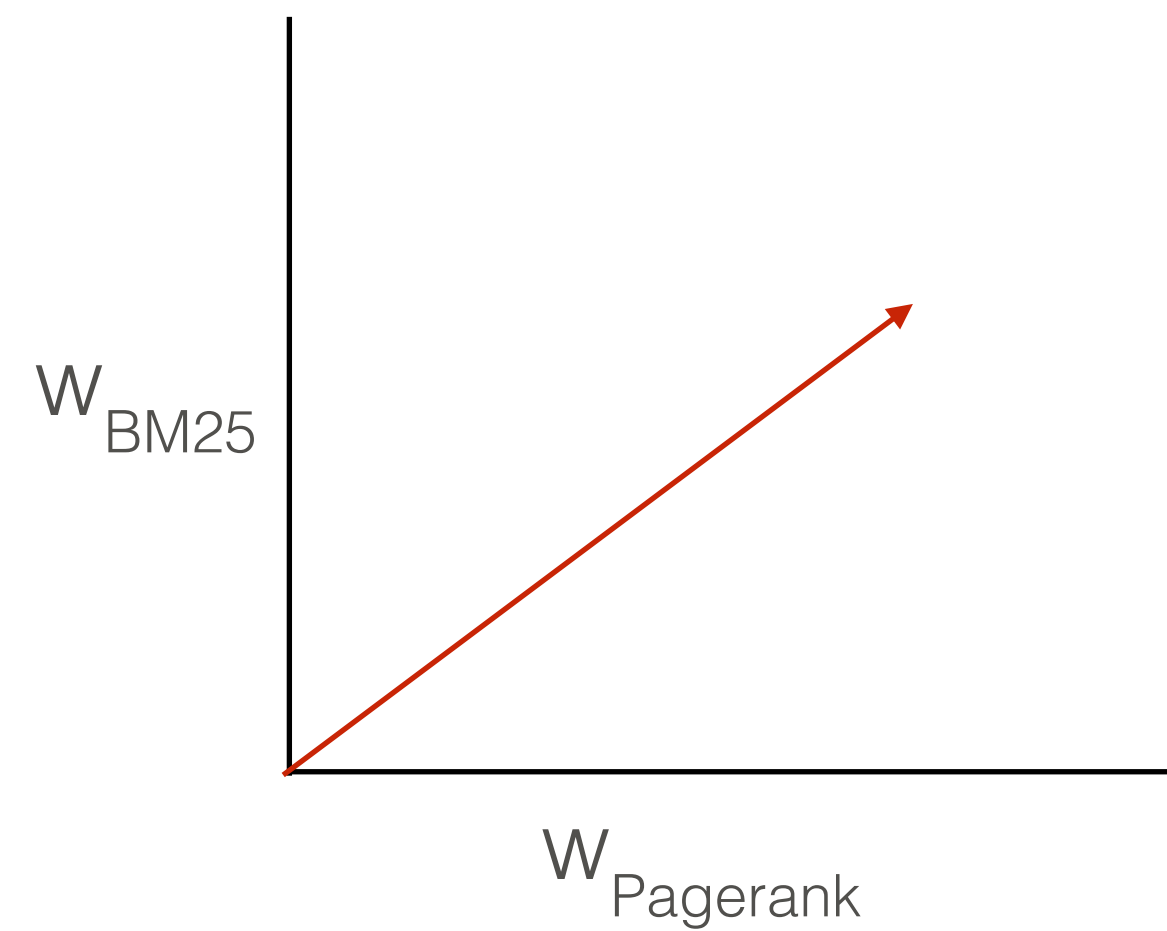


[Yue et al, 2009; Hofmann et al., 2011]

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For Blendle the user would be the query

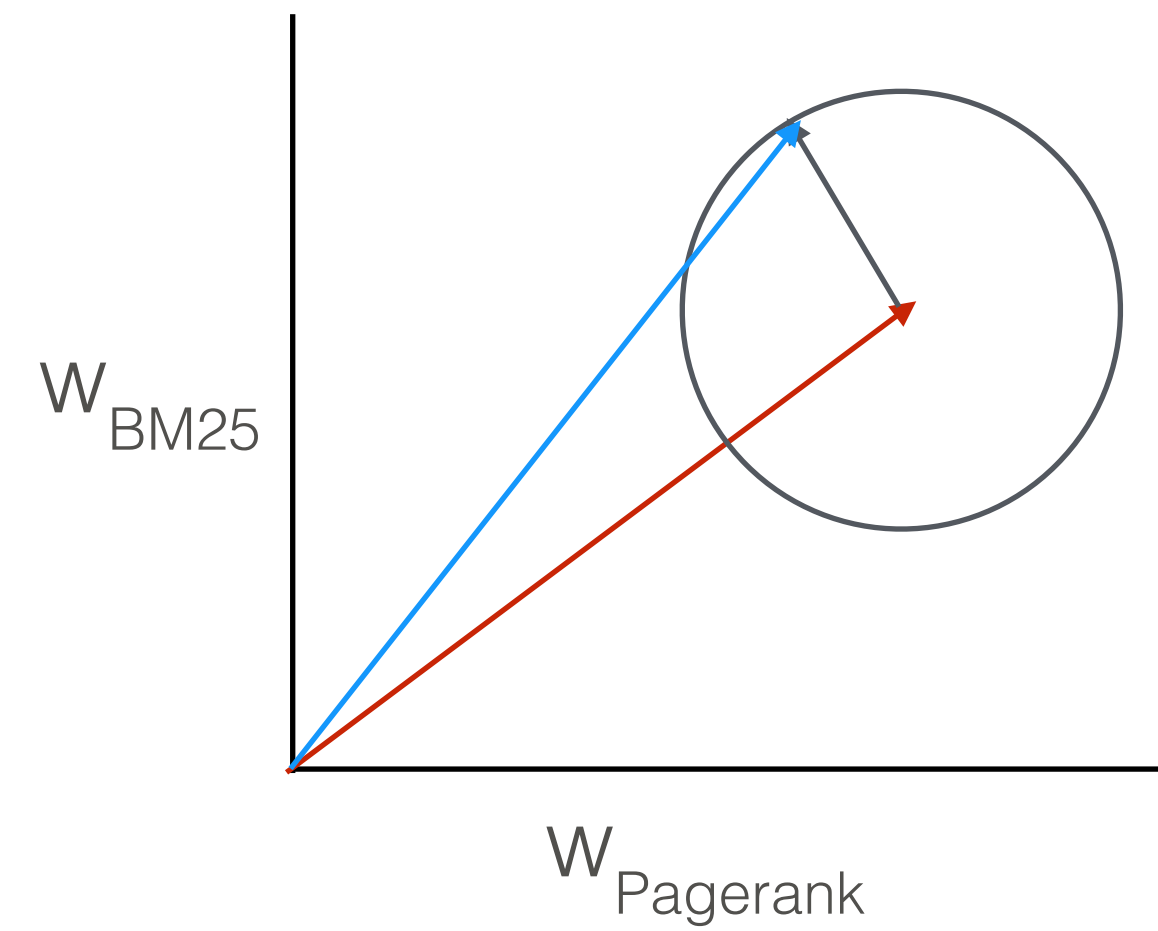
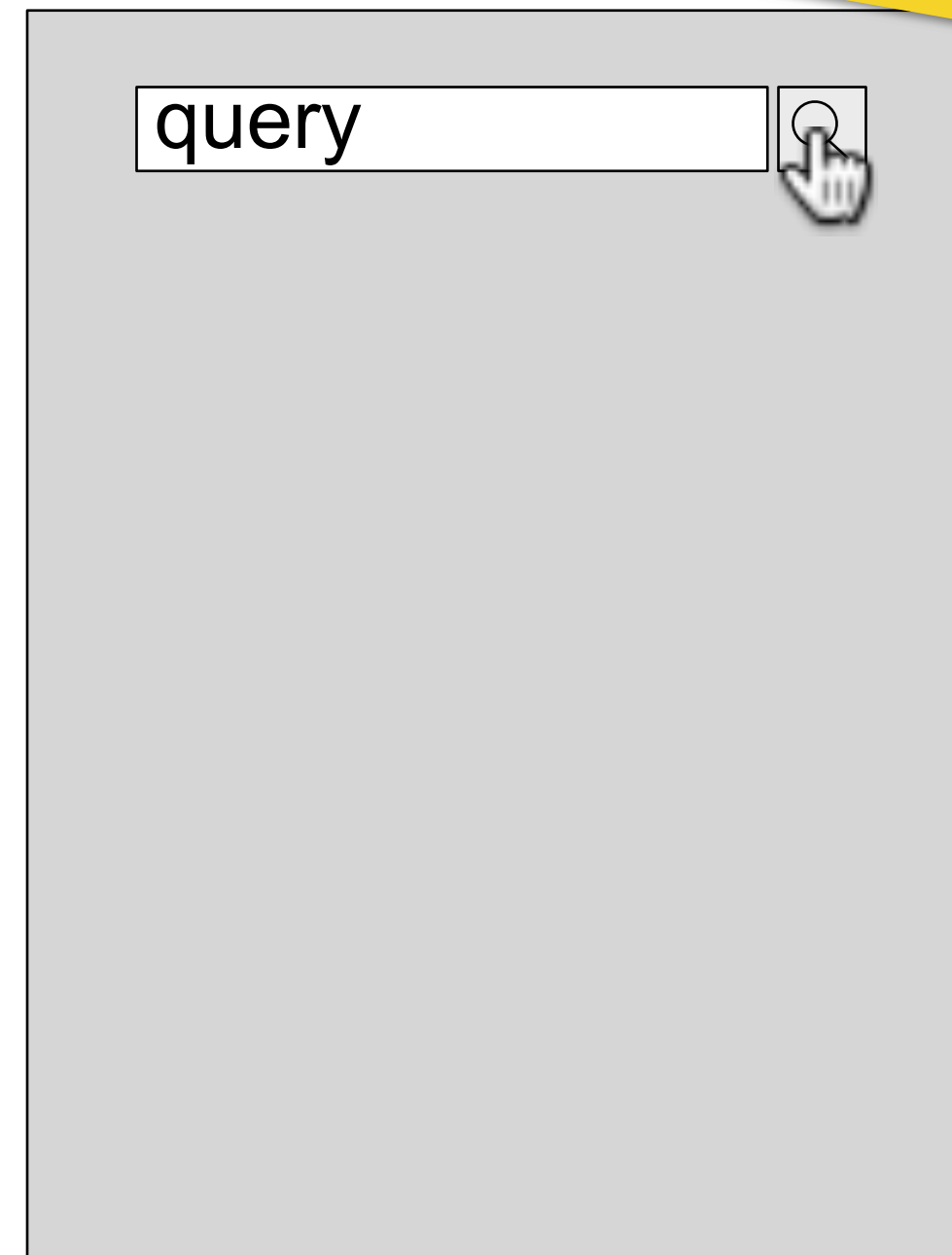
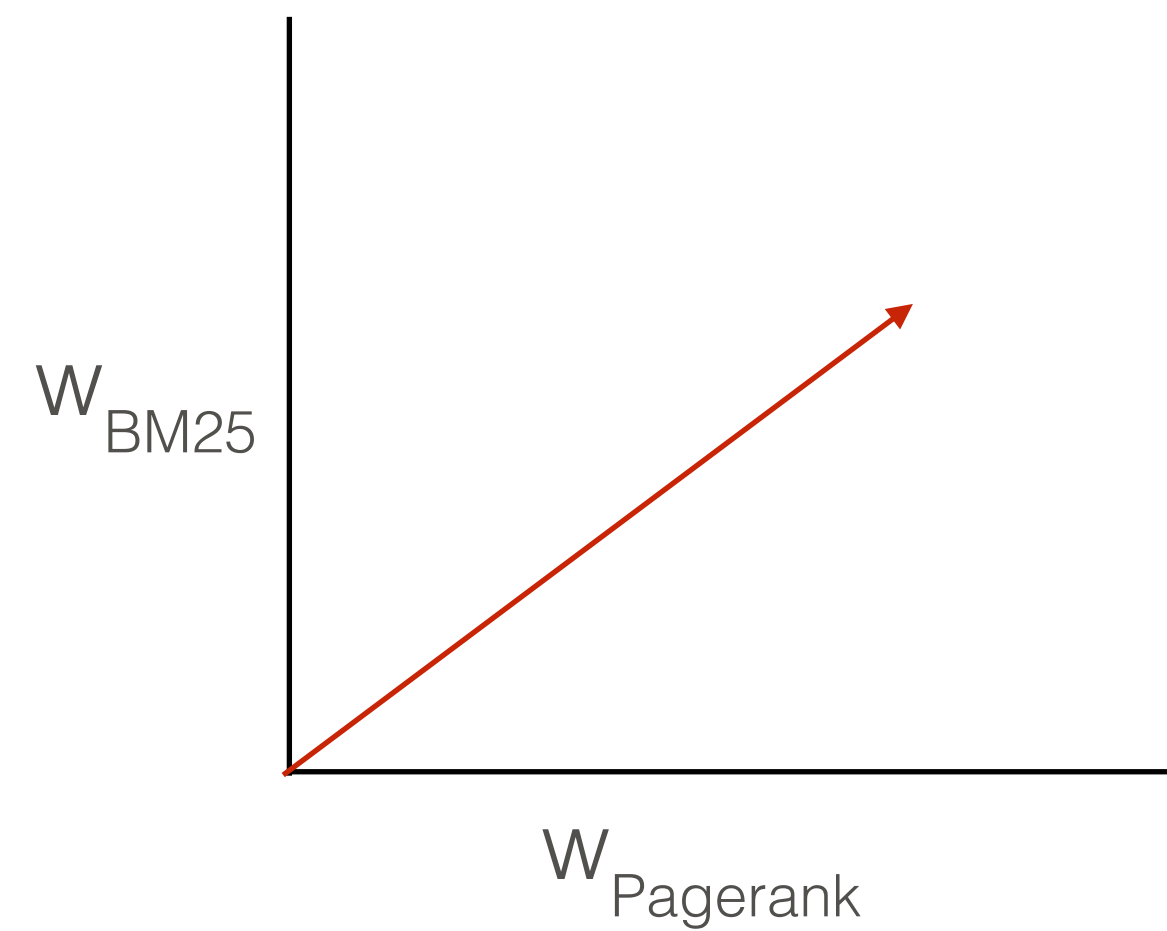


[Yue et al, 2009; Hofmann et al., 2011]

Dueling Bandit Gradient Descent

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For Blendle the user would be the query

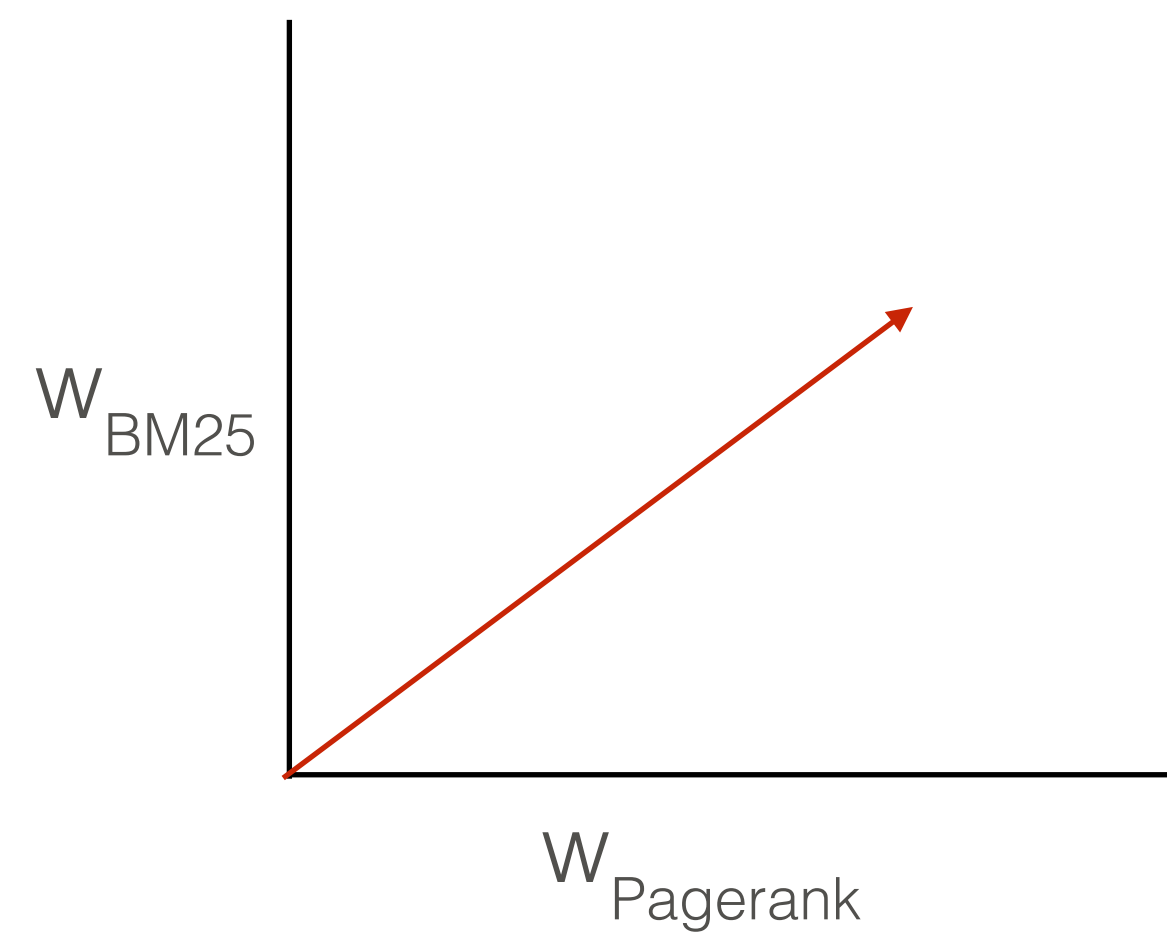


[Yue et al, 2009; Hofmann et al., 2011]

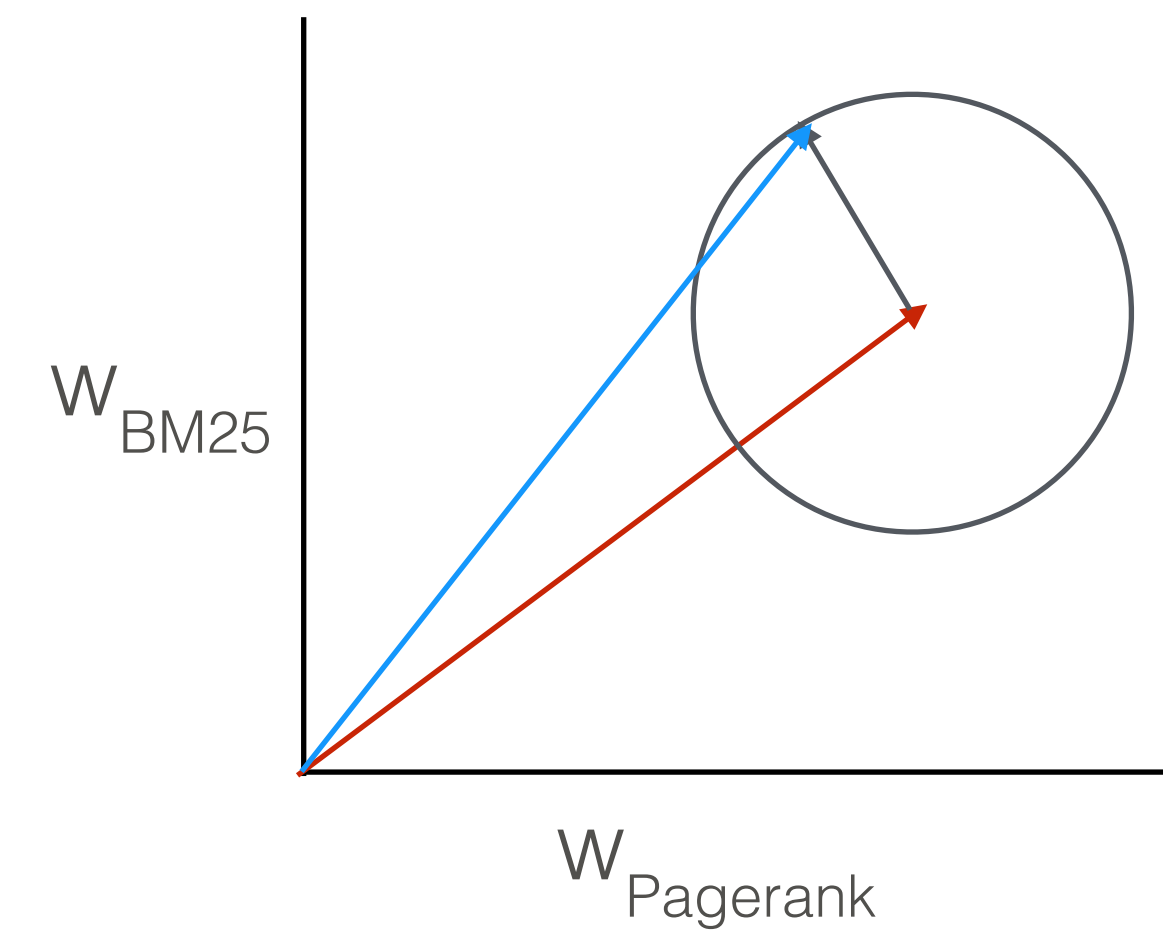
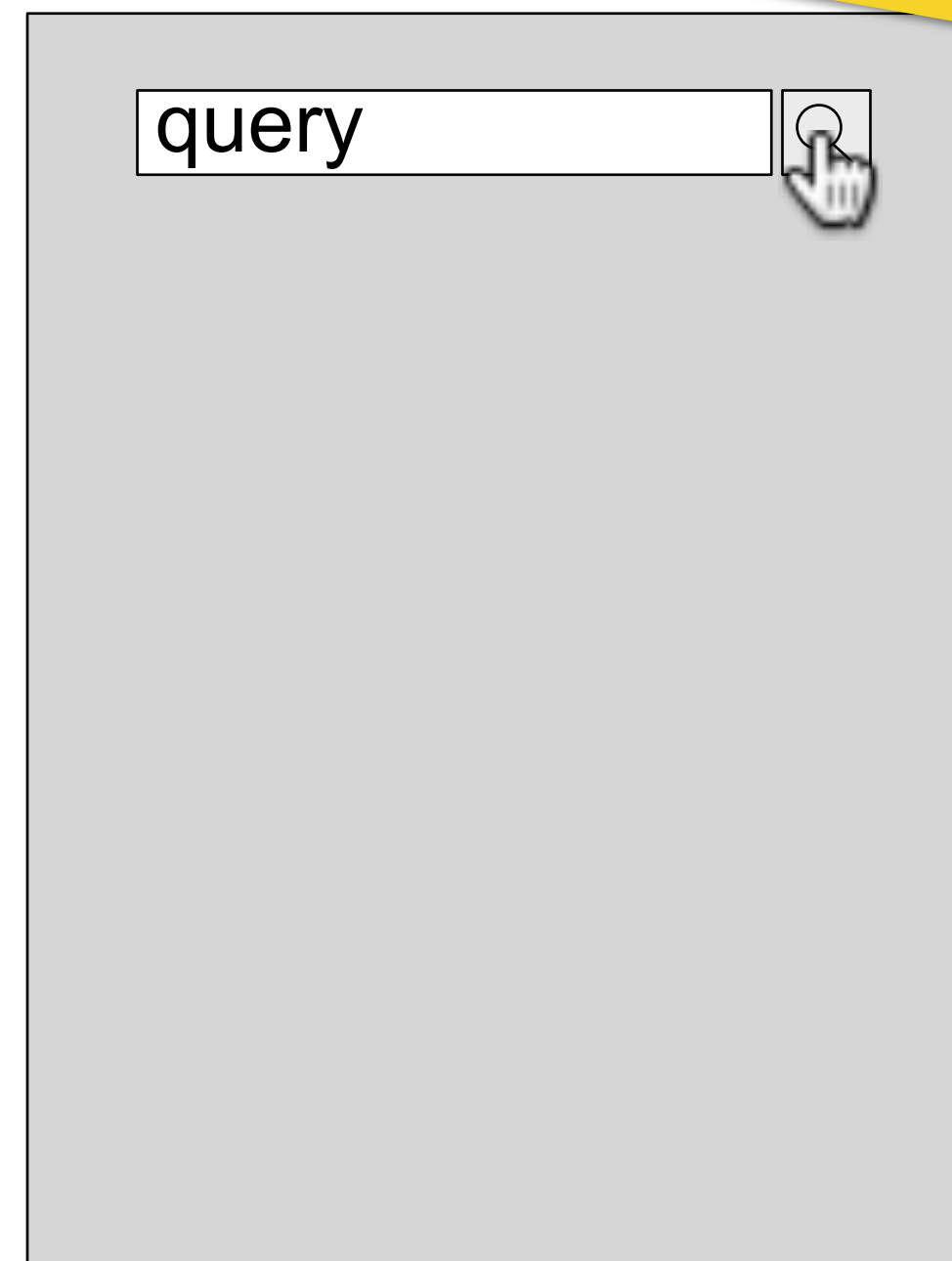
Dueling Bandit Gradient Descent

We are not yet doing this at Blendle

Exploitative Ranker



For Blendle the user would be the query



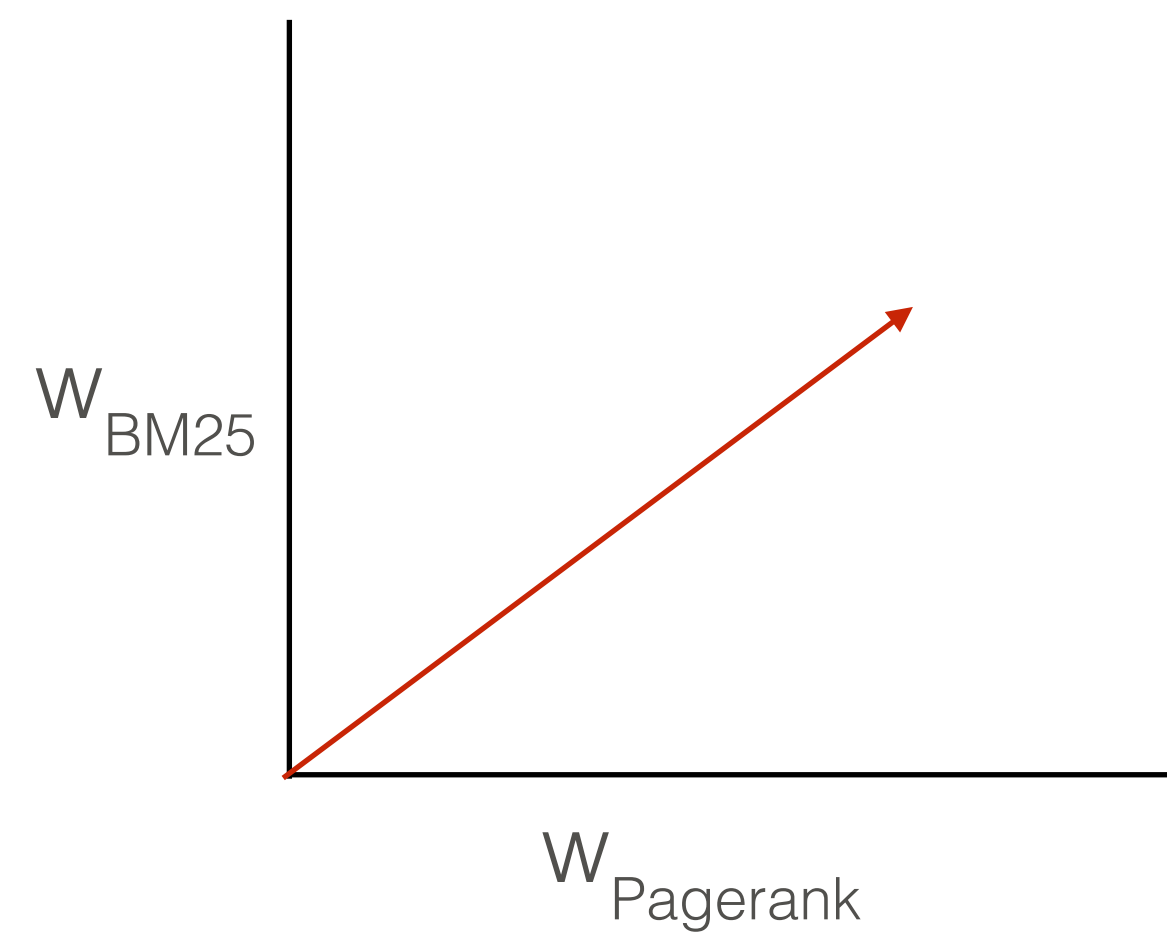
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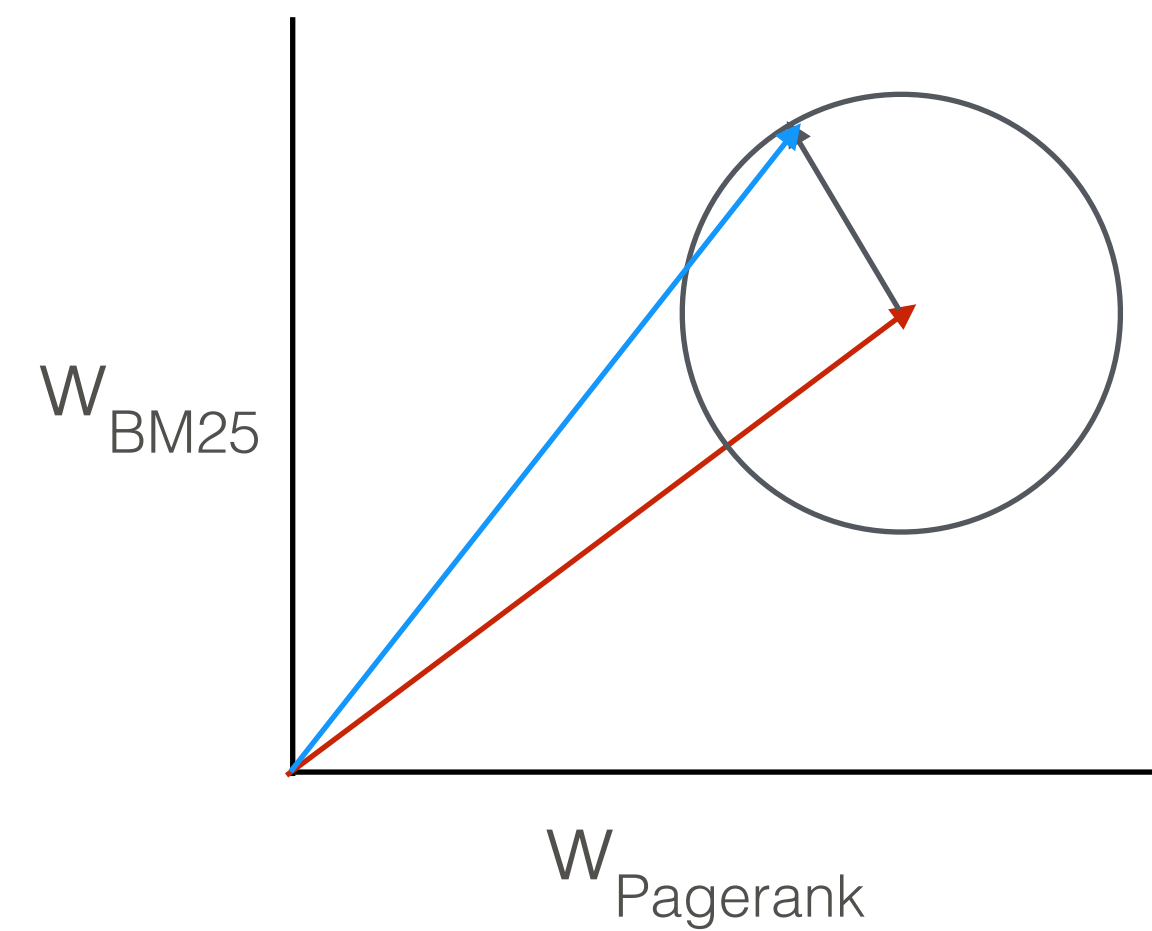
We are not yet doing this at Blendle

For Blendle the user would be the query

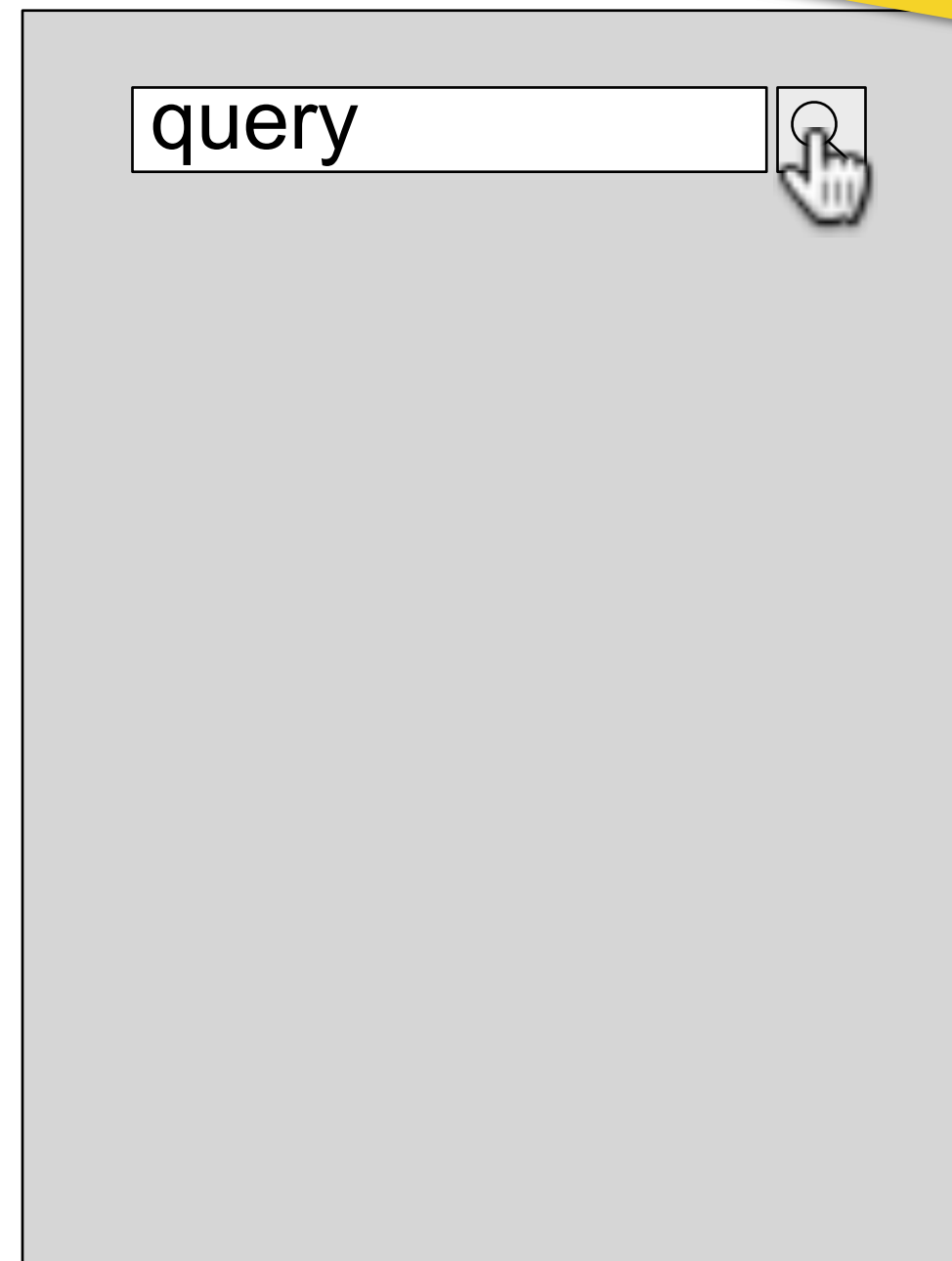
Exploitative Ranker



Explorative Ranker



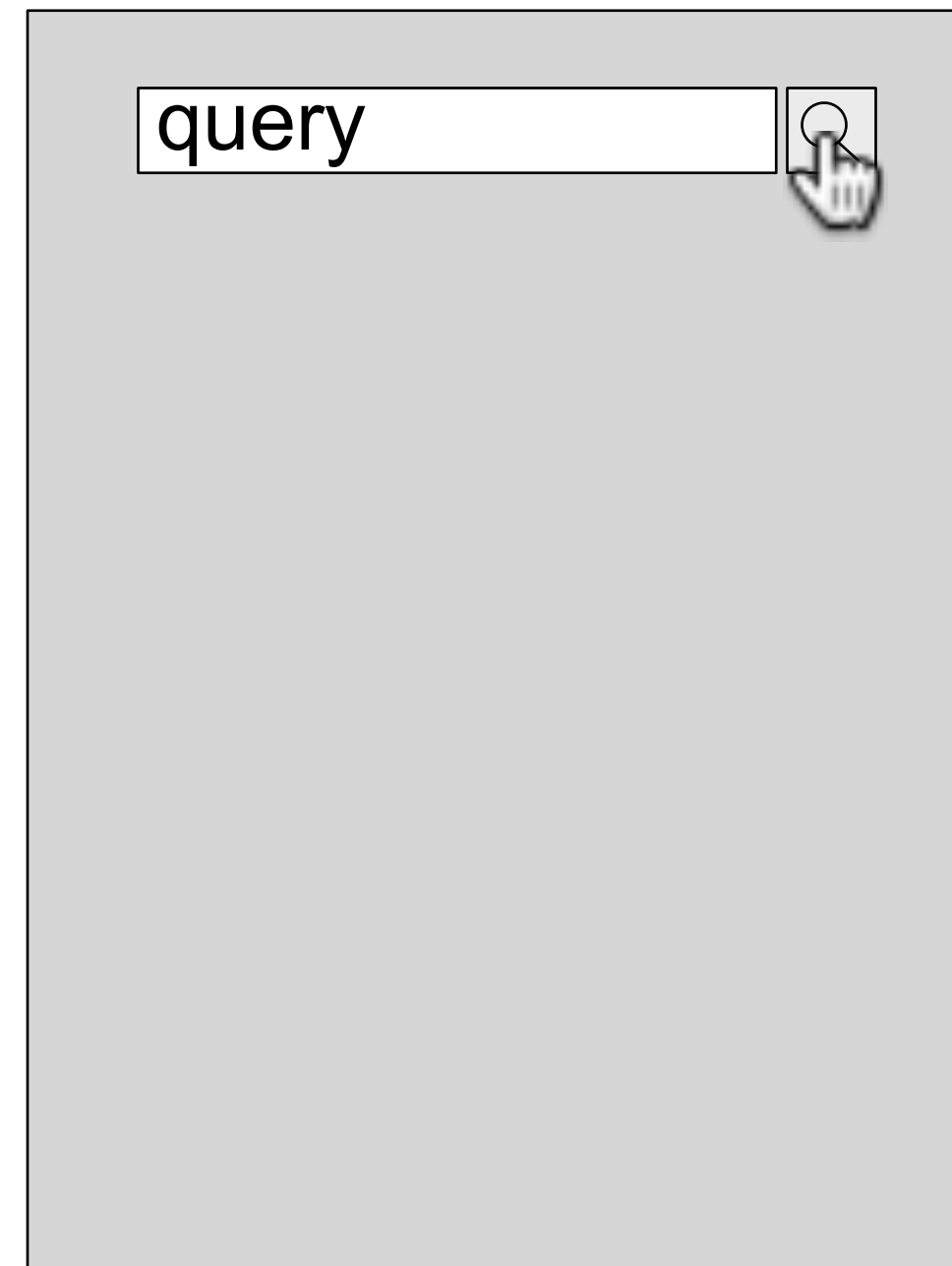
[Yue et al, 2009; Hofmann et al., 2011]



TeamDraft Interleave

We are not yet doing
this at Blendle

Interleaved Ranking



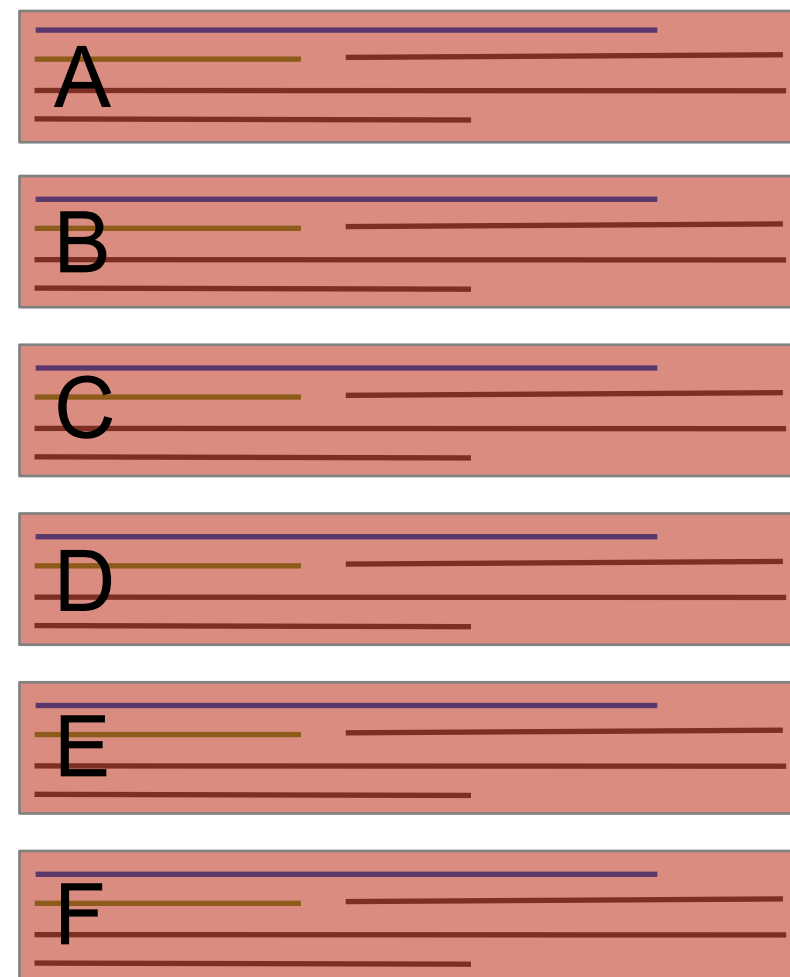
query

Radlinski, F., Kurup, M., & Joachims, T. (2008). How does clickthrough data reflect retrieval quality? In CIKM '08.

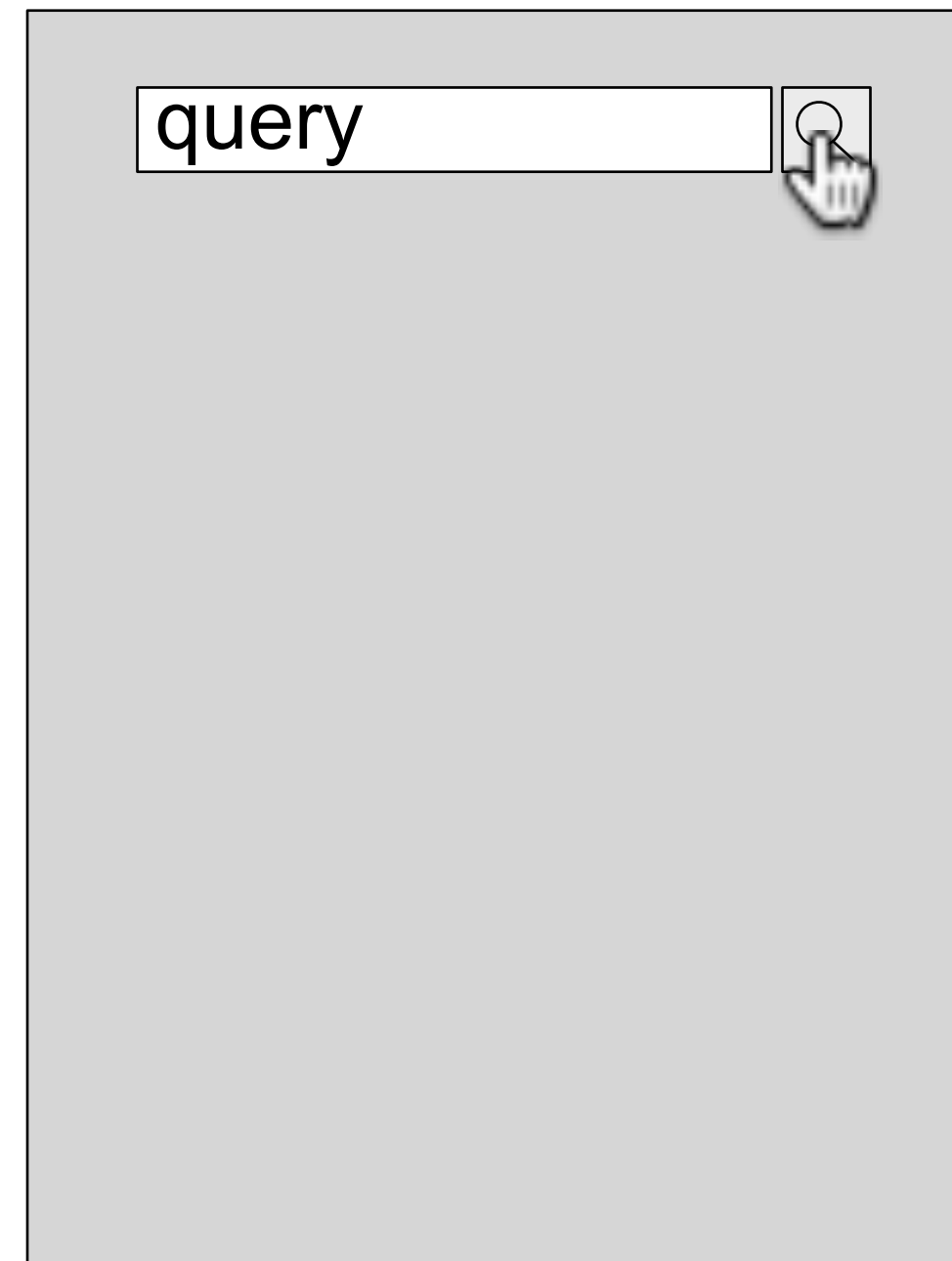
TeamDraft Interleave

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Exploitative Ranking



Interleaved Ranking

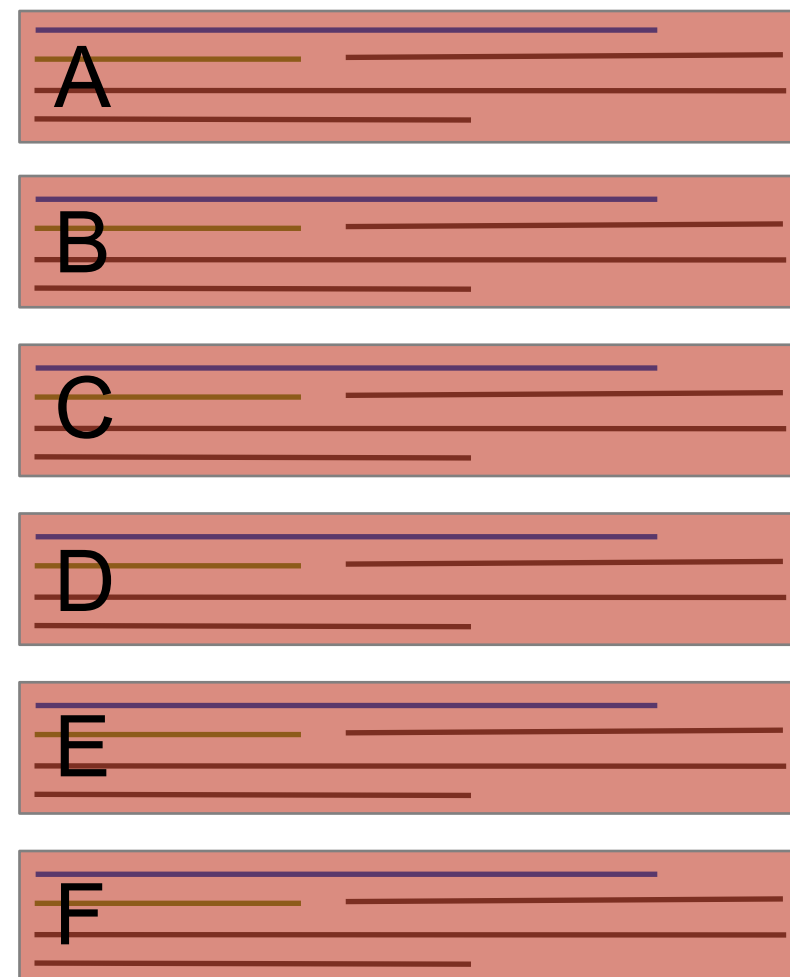


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TeamDraft Interleave

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Exploitative Ranking



Interleaved Ranking

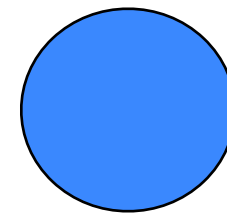
A search interface with a light gray background. At the top, there is a white input field containing the text 'query'. To the right of the input field is a magnifying glass icon with a hand cursor pointing at it.

Explorative Ranking

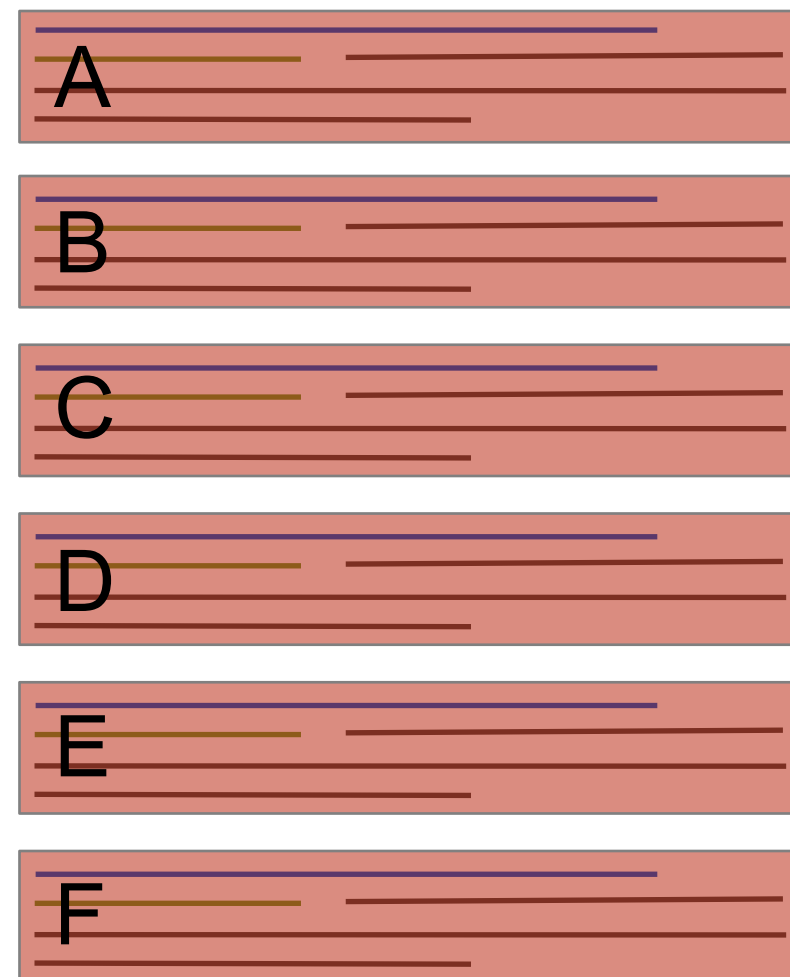


Radlinski, F., Kurup, M., & Joachims, T. (2008). How does clickthrough data reflect retrieval quality? In CIKM '08.

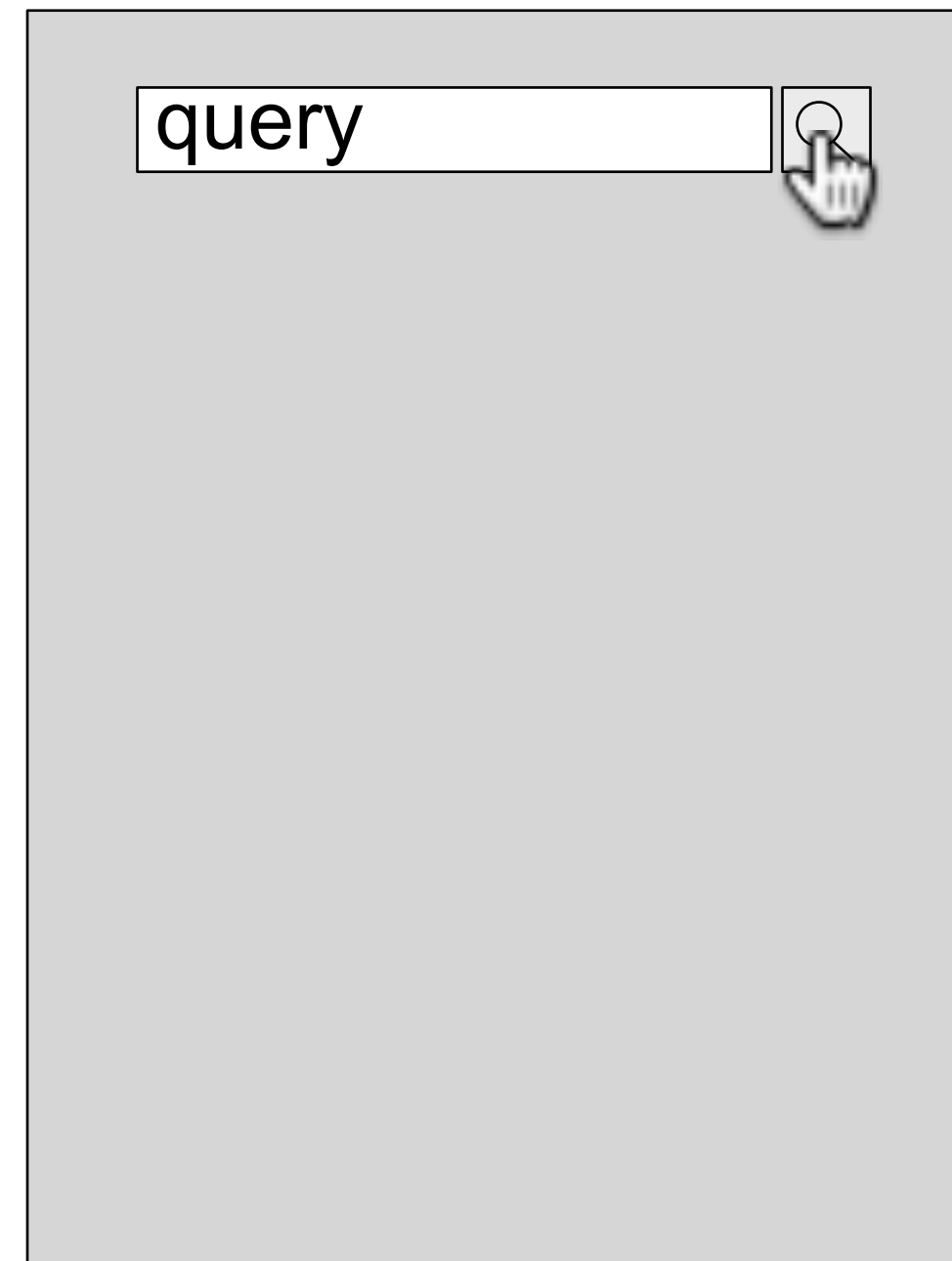
TeamDraft Interleave



Exploitative Ranking



Interleaved Ranking

A gray rectangular panel representing a search interface. At the top, there is a white text input field containing the word "query". To the right of the input field is a magnifying glass icon with a hand cursor pointing at it.

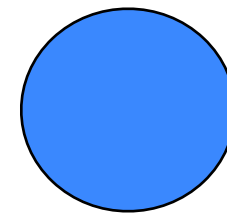
Explorative Ranking



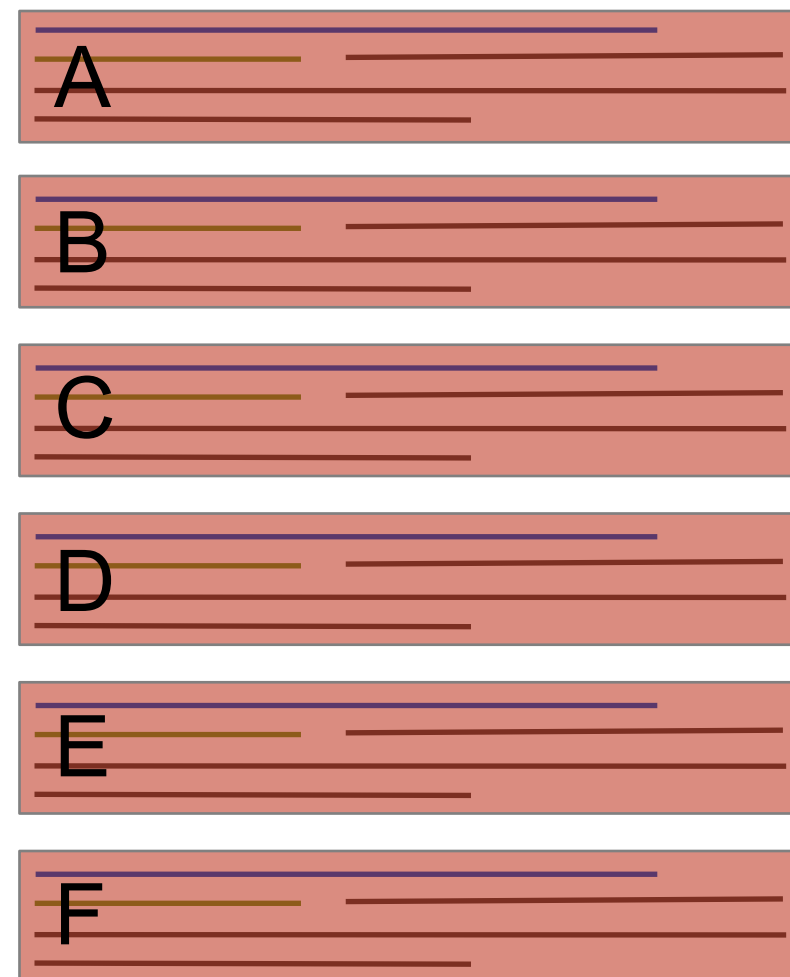
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Radlinski, F., Kurup, M., & Joachims, T. (2008). How does clickthrough data reflect retrieval quality? In CIKM '08.

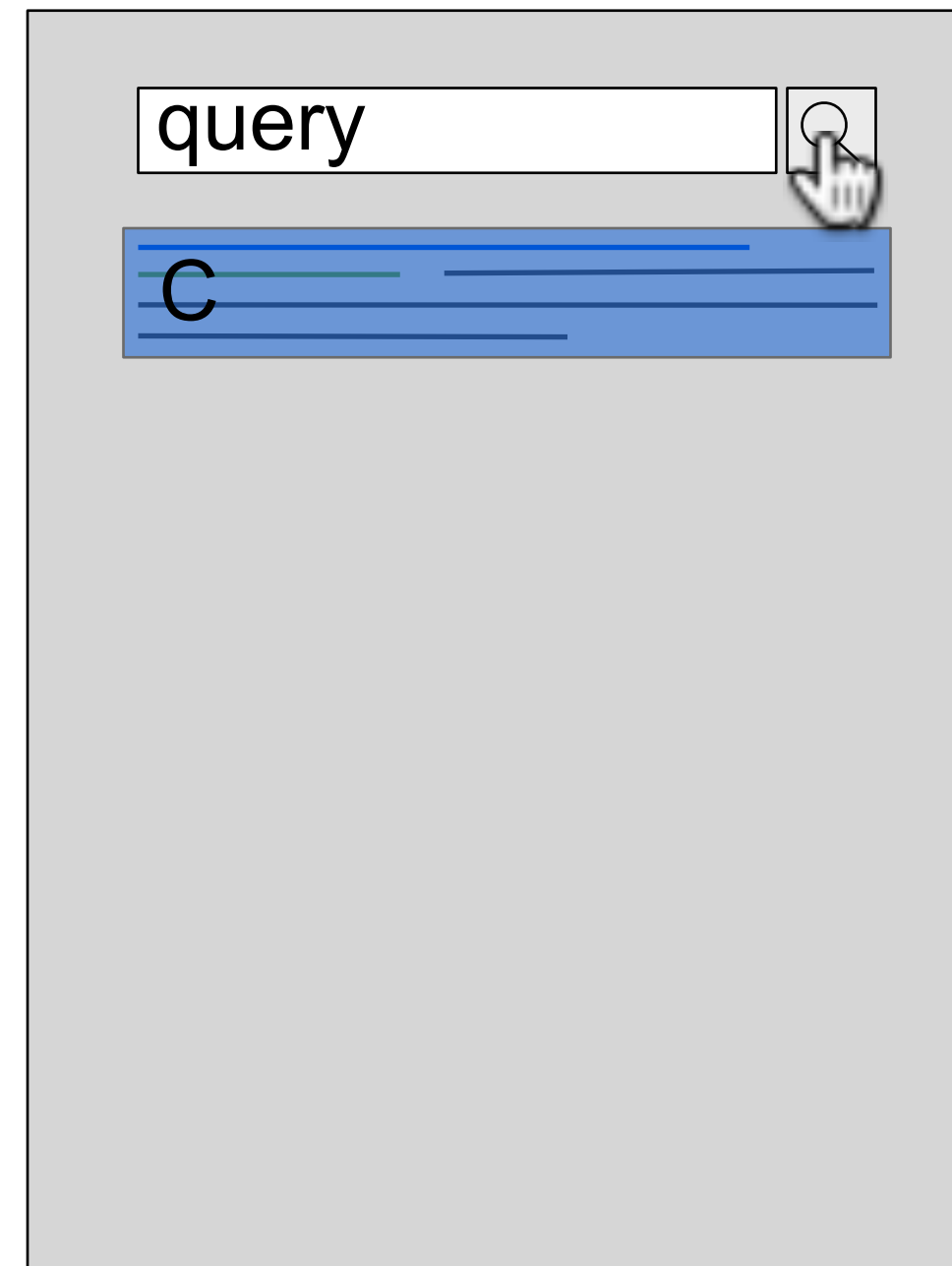
TeamDraft Interleave



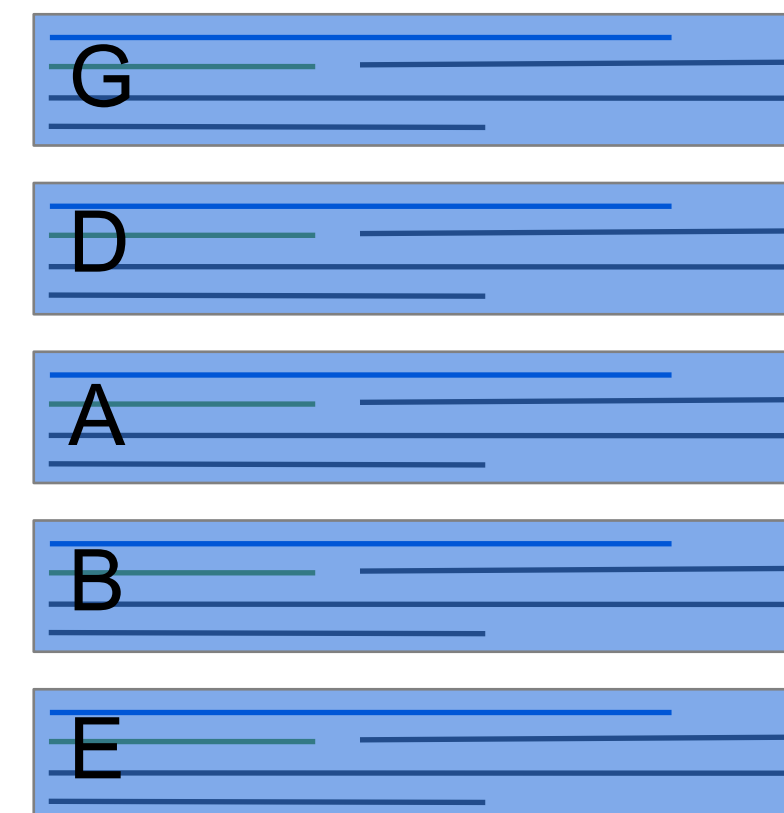
Exploitative Ranking



Interleaved Ranking



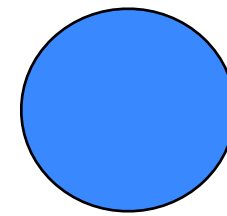
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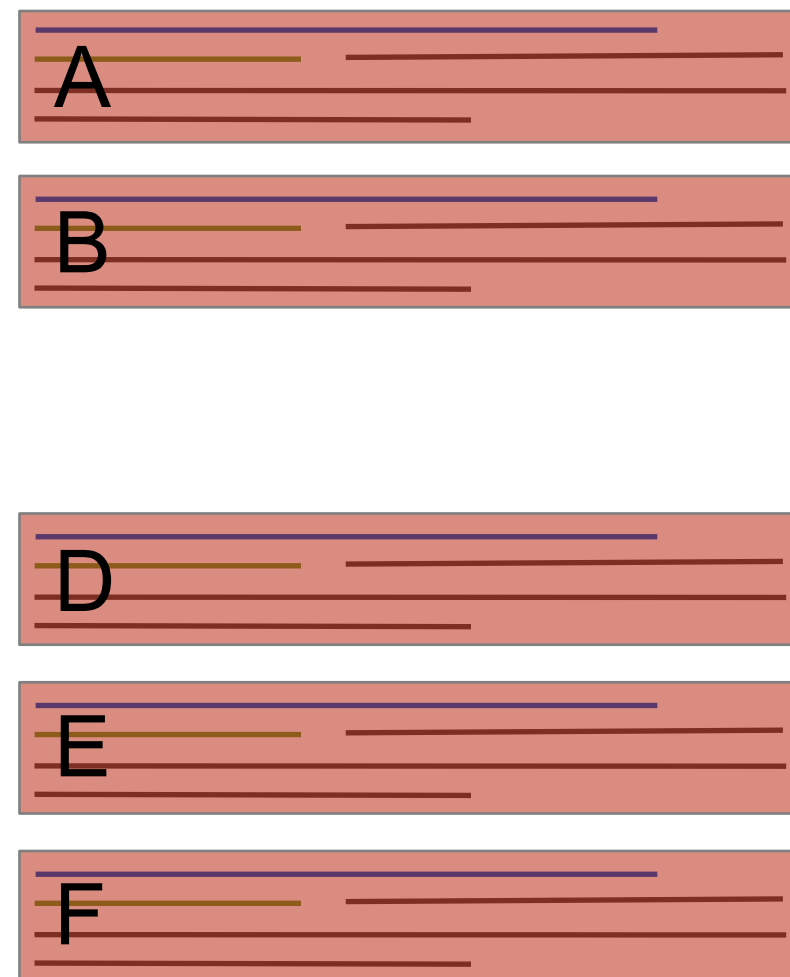
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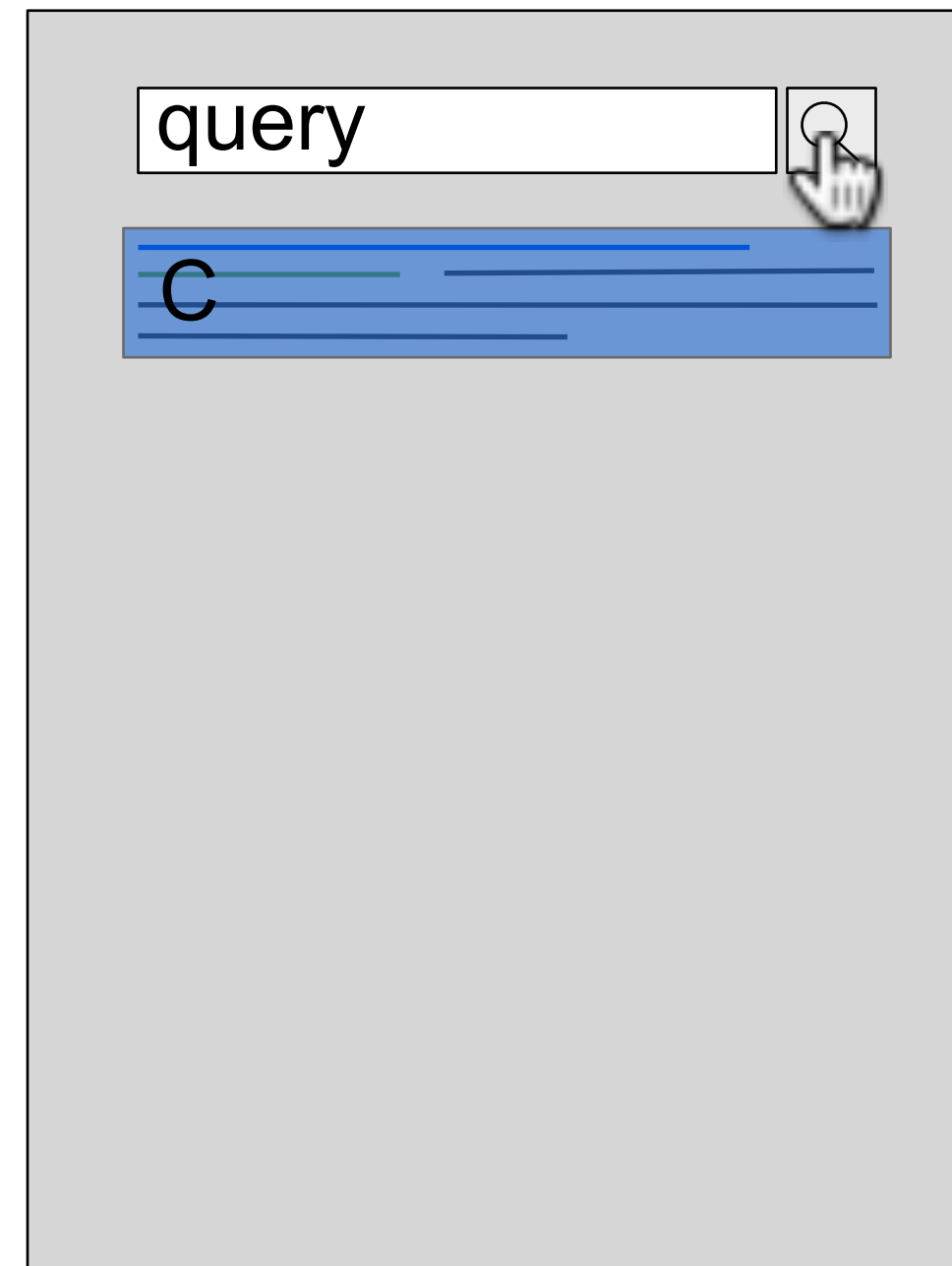
TeamDraft Interleave



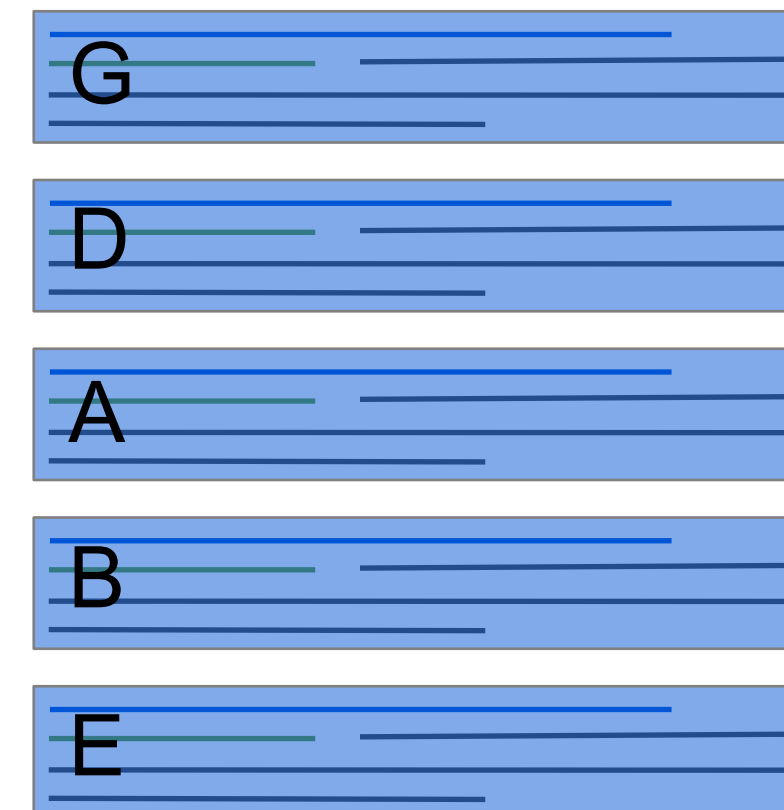
Exploitative Ranking



Interleaved Ranking



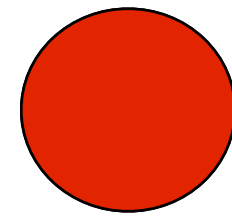
Explorative Ranking



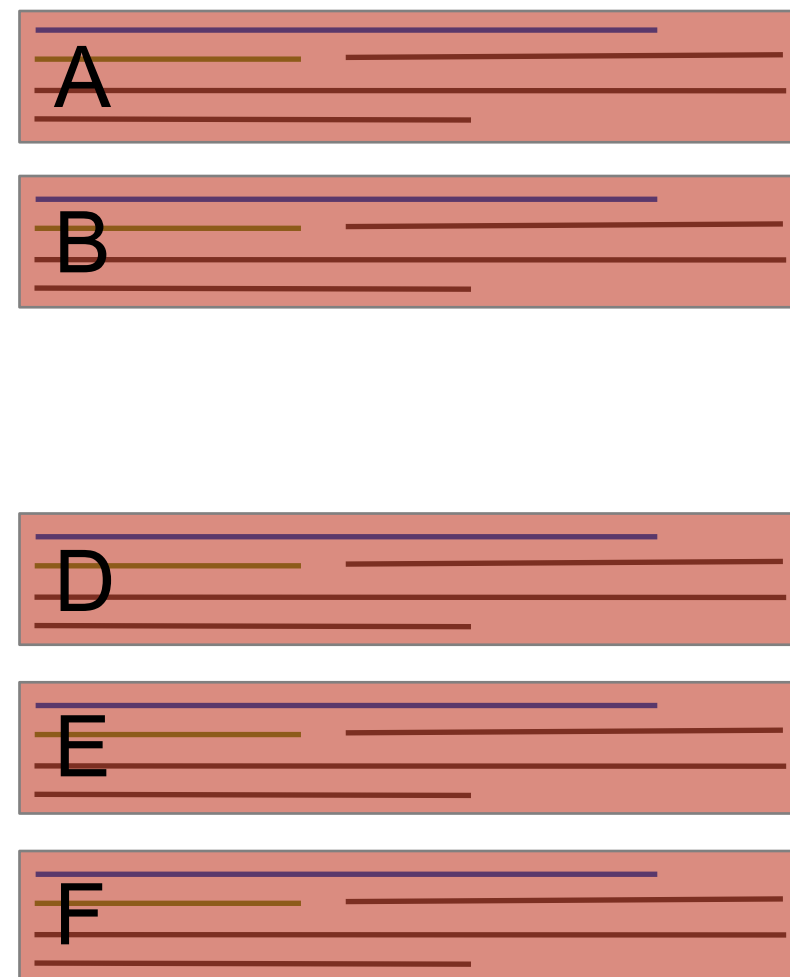
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Radlinski, F., Kurup, M., & Joachims, T. (2008). How does clickthrough data reflect retrieval quality? In CIKM '08.

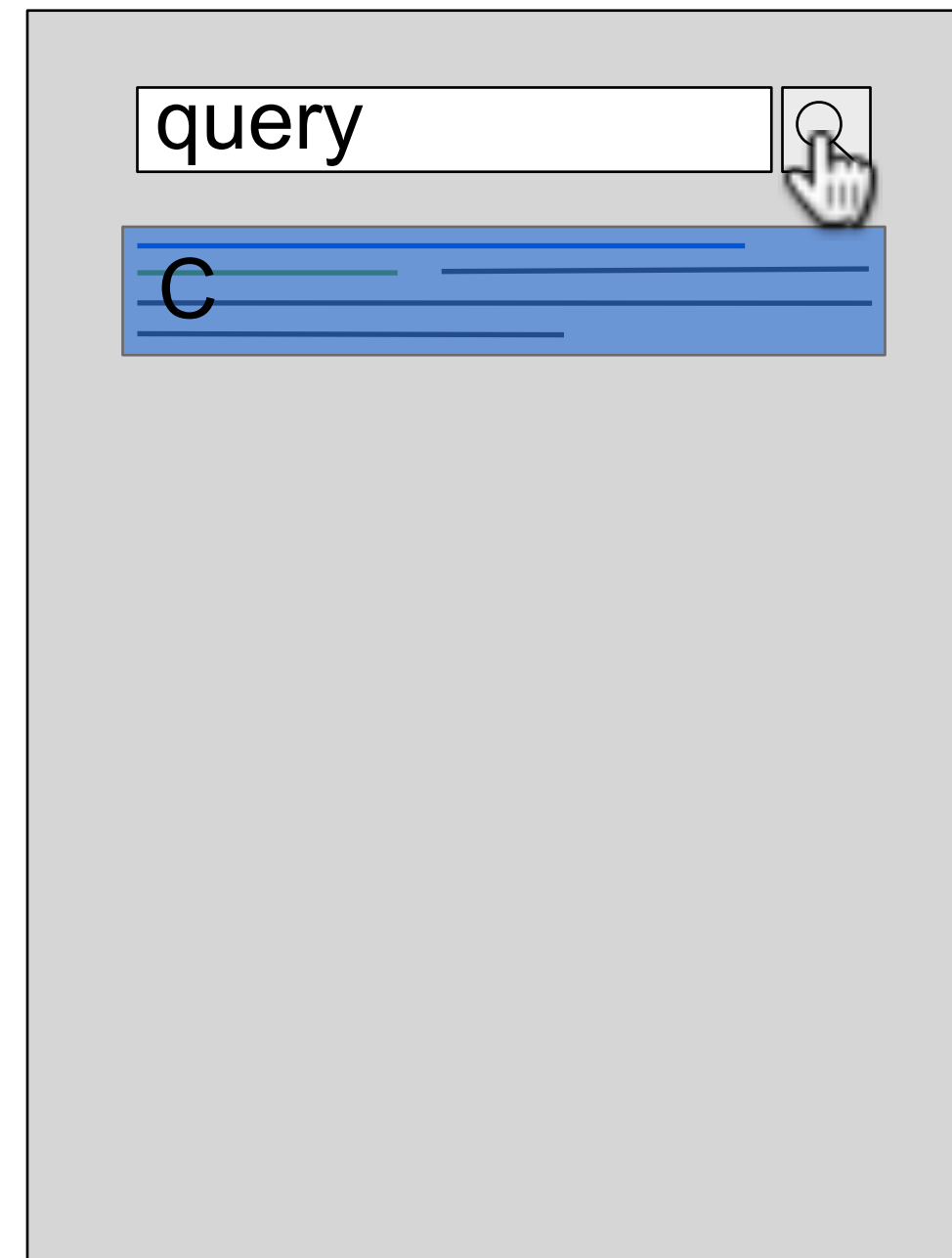
TeamDraft Interleave



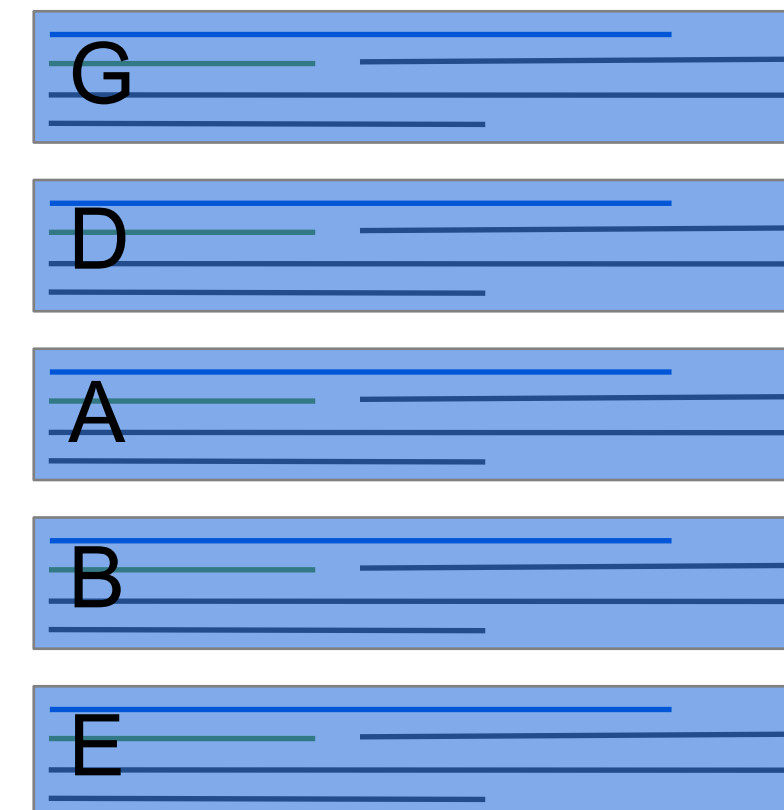
Exploitative Ranking



Interleaved Ranking



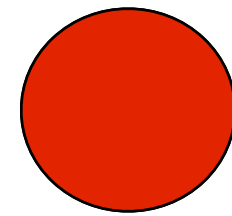
Explorative Ranking



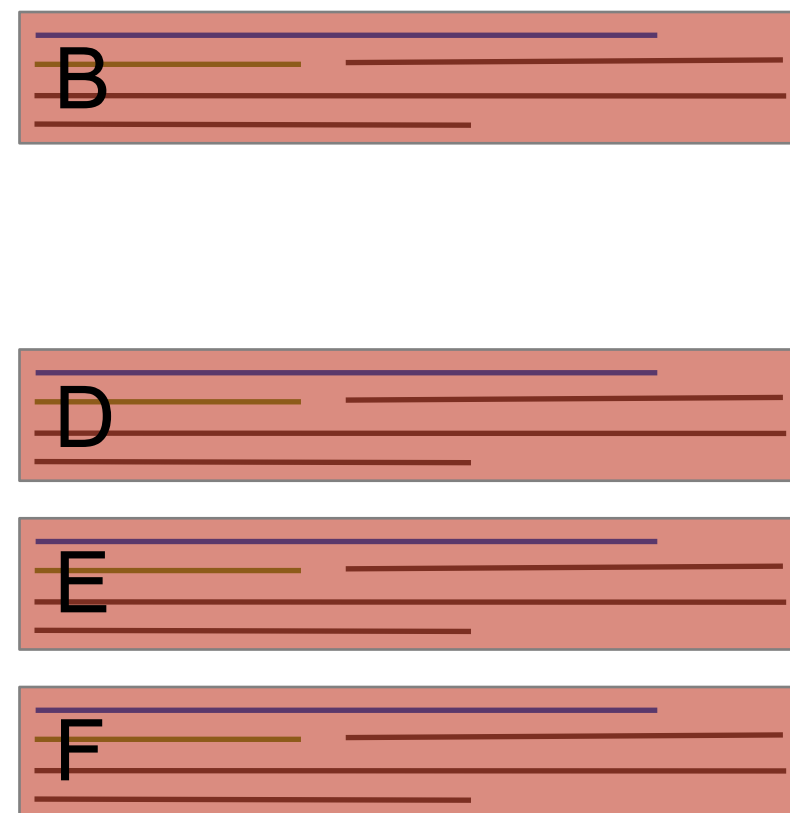
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Radlinski, F., Kurup, M., & Joachims, T. (2008). How does clickthrough data reflect retrieval quality? In CIKM '08.

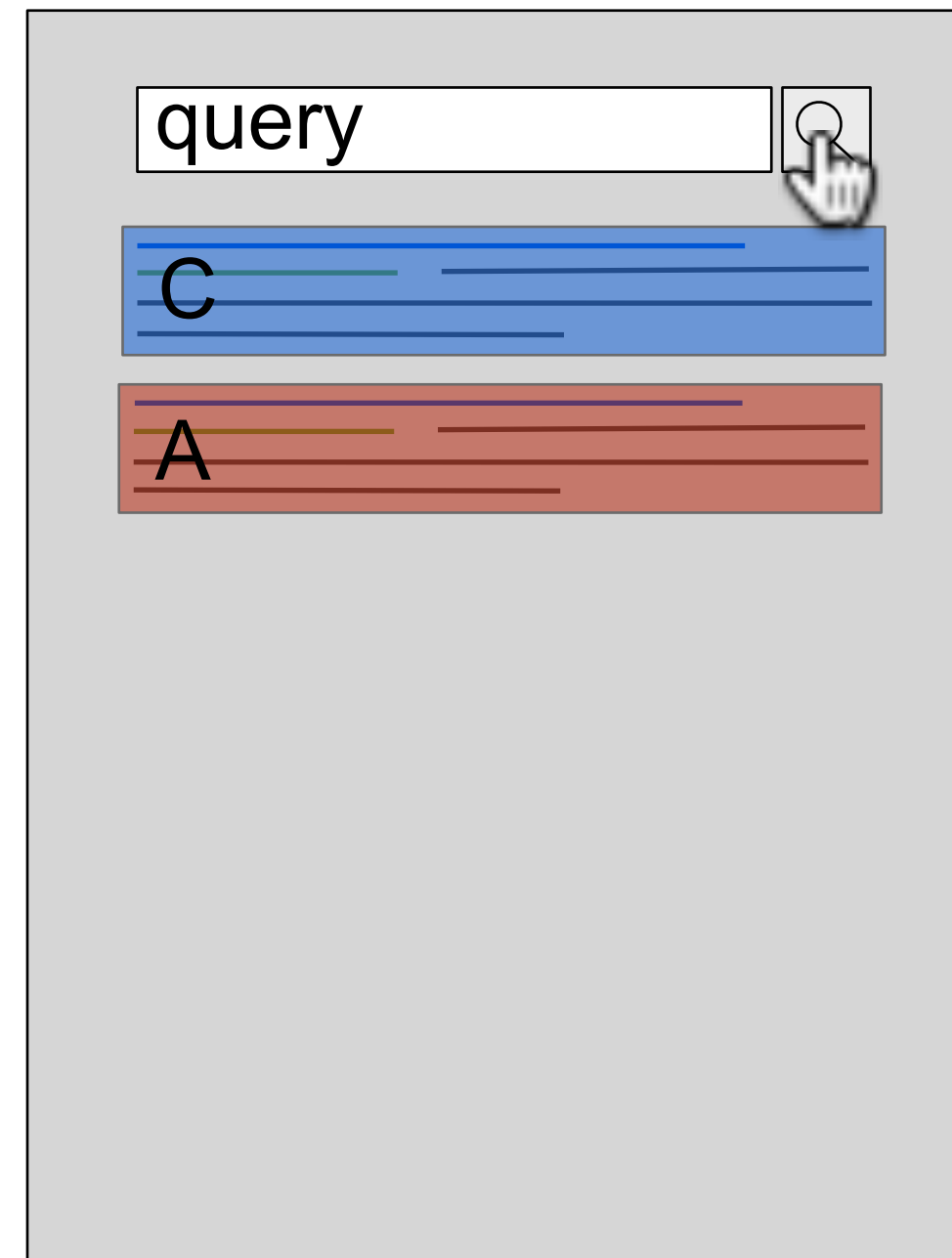
TeamDraft Interleave



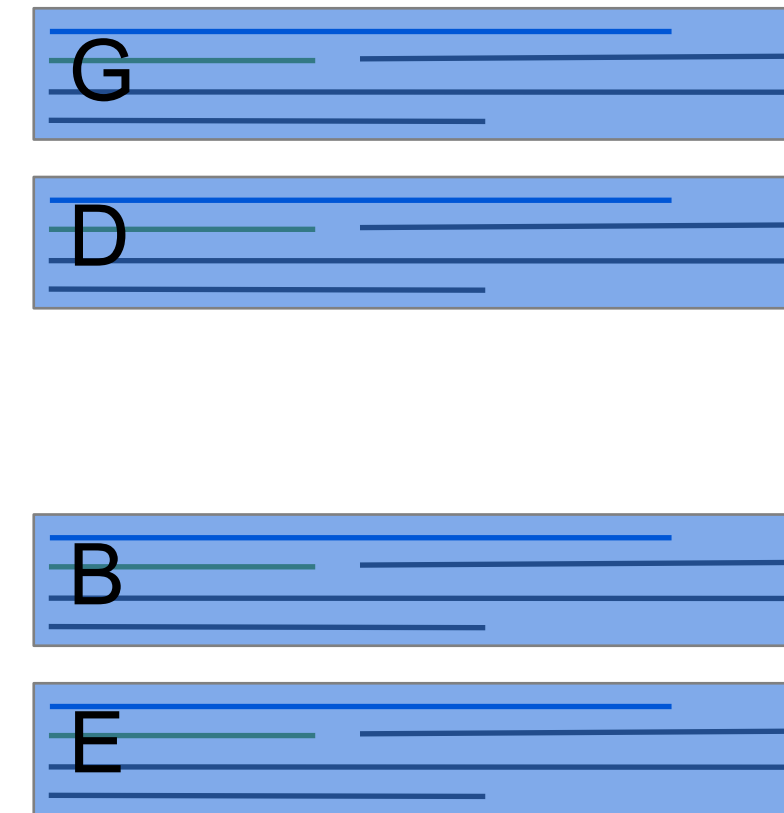
Exploitative Ranking



Interleaved Ranking



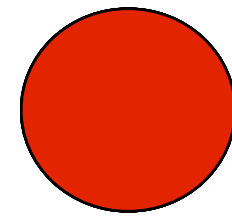
Explorative Ranking



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Radlinski, F., Kurup, M., & Joachims, T. (2008). How does clickthrough data reflect retrieval quality? In CIKM '08.

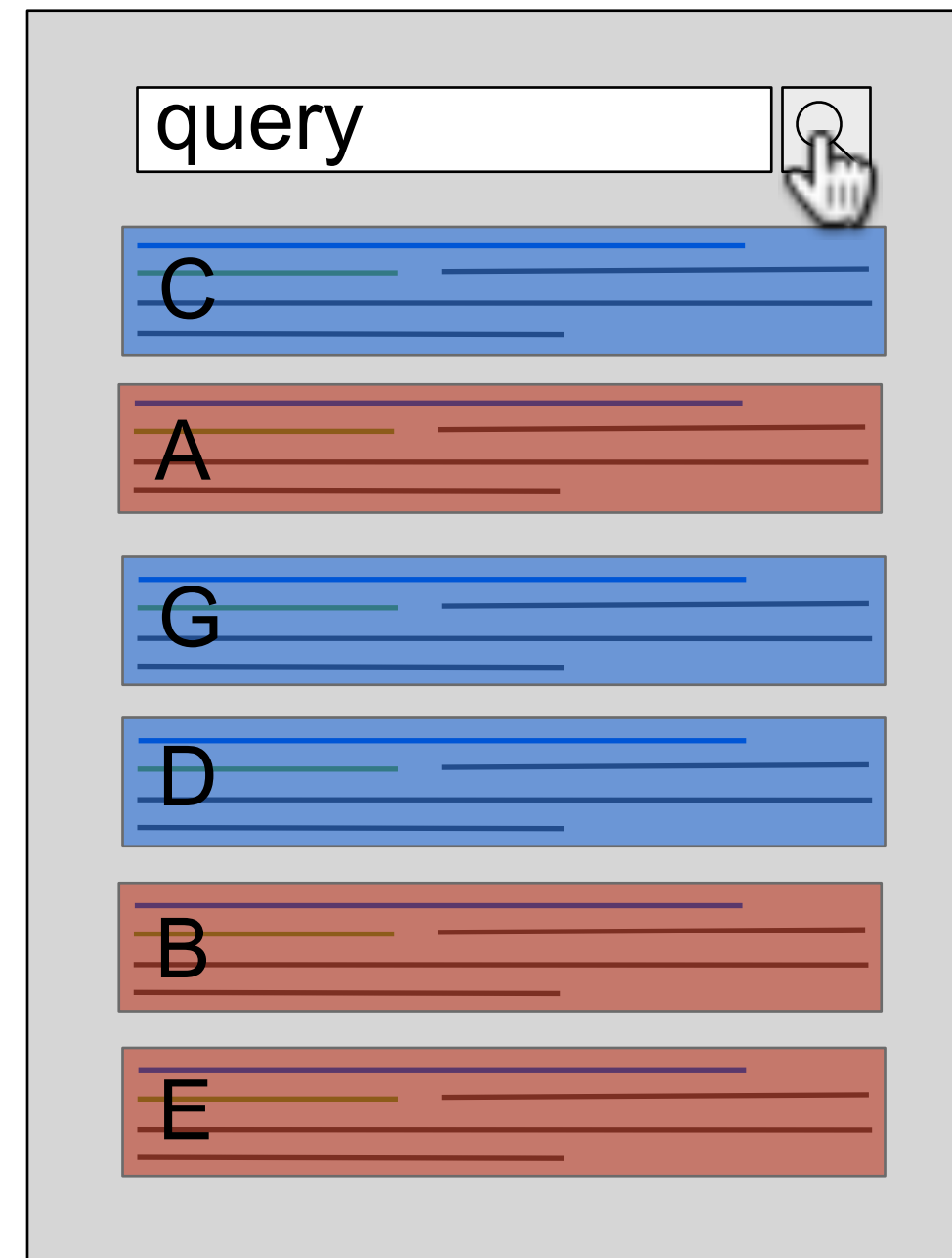
TeamDraft Interleave



Exploitative Ranking

Interleaved Ranking

Explorative Ranking



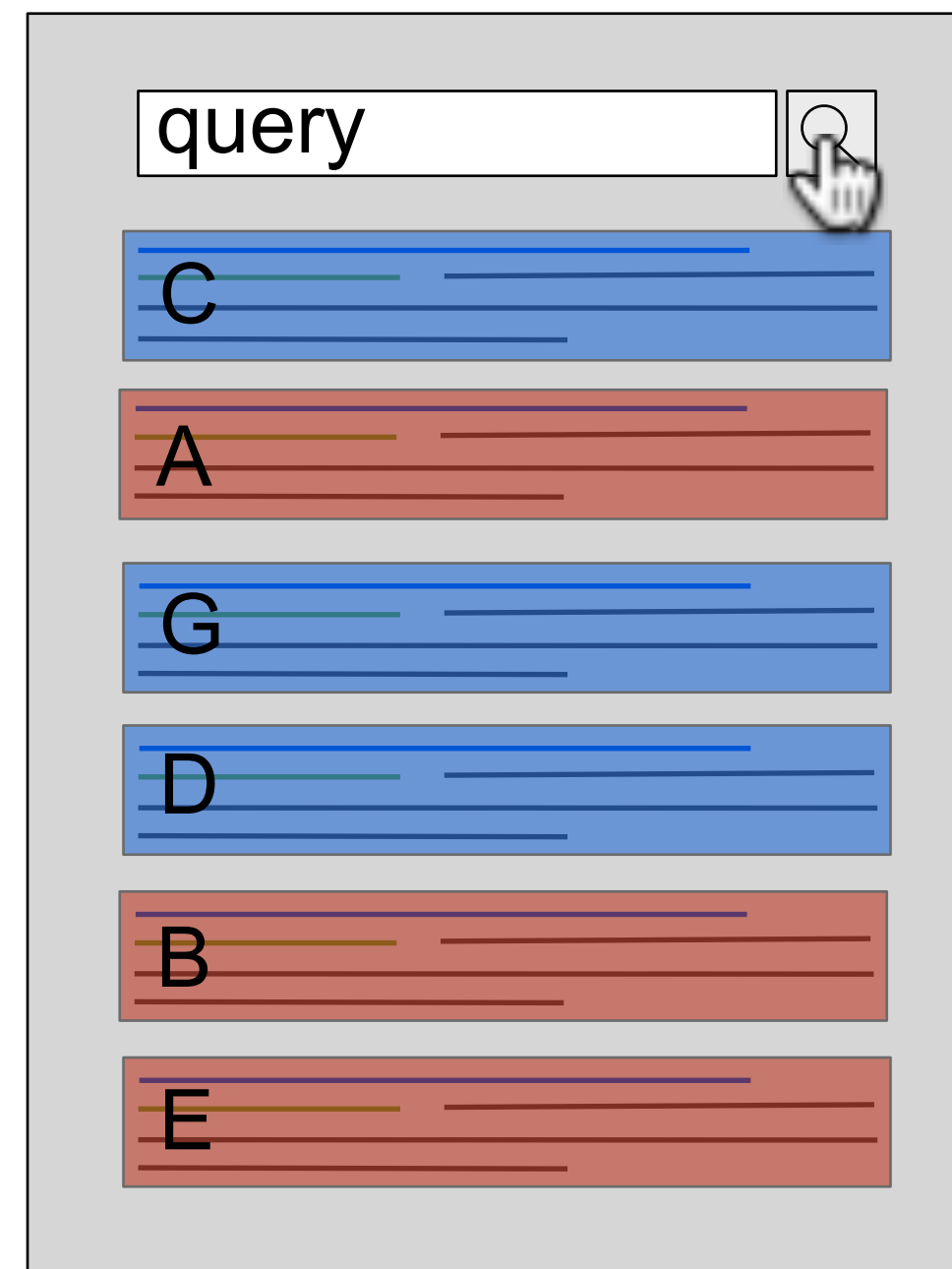
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Radlinski, F., Kurup, M., & Joachims, T. (2008). How does clickthrough data reflect retrieval quality? In CIKM '08.

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Interleaved Ranking



Radlinski, F., Kurup, M., & Joachims, T. (2008). How does clickthrough data reflect retrieval quality? In CIKM '08.

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Interleaved Ranking

The diagram illustrates an interleaved ranking interface. At the top is a search bar containing the text "query" and a magnifying glass icon. Below the search bar is a vertical list of seven results, labeled A through G. Each result is represented by a horizontal bar with a colored background and a progress bar. The progress bars are colored blue for results C, G, and D, and red for results A, B, and E. A mouse cursor is shown clicking on the progress bar of result G.

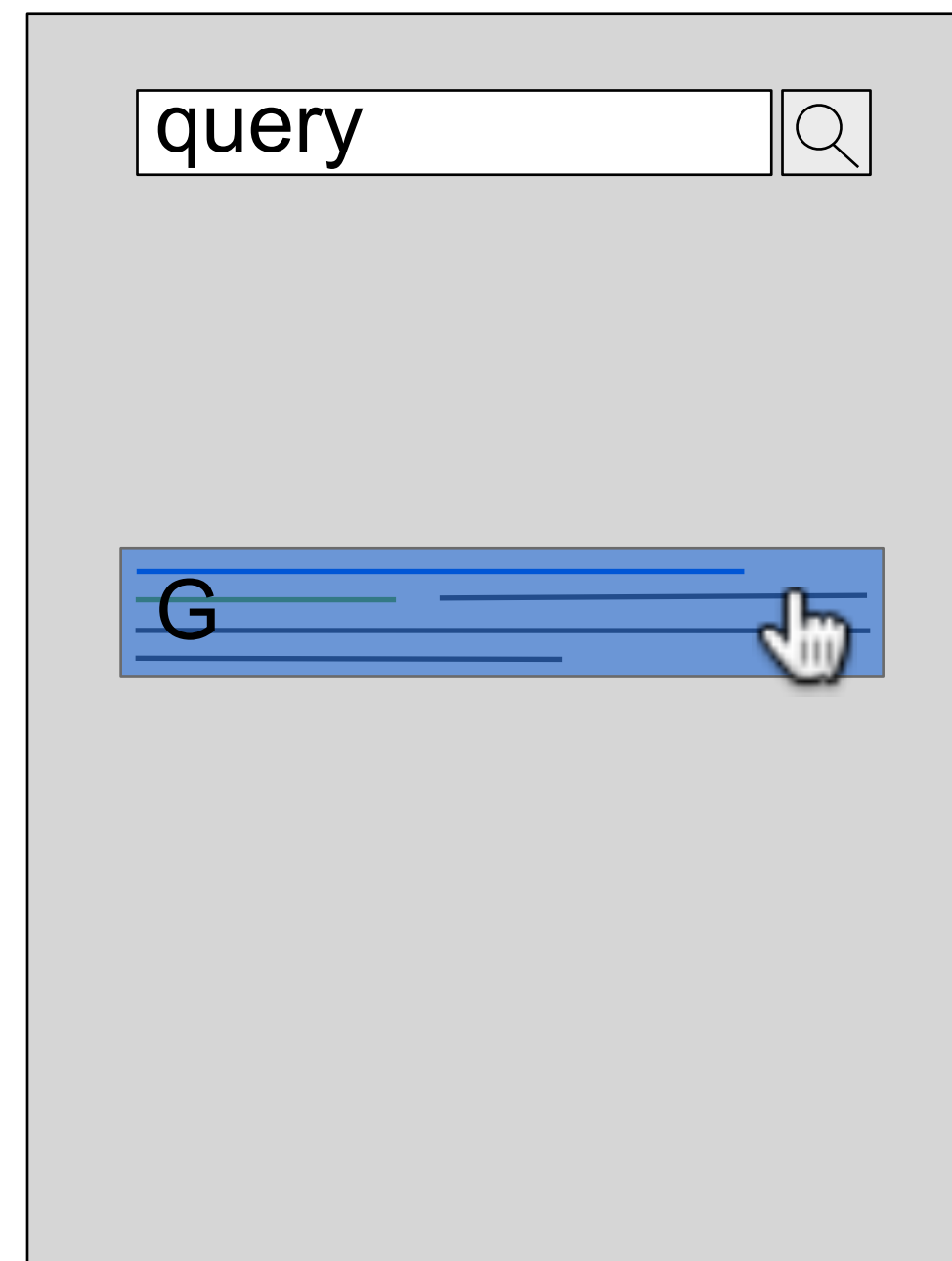
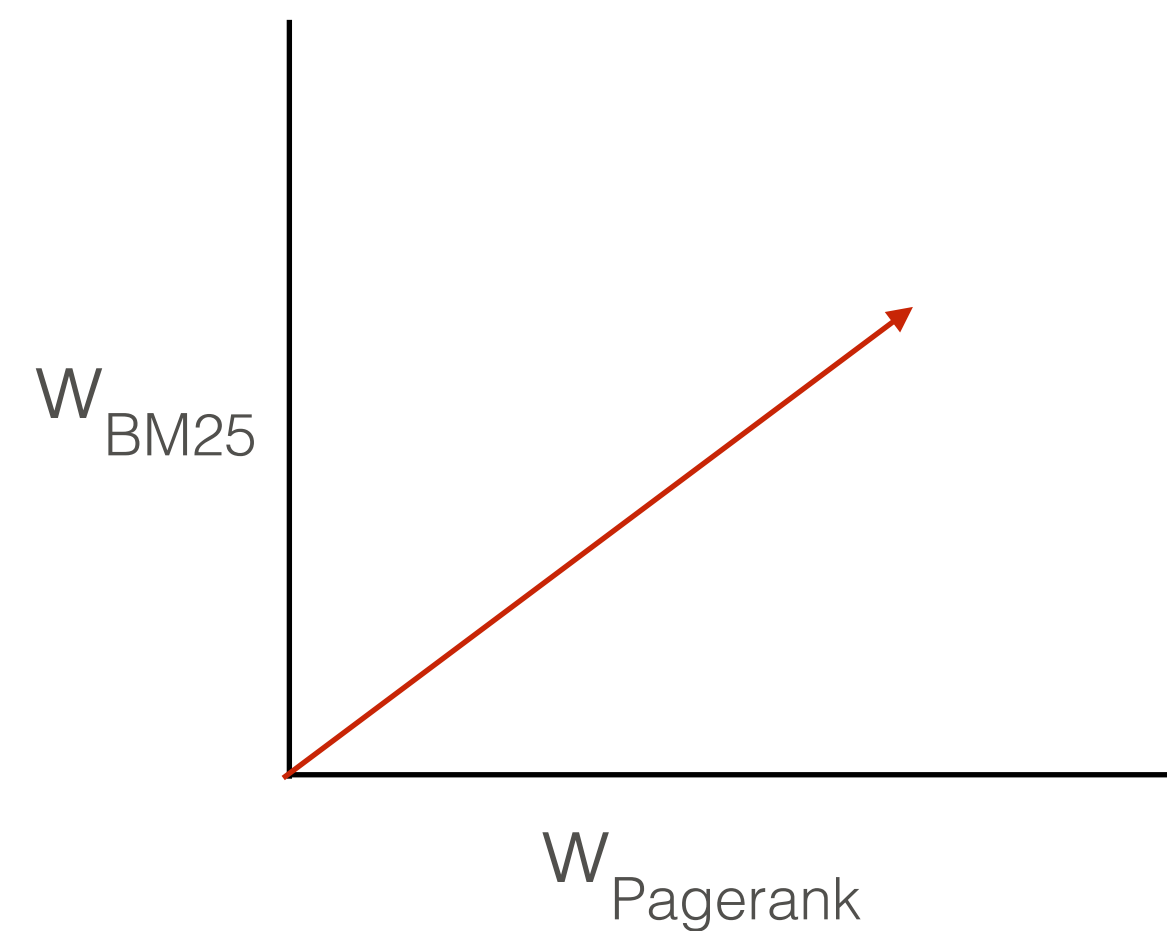
| Result | Color | Progress Bar Color |
|--------|-------|--------------------|
| A | Red | Red |
| B | Red | Red |
| C | Blue | Blue |
| D | Blue | Blue |
| E | Red | Red |
| G | Blue | Blue |

Radlinski, F., Kurup, M., & Joachims, T. (2008). How does clickthrough data reflect retrieval quality? In CIKM '08.

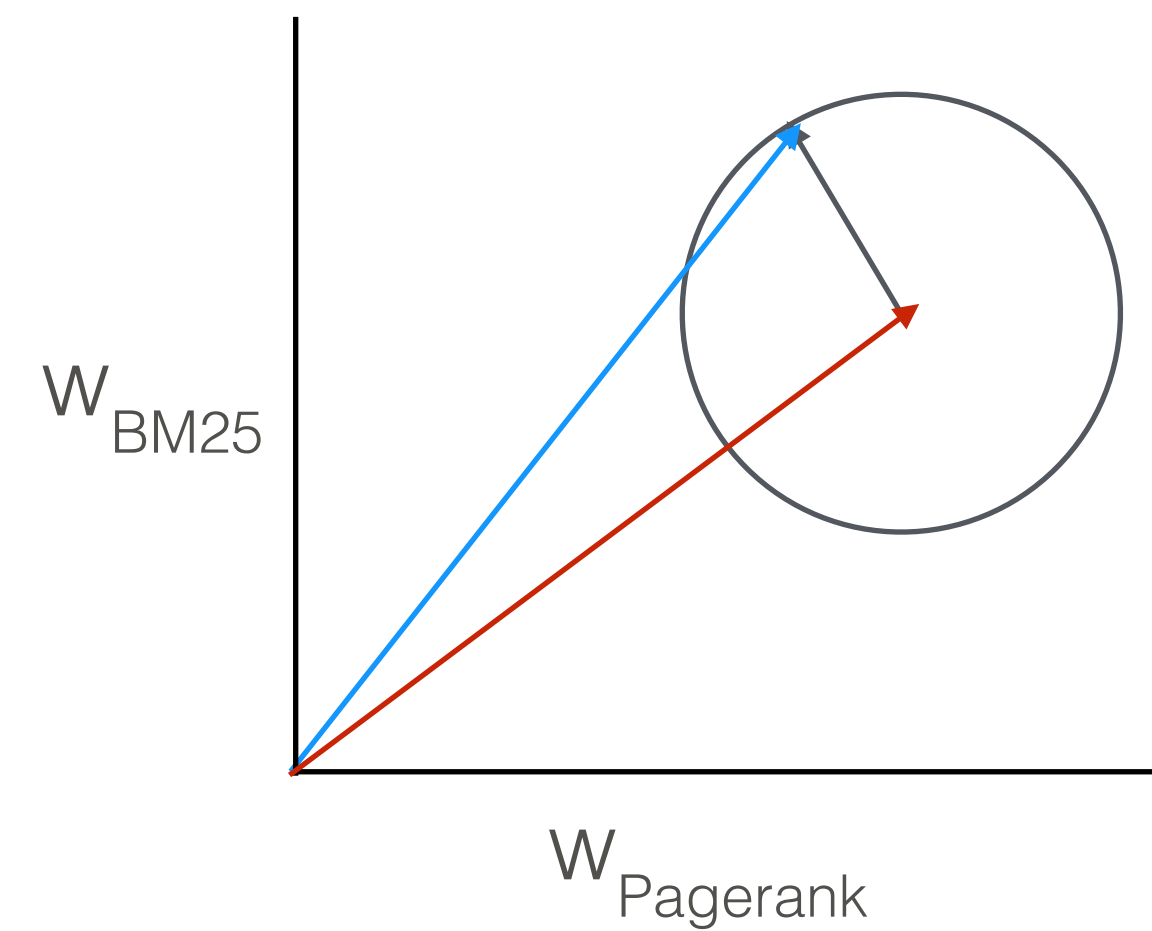
Dueling Bandit Gradient Descent

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Exploitative Ranker



Explorative Ranker

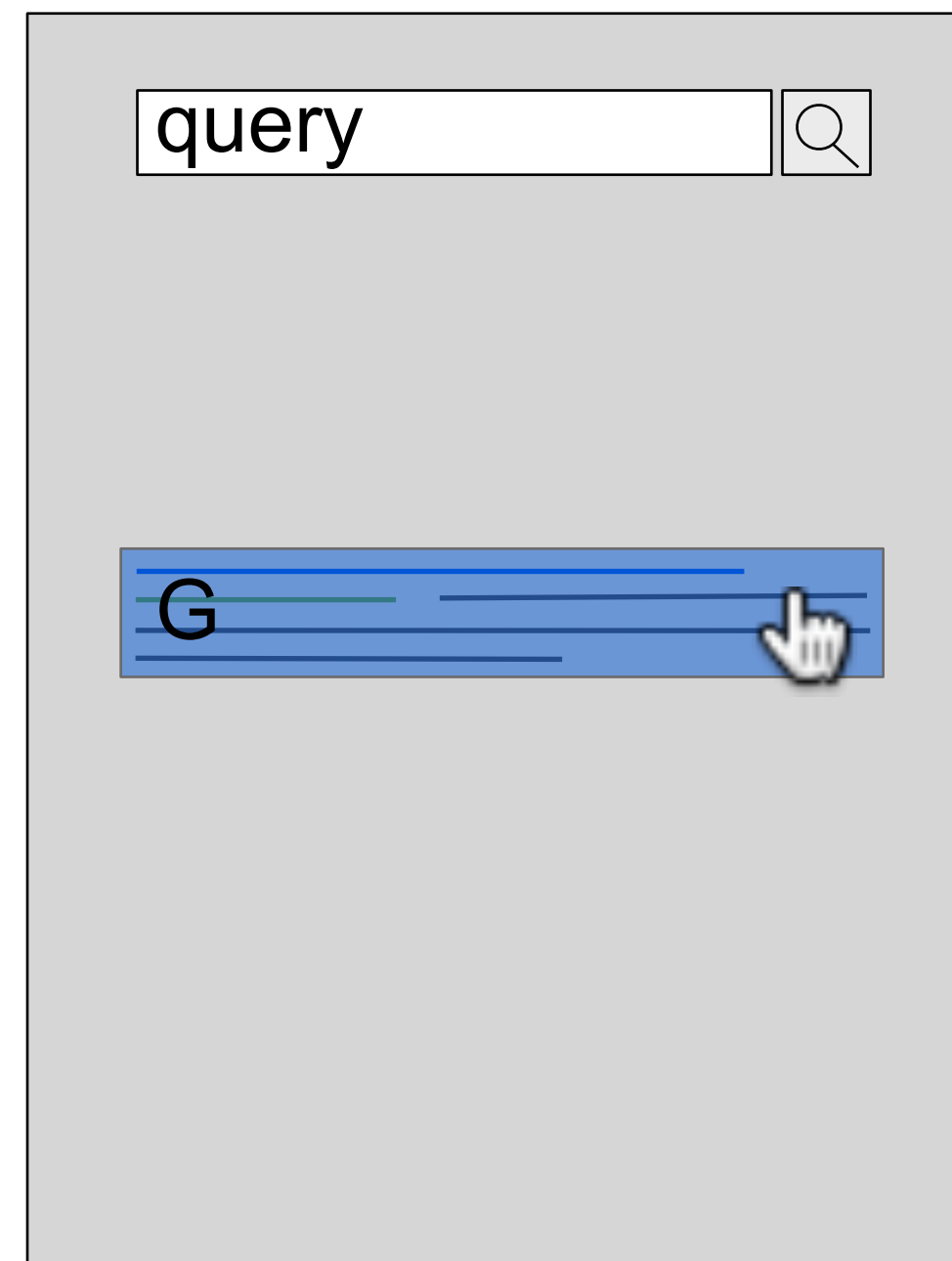
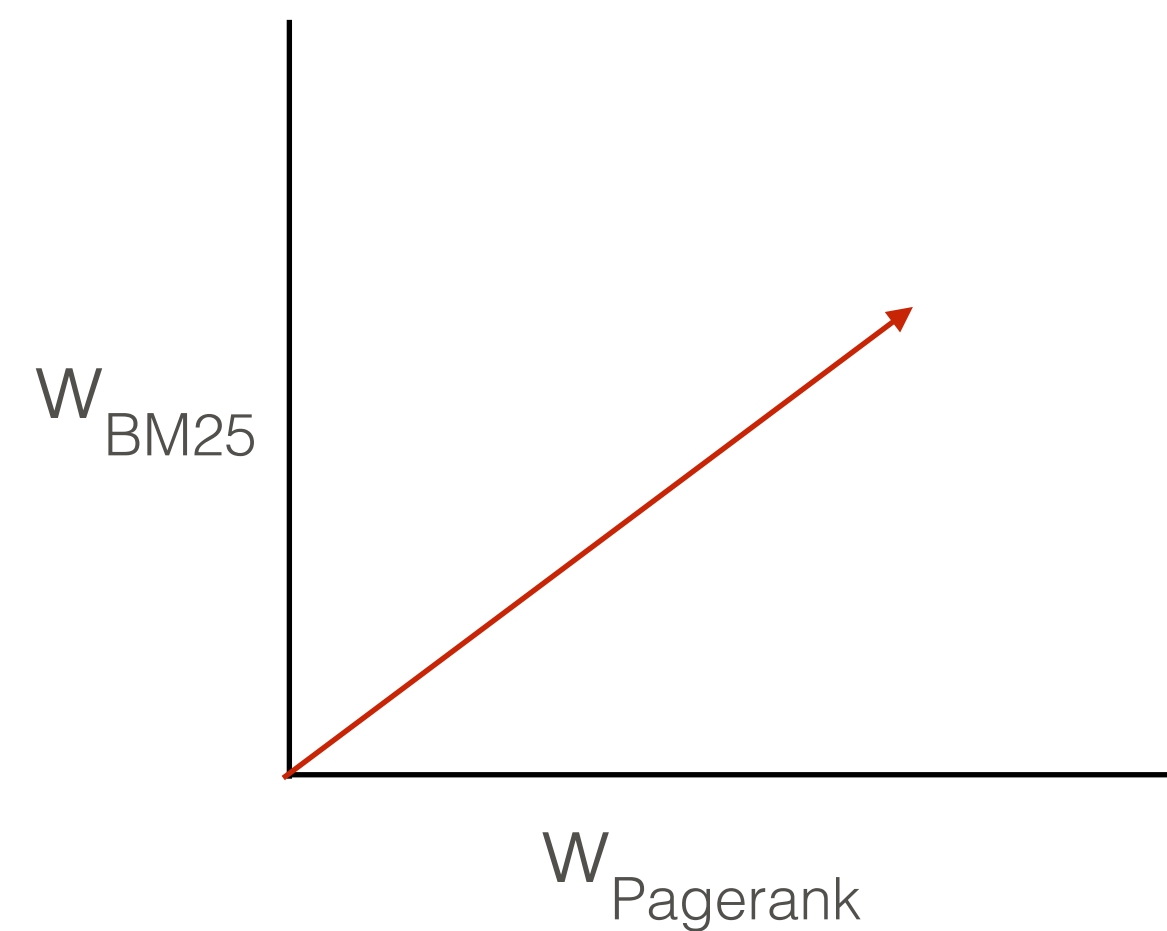


[Yue et al, 2009; Hofmann et al., 2011]

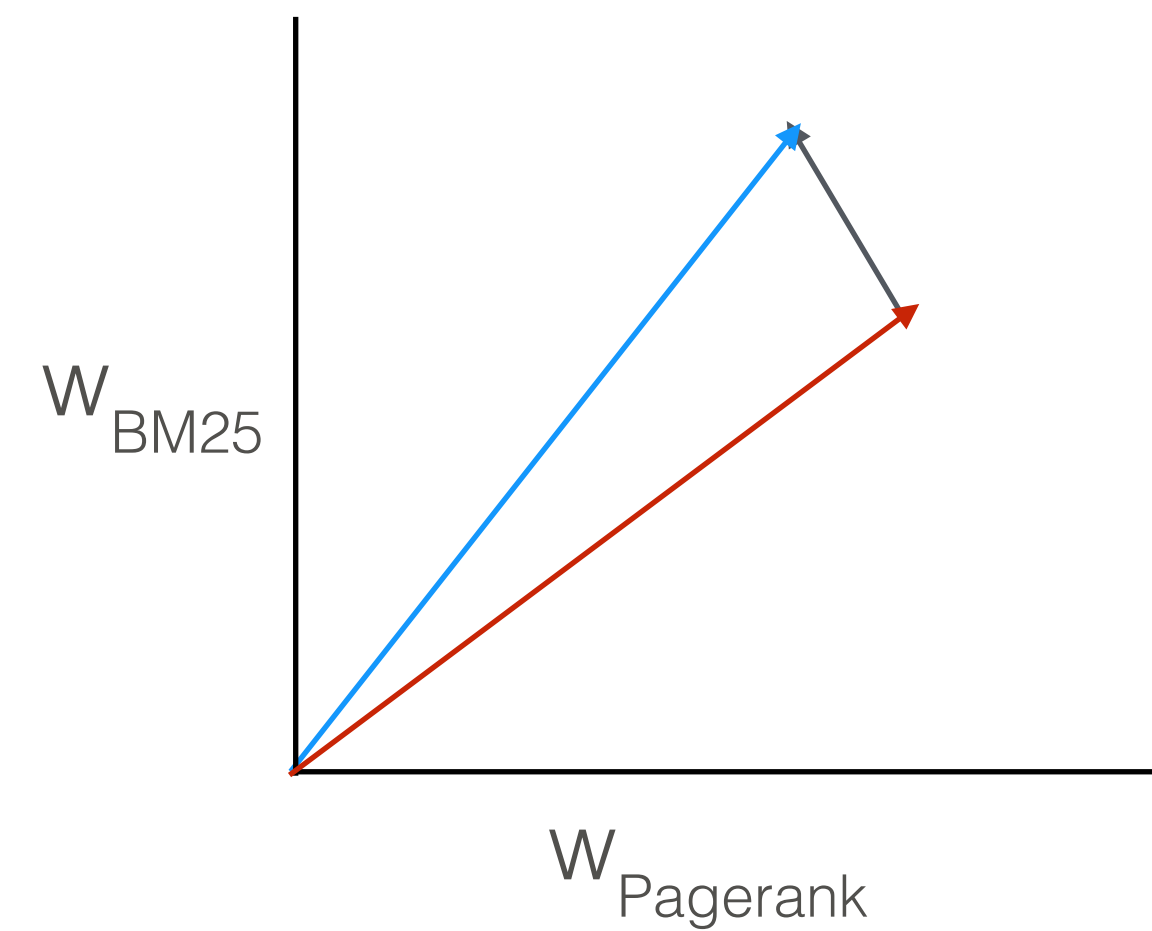
Dueling Bandit Gradient Descent

We are not yet doing
this at Blendle

Exploitative Ranker



Explorative Ranker

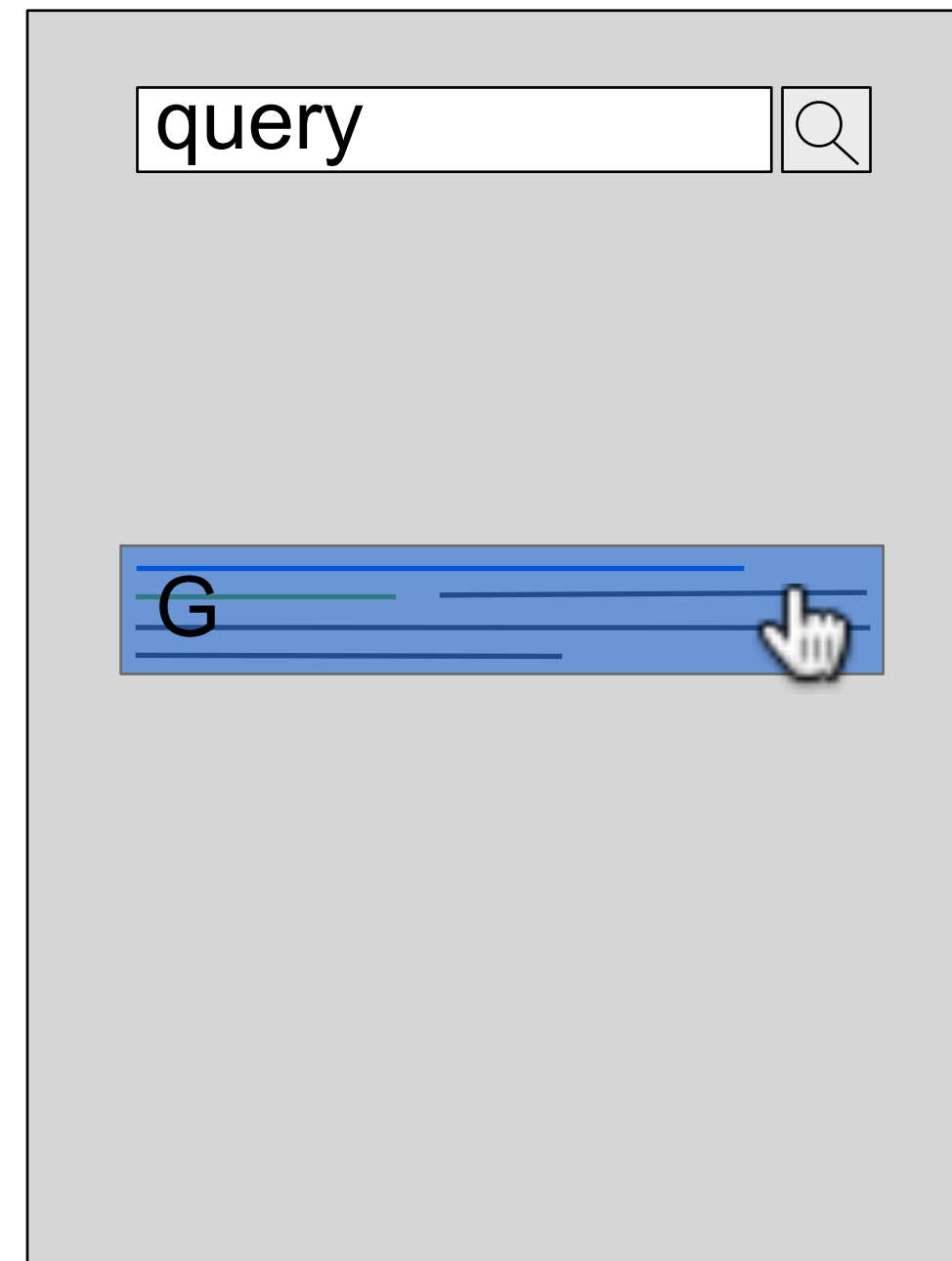
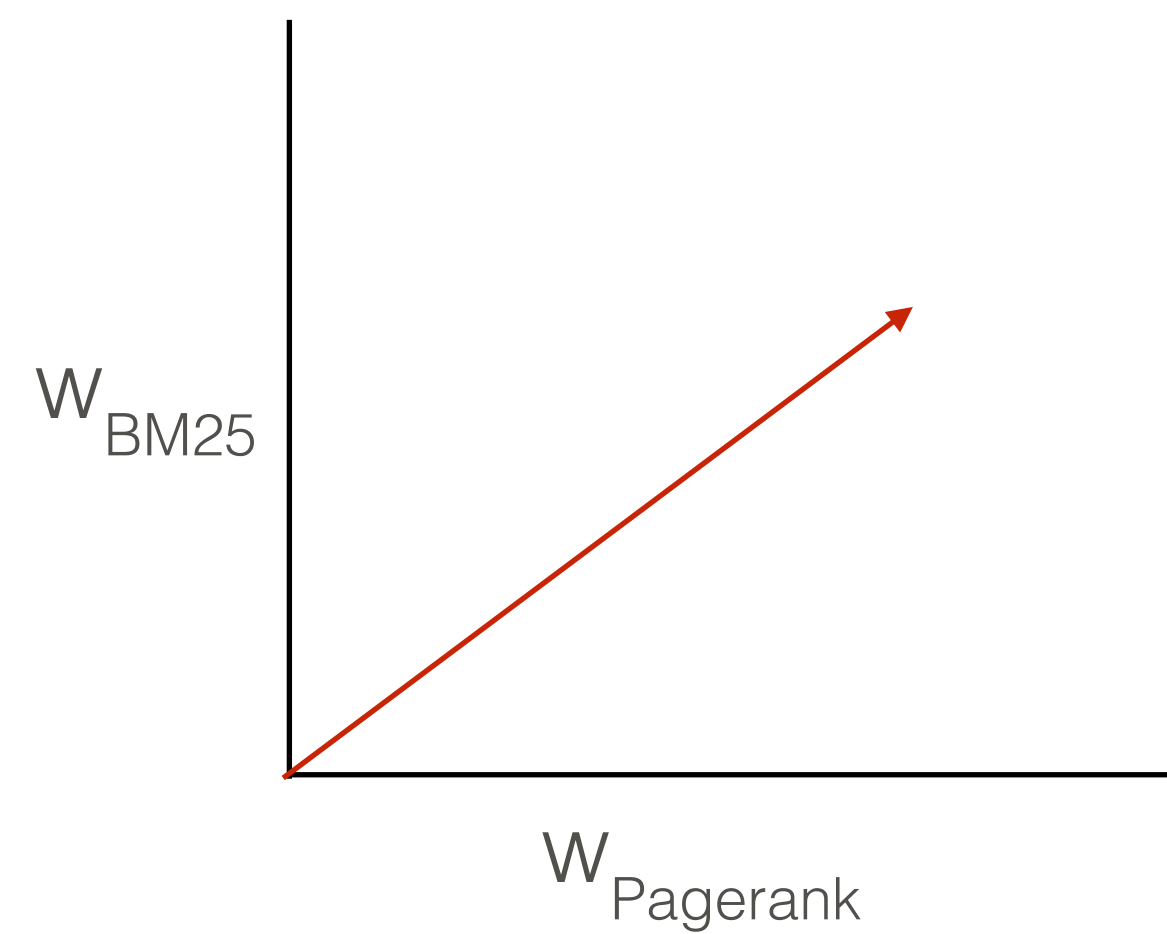


[Yue et al, 2009; Hofmann et al., 2011]

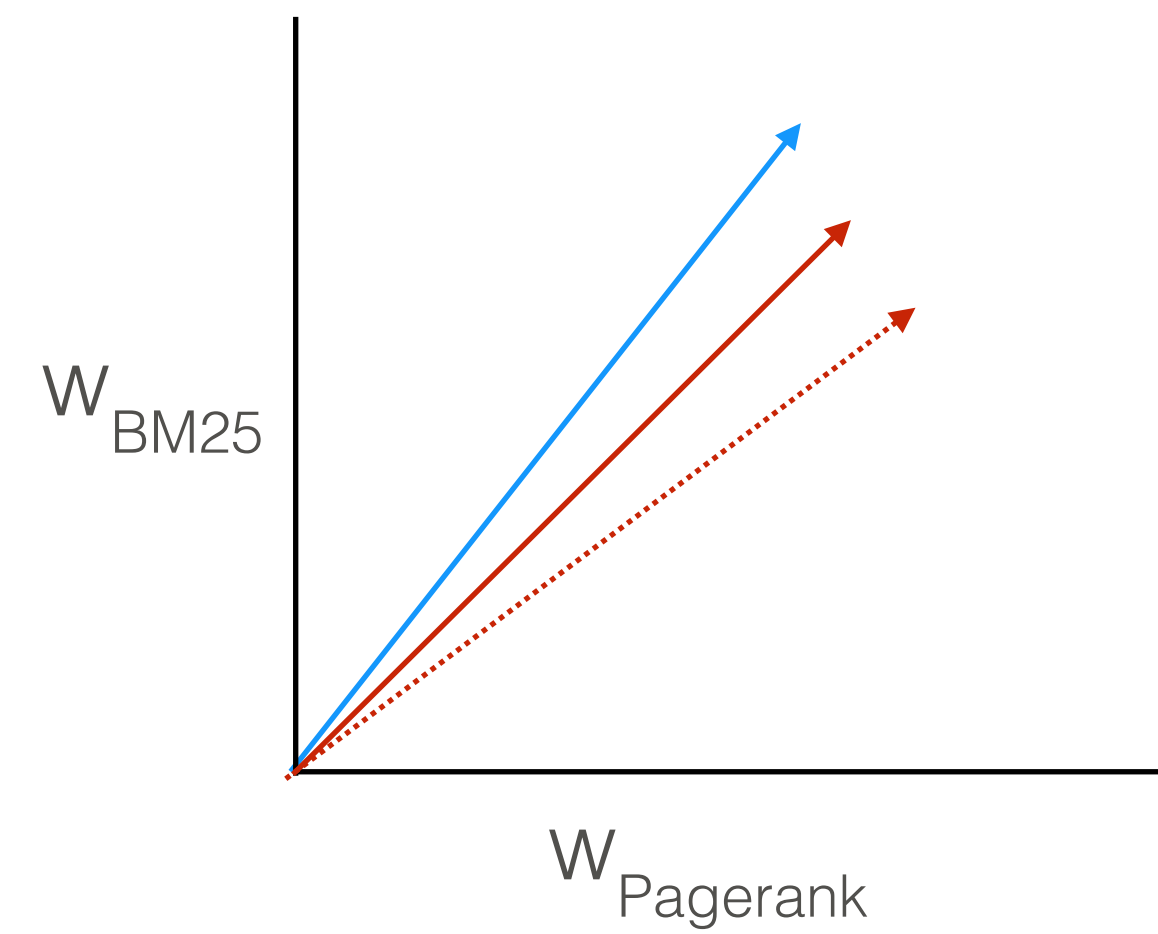
Dueling Bandit Gradient Descent

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Exploitative Ranker



Explorative Ranker

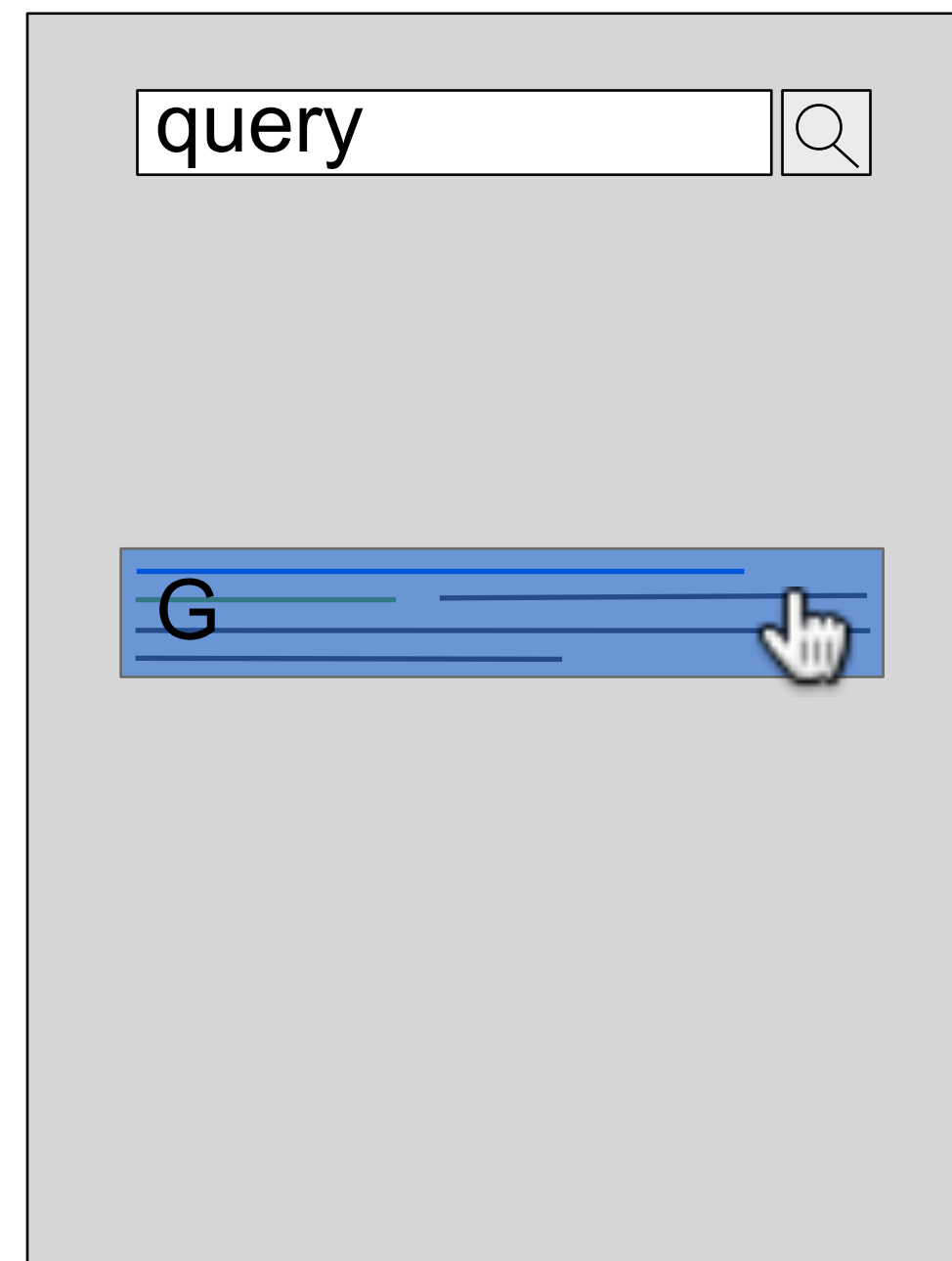
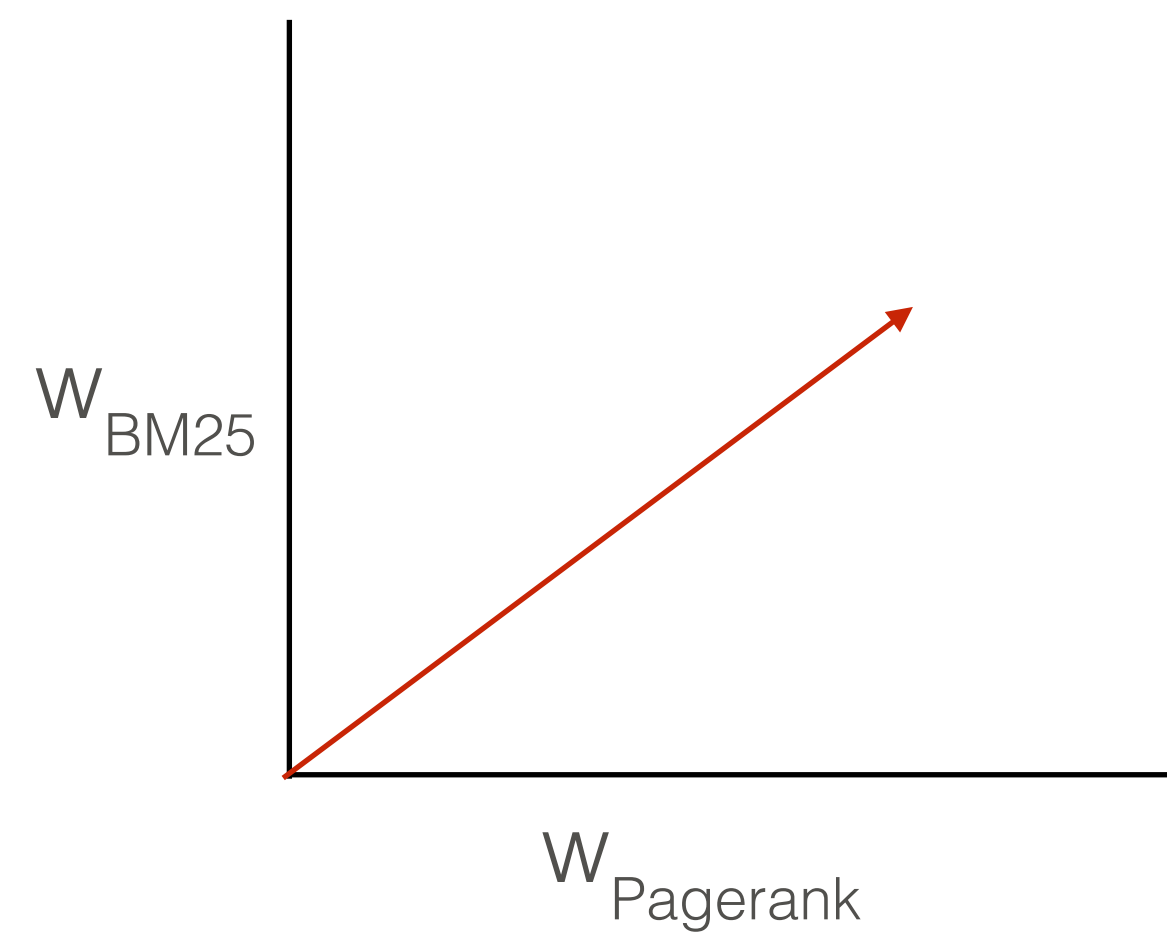


[Yue et al, 2009; Hofmann et al., 2011]

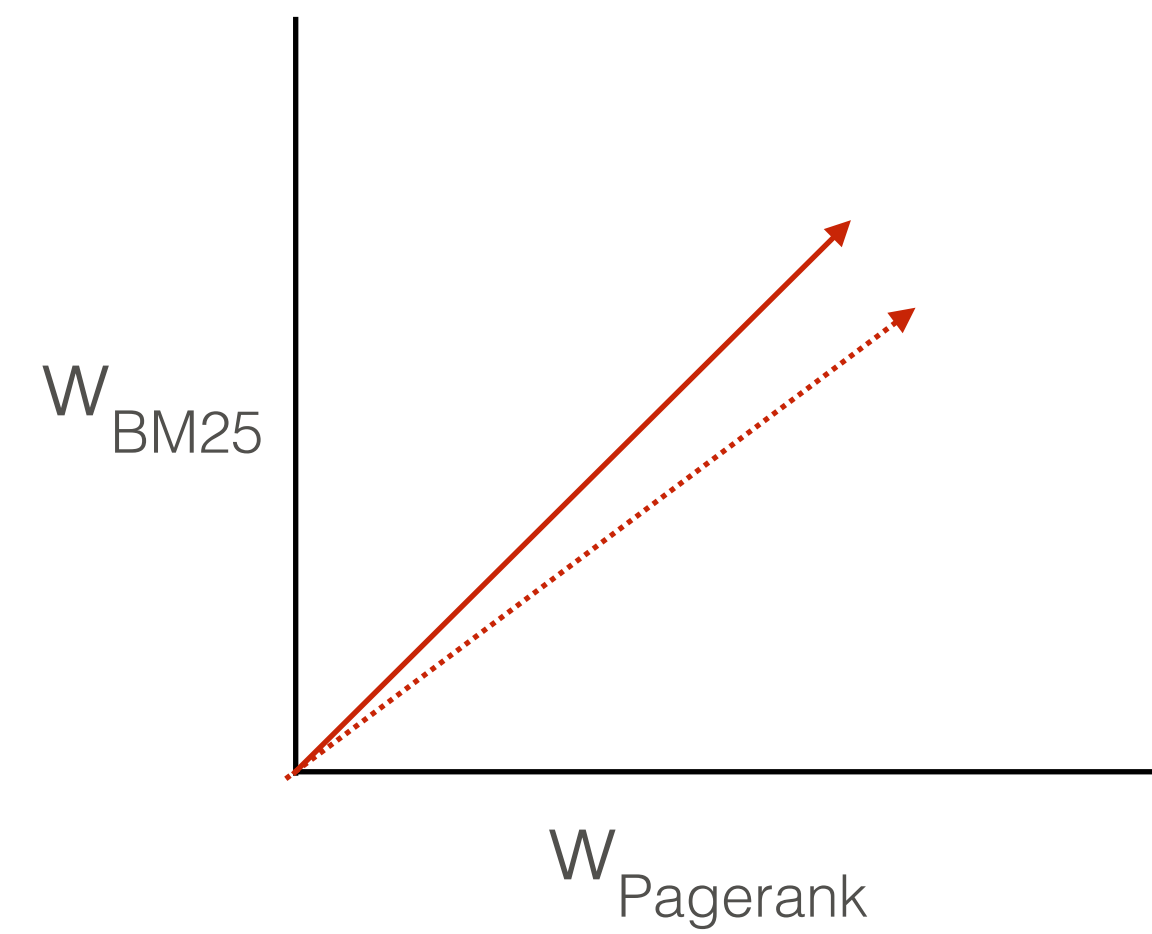
Dueling Bandit Gradient Descent

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Exploitative Ranker



Explorative Ranker

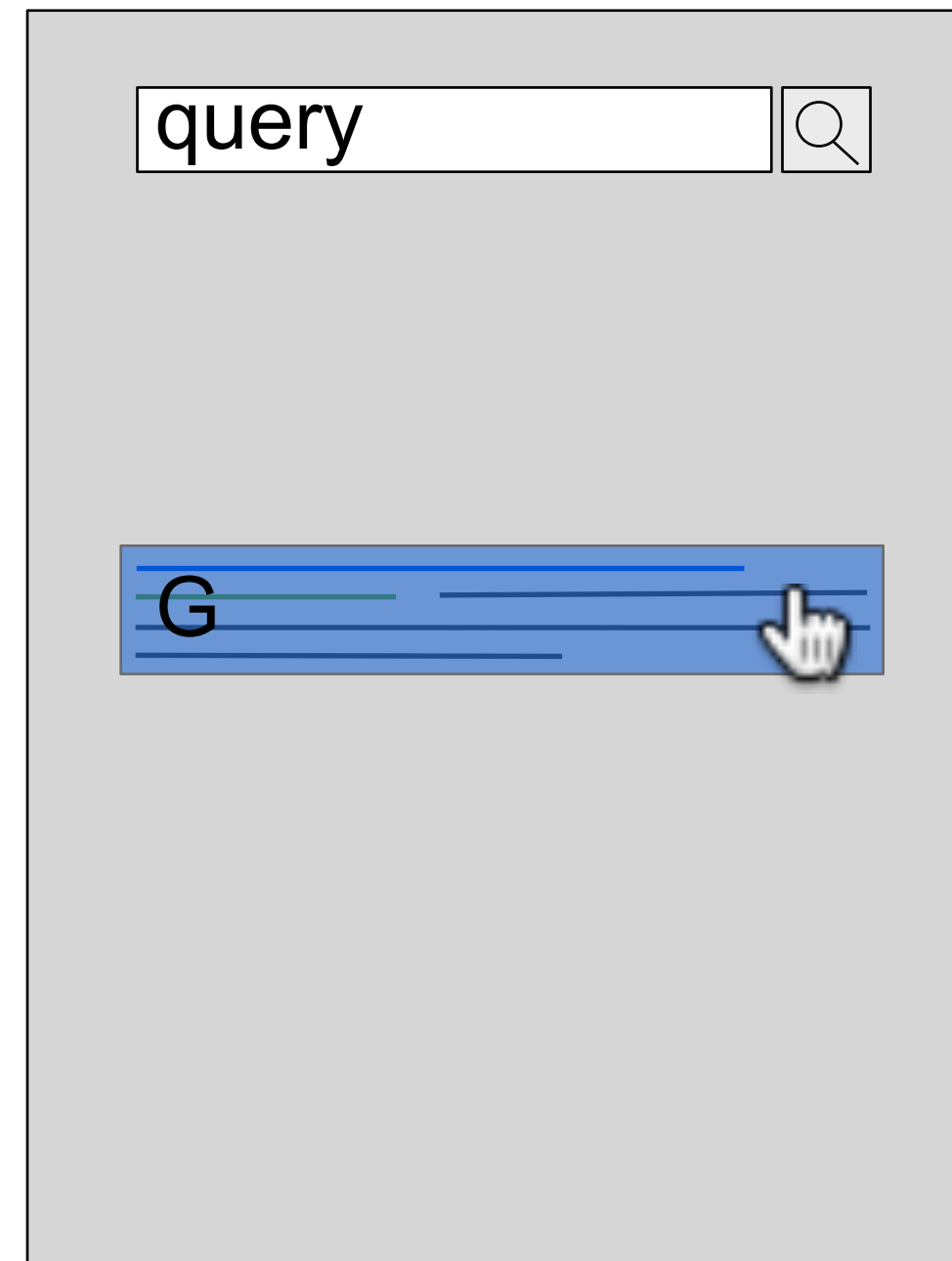
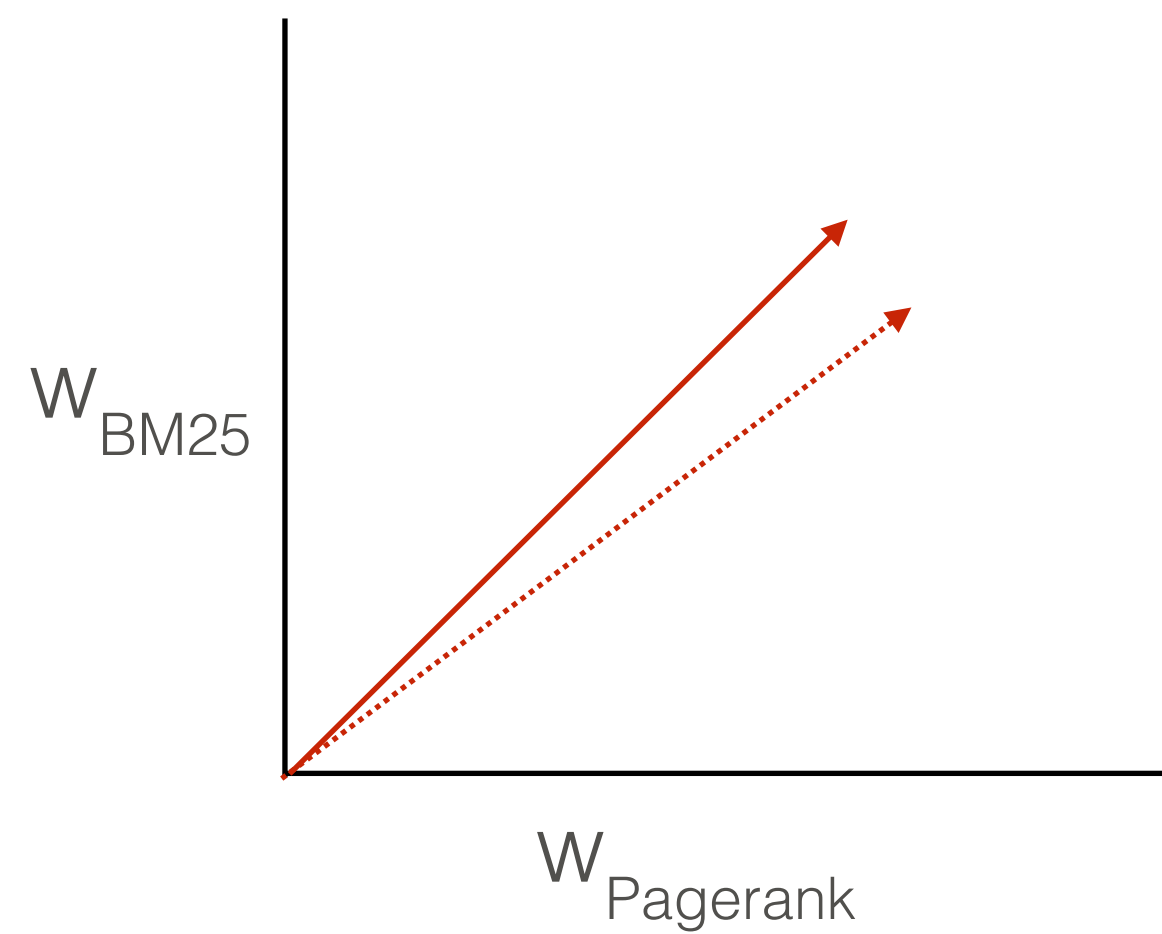


[Yue et al, 2009; Hofmann et al., 2011]

Dueling Bandit Gradient Descent

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Exploitative Ranker



[Yue et al, 2009; Hofmann et al., 2011]

Offline vs Online

Offline Learning

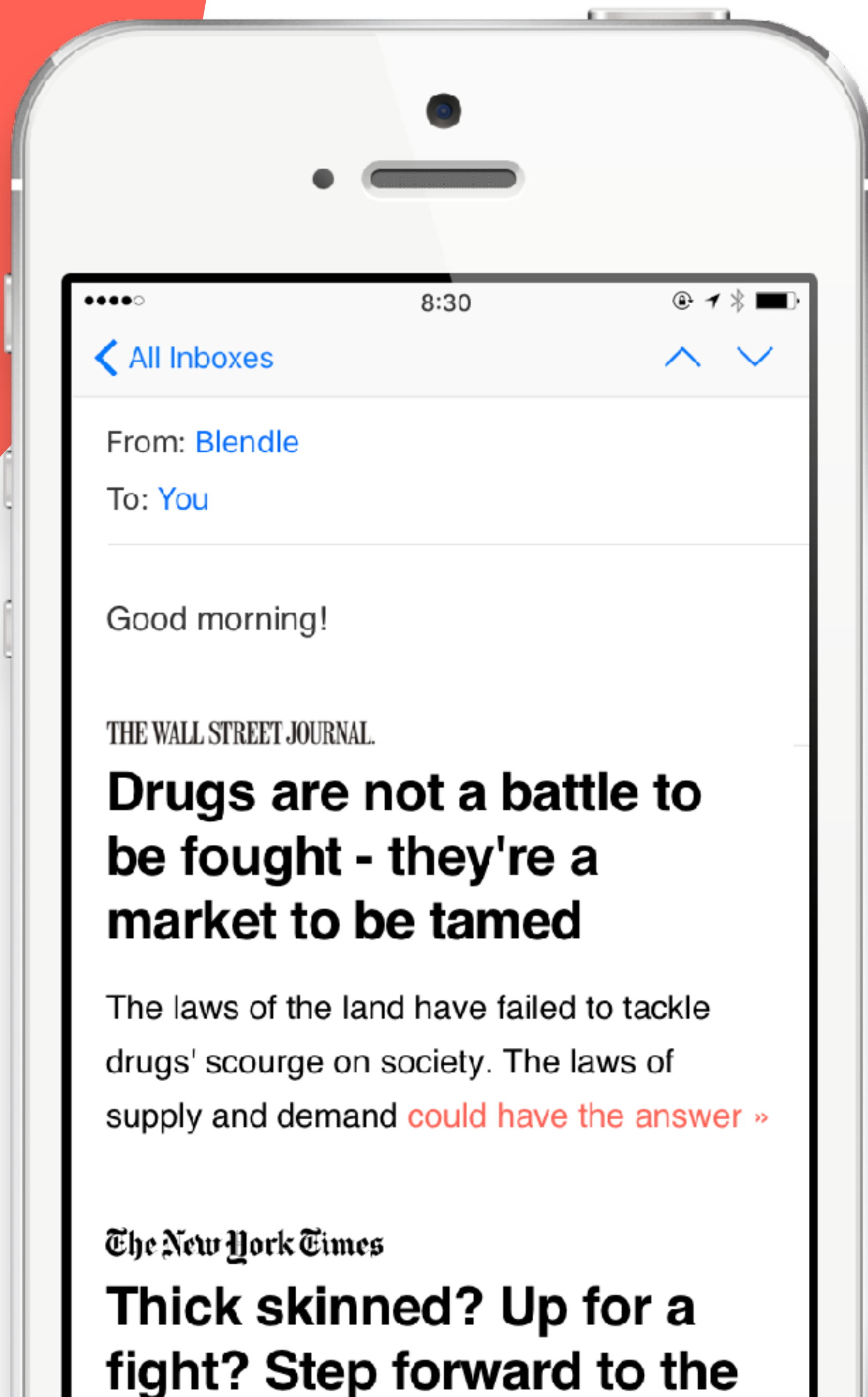
- ☒ Better studied, so more ML tools.
- ☐ Not easily adaptable as things change.
- ☐ Often (but not always) the method requires explicit annotations.

Online Learning

- ☒ Better for a dynamic environment
- ☒ More sample efficient since the algorithm plays an active role.
- ☐ Can't (easily) go back and retrain.

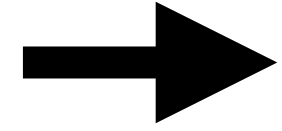
Timing problem

- Our editors wake up at 5am and are done reading at 8am
- Which is also when we want to send our newsletter
- We simply can't wait for a batch process





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Blendle

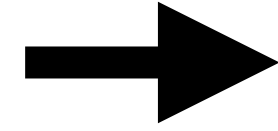
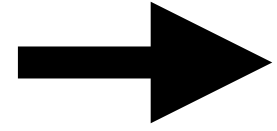


@anneschuth

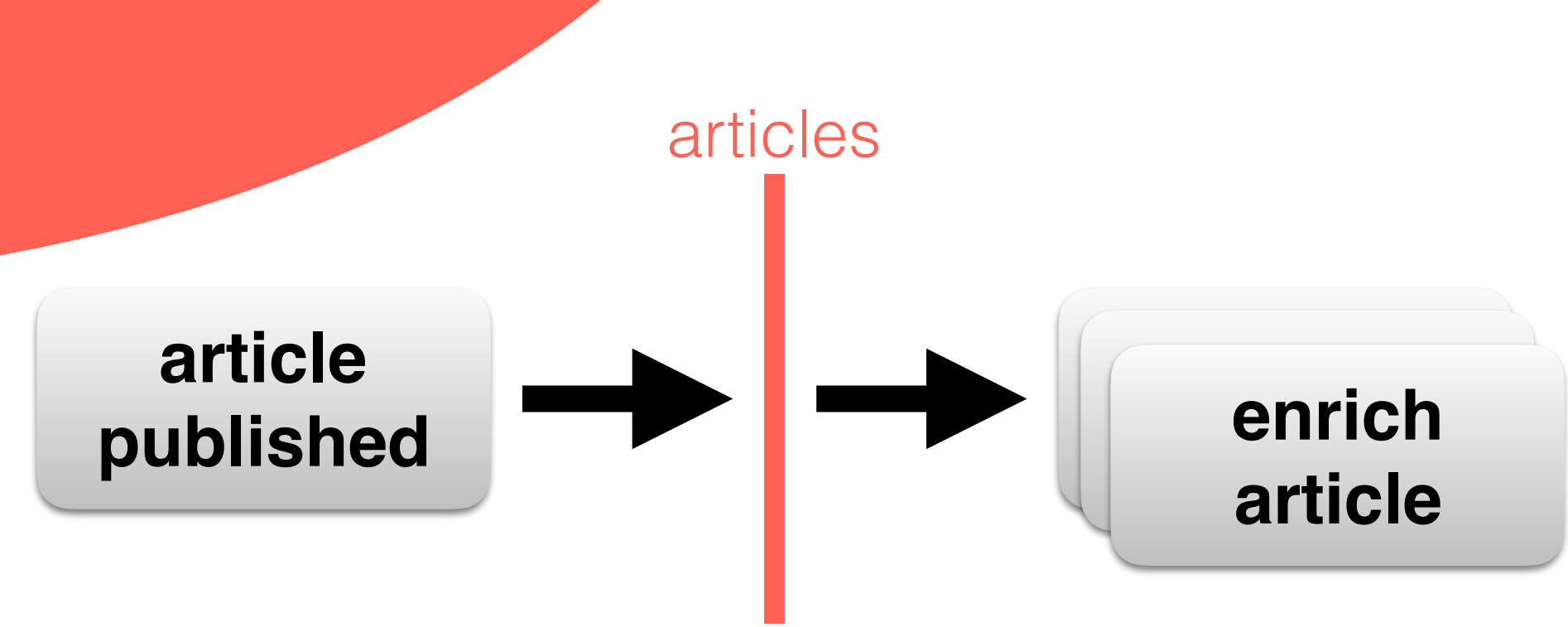


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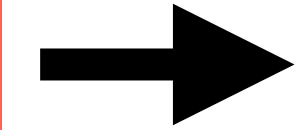
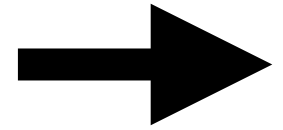




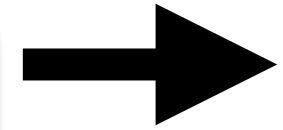
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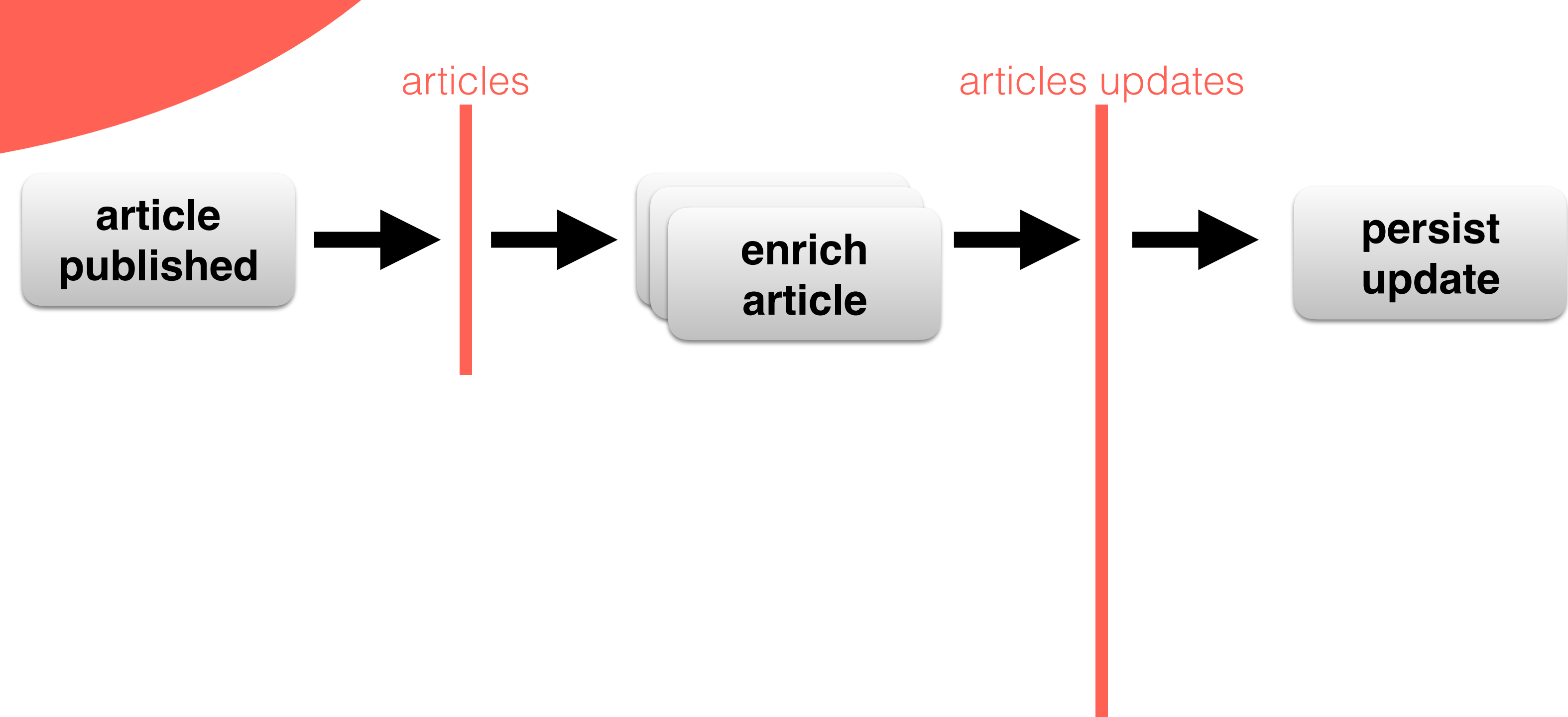
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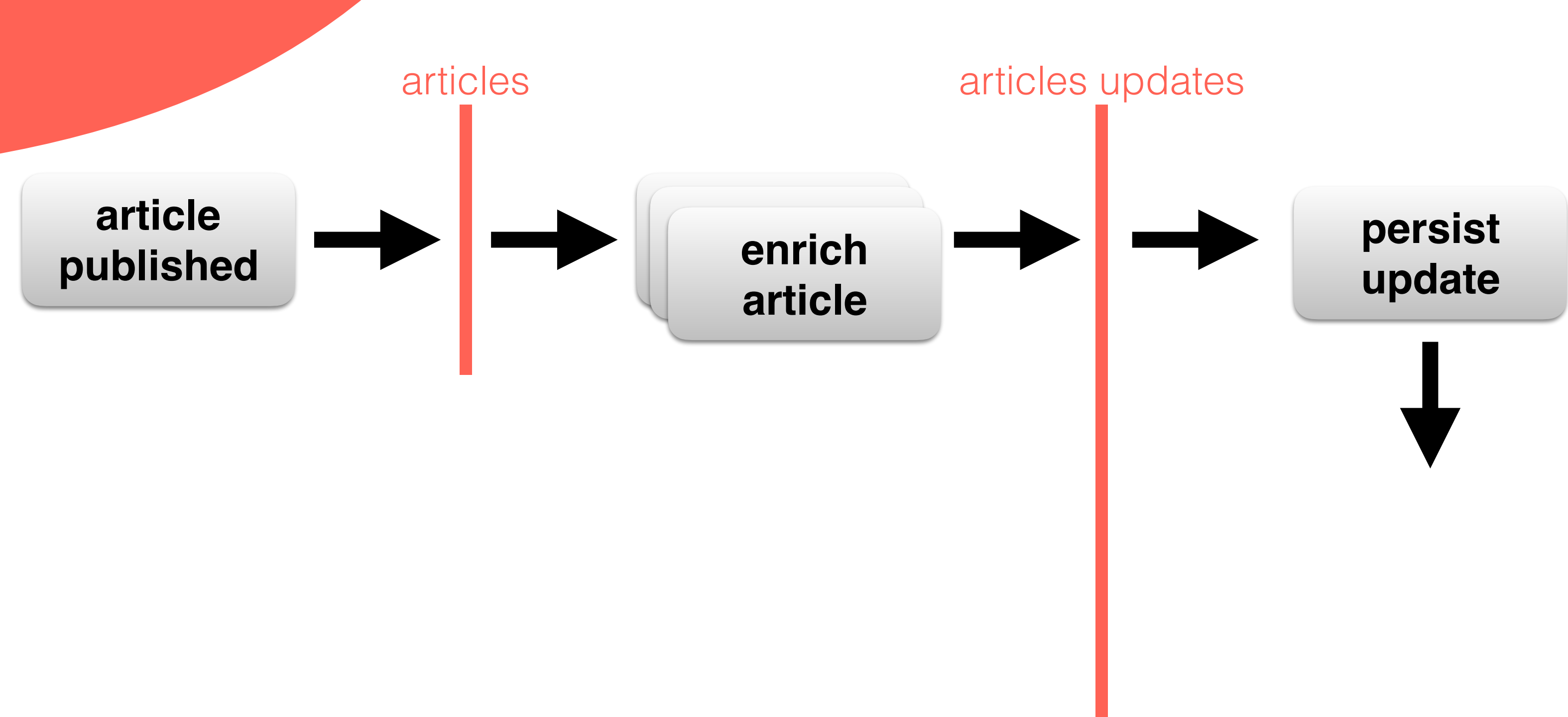
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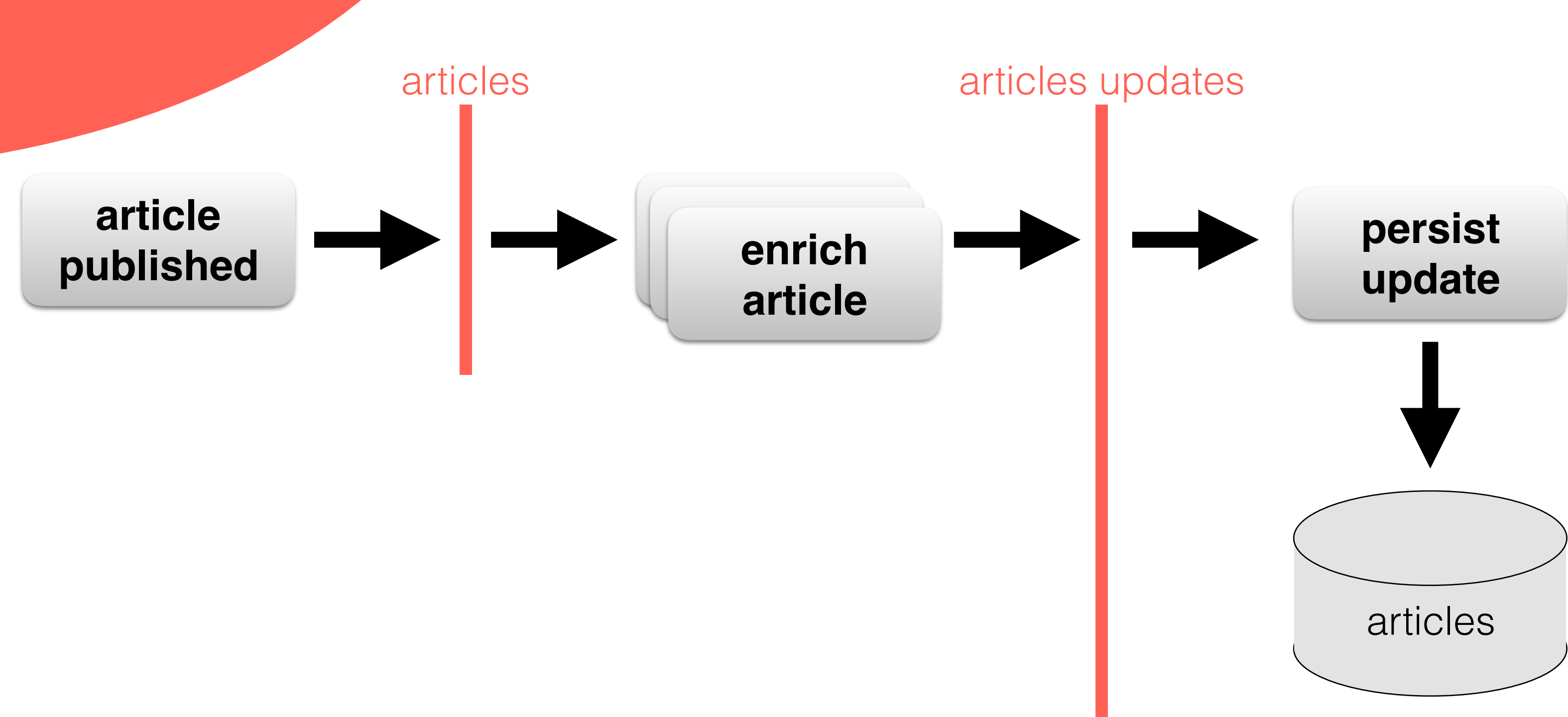


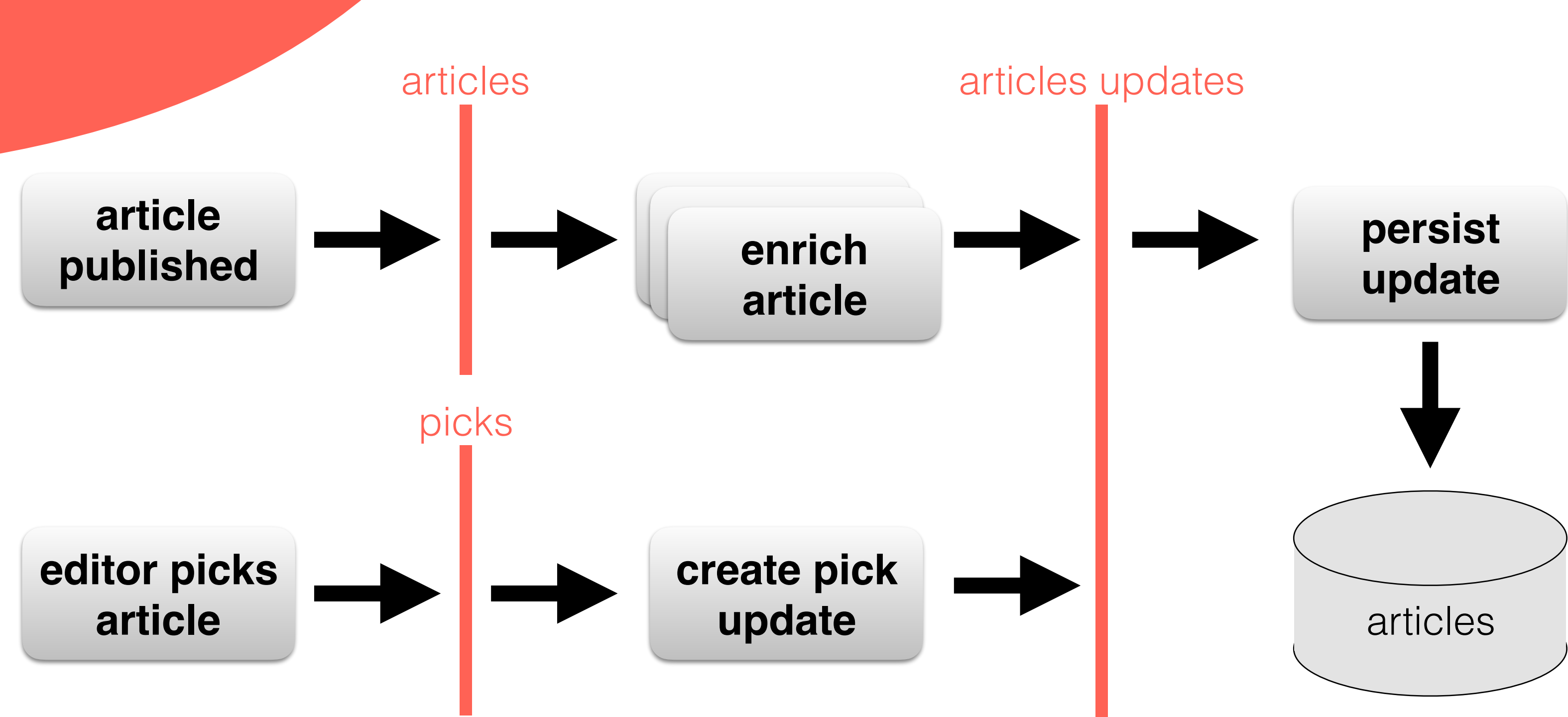
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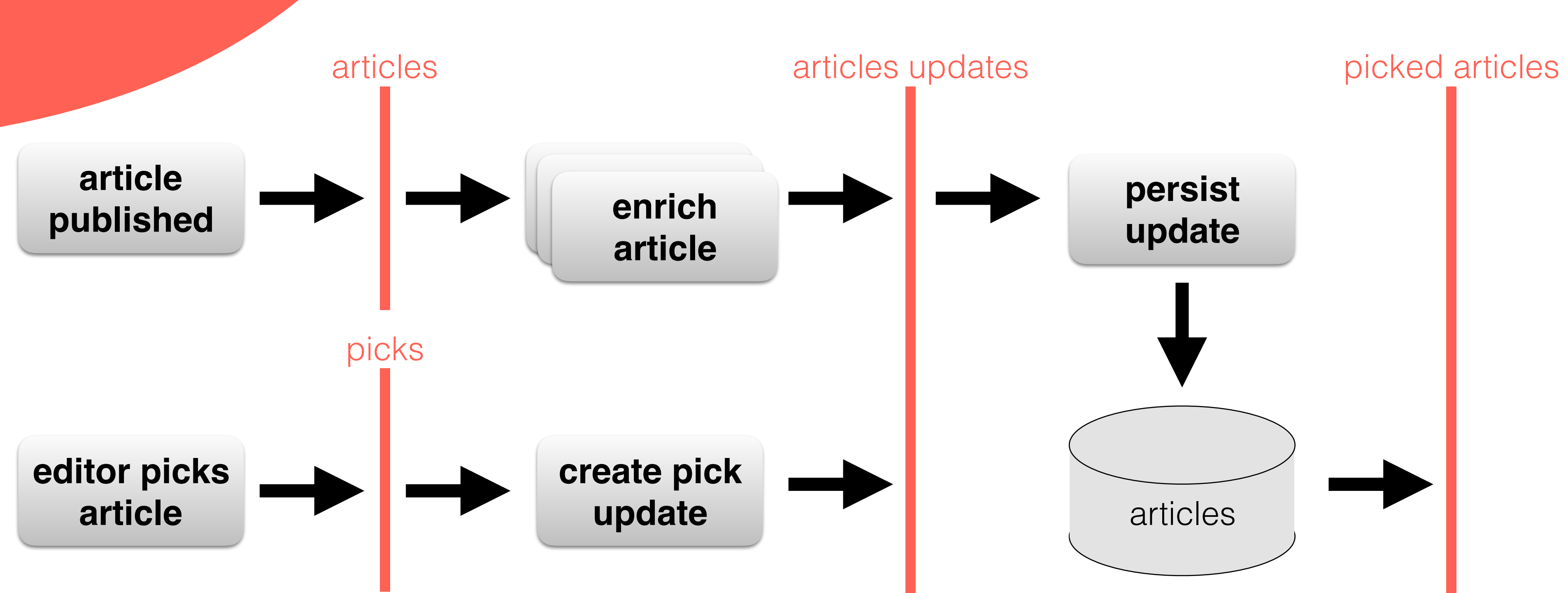


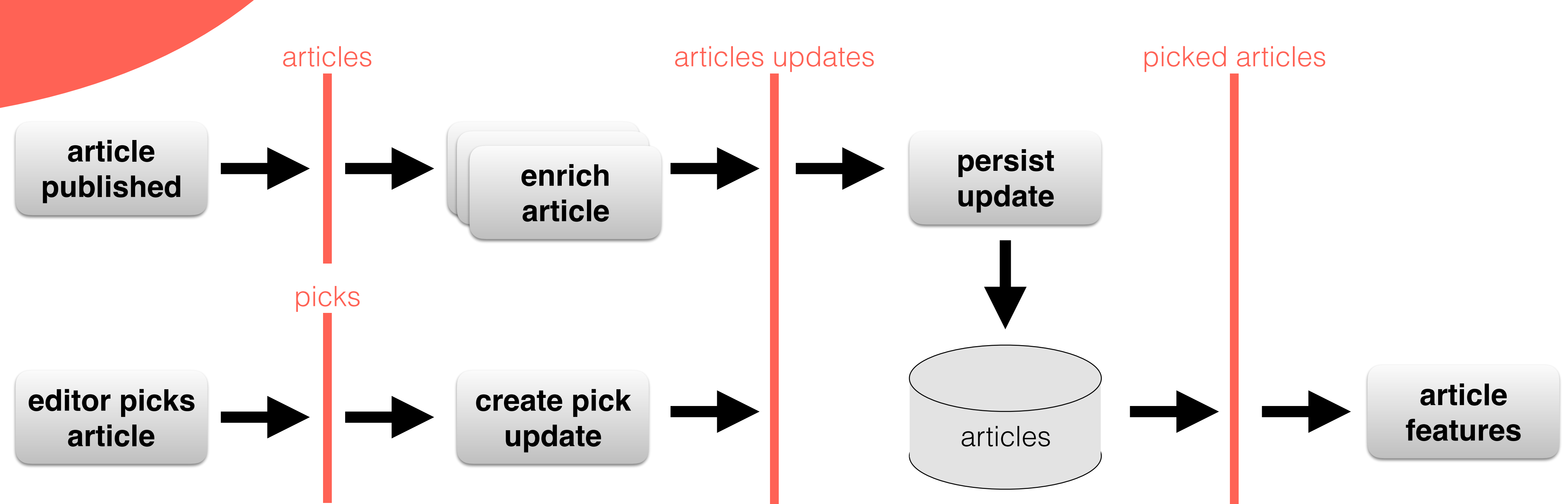


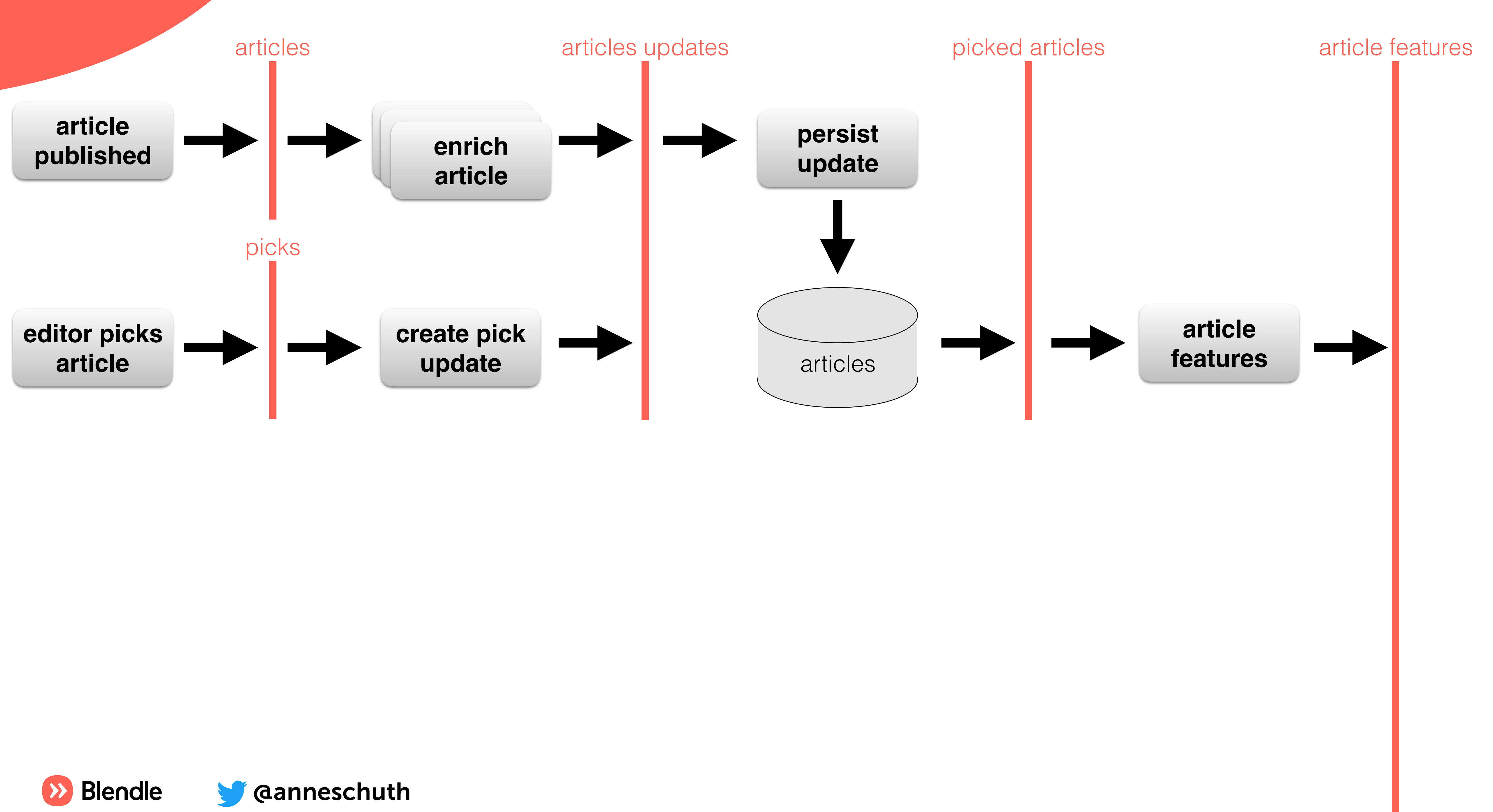


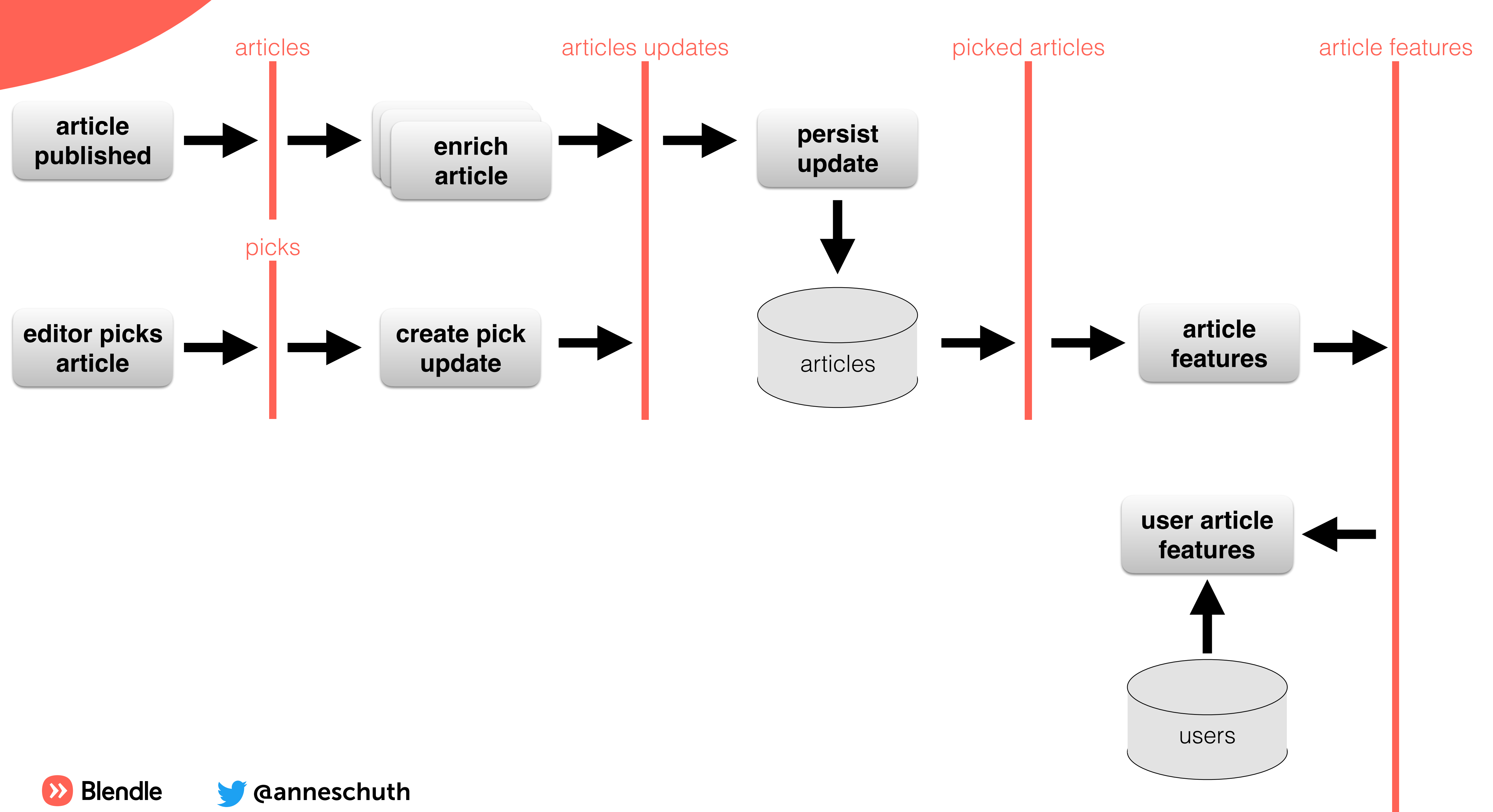


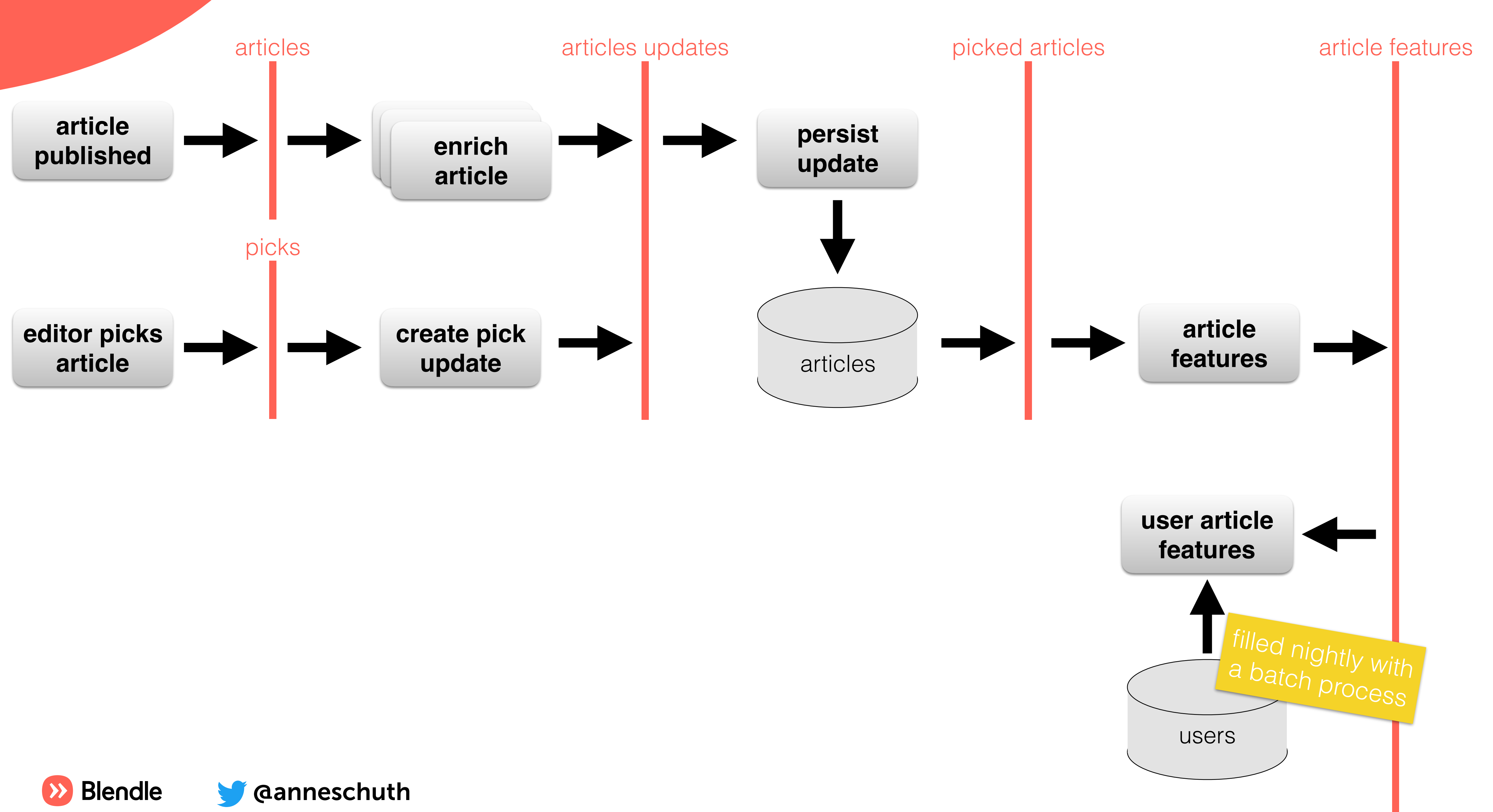


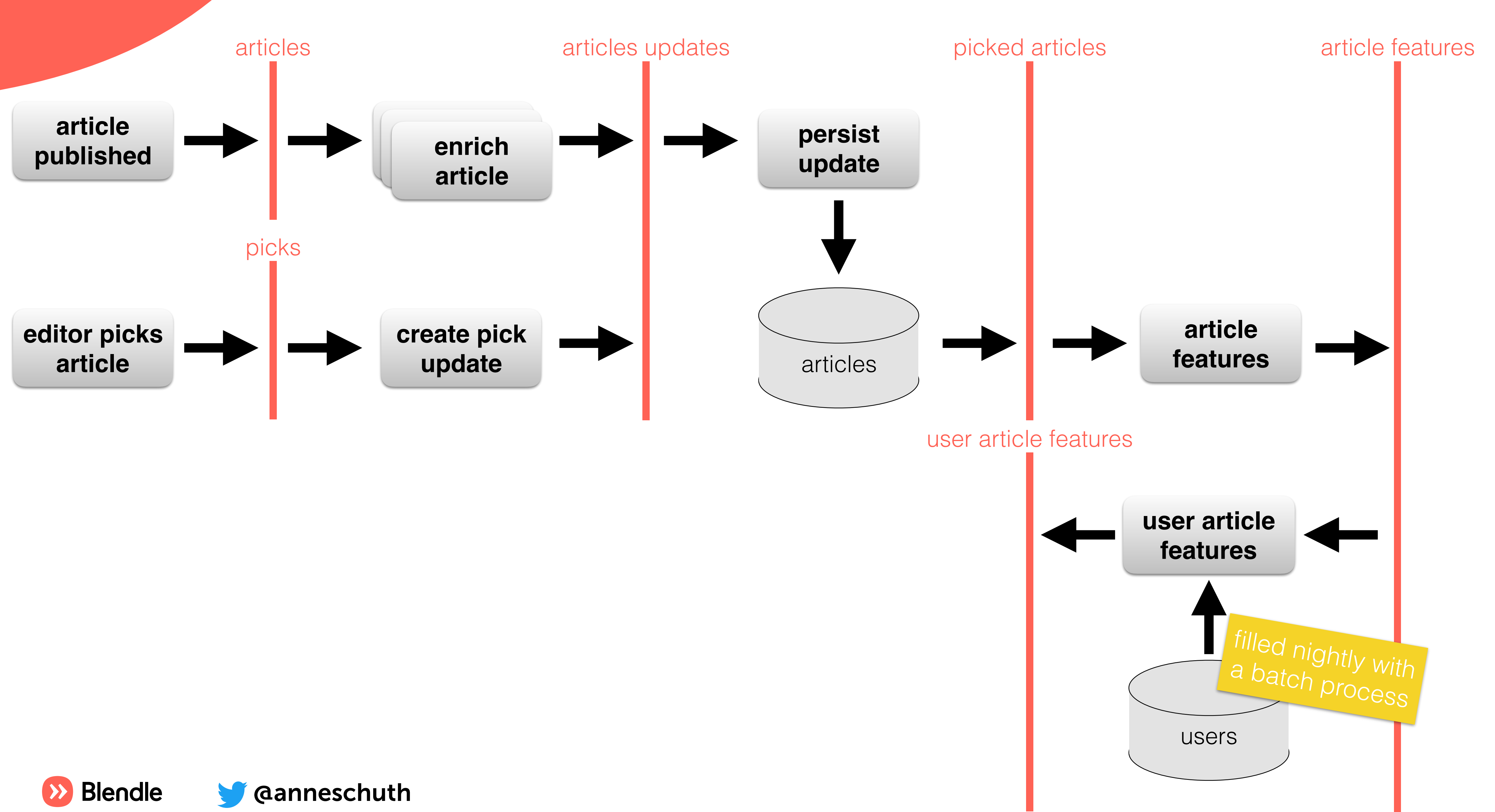


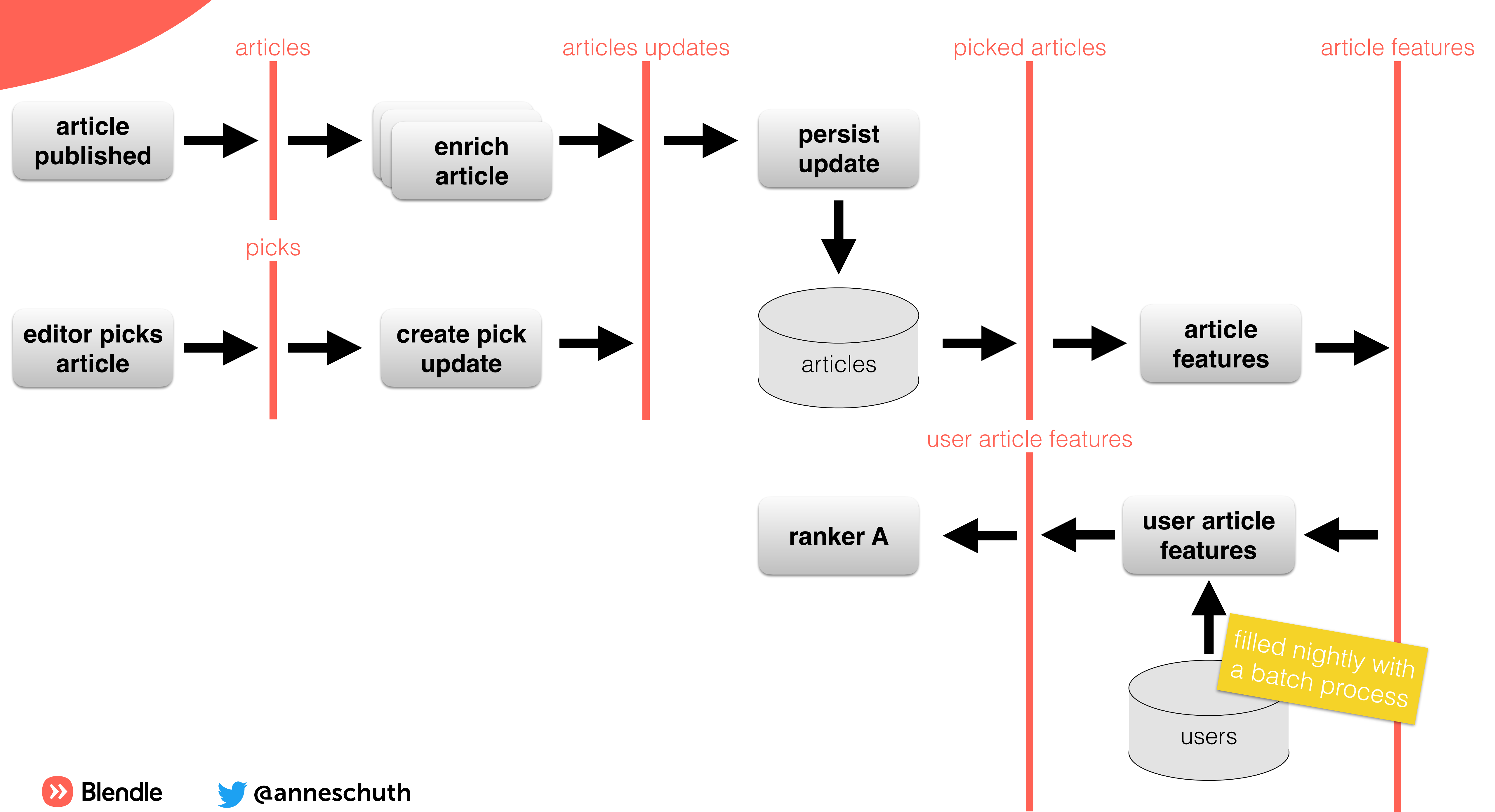


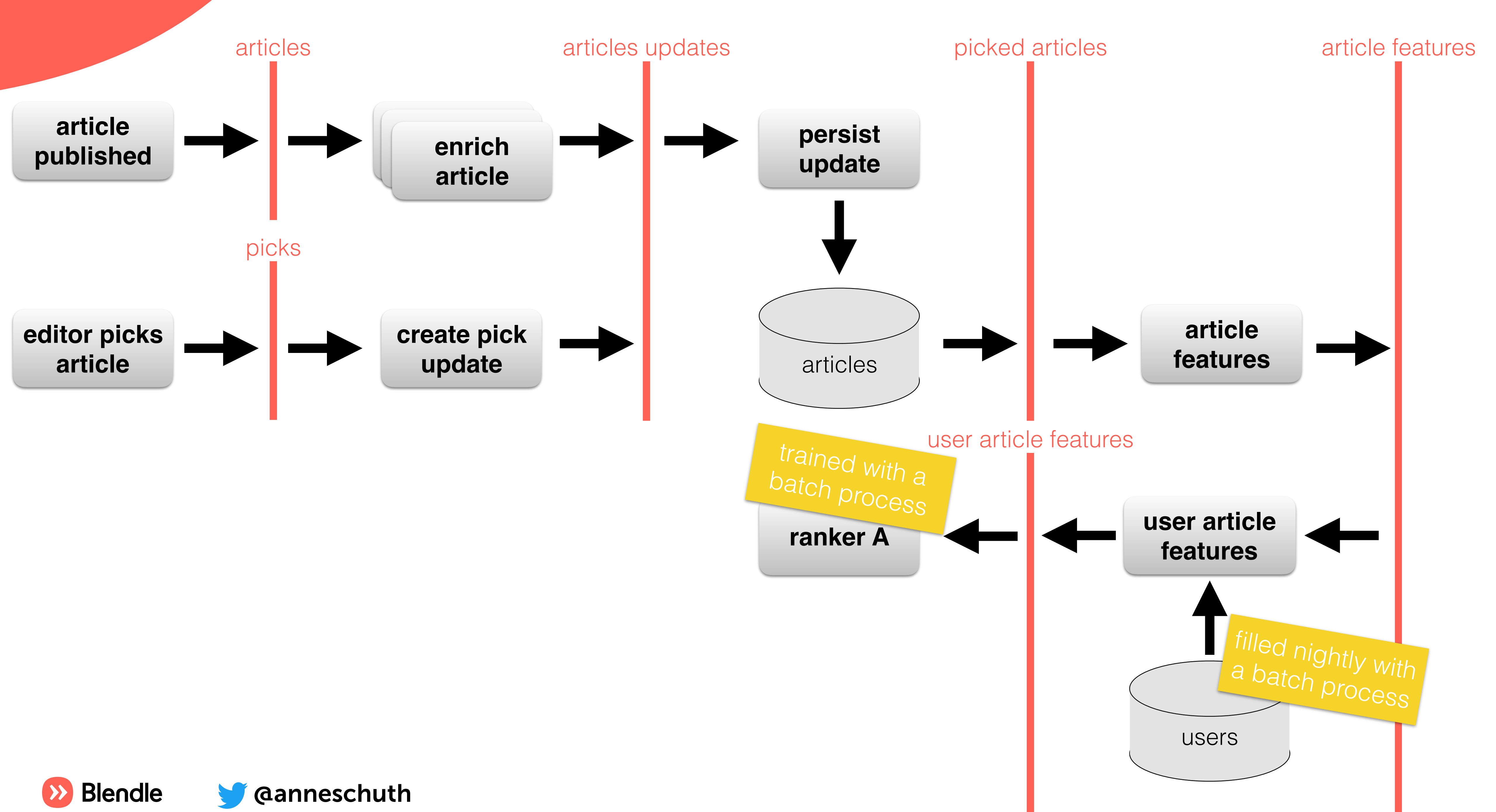


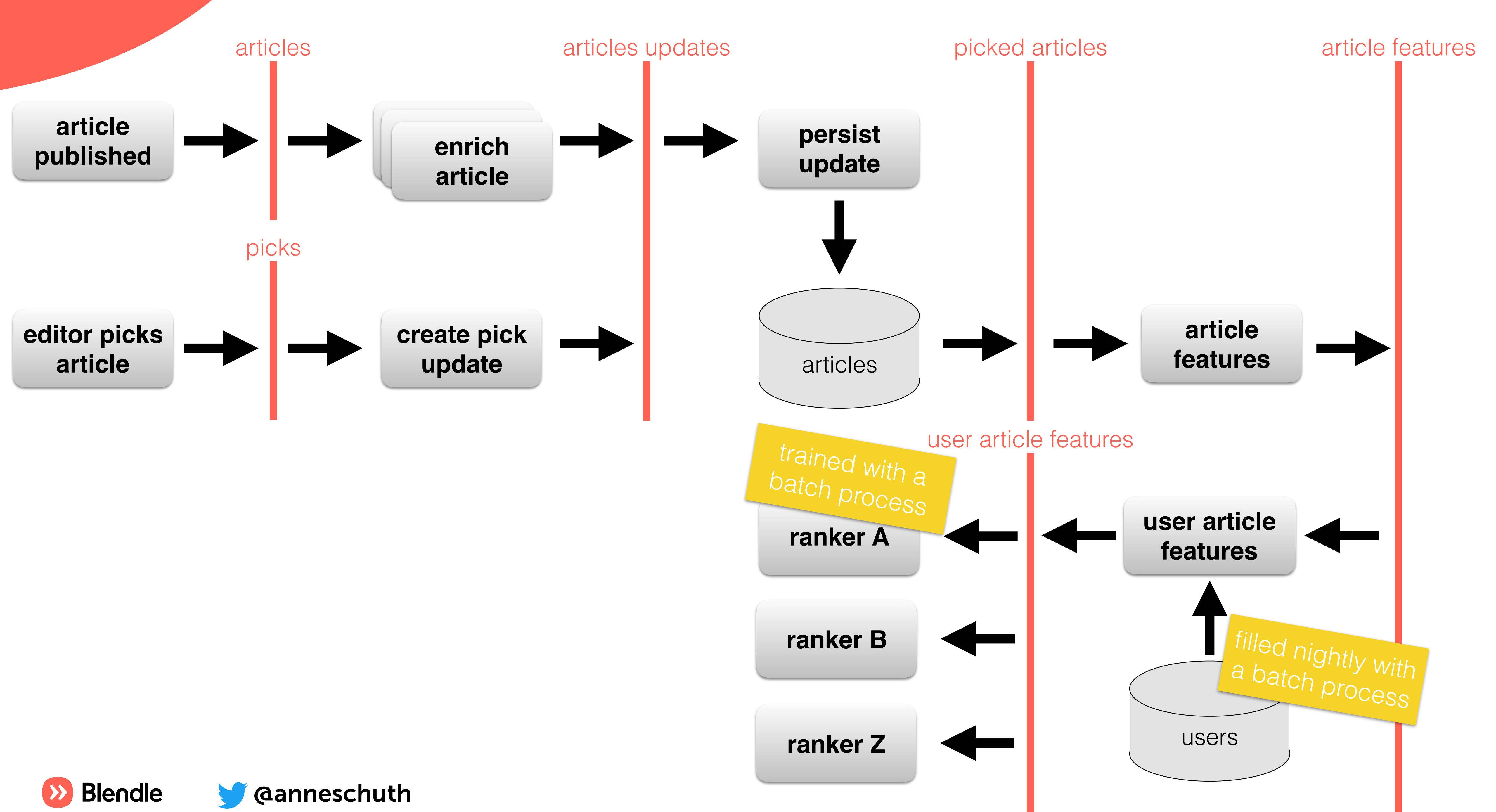


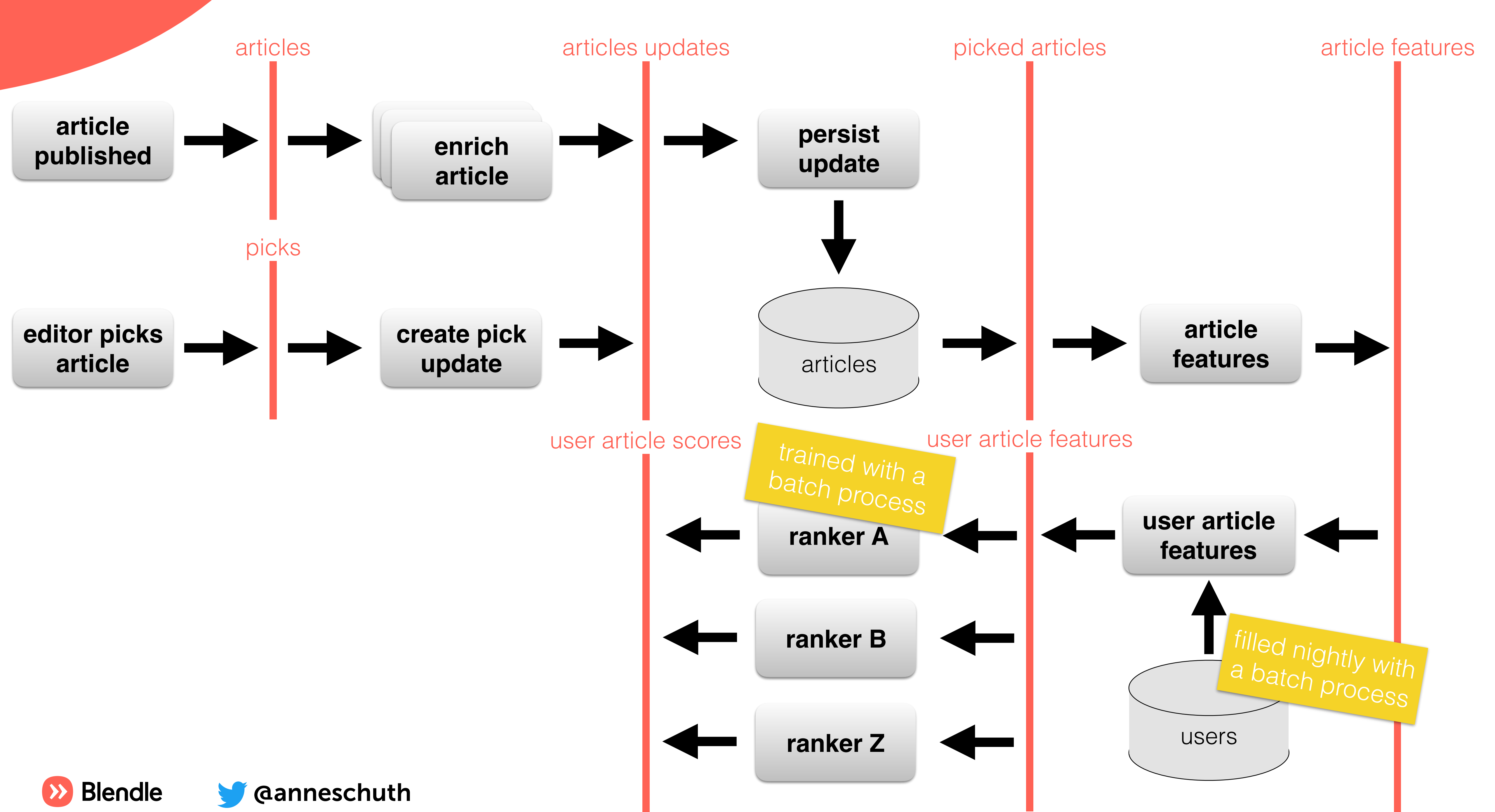


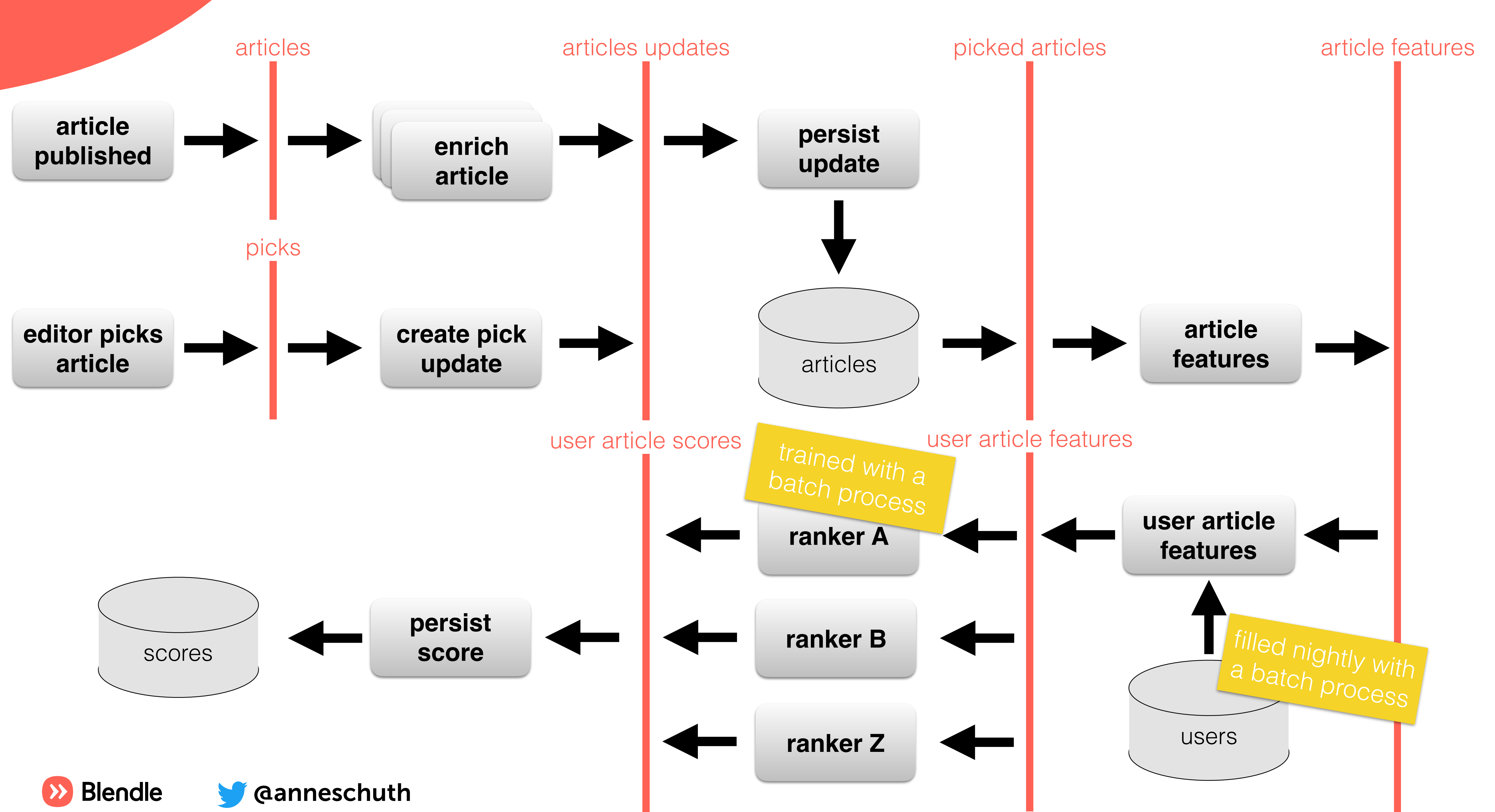


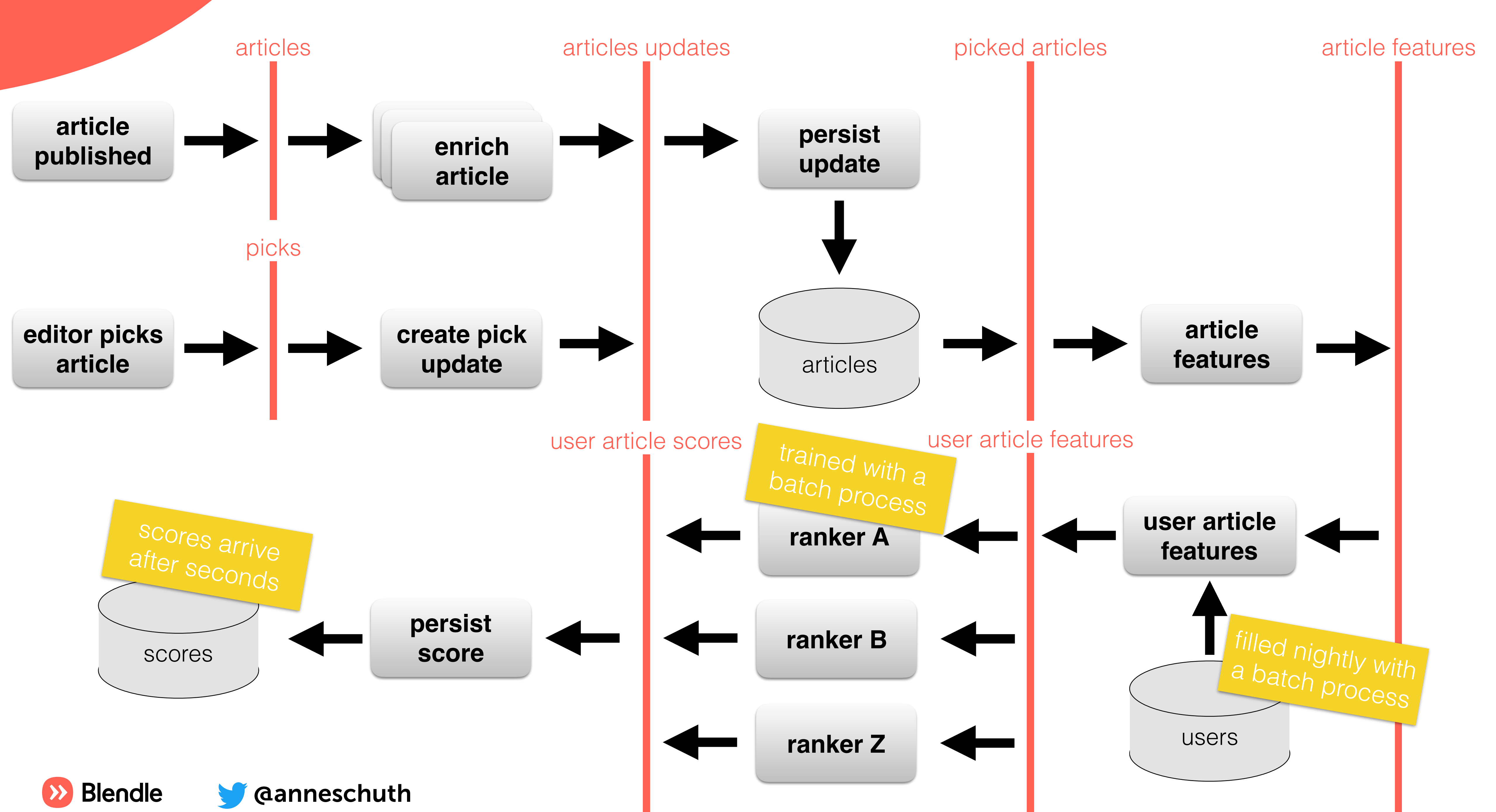


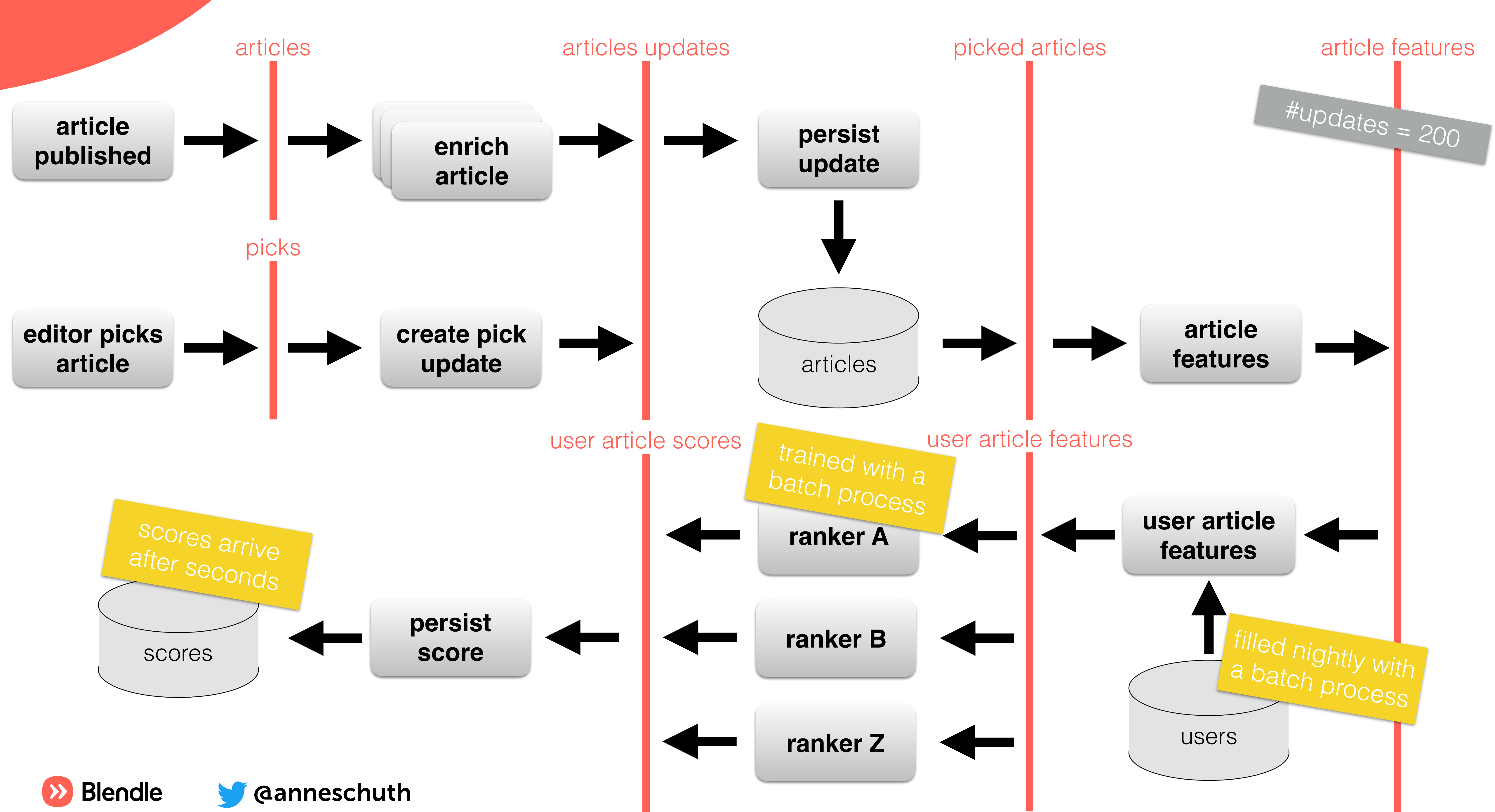


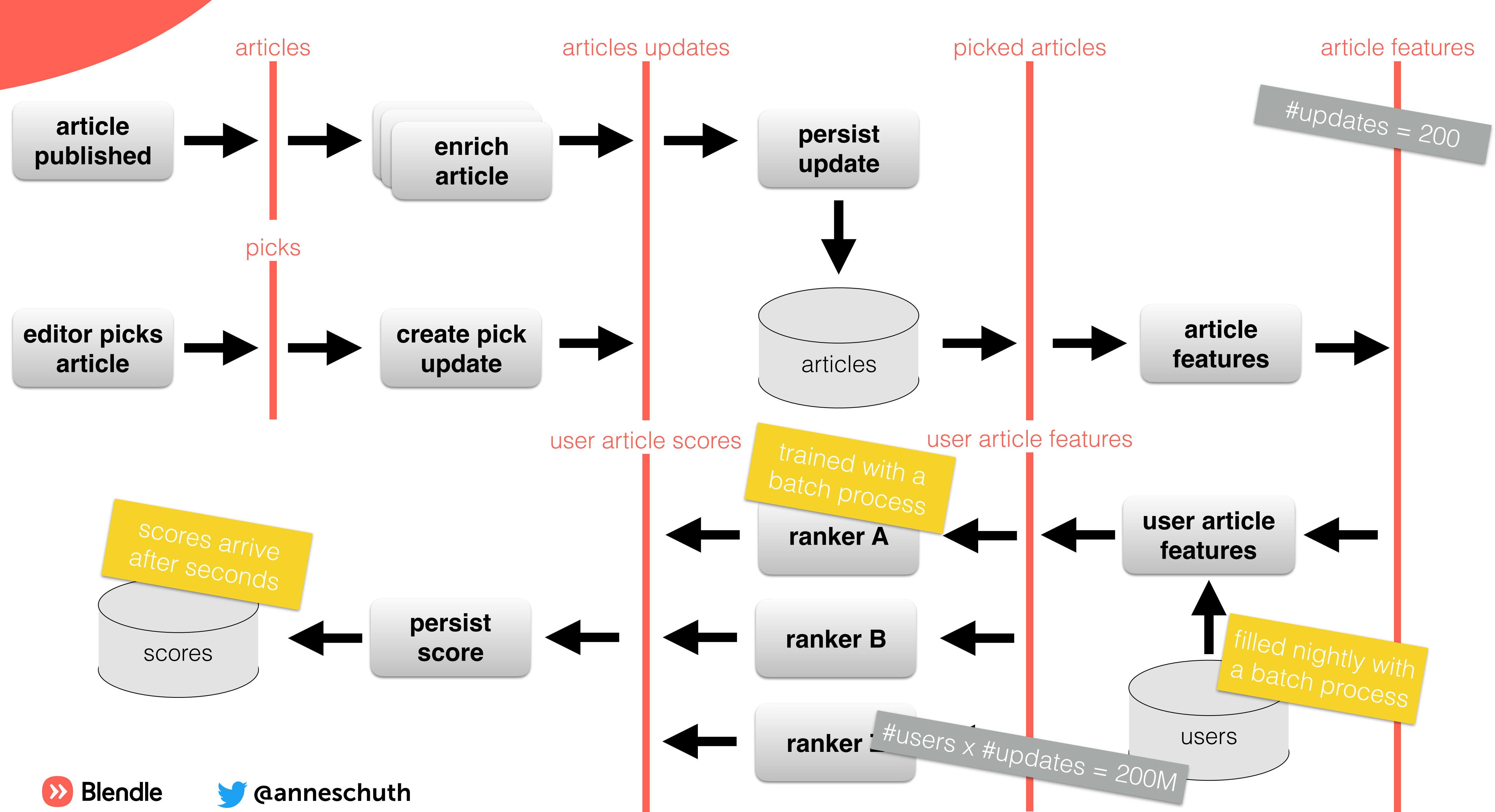


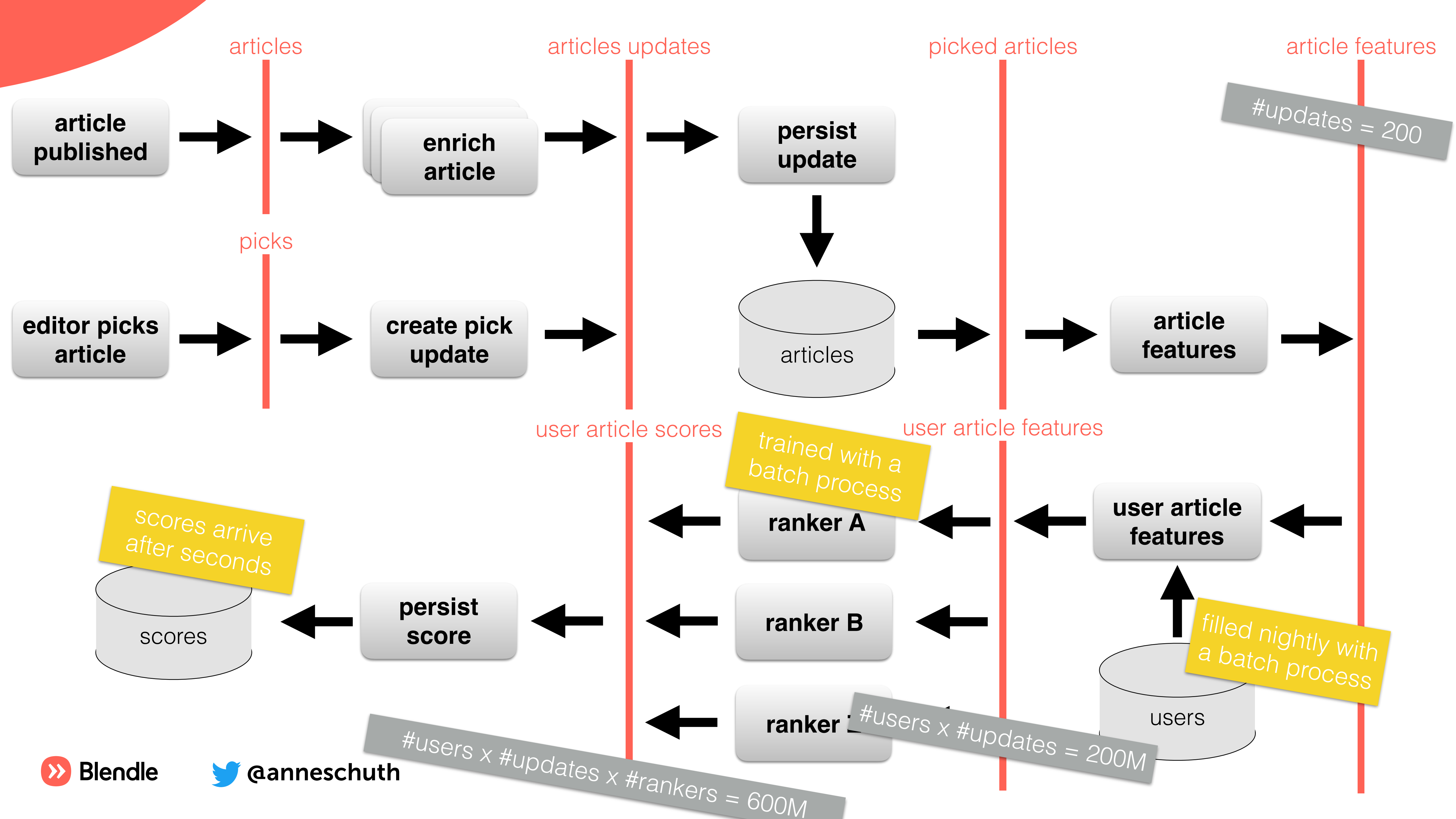






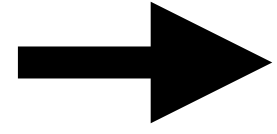






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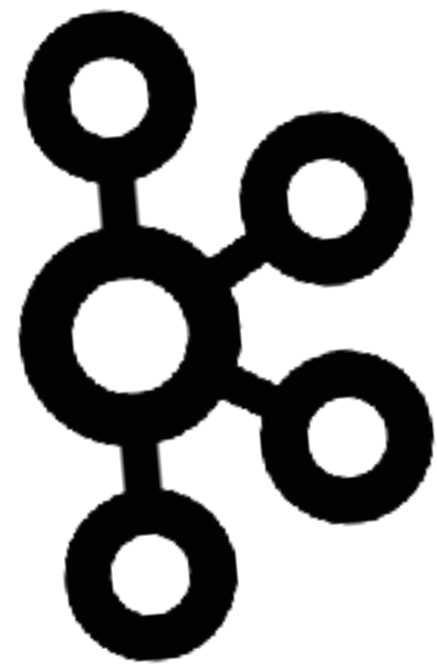
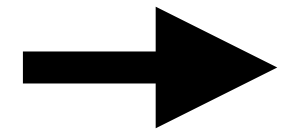
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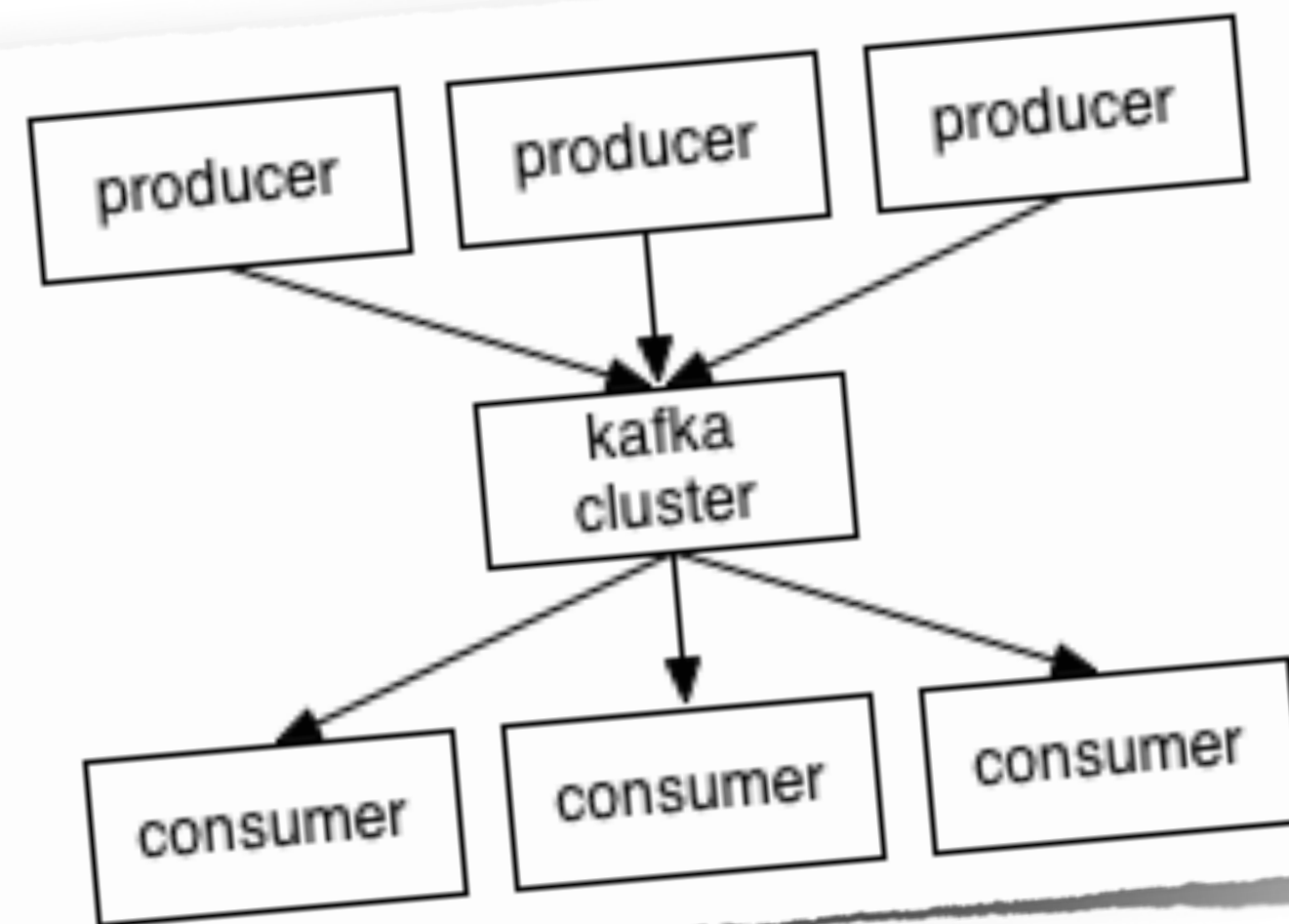
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Kafka

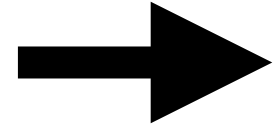
1.1 Introduction

Kafka is a distributed, partitioned, replicated commit log service. It provides the functionality of a messaging system, but with a unique design.



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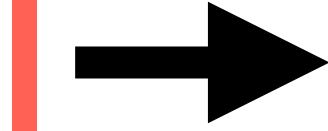
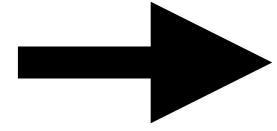


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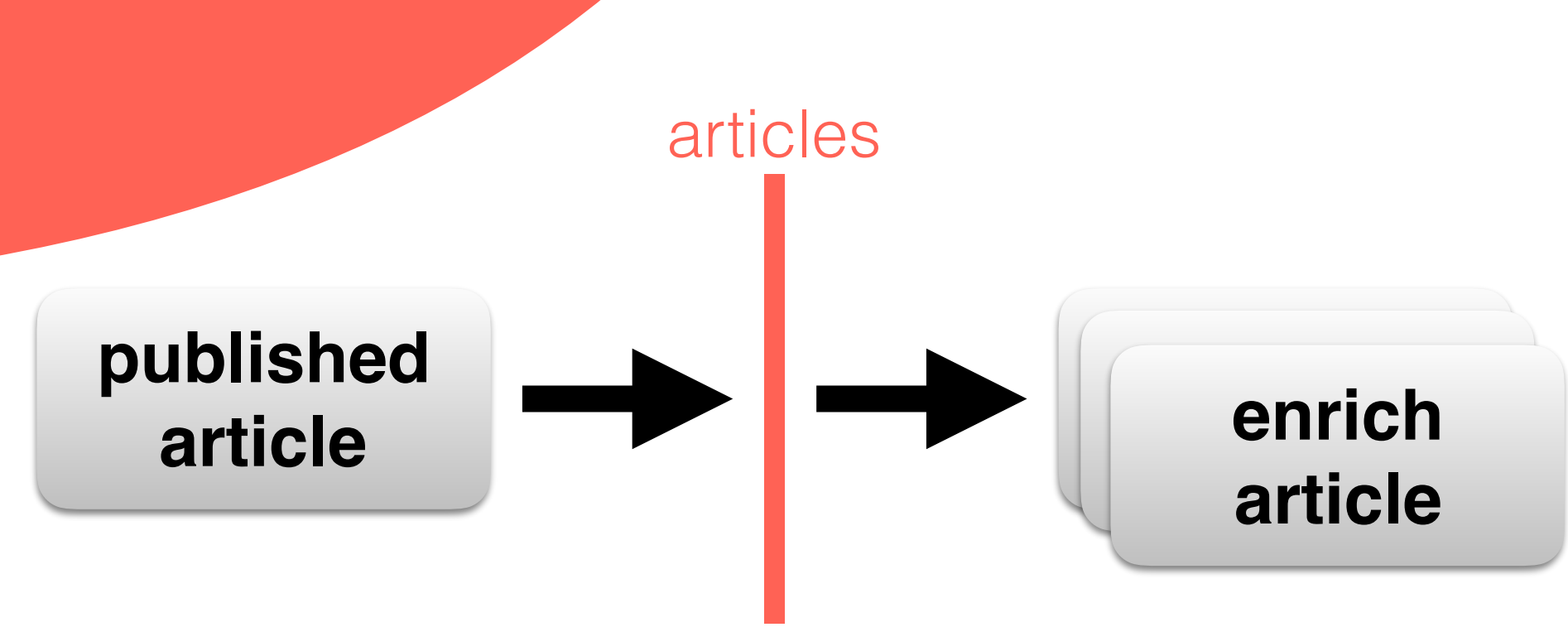


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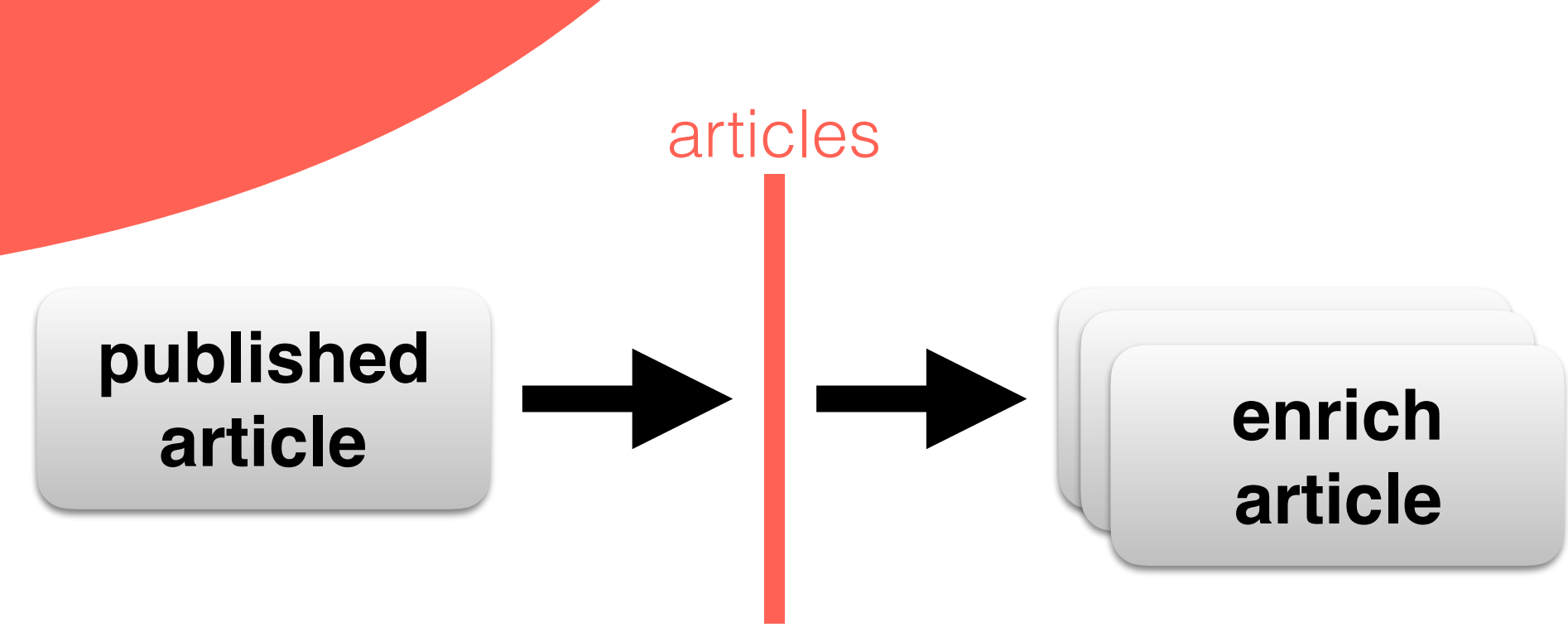
```
import argparse
import os
import sys

from blendle.pipes.task import Task
from blendle.tasks.enrich.itemprofiles import Pipeline

ENRICH_PIPELINE = os.environ.get('ENRICH_PIPELINE',
                                  'language,tokenizer,postagger,ner,stylometry,author').split(',')

class Enrich(Task):
    def __init__(self, in_file, out_file, error_file, **kwargs):
        self.enricher = kwargs.get('enricher', ENRICH_PIPELINE)
        self.pipeline = Pipeline(self.enricher)
        super().__init__(in_file, out_file, error_file, **kwargs)

    def process(self, item):
        enrichments = self.pipeline(item).get('enrichments', {})
        yield {'id': item['id'],
               'item-metadata': {'enrichments': enrichments}}
```

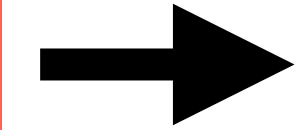
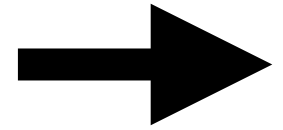




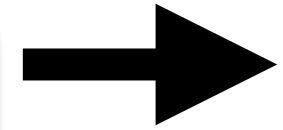
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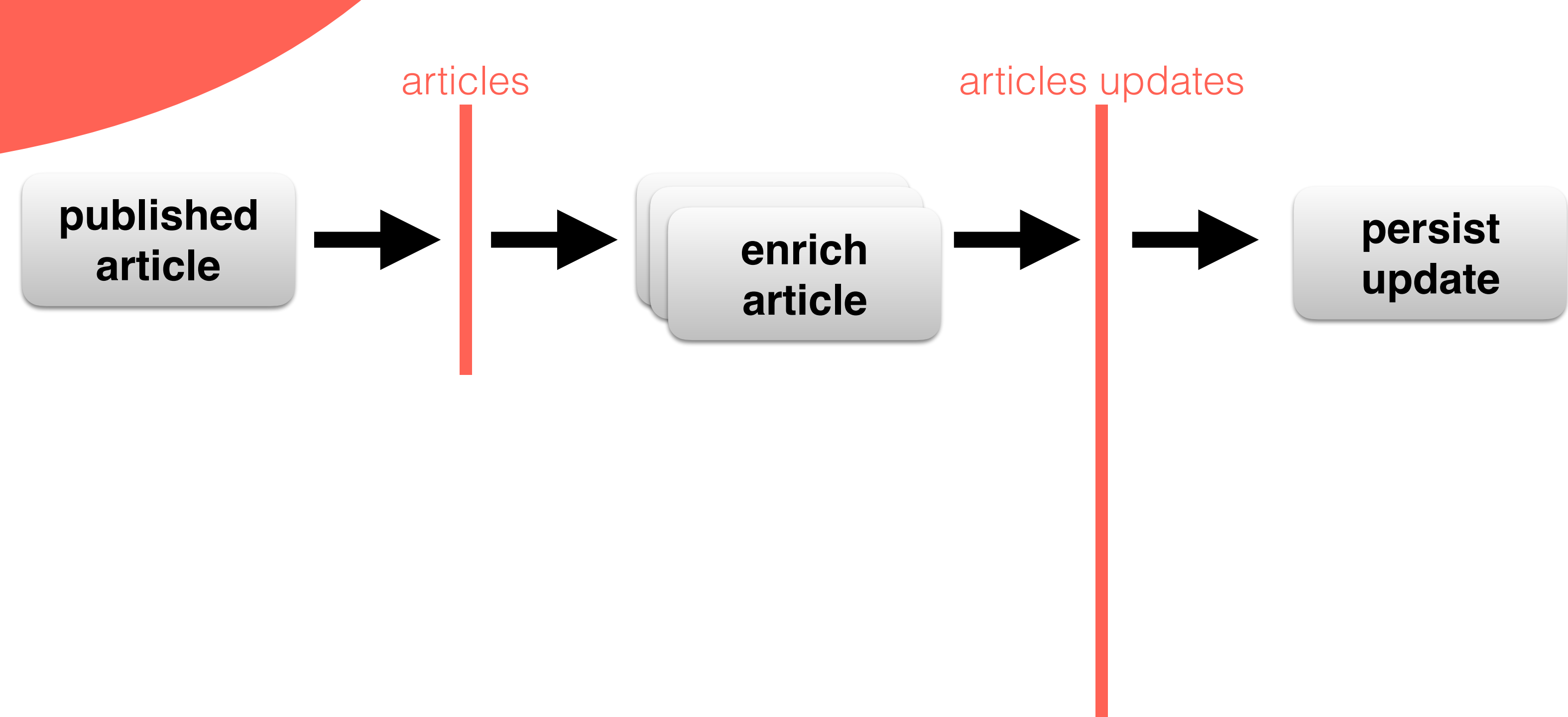
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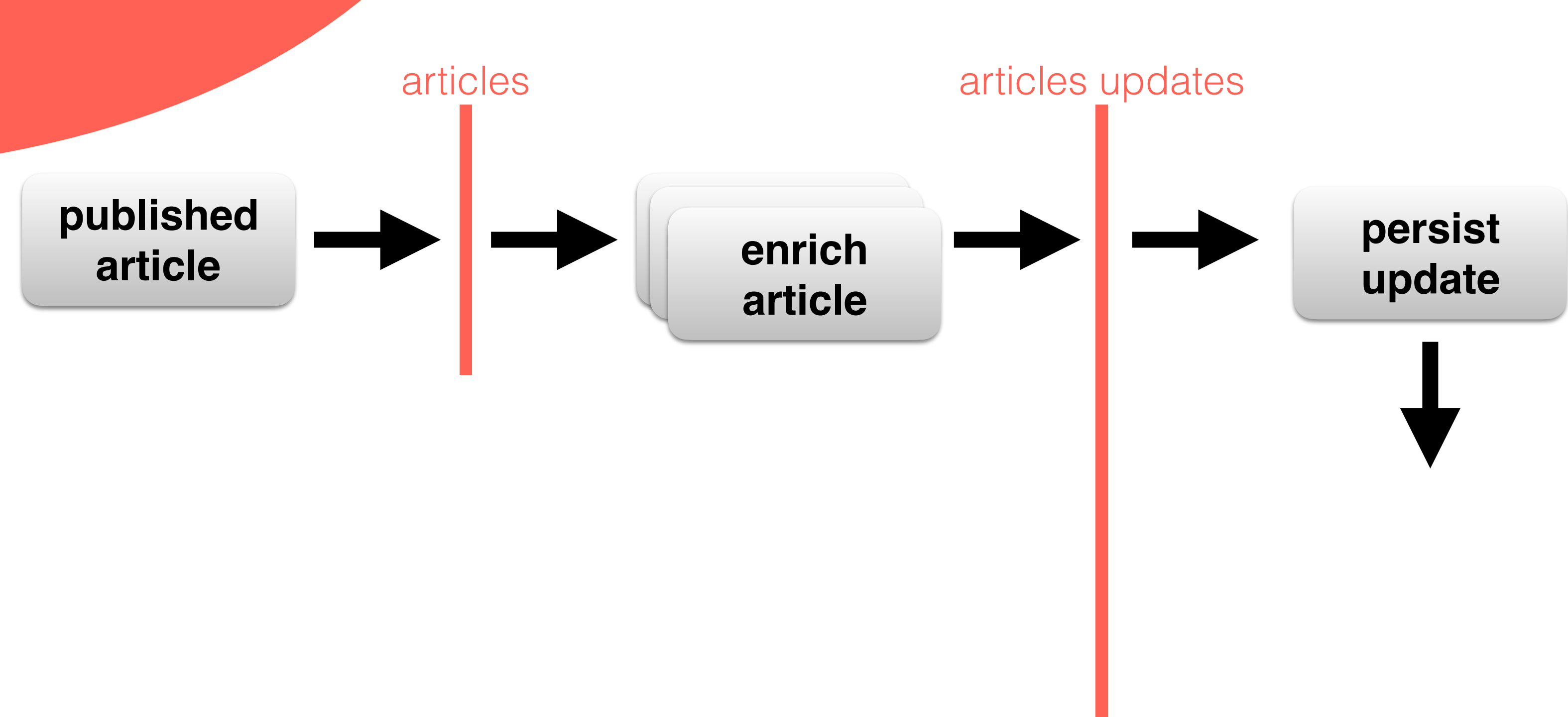
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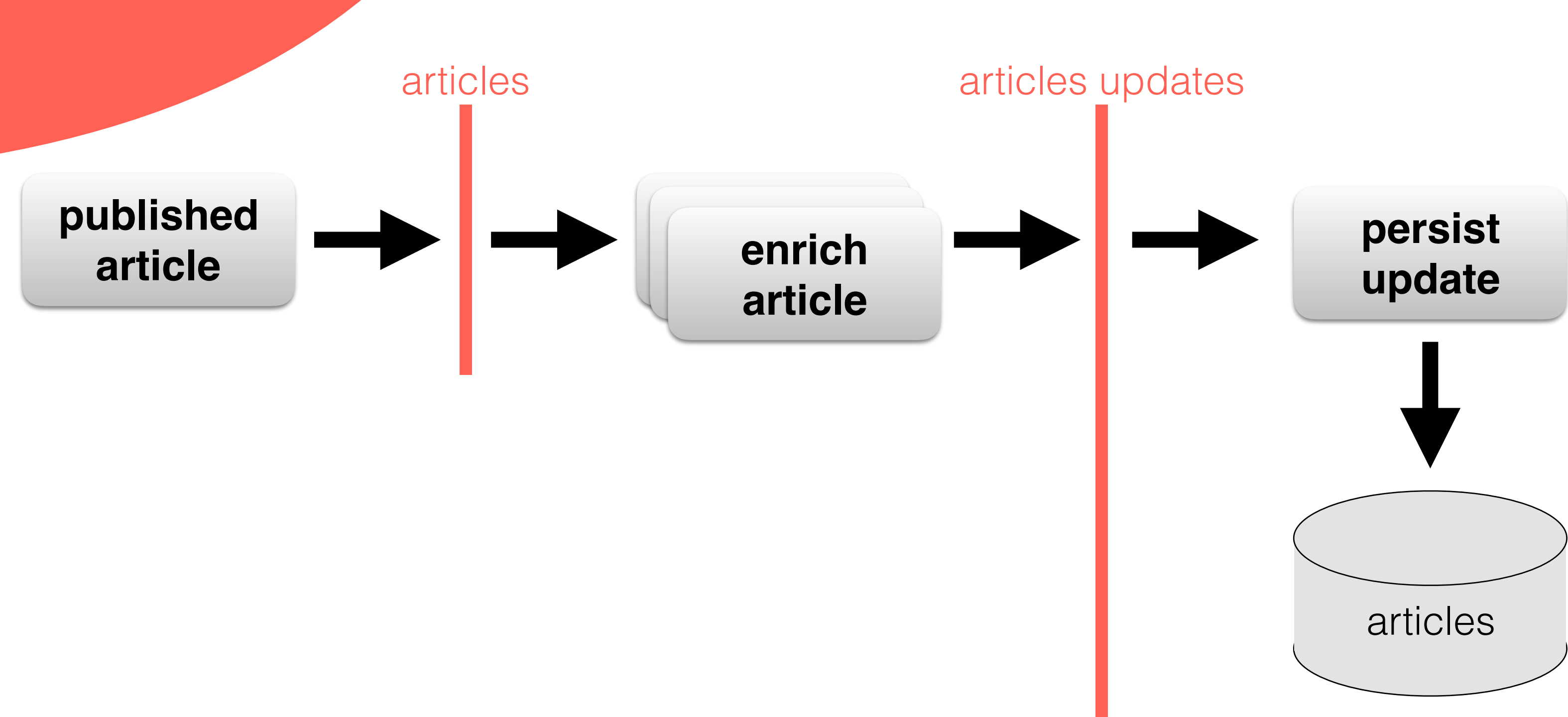


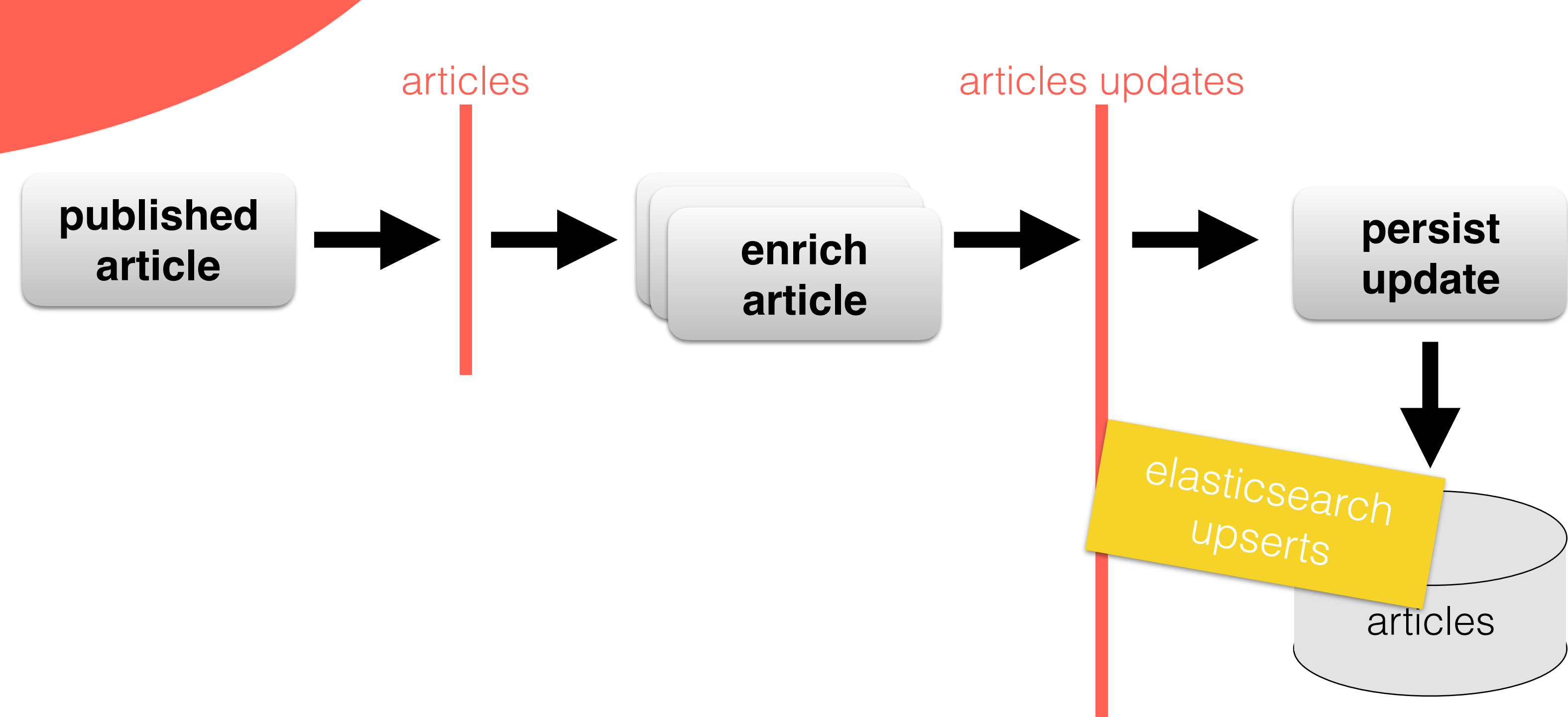
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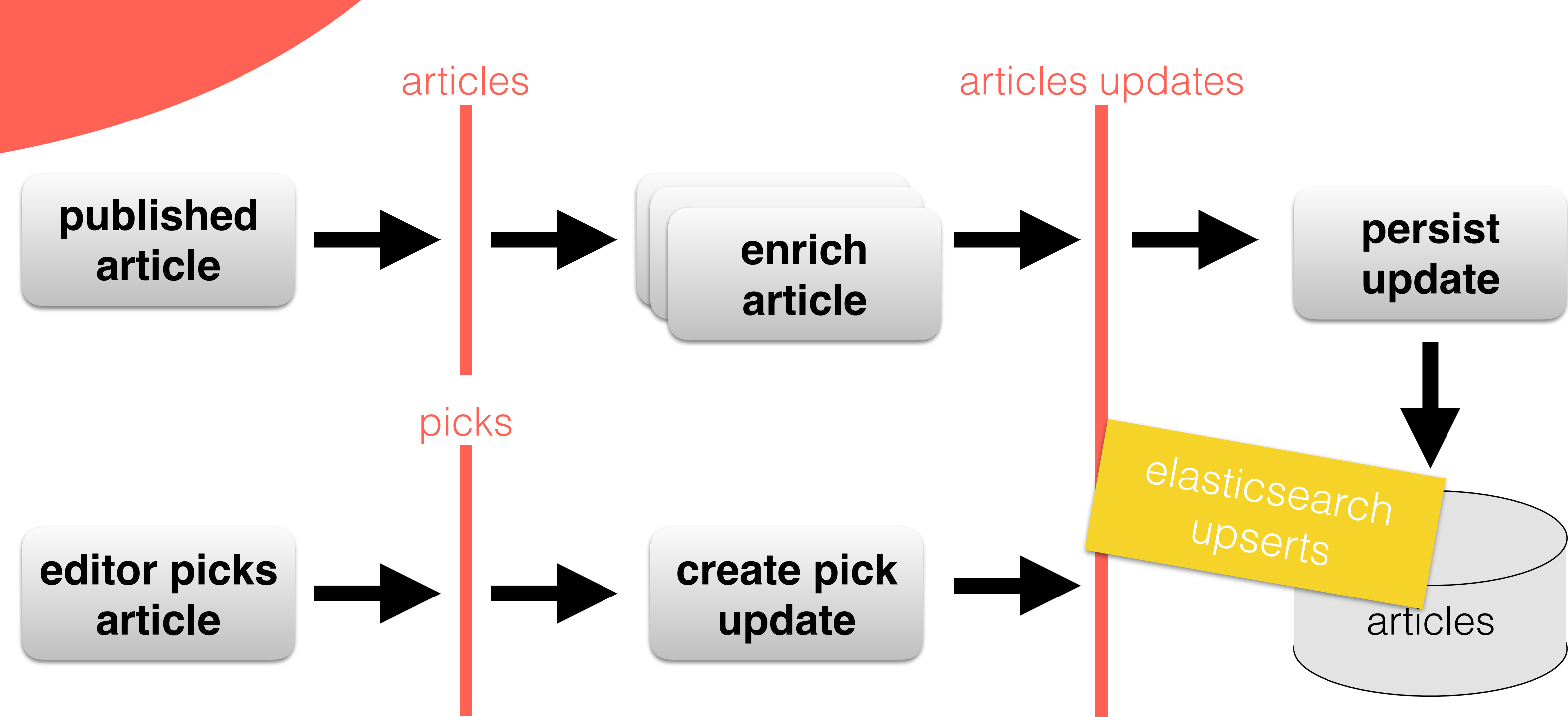


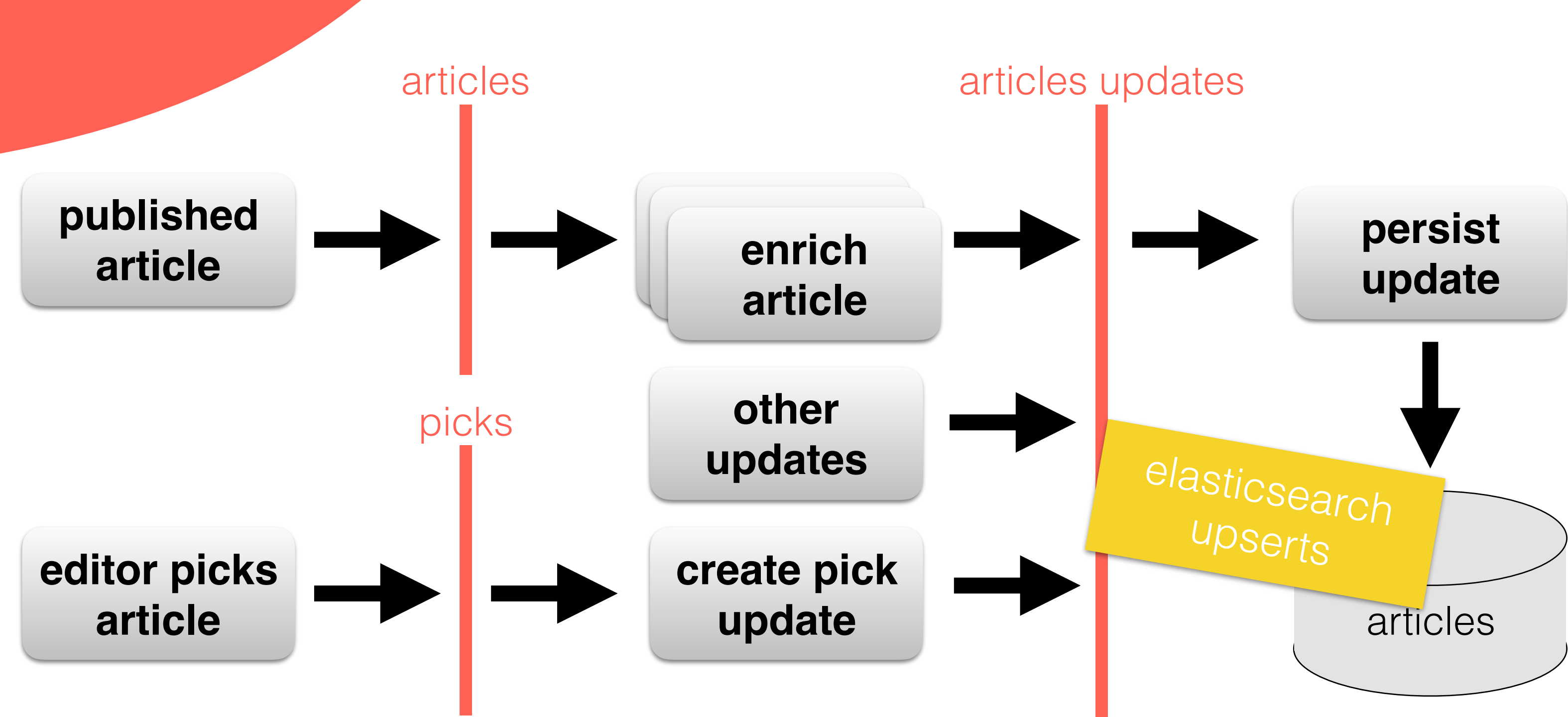


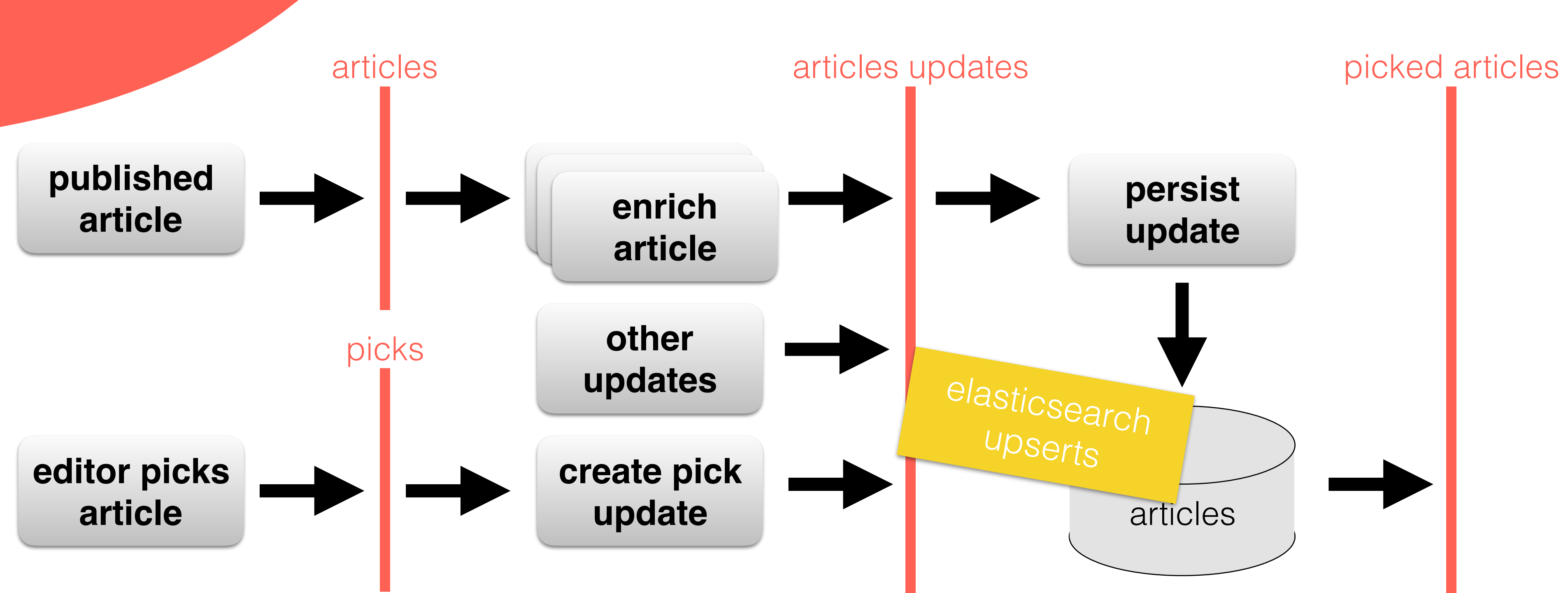


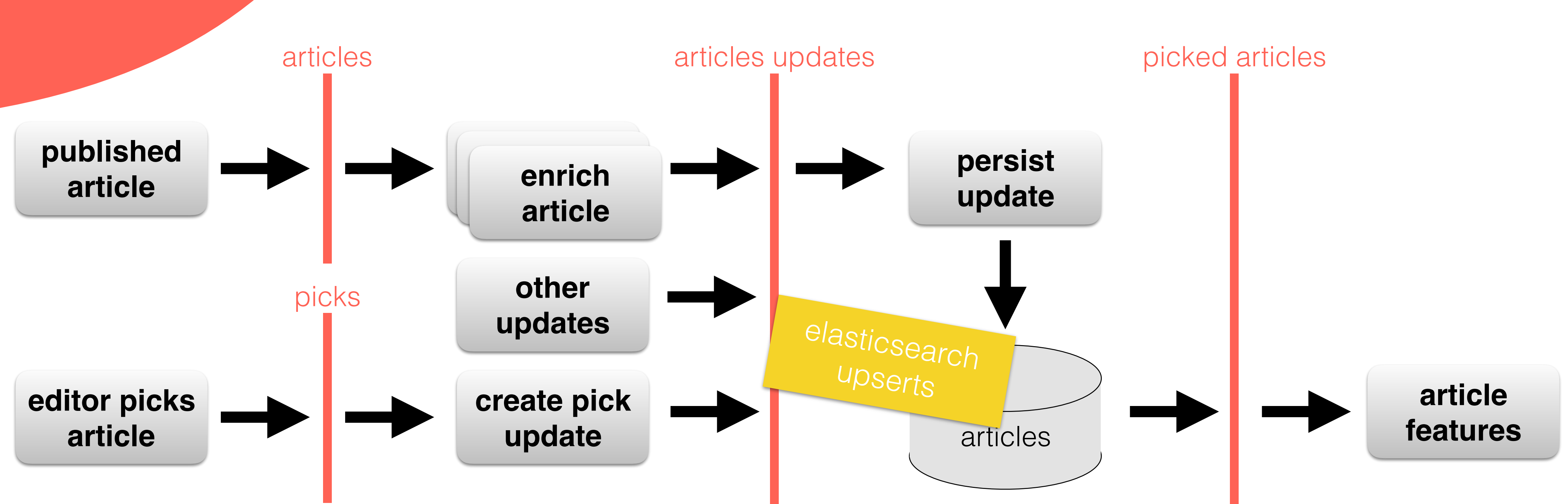


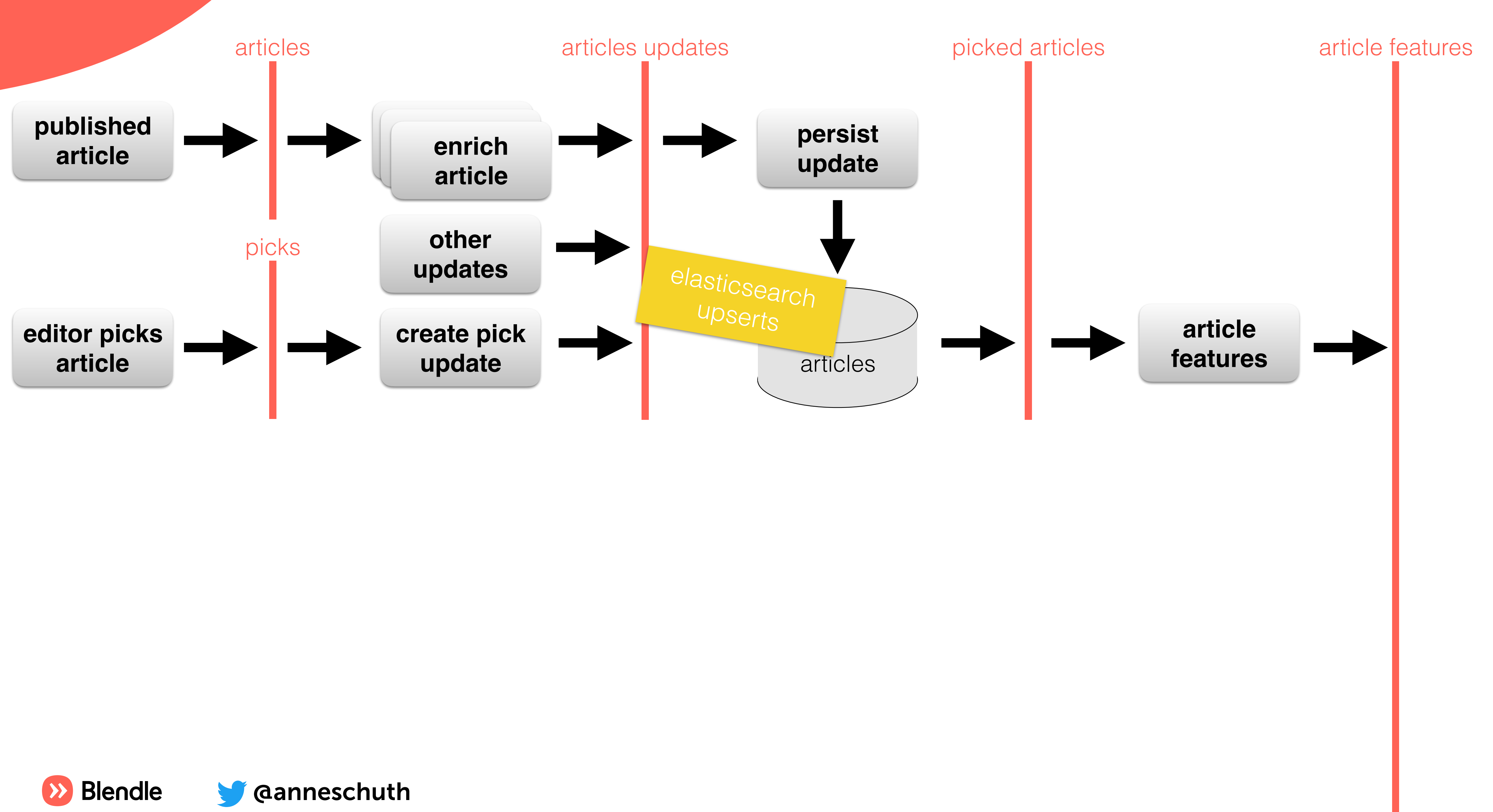


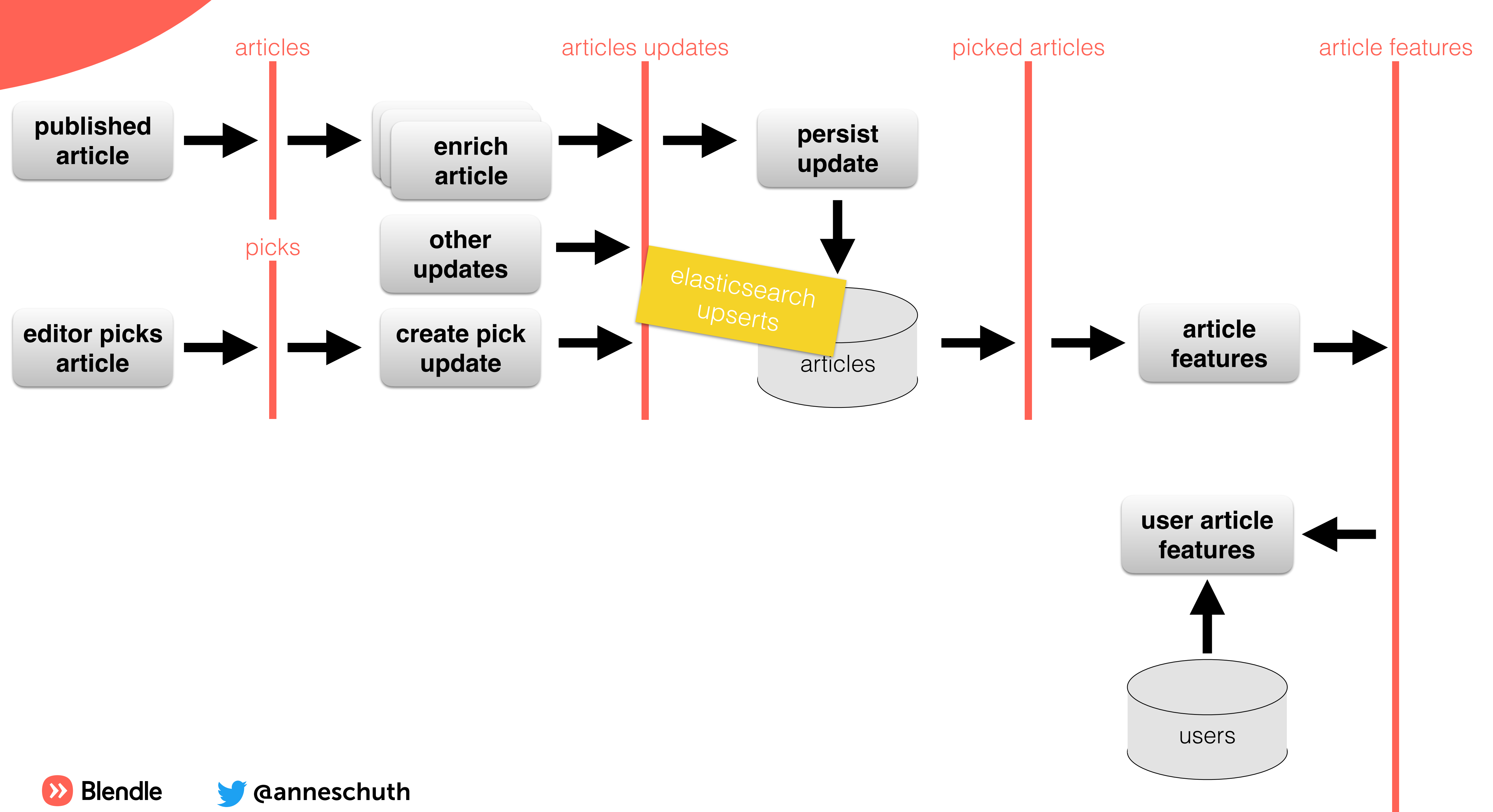


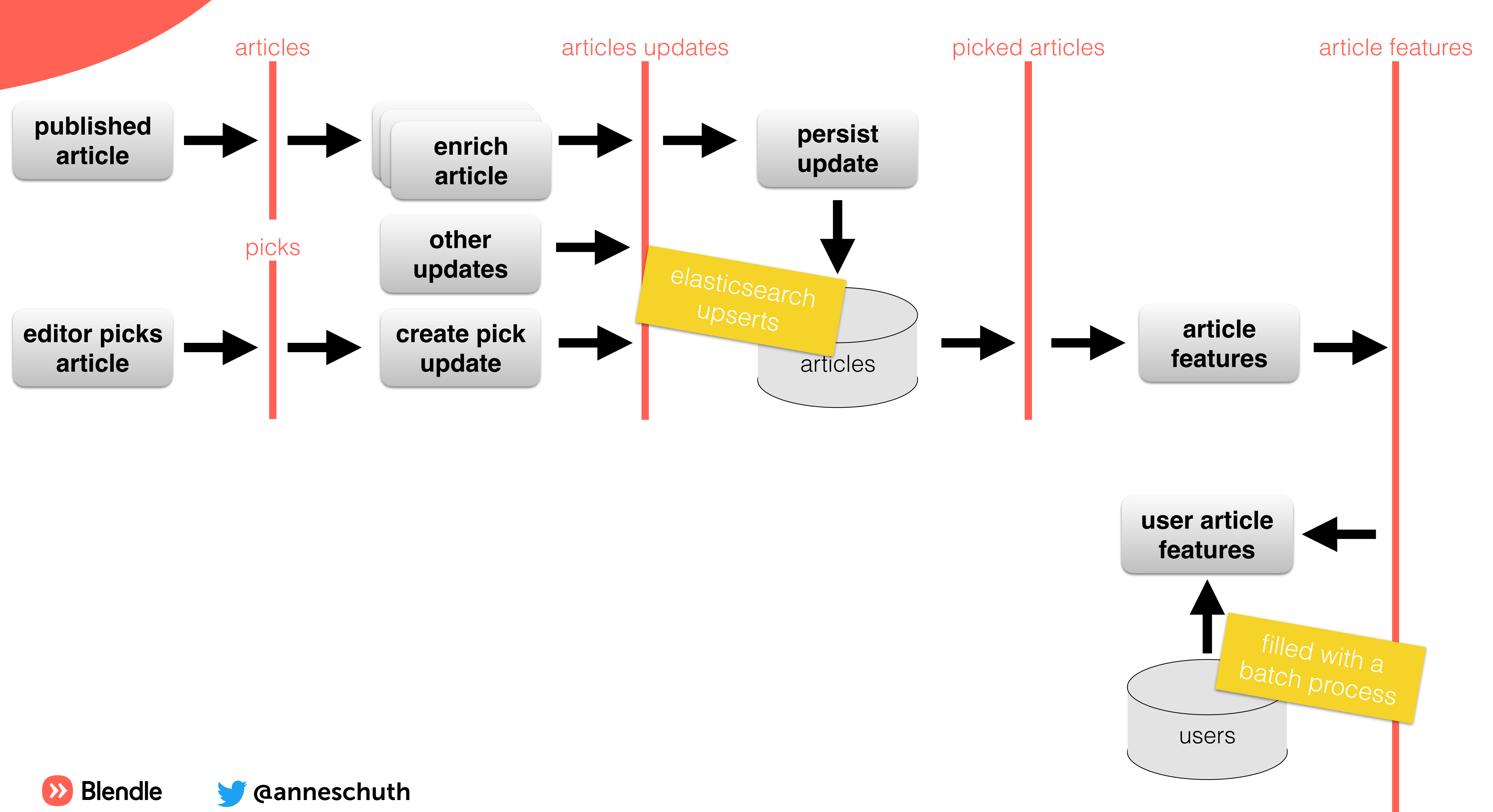


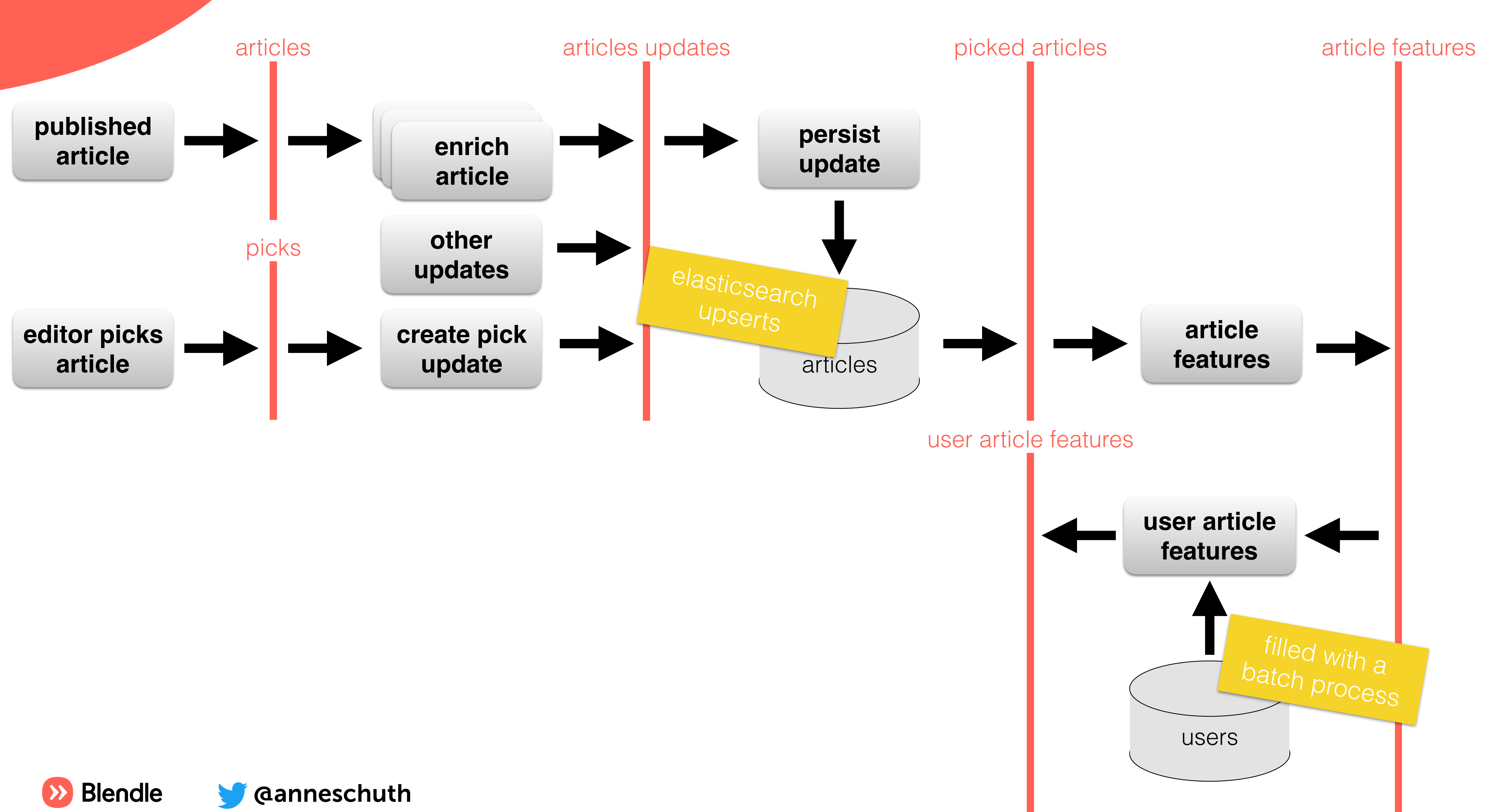


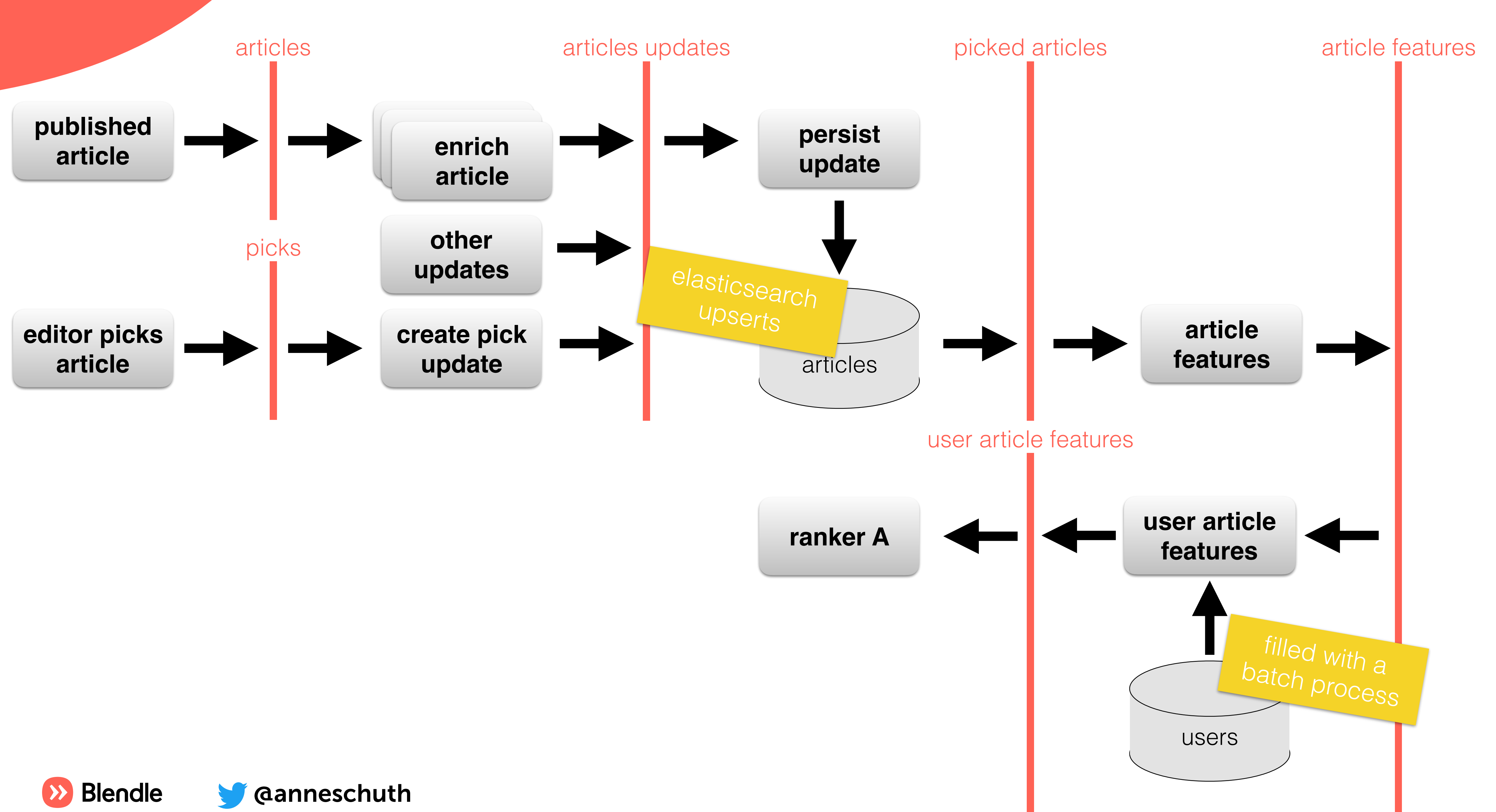


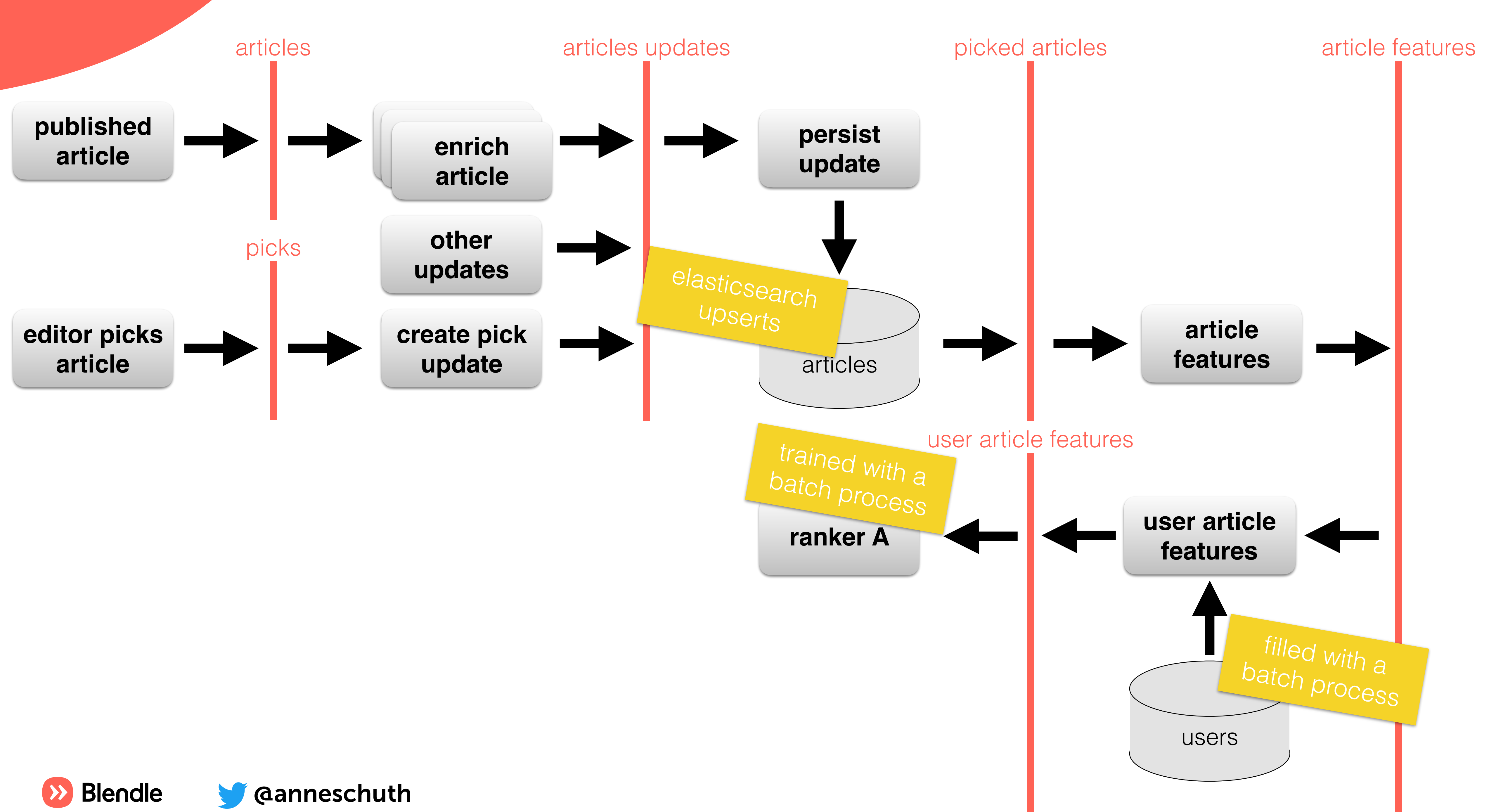


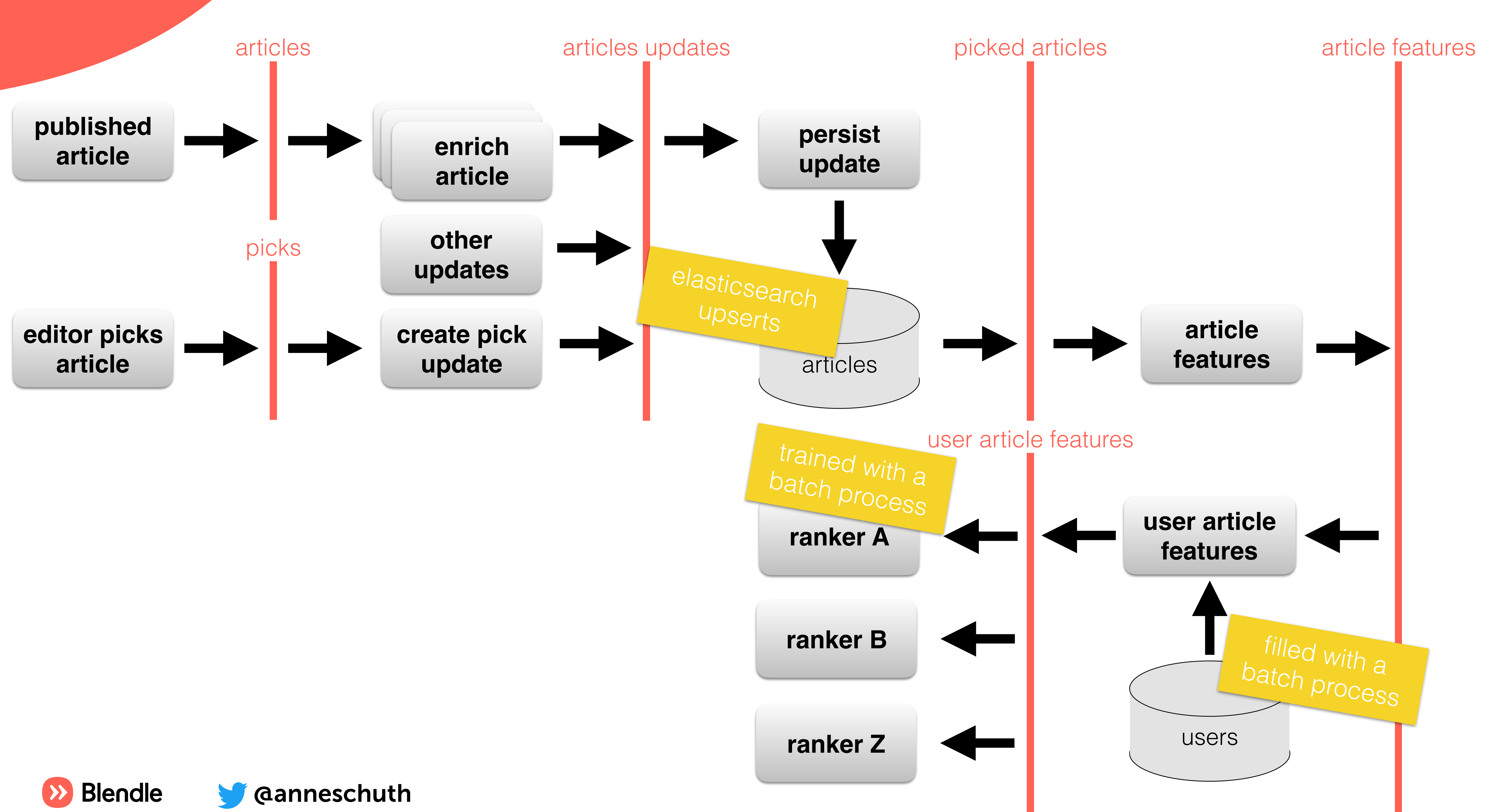


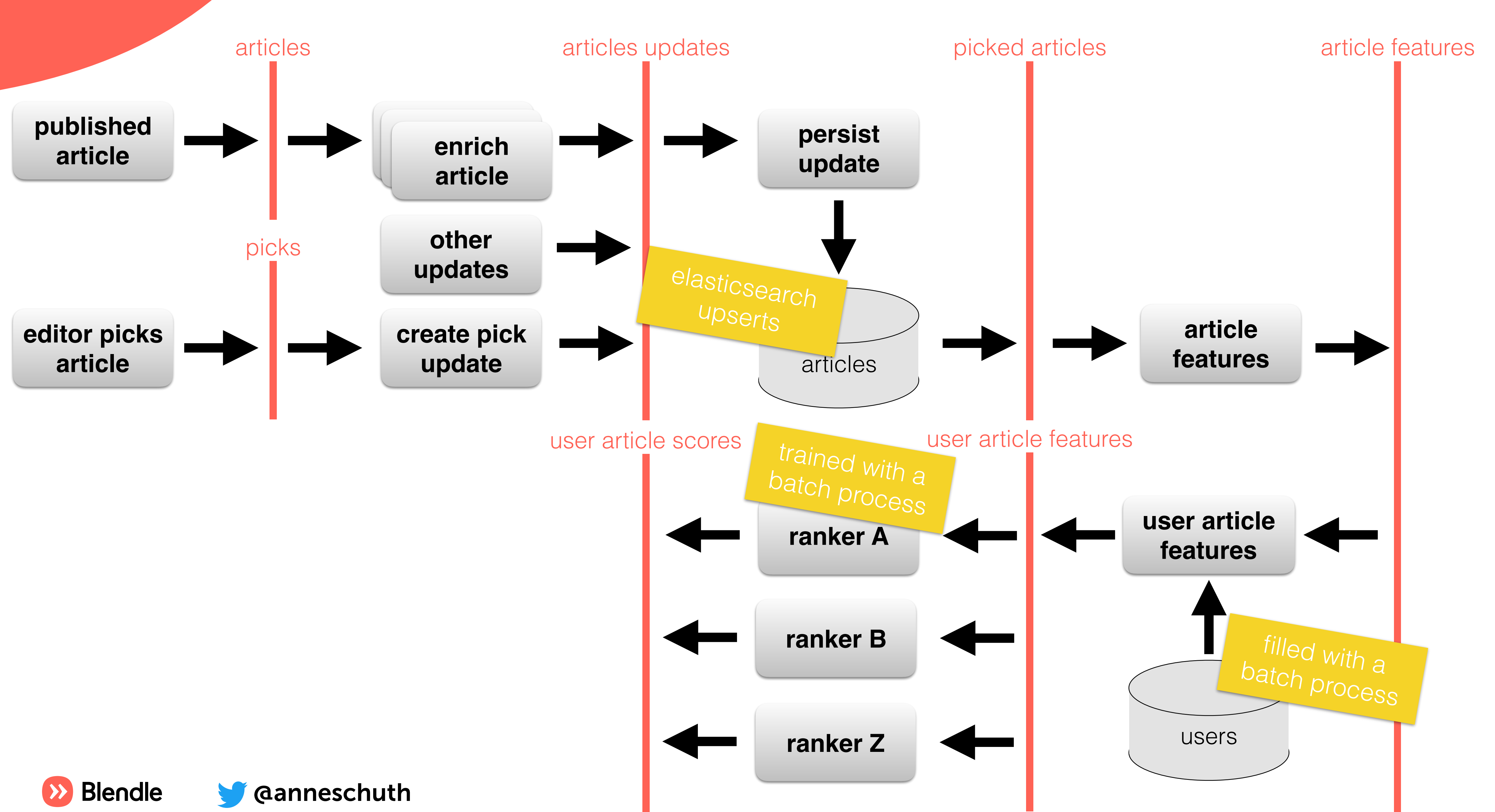


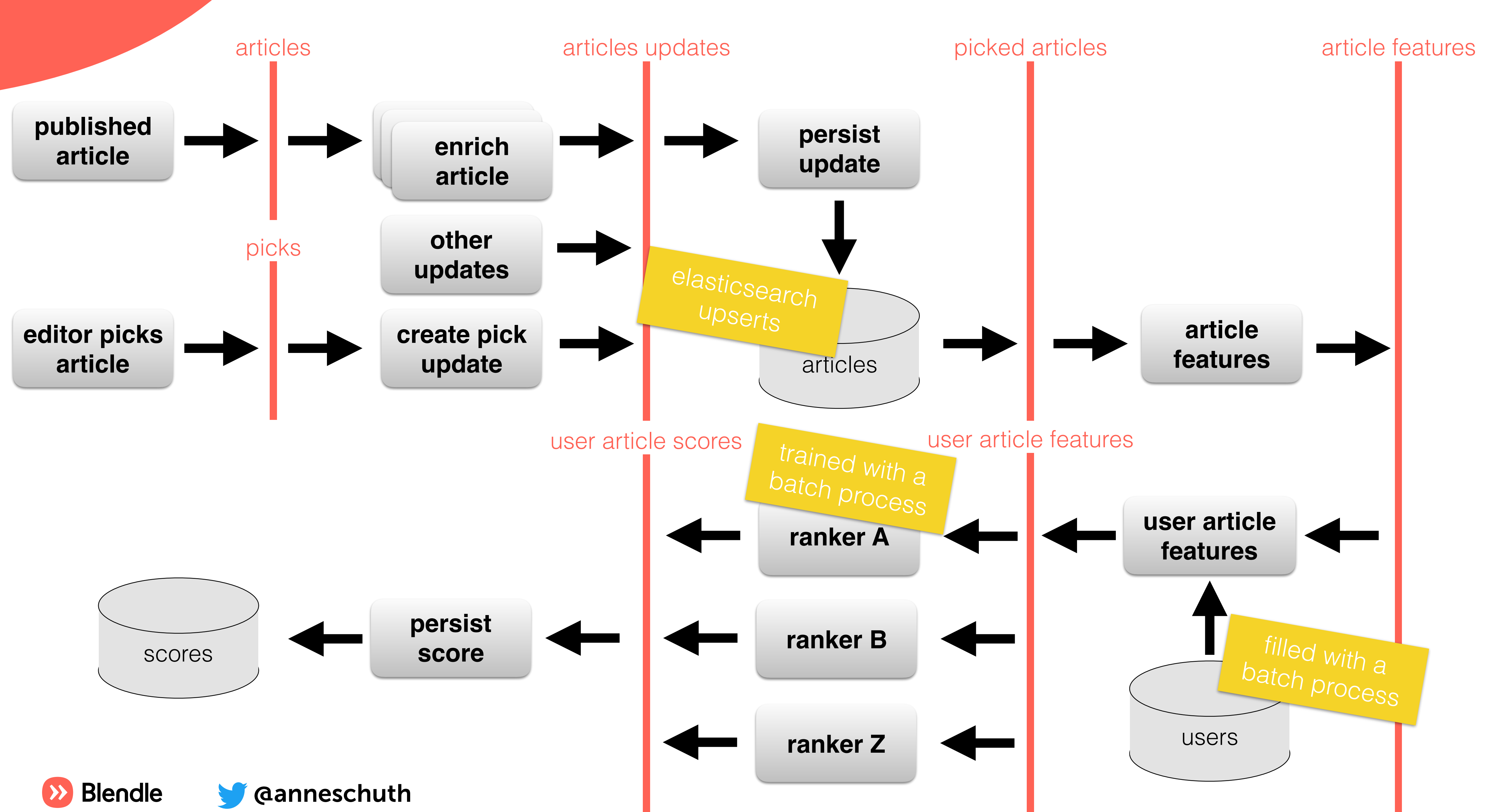


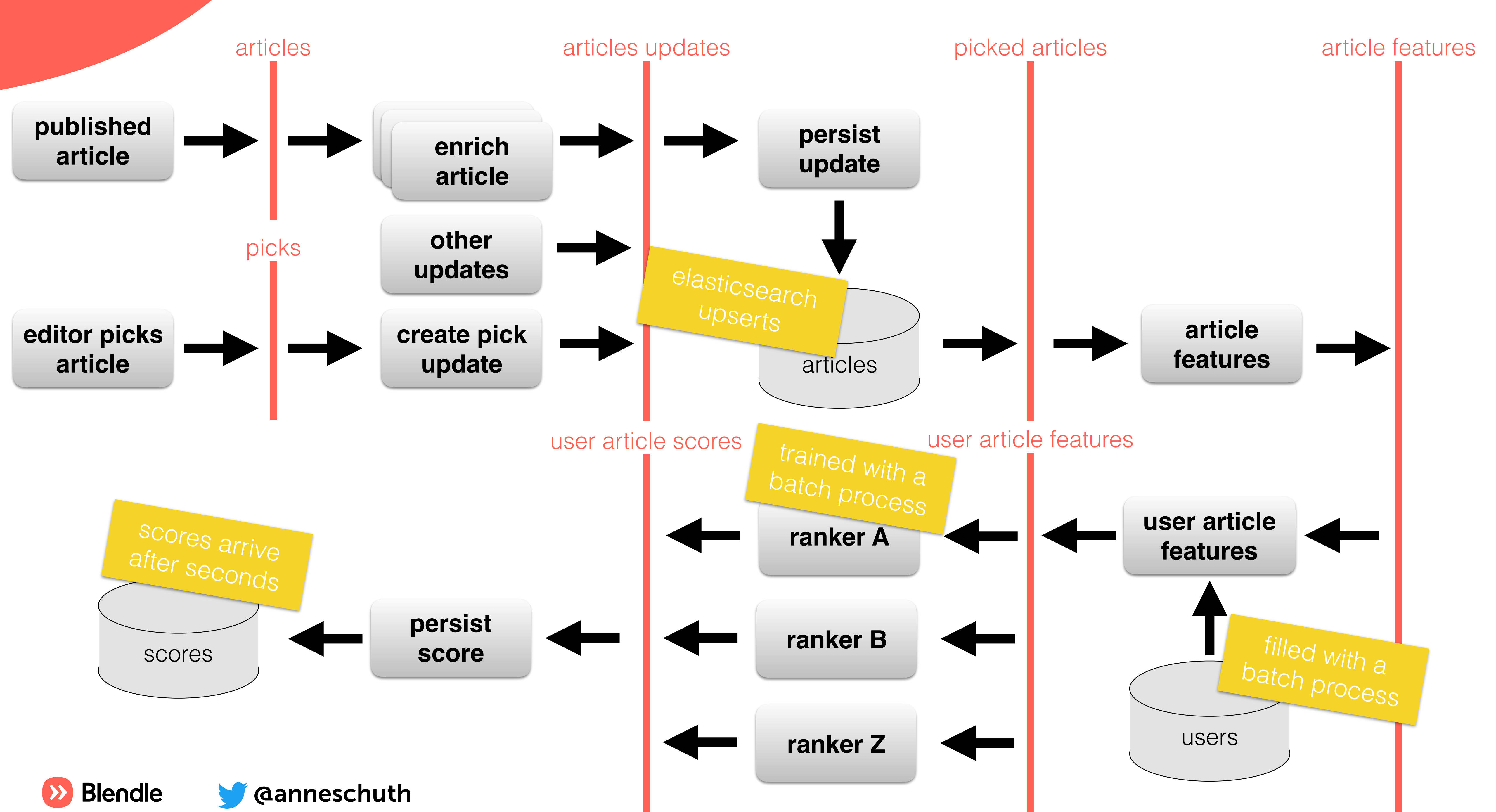


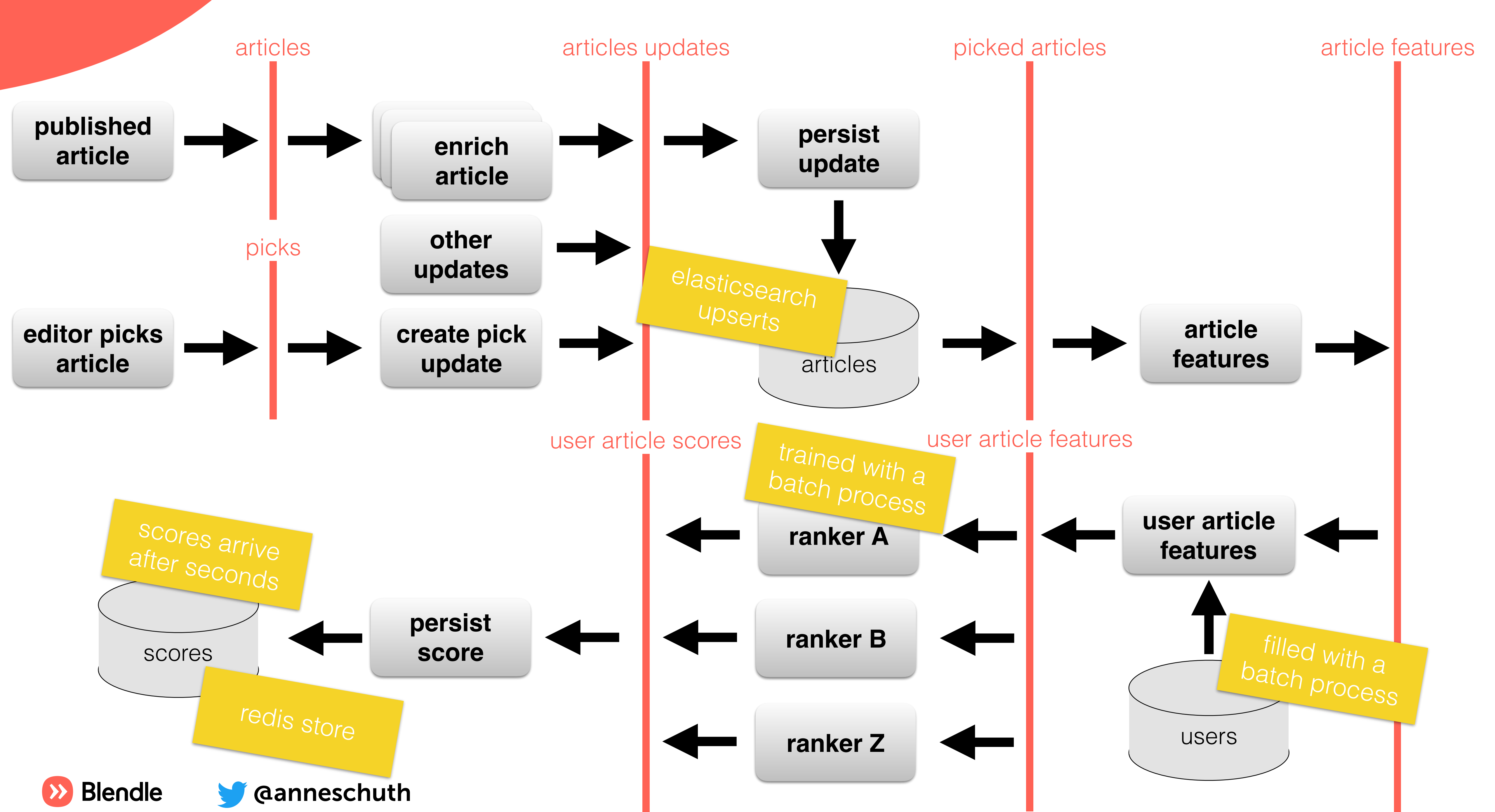


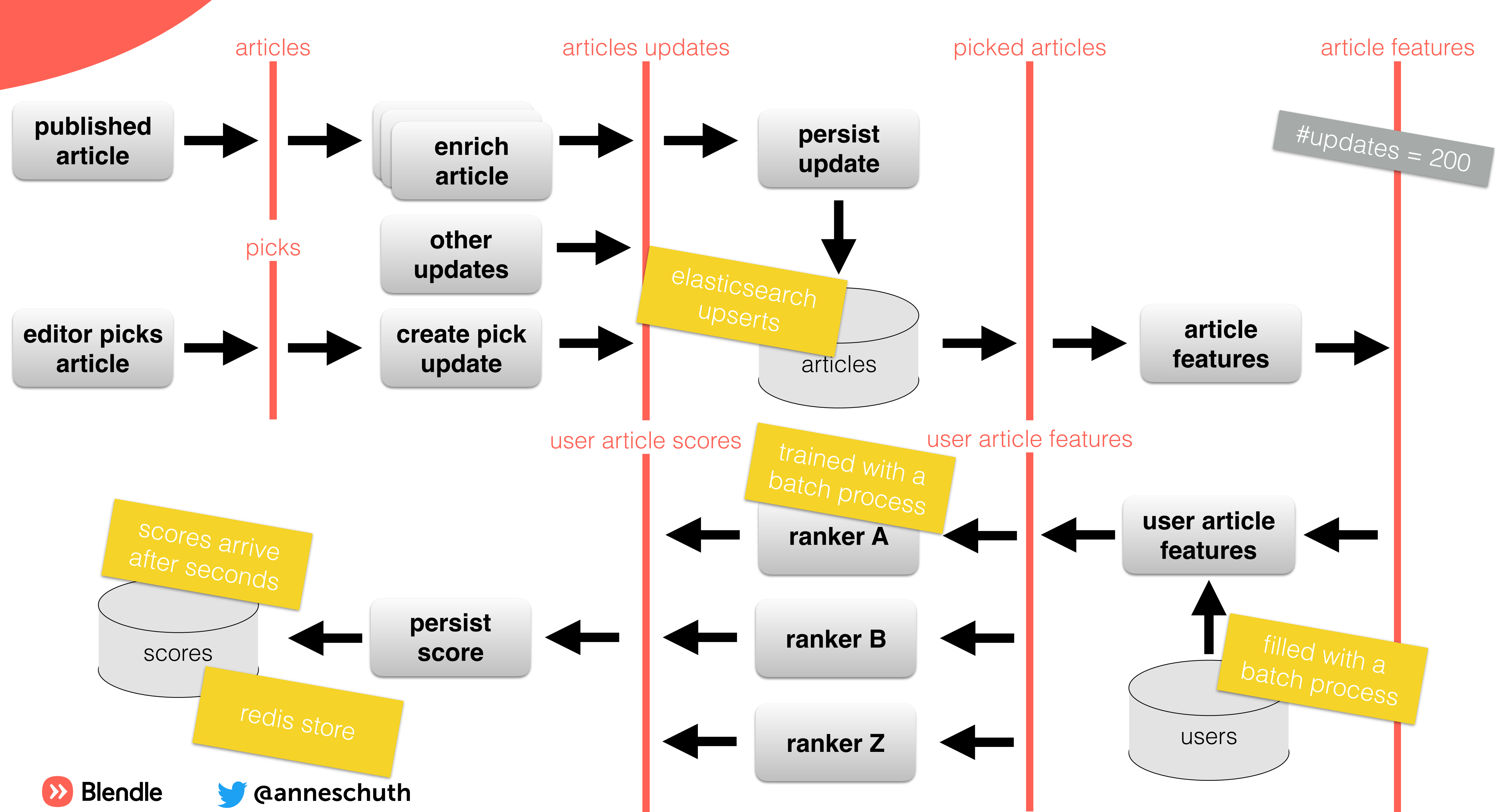


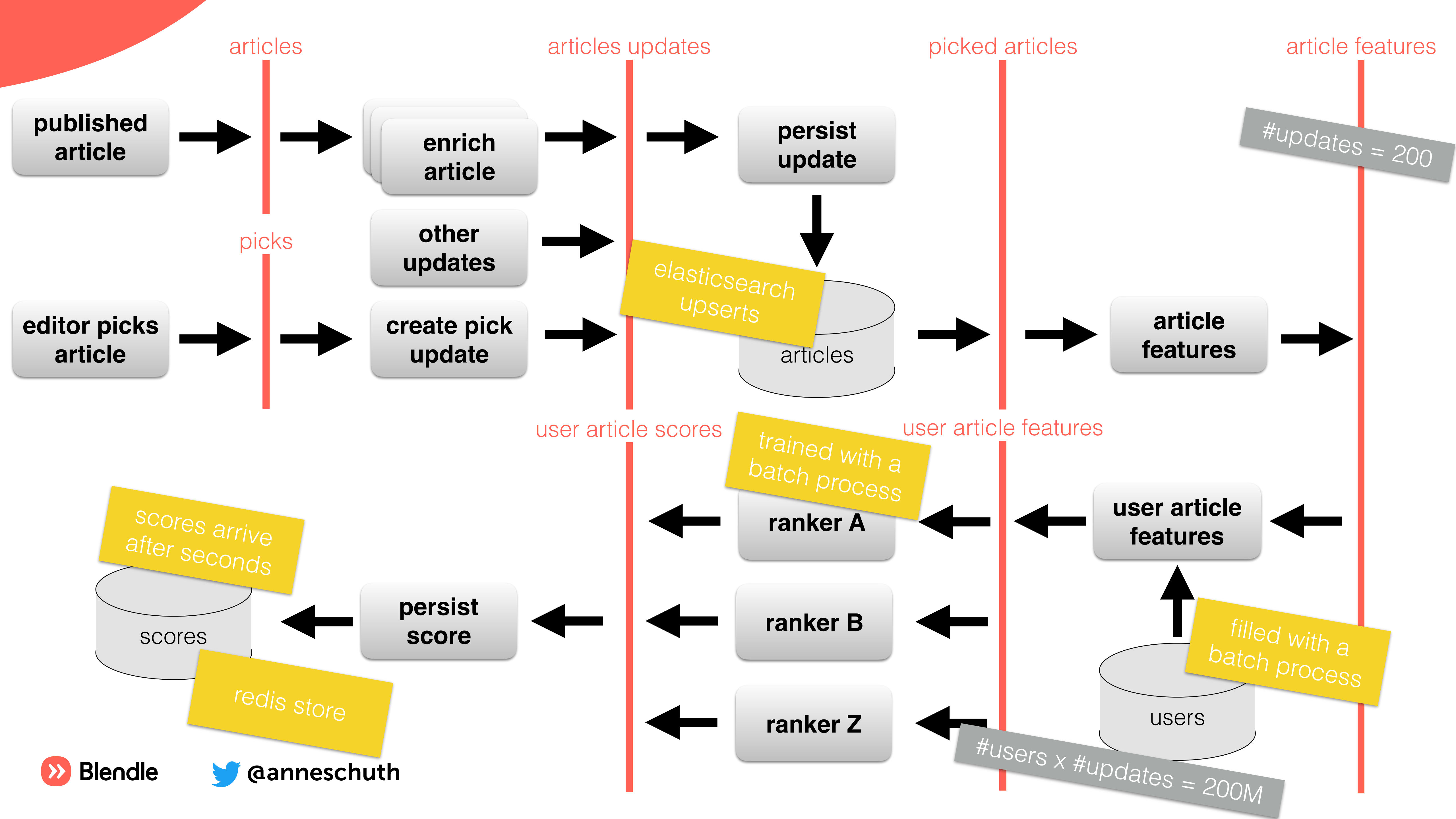


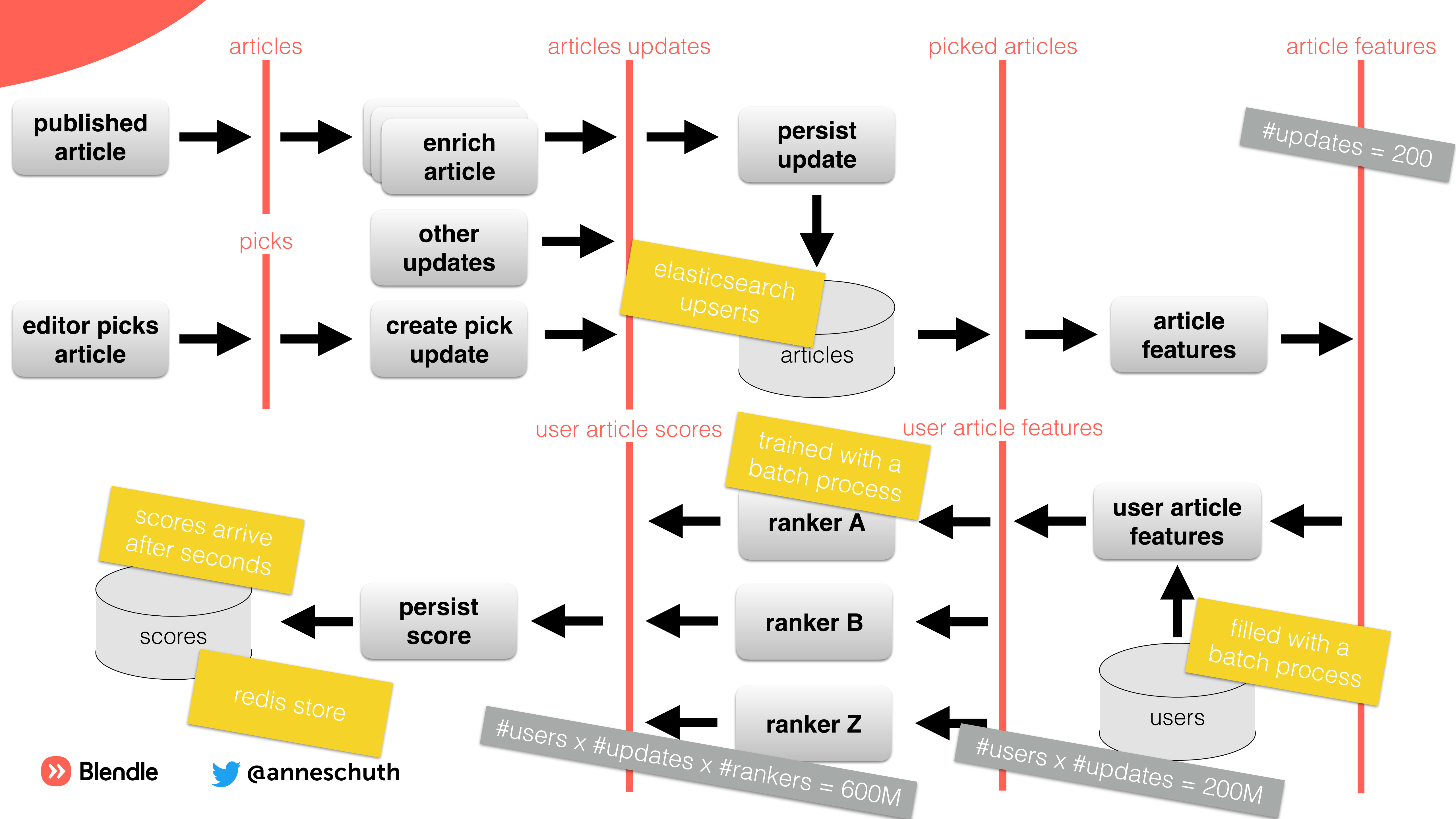






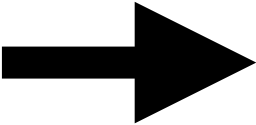




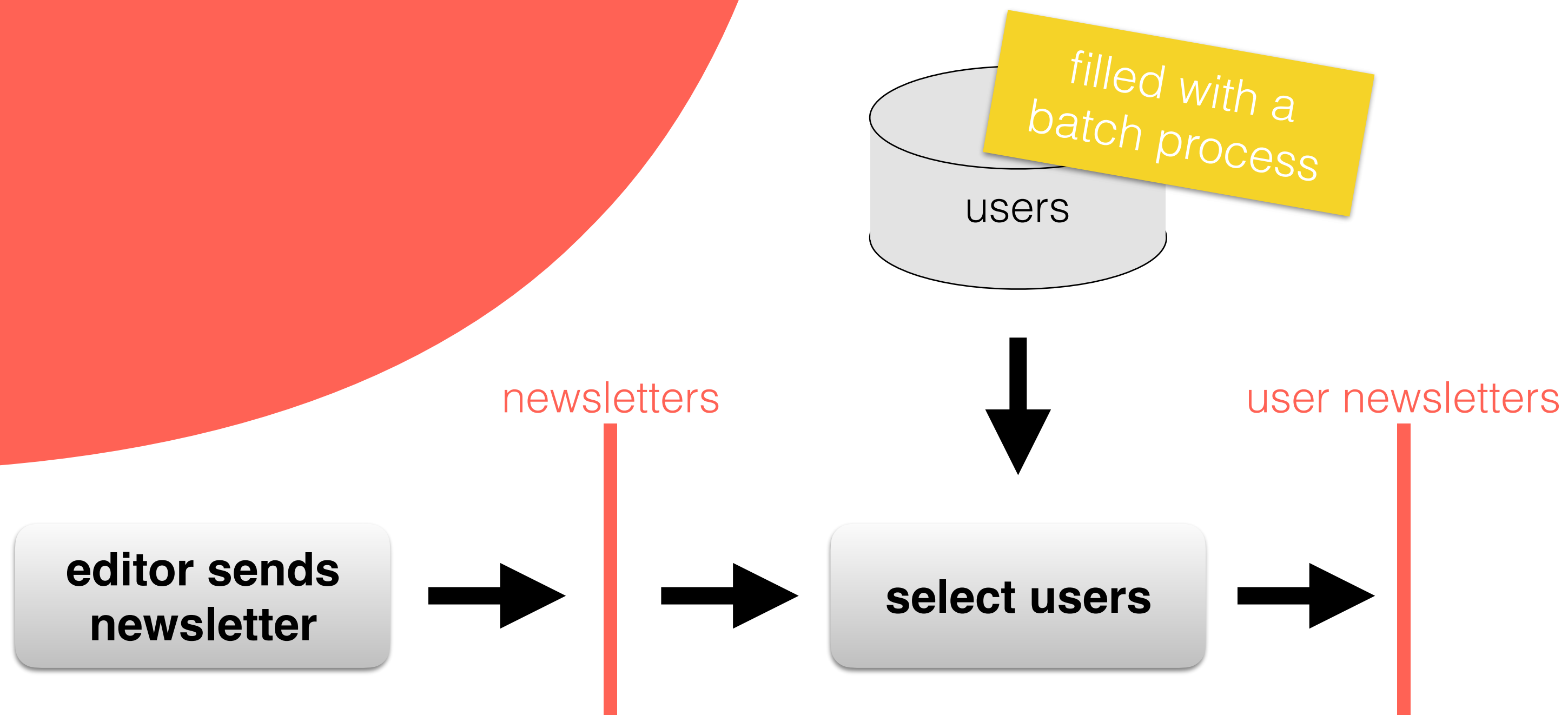


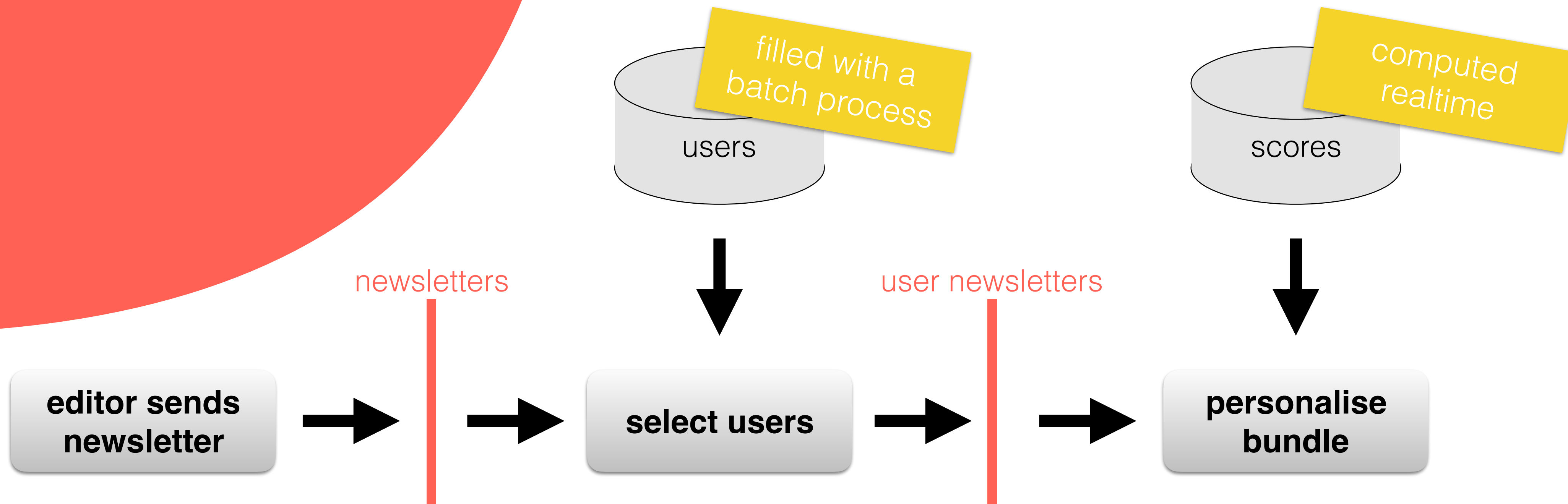


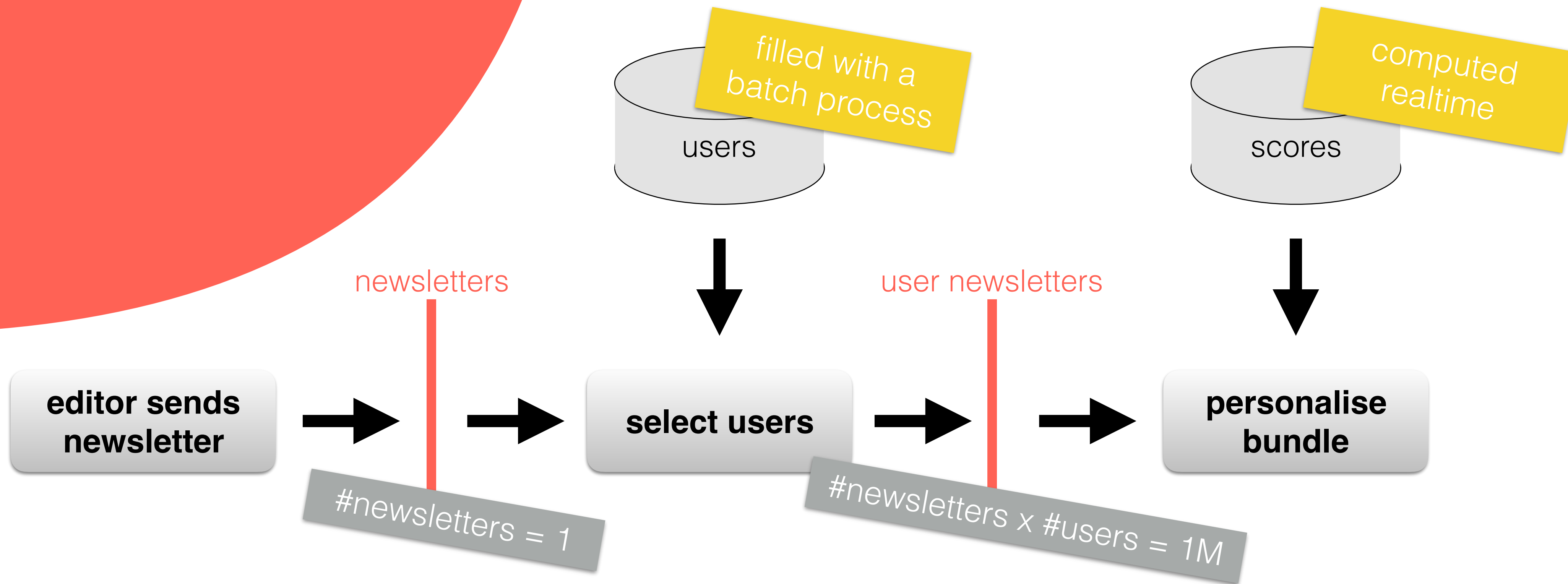
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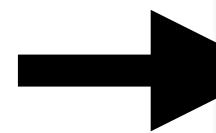
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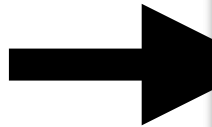
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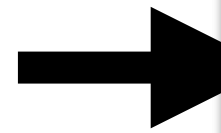
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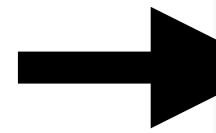
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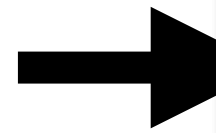
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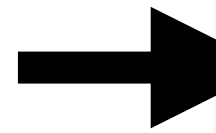
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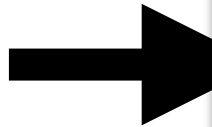
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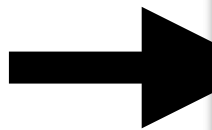
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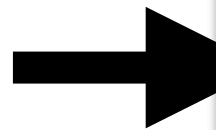
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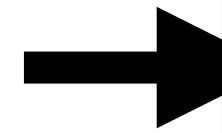
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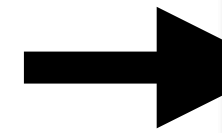
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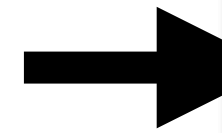
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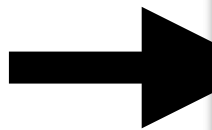
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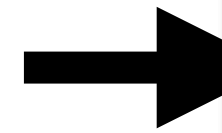
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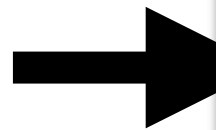
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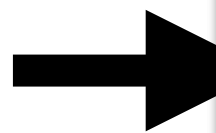
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Aboutaleb, Van Aartsen en Van Zanten: 'Het blijft absurd dat wij benoemd zijn'

Grote Interviews Politiek

EXPIRES 12/01/2016

RATING: ★★

VIVA

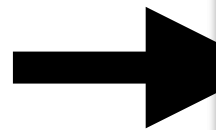
PSSSST

Liefde, seks & relaties

EXPIRES 11/08/2016

RATING: ★

editor sends
newsletter



#ne

Bundler

Filter

Score

Sort

Diversify

Top

HP/DETIJ

Vriend & vijand over Rutger Castricum: 'Ik word nog altijd nerveus van hem'

Medie Politiek

EXPIRES 12/01/2016

RATING: ★★

HUMO

Waarom de rest van de wereld het Westen haat

Grote Interviews Terrorisme

EXPIRES 11/08/2016

RATING: ★★

VIVA

PSSSST

Liefde, seks & relaties

EXPIRES 11/08/2016

RATING: ★

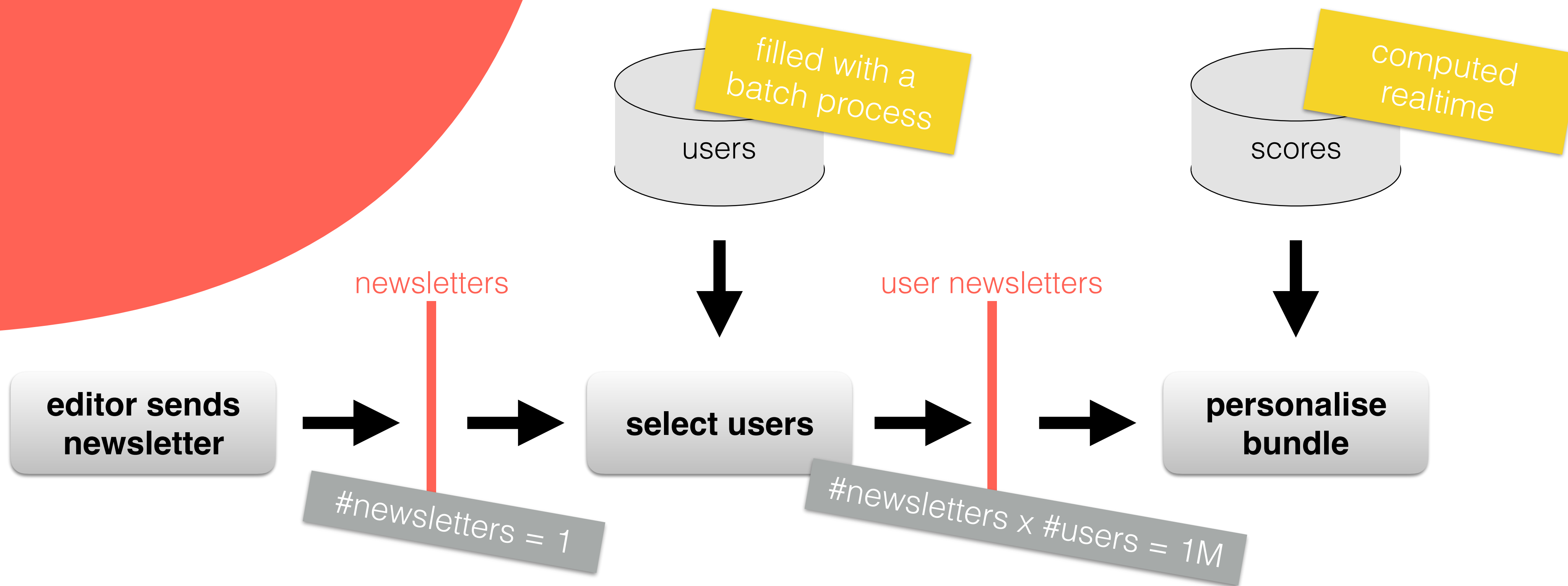
HP/DETIJ

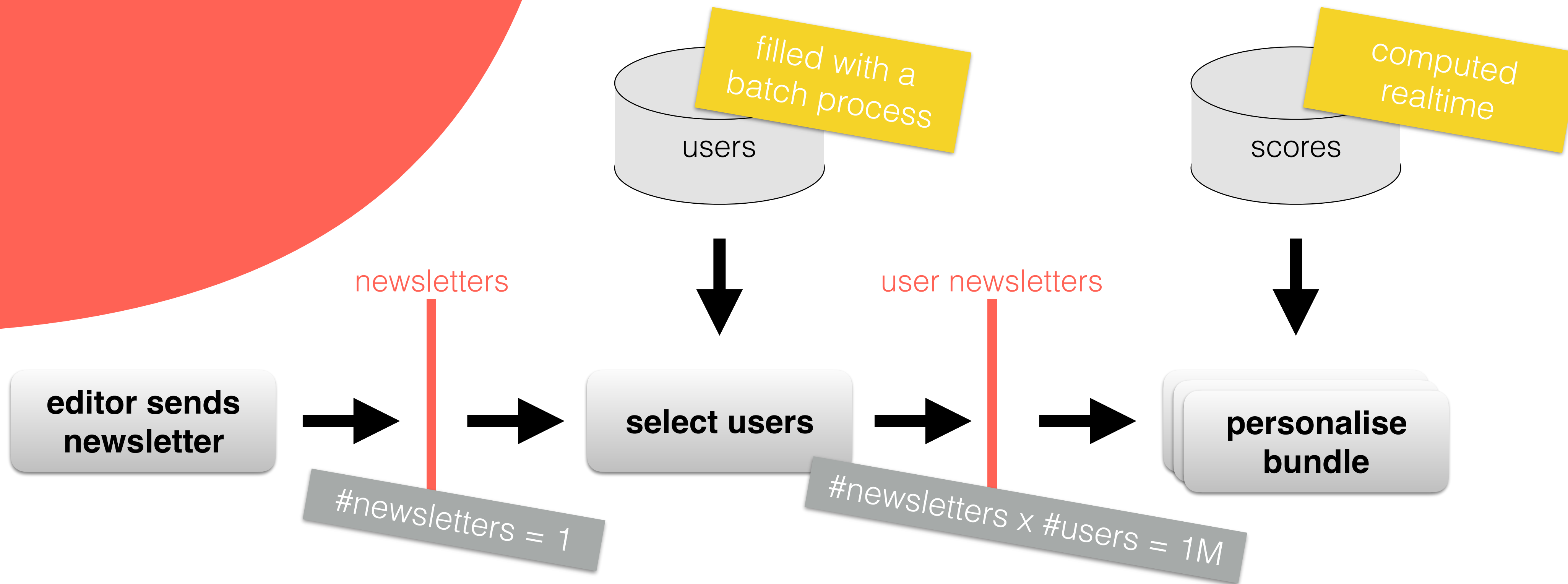
Aboutaleb, Van Aartsen en Van Zanten: 'Het blijft absurd dat wij benoemd zijn'

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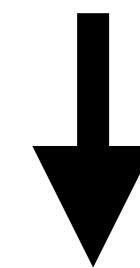
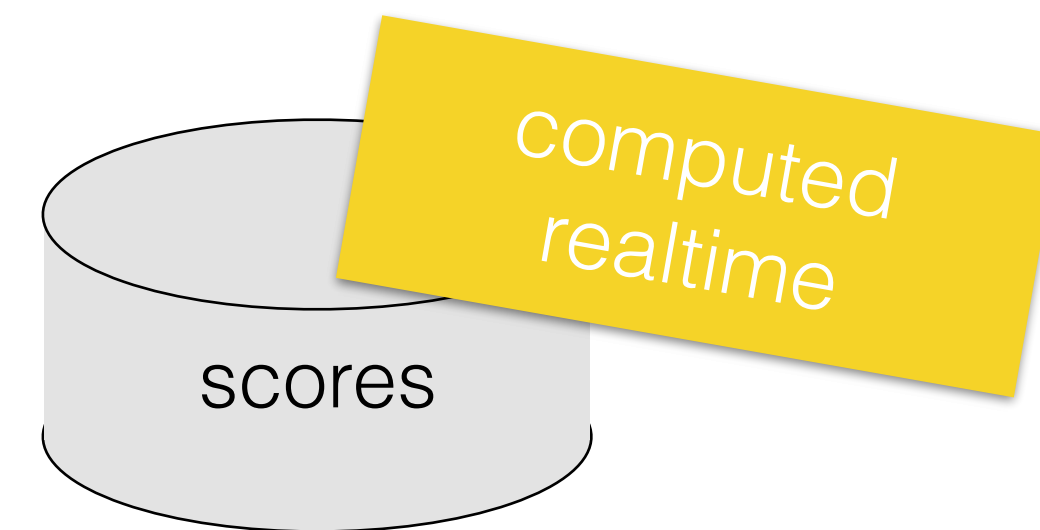






Docker

- containerise tasks
- easy dev/test/deploy



= 1M



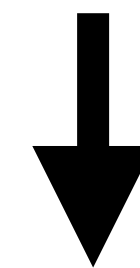
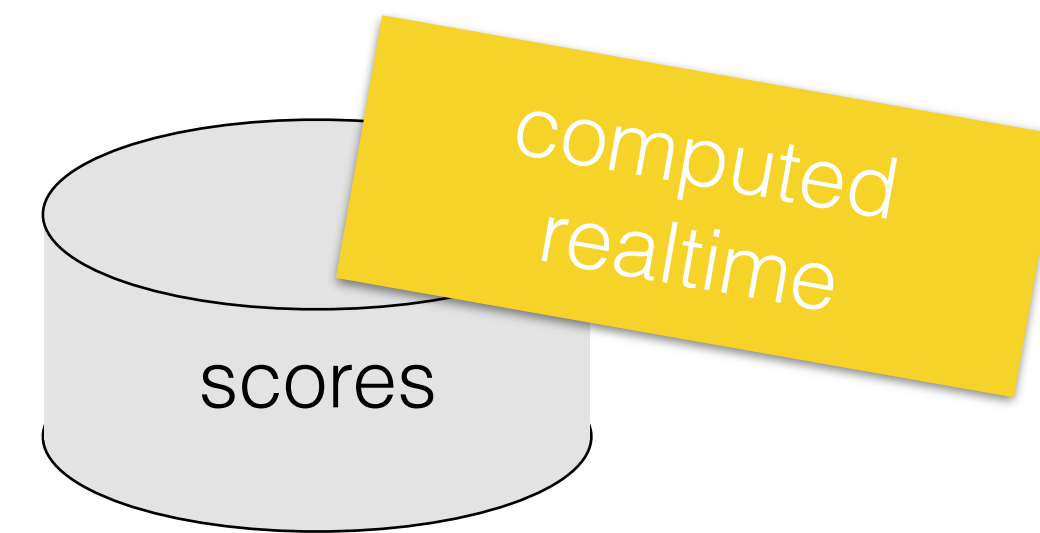
Docker

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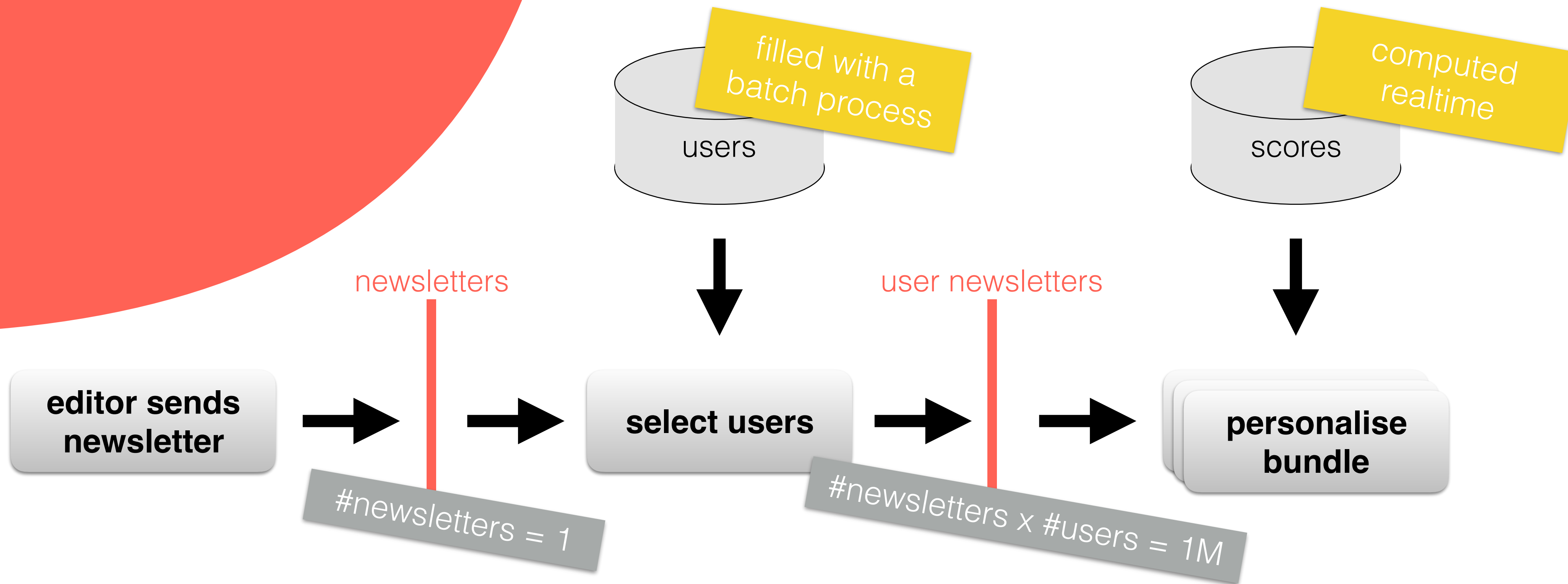


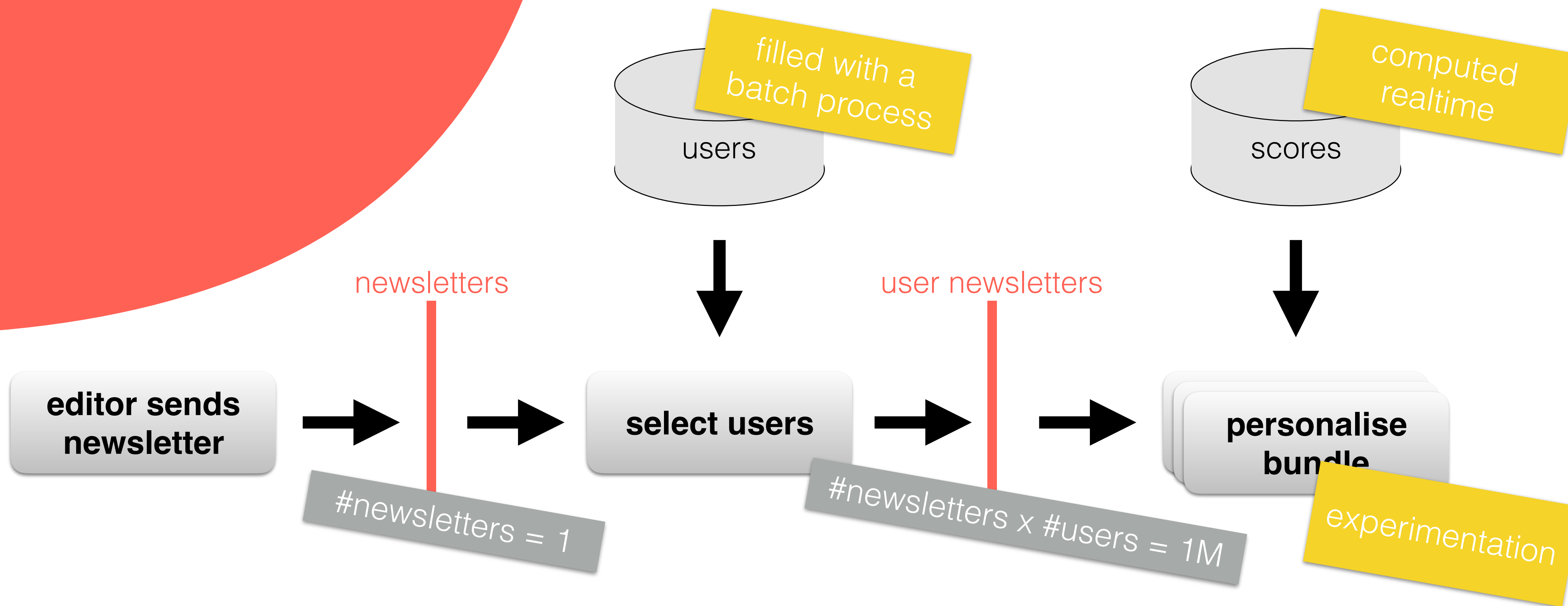
Kubernetes

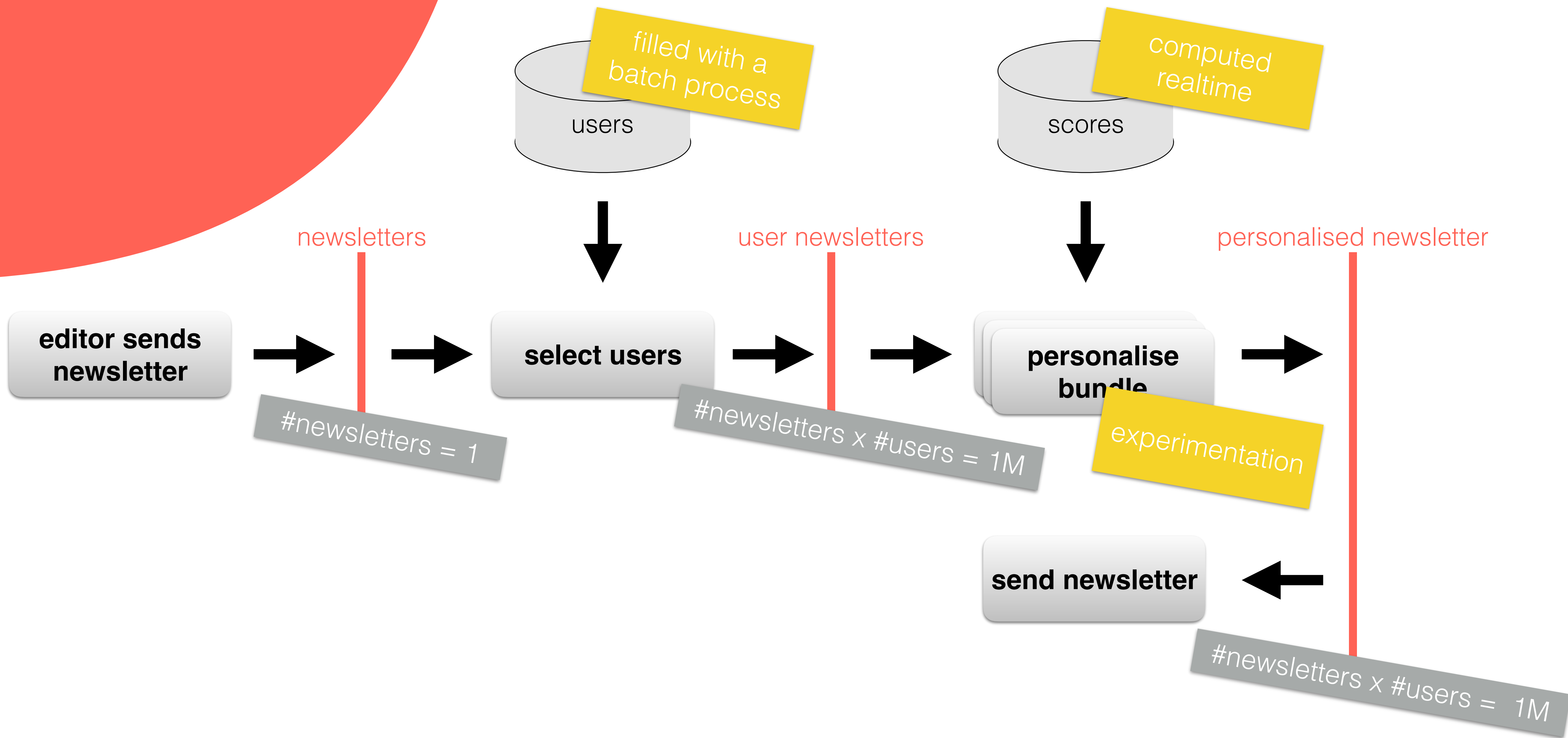
- orchestrate deployment
- autoscaling

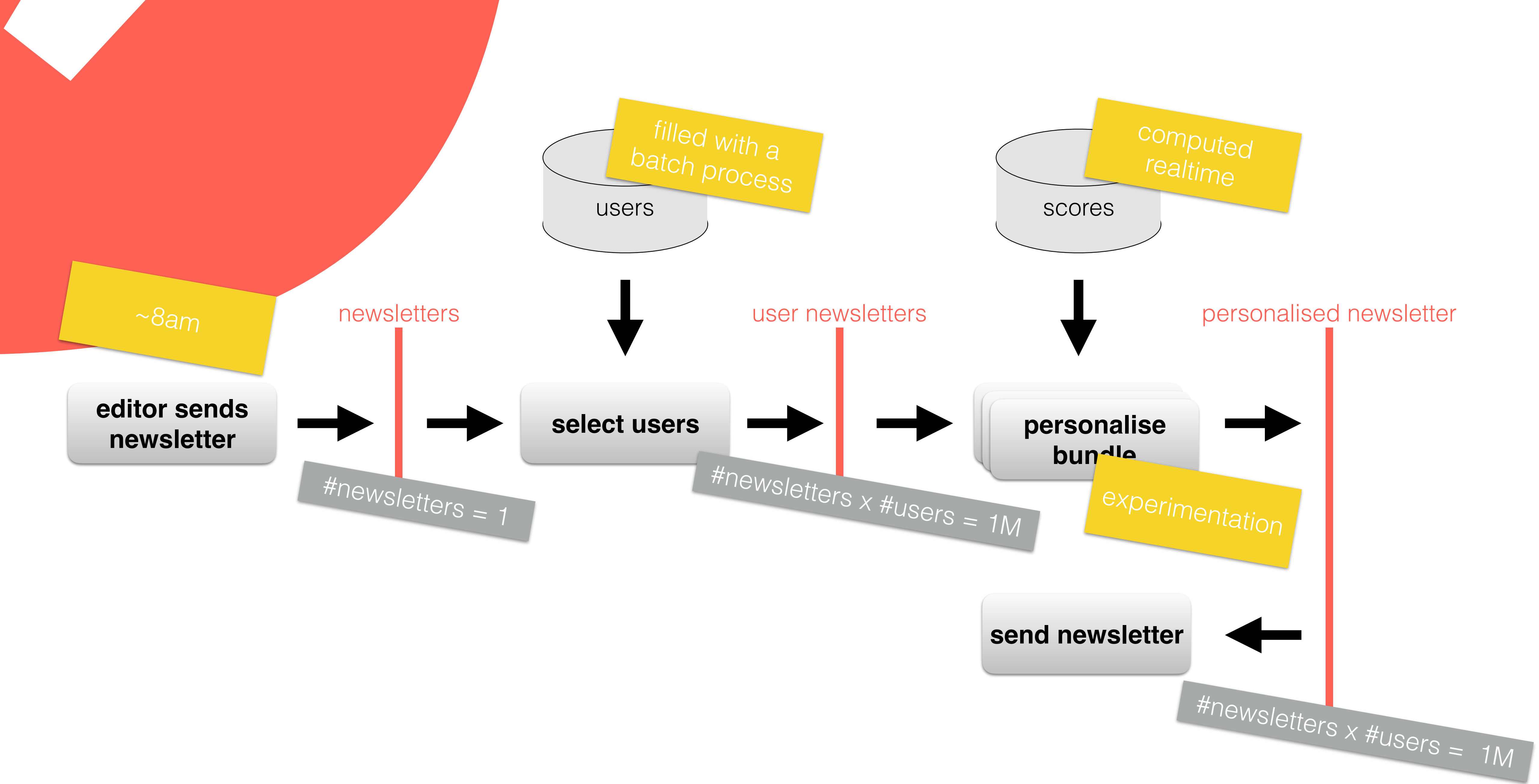


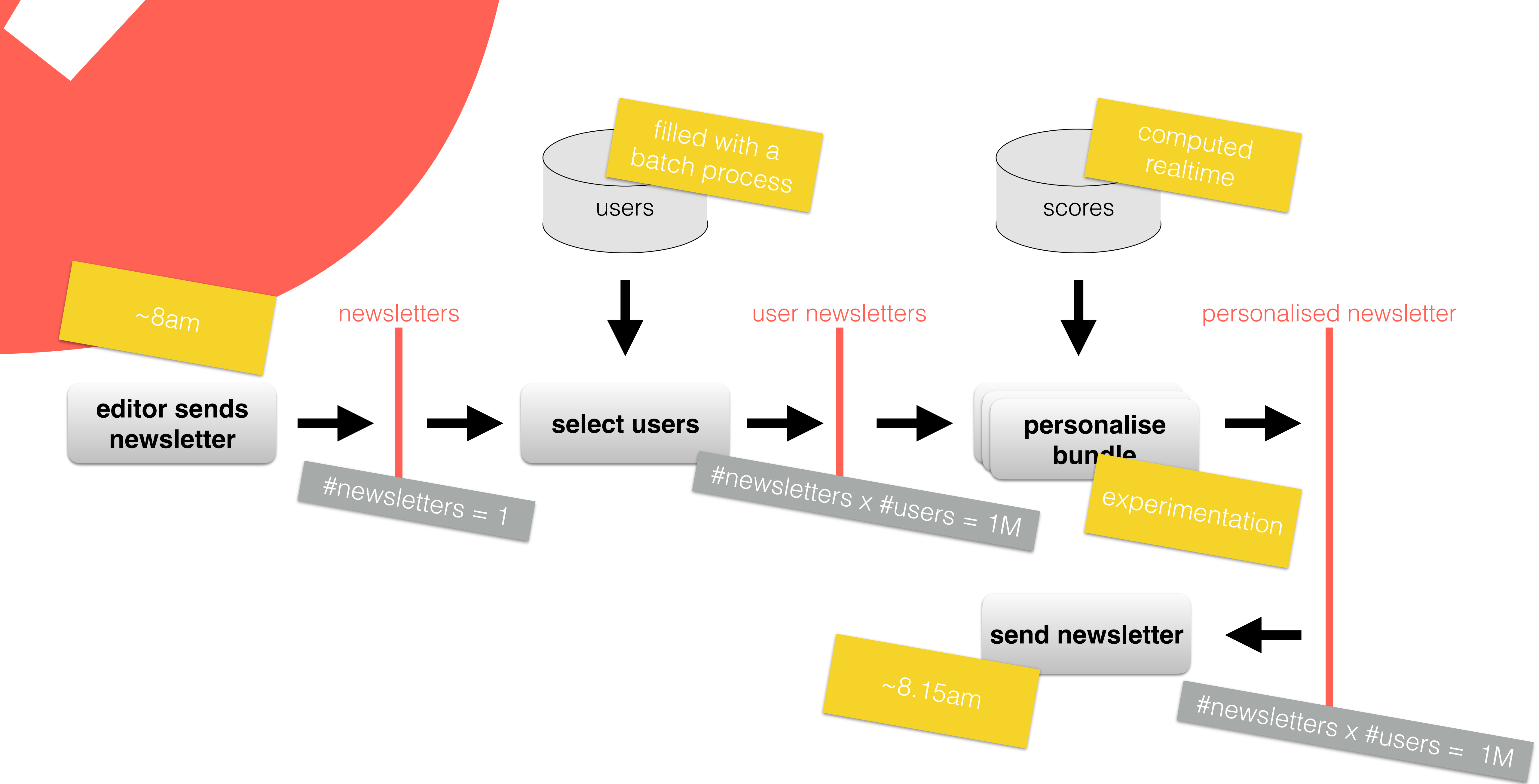
= 1M









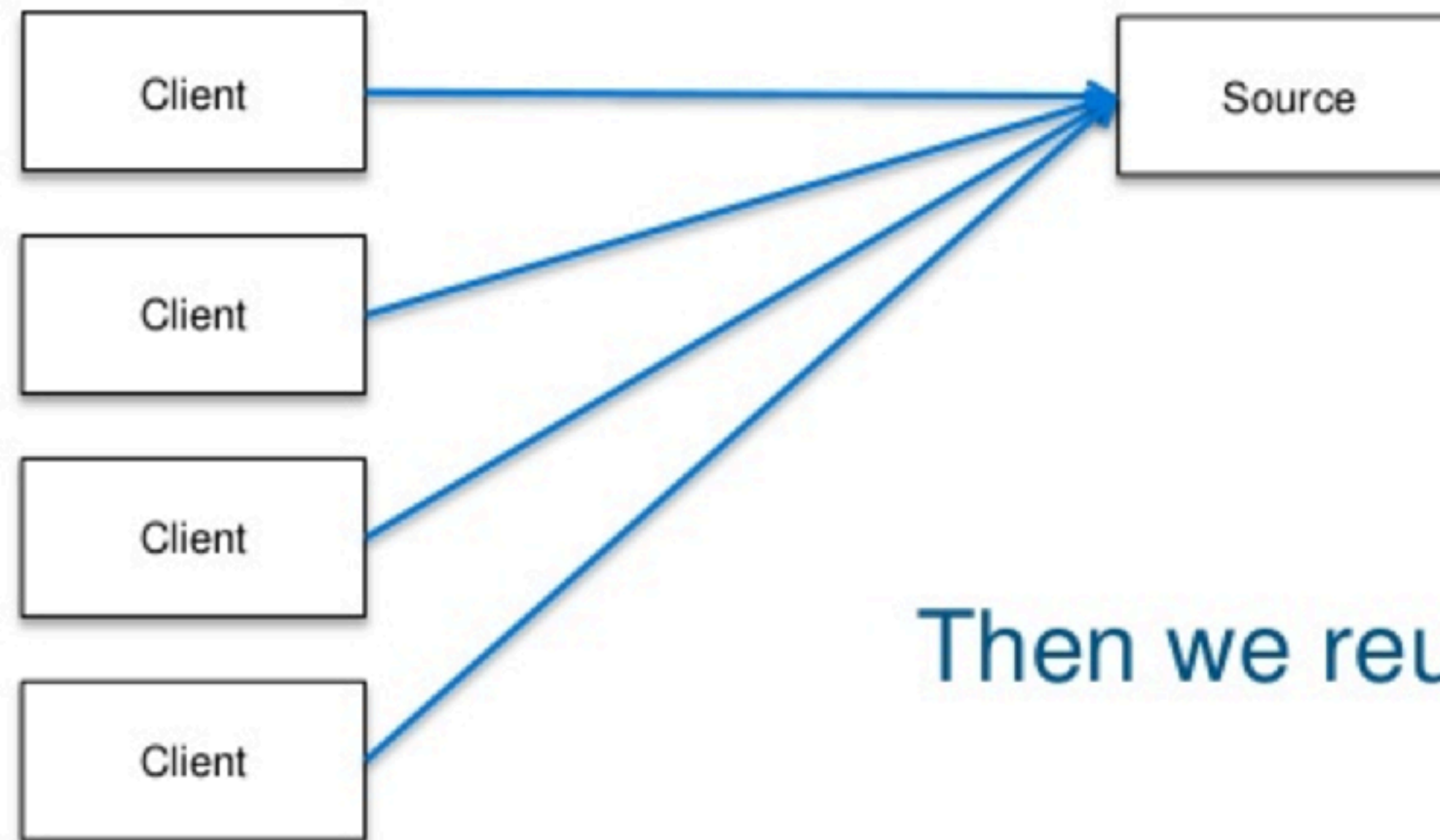


Why Kafka



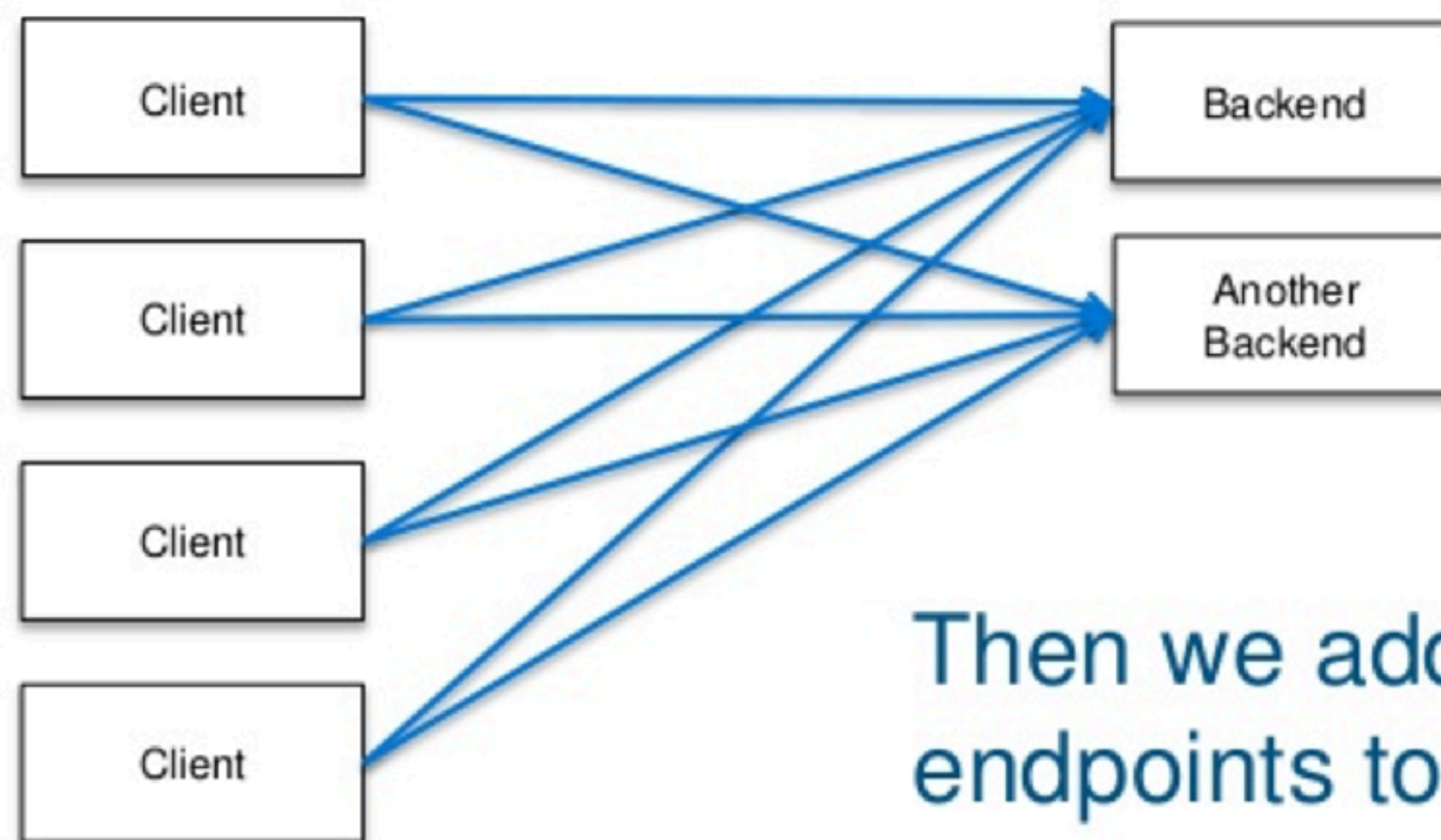
Data Pipelines Start like this.

Why Kafka



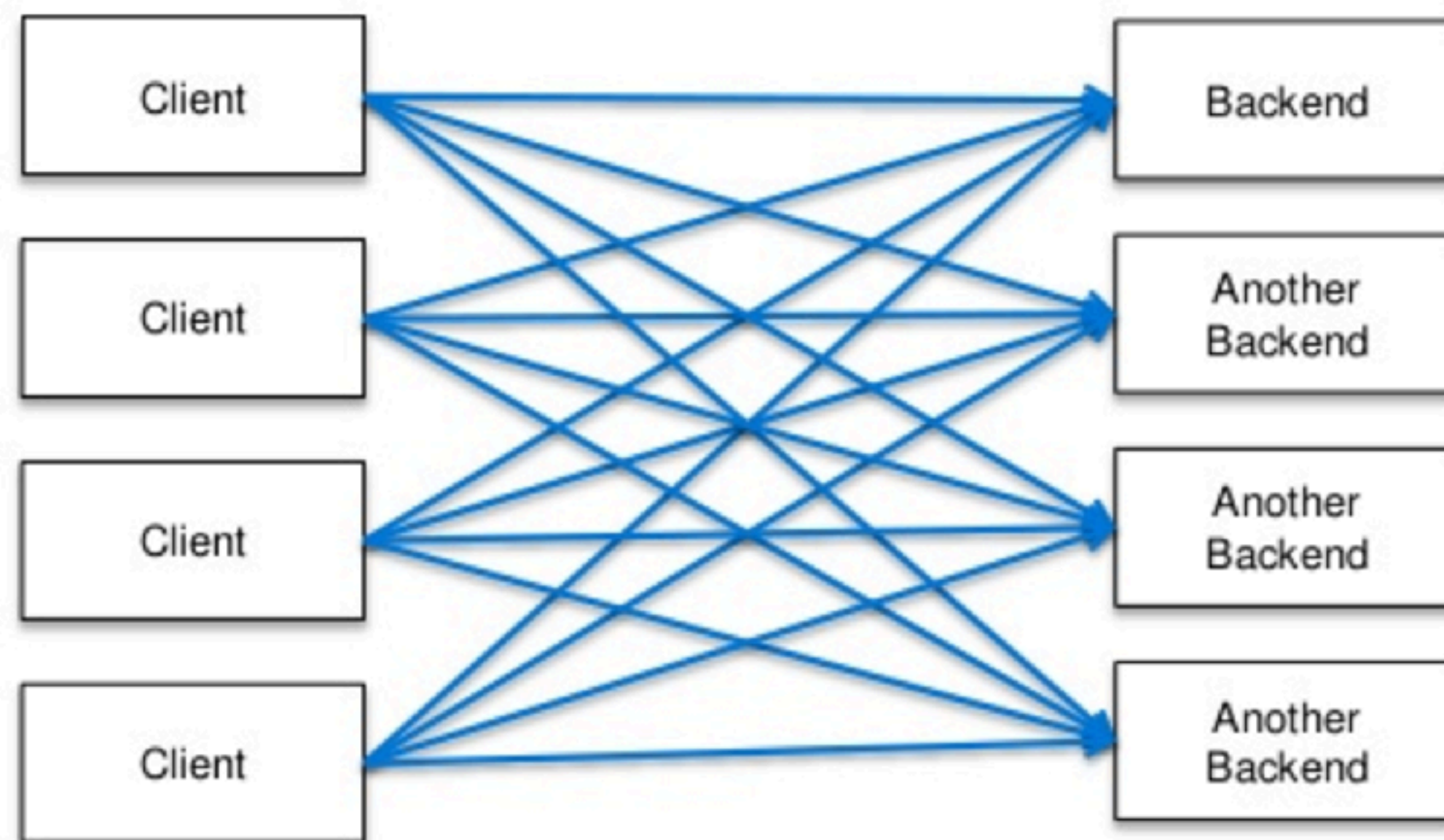
Then we reuse them

Why Kafka



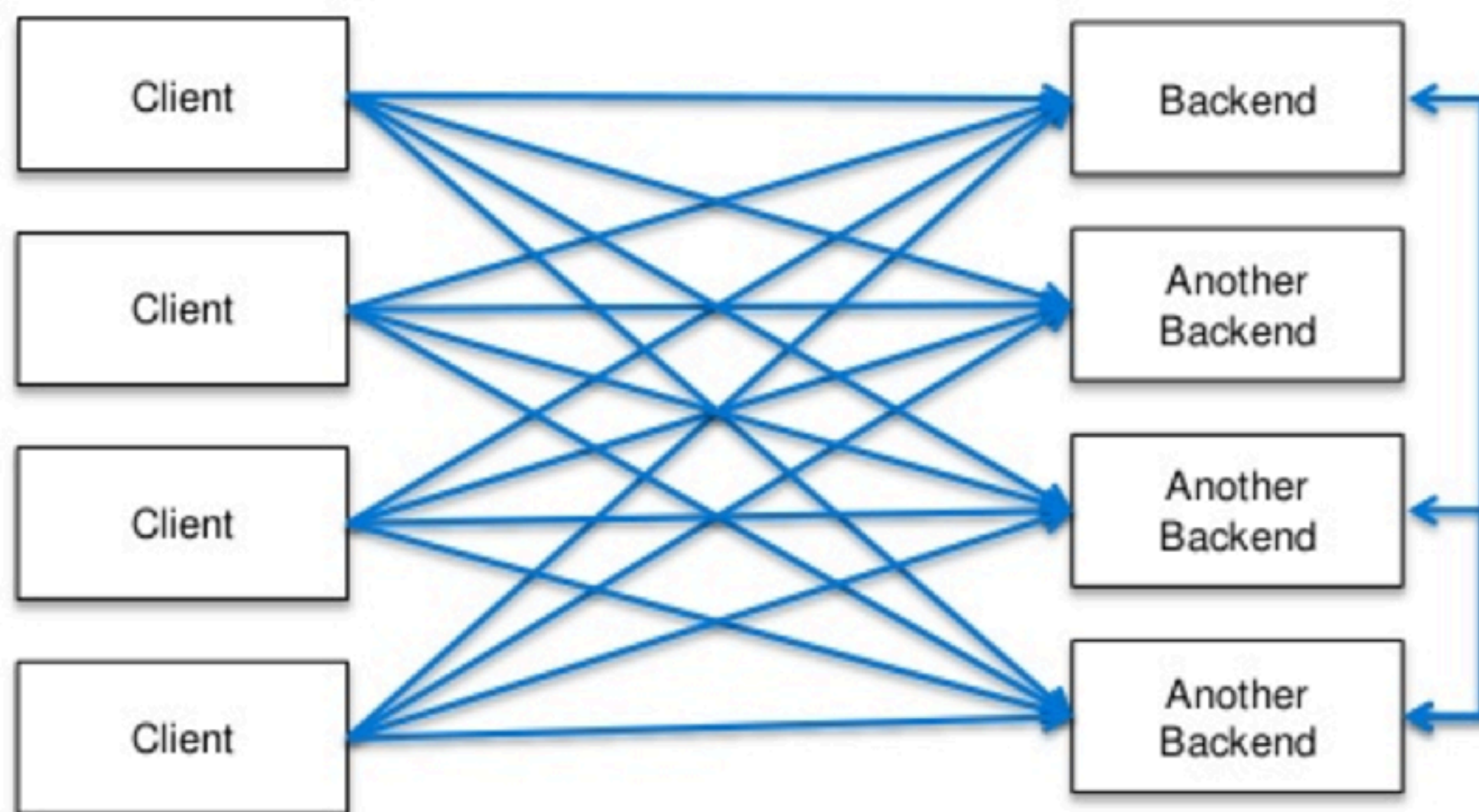
Then we add additional endpoints to the existing sources

Why Kafka



Then it starts to look like this

Why Kafka



With maybe some of this

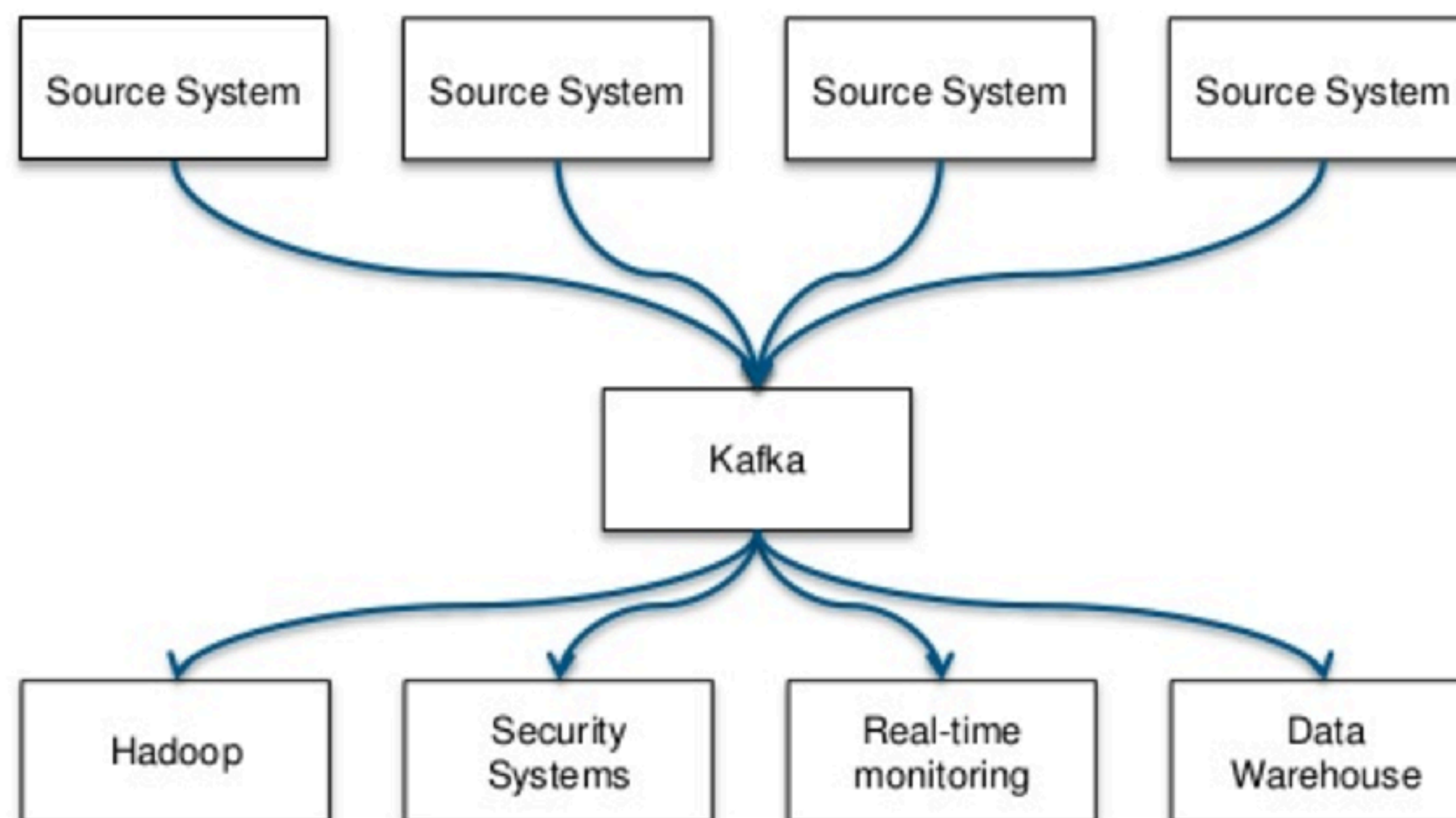
As distributed systems and services increasingly become part of a modern architecture, this makes for a fragile system

Why Kafka

Producers

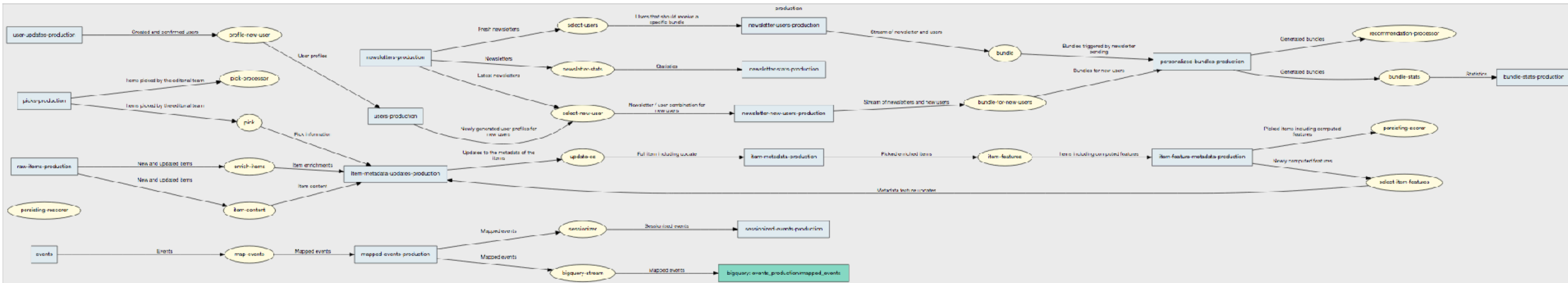
Brokers

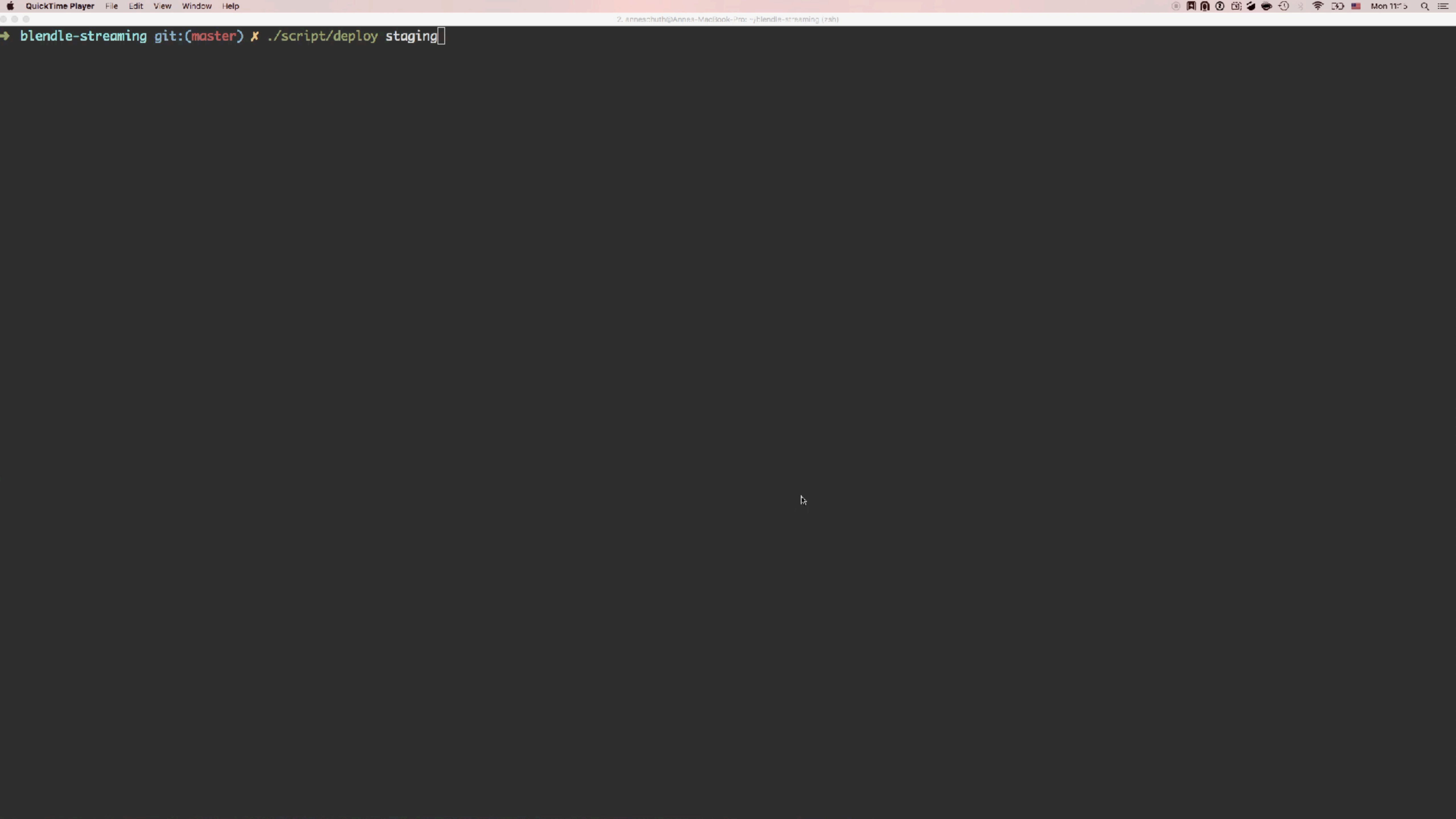
Consumers



Kafka decouples Data Pipelines

Streaming Architecture

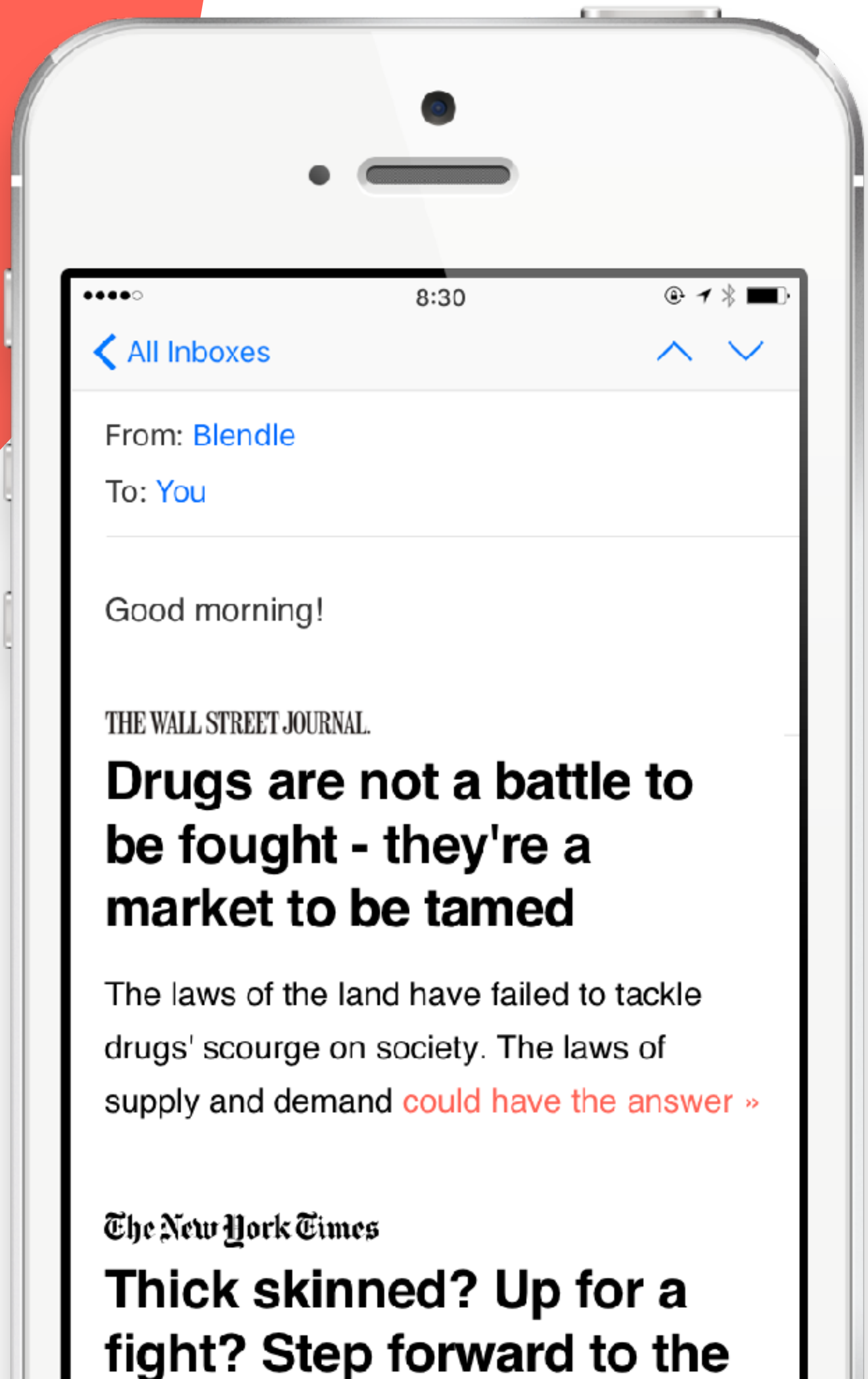




→ blendle-streaming git:(master) ✖ ./script/deploy staging

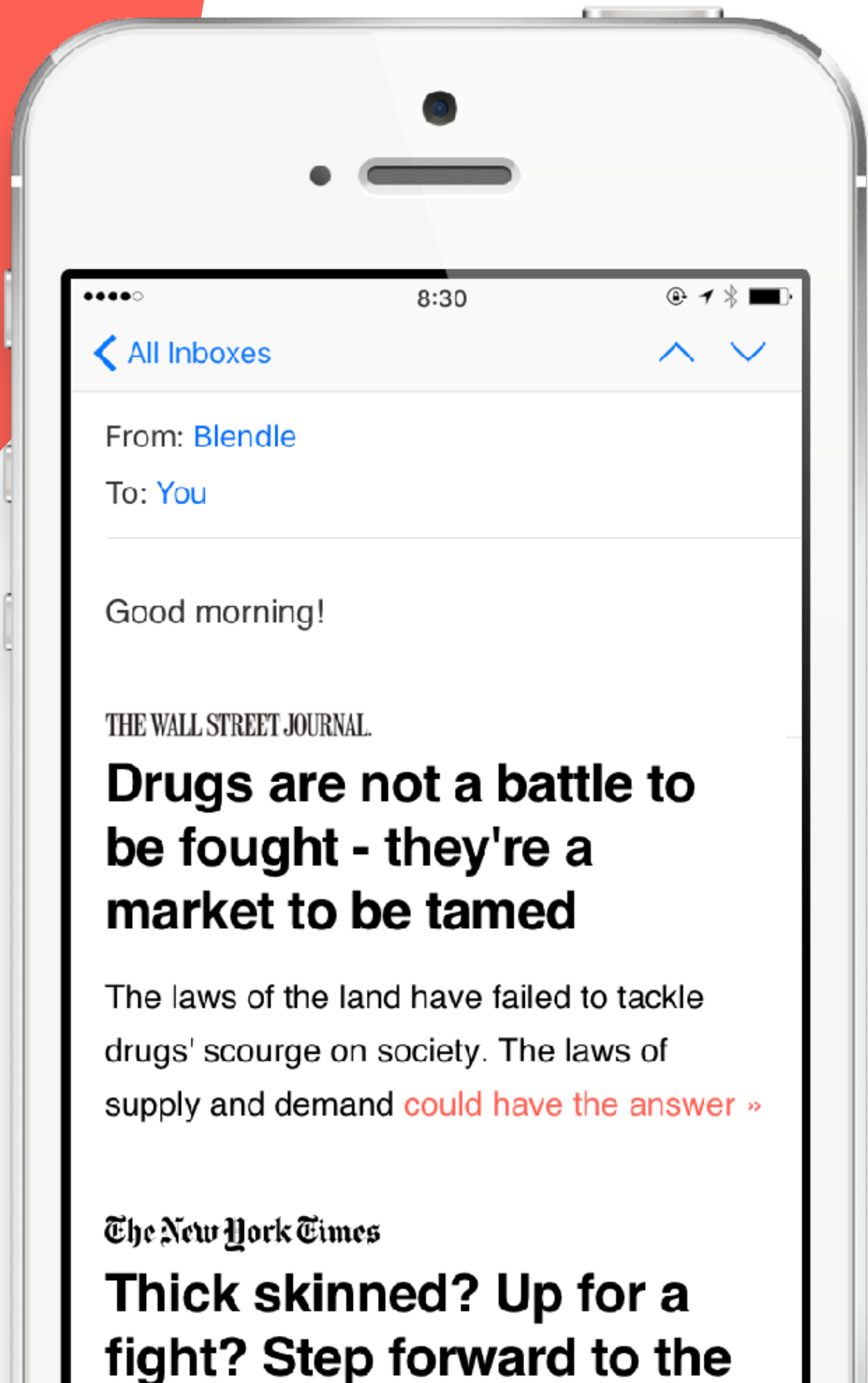
Cold start problem

- So we enrich our content



Timing problem

- So we precompute as much as possible



Components we use for **Machine Learning**

Components we use for **Machine Learning**



Spark
- processing large data

Components we use for **Machine Learning**



Spark
- processing large data

Components we use for Machine Learning



Spark
- processing large data

MLib
- production ML



Components we use for Machine Learning



Components we use for Machine Learning



*Spark
- processing large data*

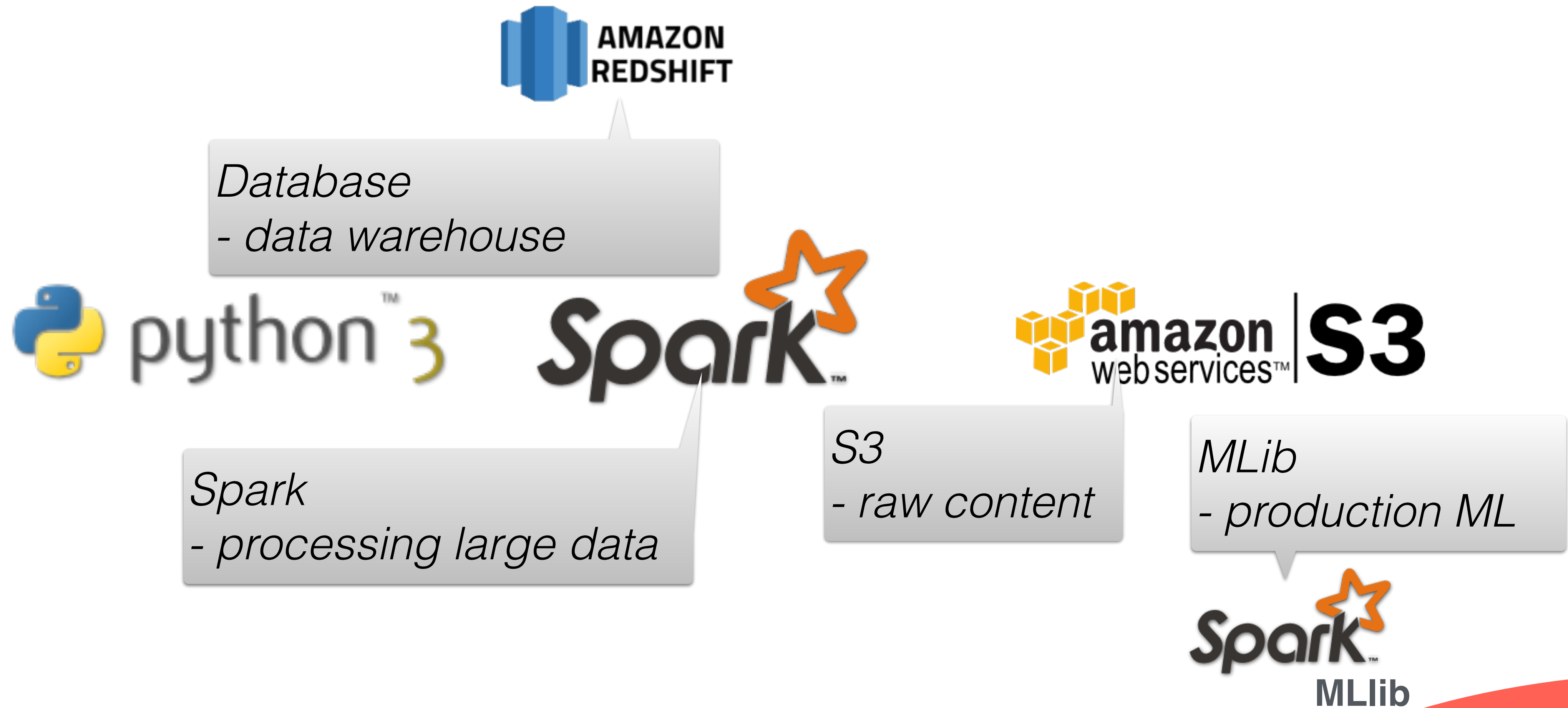


*S3
- raw content*

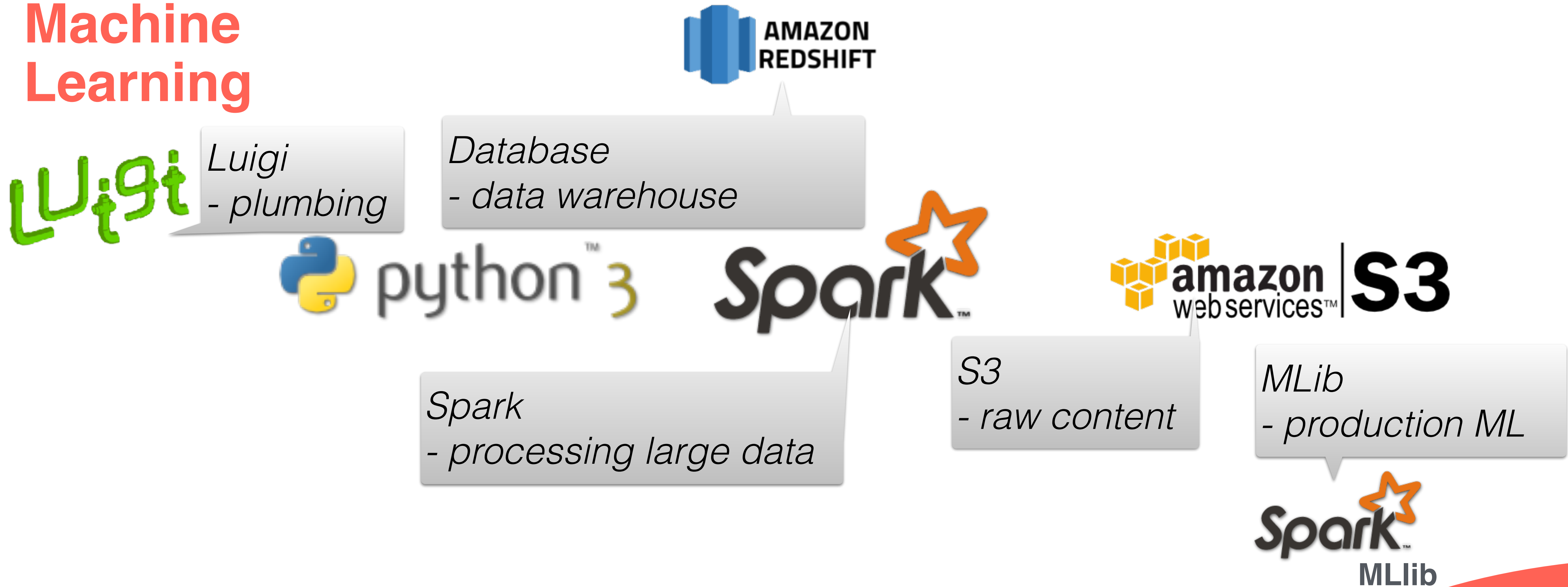
*MLib
- production ML*



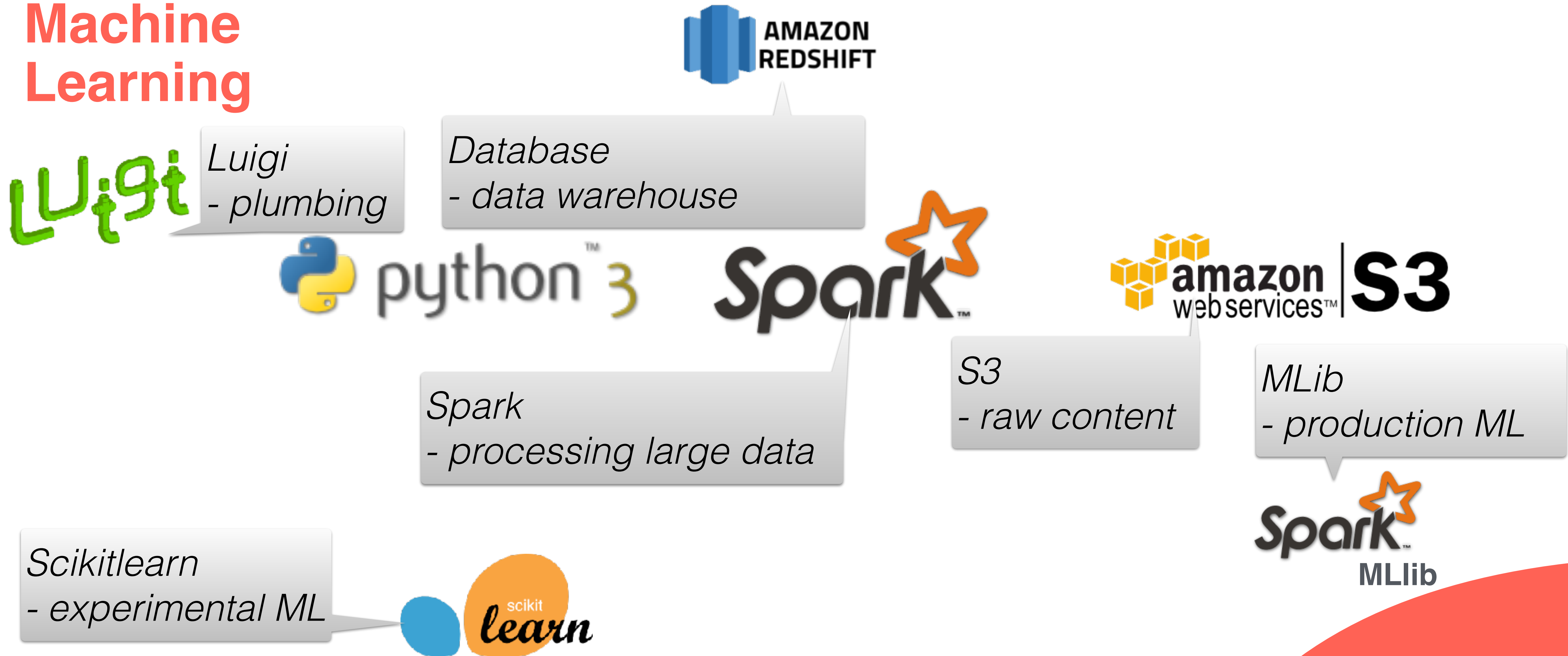
Components we use for Machine Learning



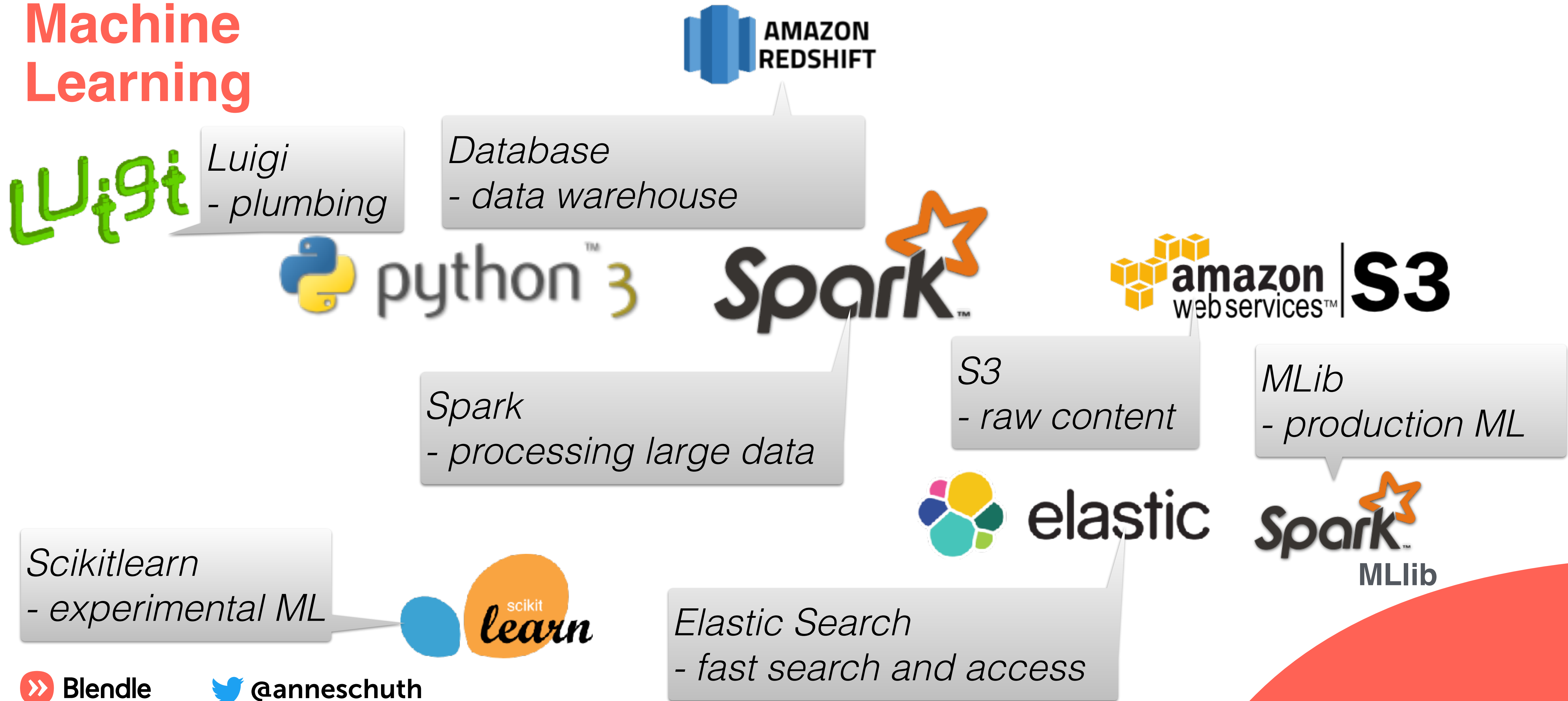
Components we use for Machine Learning



Components we use for Machine Learning



Components we use for Machine Learning



Components we use for Machine Learning



Luigi
- plumbing



Database
- data warehouse



Redis
- fast access



Spark
- processing large data



S3
- raw content

MLib
- production ML

Scikitlearn
- experimental ML



Elastic Search
- fast search and access



Components we use for Machine Learning



Luigi
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Spark
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Elastic Search
- fast search and access



Components we use for **Machine Learning**



*Docker + Kubernetes
- containerisation*



*Redis
- fast access*



redis



*Kafka
- streaming*



*Luigi
- plumbing*

*Database
- data warehouse*



*Spark
- processing large data*



S3

*S3
- raw content*

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elastic



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redis

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*Kafka
- streaming*



*Luigi
- plumbing*



python 3



*Spark
- processing large data*



amazon S3

*S3
- raw content*

*MLib
- production ML*

*Cucumber
- BDD development*

cucumber



*Scikitlearn
- experimental ML*



*Elastic Search
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elastic



Internship Ideas

- Computer Vision



Internship Ideas

- Computer Vision
 - Death Recognition



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 - 'Share from the newspaper'



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Thank You