Analysis of music tagging and listening patterns: Do tags really function as retrieval aids?

Jared Lorince[1], Kenny Joseph[2], & Peter M. Todd[1]

[1]Adaptive Behavior & Cognition Lab, Indiana University
[2]Computation, Organization, and Society Program, Carnegie Mellon University

In a nutshell:

The problem: It is assumed tags are used as cues for one's own future retrieval, but there is no behavioral evidence for this.

The research question: Is there evidence that tagging content increases the probability of future interaction with that content?

The findings: Tagging seems to lead to *small* increases in future content interaction, and only for some tags: Future retrieval does *not* appear to be the primary motivation for tagging.

Dethklok

Tracks Albums Pictures Videos Events More...

Tags

00s
100 times bigger than the beatles
adult swim
american
awesome
black metal
blacker than the blackest black times infinity
brendon small
brutal
brutal death metal
brutal heavy metal
brutal metal
cartoon
comedy
comedy metal
death
death metal
deja vu psycho metal
deth metal
dethklok
epic
everything will be metal
fucking awesome
funny
heavy metal
in control
look behind you
melodic death metal
melodic metal
metal
metalocalypse
metalocaylpse
music that makes me want to beat children
music that makes your head explode of amazement
nathan explosion
parody
pet cemetery
planet x
power metal
psycho metal
psycho metal 4 life
psycho metal tag radio
psycho metal this is psycho
psychometal
psychometal4life
real coffee from the hills of columbia
rock
sacrafice psycho metal
soundtrack
stfu
swisgar swiself taller than a tree
technical death metal
the most metal thing i have ever heard in my whole life
this is psycho
thrash metal
toki wartooth not a bumblebee
true metal
usa
virtual band
william murderface murderface murderface


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usa
virtual band
william murderface murderface murderface
00s
90s
acoustic
alternative
alternative rock
amazing
ambient
art rock
atmospheric
avant-garde
awesome
beautiful
chill
chillout
downtempo
dream pop
dreamy
easy listening
electronic
electronica
emo
emotional
epic
ethereal
experimental
experimental rock
favorites
favourites
folk
iceland
icelandic
indie
indie pop
indie rock
instrumental
love
male vocalists
melancholic
melancholy
mellow
minimalist
nordic
pop
post rock
post-rock
progressive
progressive rock
psychedelic
relax
relaxing
rock
scandinavian
shoegaze
sigur ros
singer-songwriter
sleep
slow-motion rock
space
trip-hop
want to see live

Collaborative Tagging


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space

Folksonomy

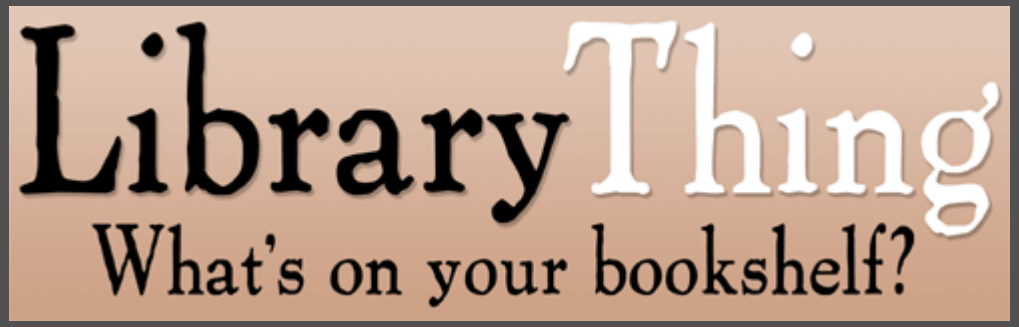

last.fm


stackoverflow


flickr


delicious


MENDELEY


LibraryThing
What's on your bookshelf?

- Tagging expertise
  Yeung, Noll, Gibbins, Meinel, & Shadbolt (2009,2011)
- Modeling of tagging behavior
  - Mathematical
    Cattuto, Loreto, & Pietronero (2007).
  - Multi-agent
    Lorince & Todd (2013)
- Consensus in collaborative tagging
  Golder & Huberman (2006), Robu, Halpin, & Shepherd (2009)
- Social networks and tagging
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  Lorince, Zorowitz, Murdock, & Todd (2014)

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We know plenty about ***how*** people tag, but ***why*** they tag is a much trickier question

“Folksonomy is the result of personal free tagging of information and objects (anything with a URL) for one's own retrieval.”

Thomas Vander Wal

http://www.vanderwal.net/random/entrysel.php?blog=1750

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The retrieval aid hypothesis

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There are alternatives…

Resource sharing vs. personal information management (Heckner, et al. 2009)

Opinion expression, performance, and activism (Zollers, 2007)

Self presentation, play/competition (Marlow, et al., 2006)

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Categorizers and describers (Körner & colleagues, 2010, 2011)

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…but they all face a serious obstacle

We must infer *why* people tag from *how* they tag

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There is simply no data available on how people *use* tags once they've applied them.

Dataset

last.fm

Total users	1,884,597
Total friendship relations	24,320,919
Total group memberships	5,458,935
Total annotations	50,372,893
Users with ≥ 1 annotation	521,780
Total unique tags	1,029,091
Unique items tagged	4,477,591
Unique artists tagged	1,049,263
Users with listening data recorded	105,425
Total listens	2,089,473,214
Unique songs listened	45,732,350
Unique artists listened	4,444,119
Total loved tracks	162,788,213
Users with ≥ 1 loved track	1,335,859
Total banned tracks	23,321,347
Users with ≥ 1 banned track	502,758

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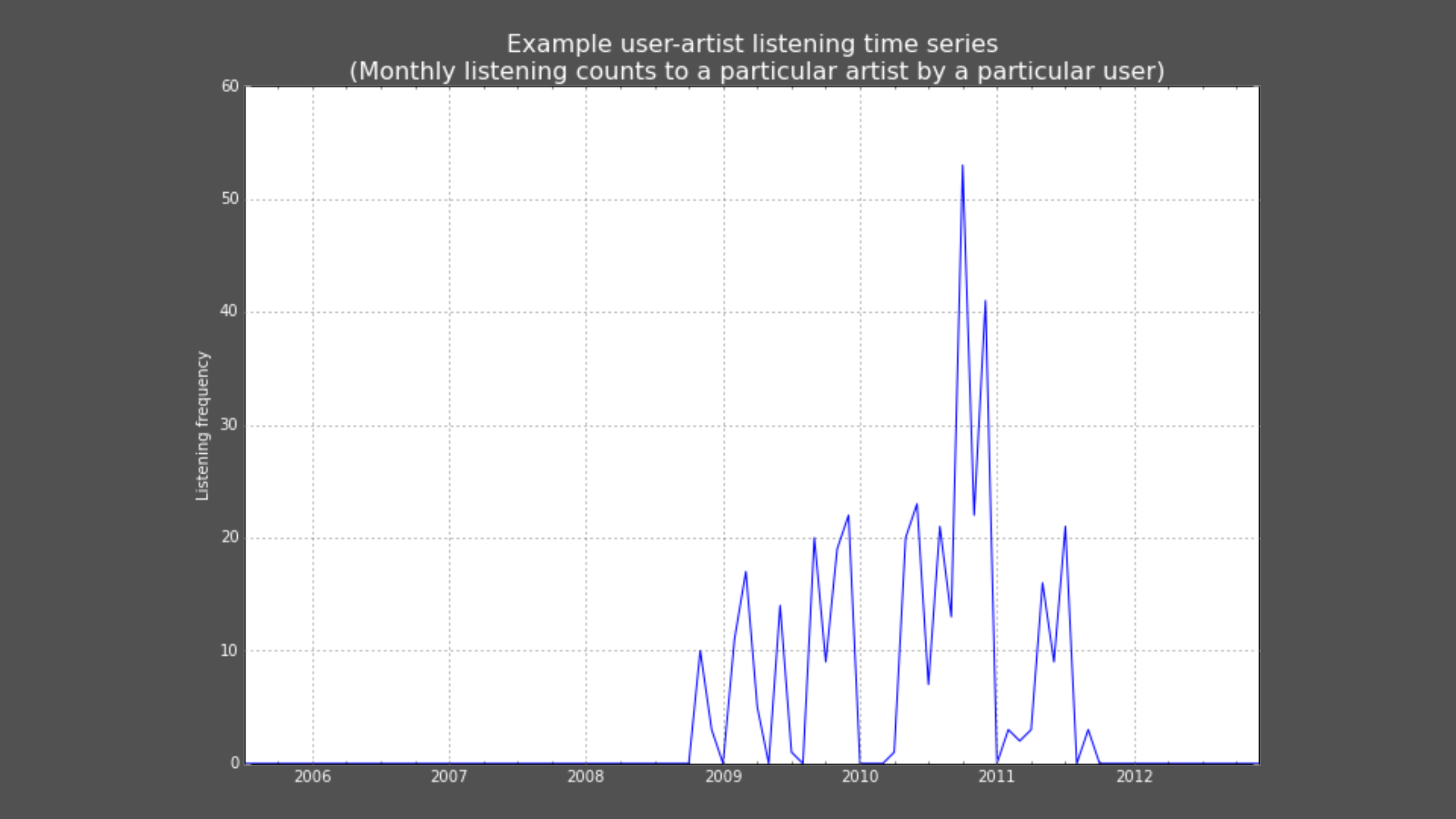
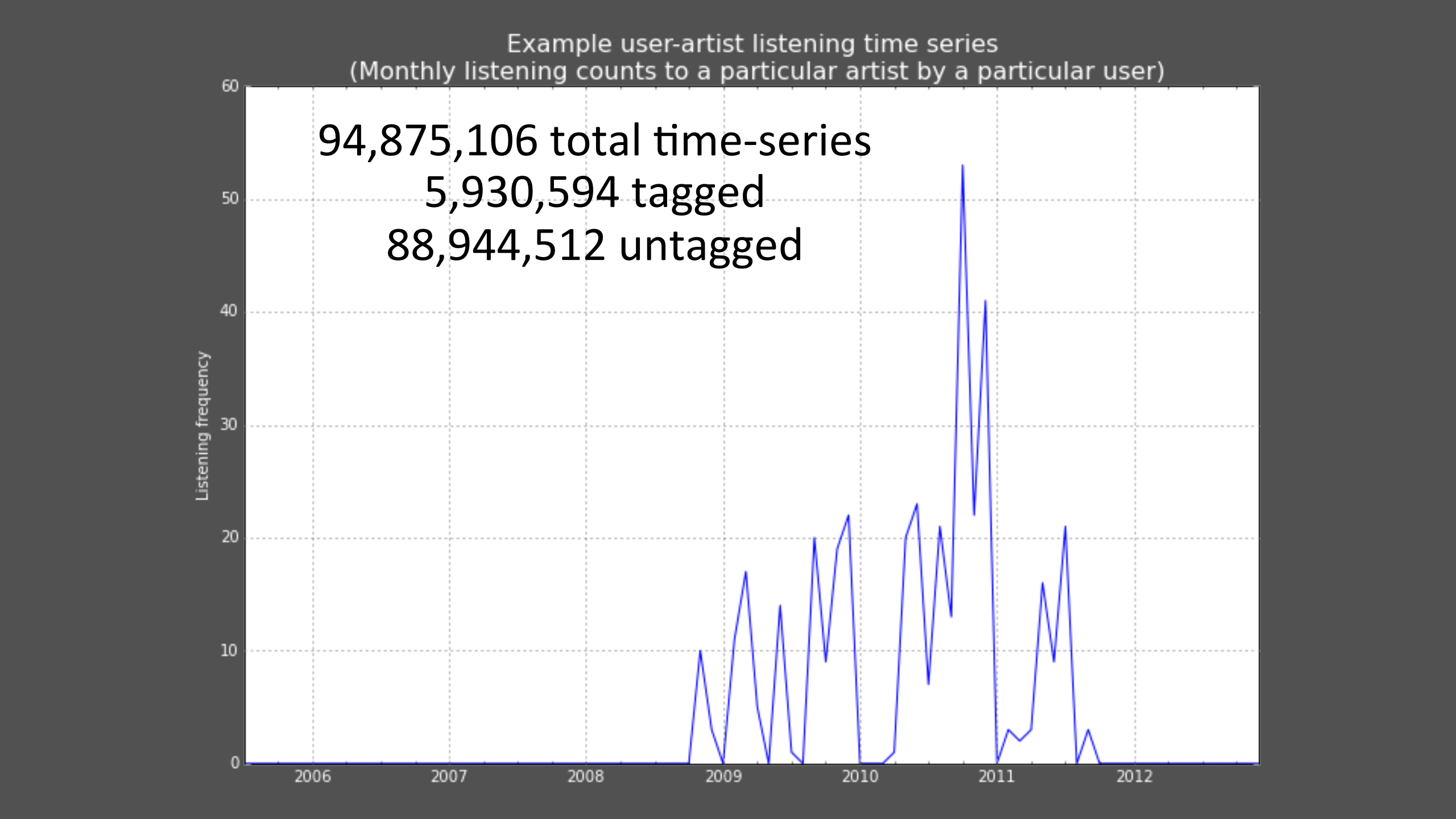

Example user-artist listening time series
(Monthly listening counts to a particular artist by a particular user)
Listening frequency
0
10
20
30
40
50
60
2006
2007
2008
2009
2010
2011
2012


Example user-artist listening time series
(Monthly listening counts to a particular artist by a particular user)
94,875,106 total time-series
5,930,594 tagged
88,944,512 untagged
Listening frequency
0
10
20
30
40
50
60
2006
2007
2008
2009
2010
2011
2012

Our approach: Compare tagged and untagged ***user-artist listening time-series***.

The hypothesis: If tags really do serve as retrieval aids, we should observe an increase in listening rates caused by application of tags.

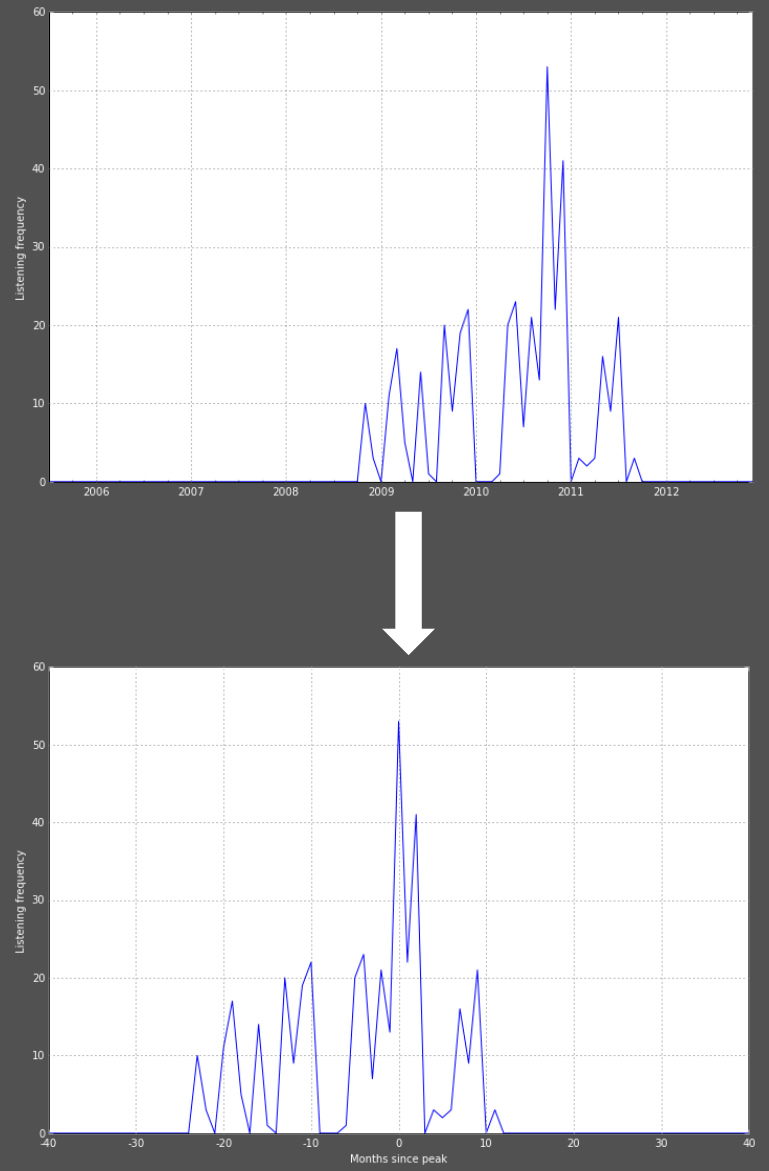
Listening rates for tagged time series are much higher when tagged, but this is not a fair comparison.

We need a ***counterfactual***

Generating a (pseudo-)counterfactual

1. Align all time series to the month of peak listening.
2. Limit analysis to a 13 month period extending from 6 months prior to the peak month to 6 months after the peak.
3. For tagged time-series, only consider those where tag was applied in the peak month

This give us a basis to compare temporally aligned tagged and untagged time-series data.



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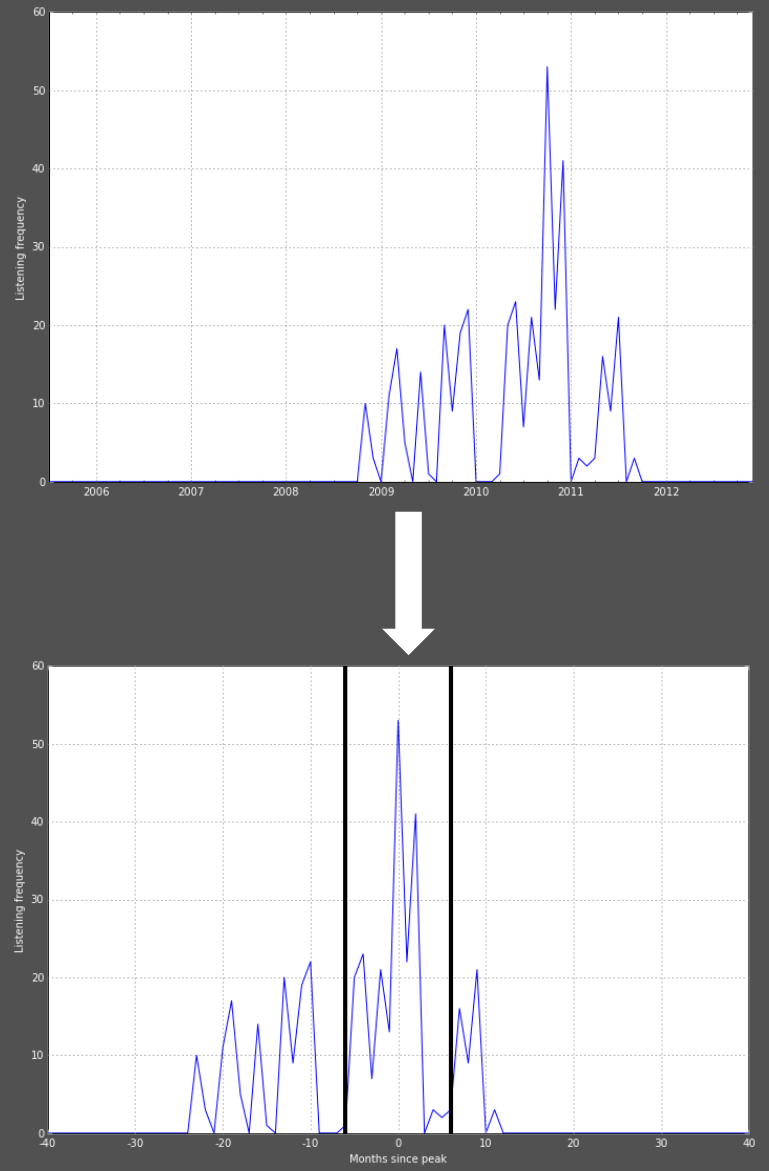

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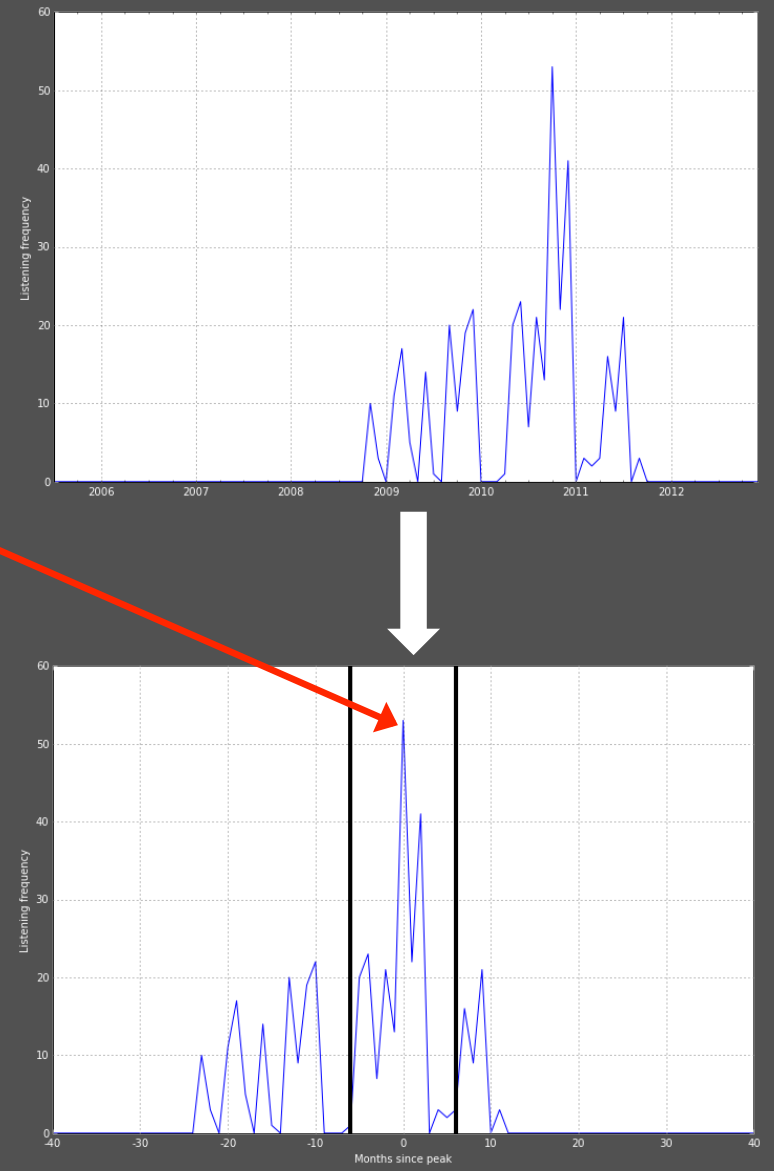

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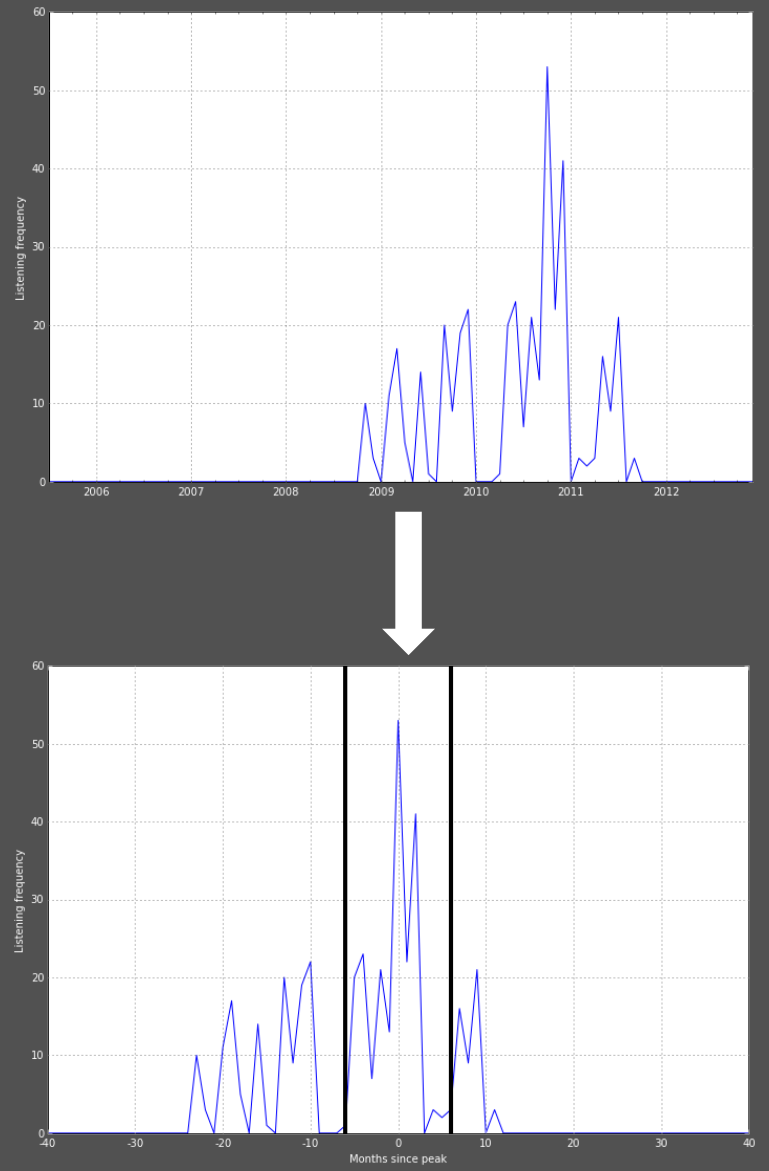
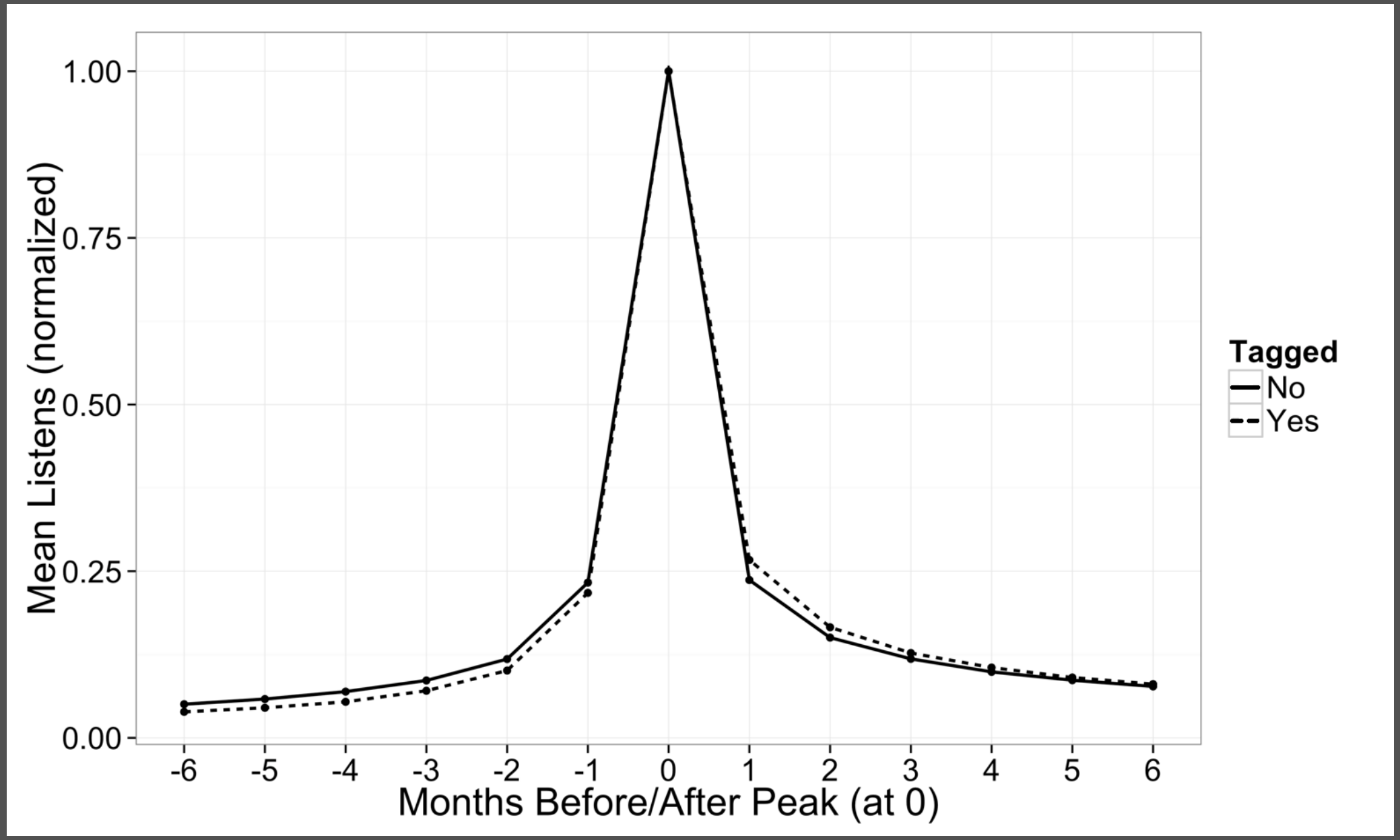



1.00
0.75
0.50
0.25
0.00
Mean Listens (normalized)
-6
-5
-4
-3
-2
-1
0
1
2
3
4
5
6
Months Before/After Peak (at 0)
Tagged
No
Yes

A regression model (GAM)

Pre-peak listening behavior + tagged? → post-peak listening

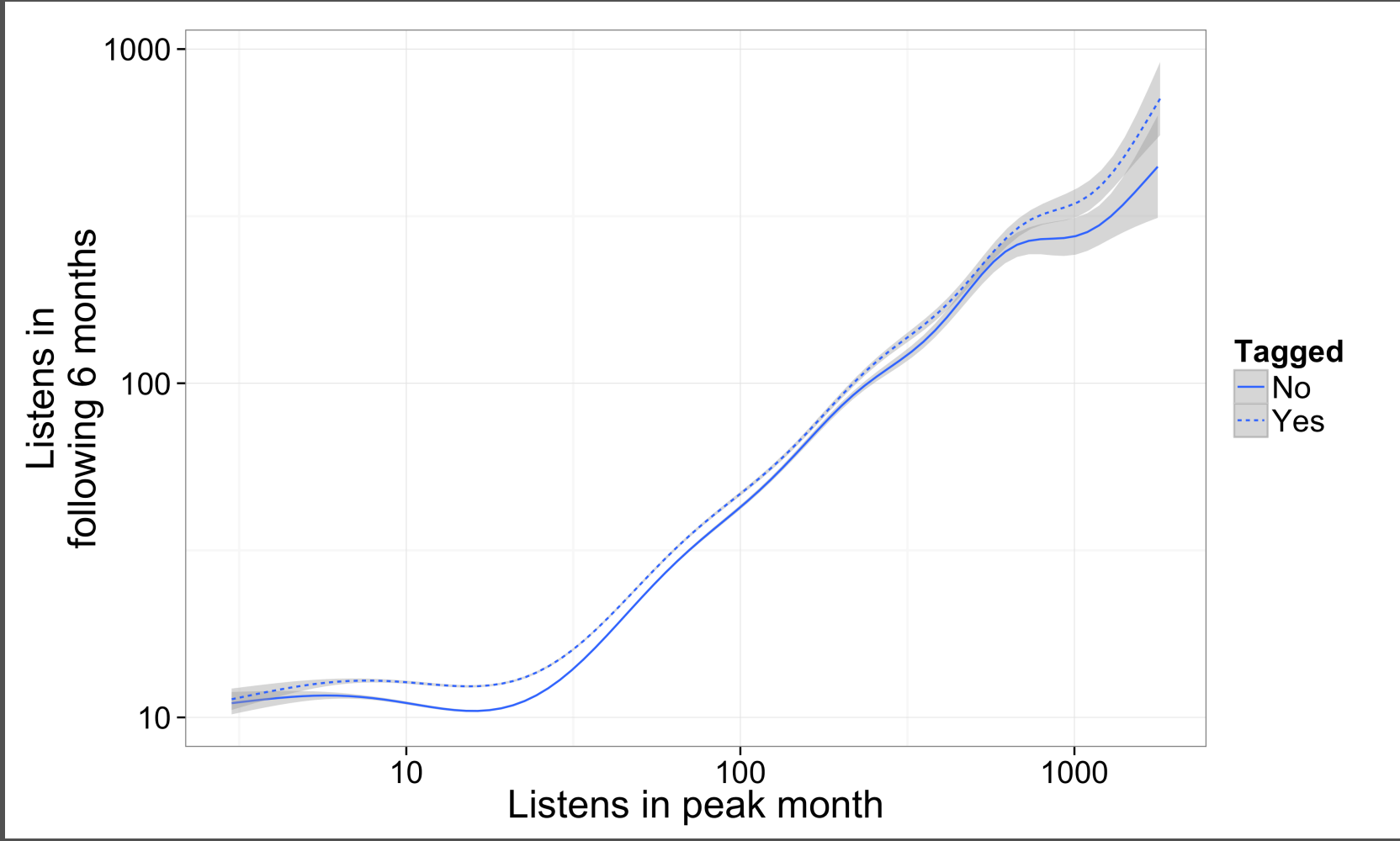
Independent variables (8 total):

Binary tagged/untagged indicator

$$\{T_{peak-6}, T_{peak-5}, \ldots T_{peak}\}$$

Dependent variable: $\sum_{i=1}^{6} T_{peak+i}$

A regression model (GAM)



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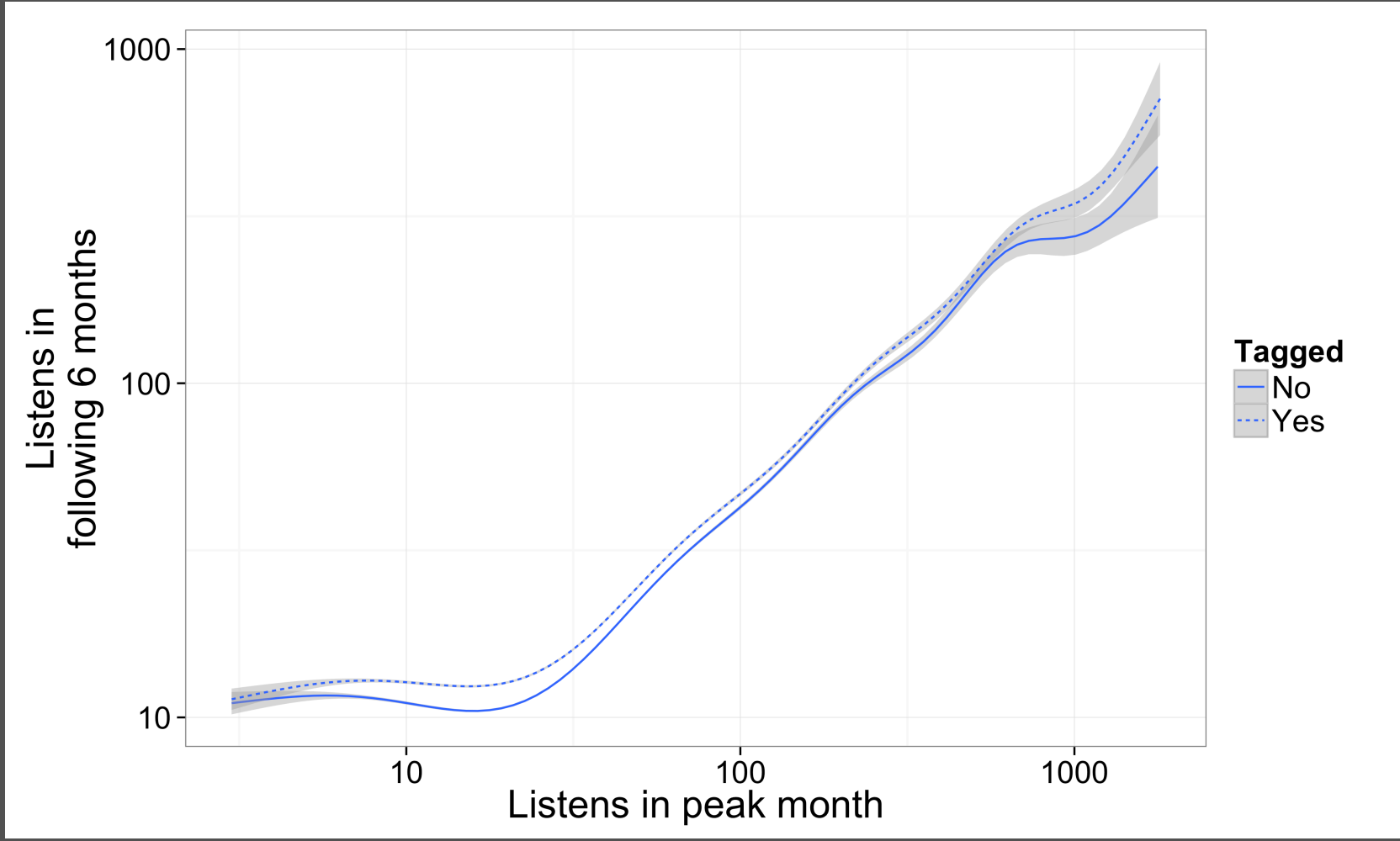


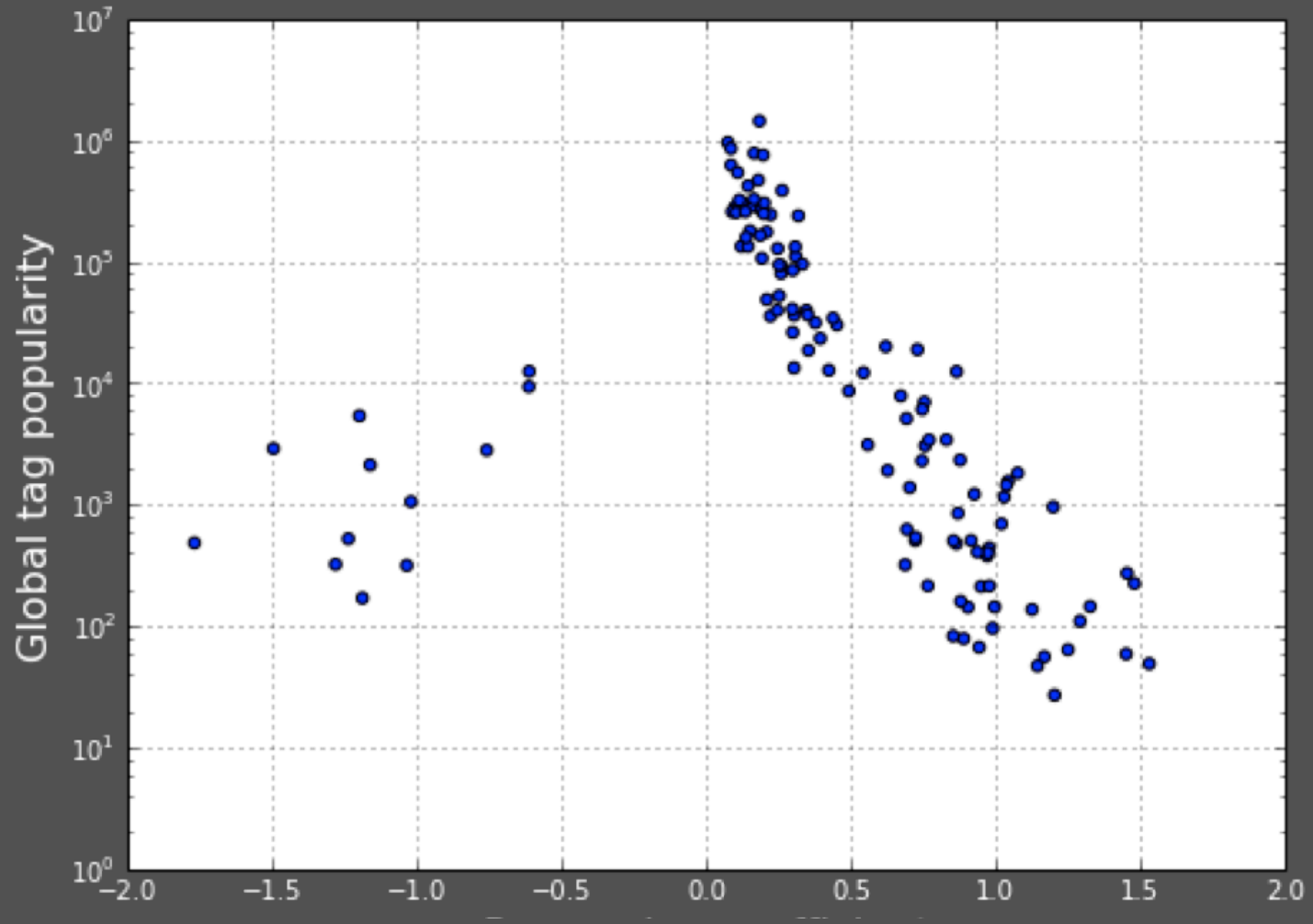
(but the difference is small: 1-2 listens over 6 months)

What about particular tags?

Another regression model, with 2 changes:

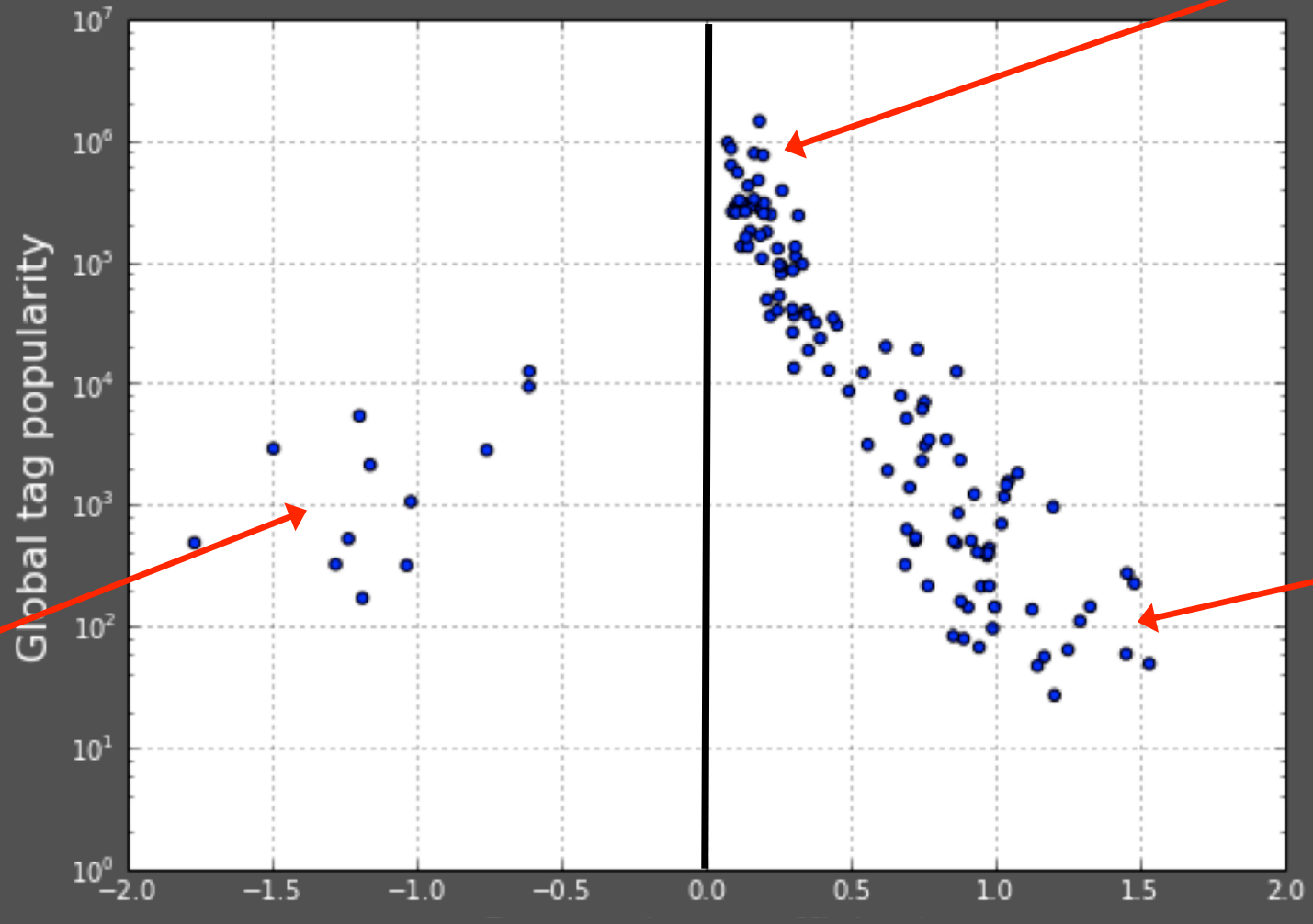
1. Binary regressors for all tags with ≥ 5 occurrences (2,290).
2. Control for listening in peak month, but not preceding months

What about particular tags?



What about particular tags?

“seen live”, “electronic”, “death metal”, “hip hop”, “female vocalists”



“meaningful songs”, “mymusic”, “meine liebsten”, “i love”, “artmunz”

“saw them live”, “5432fun”, “loved artists”, “great song”, “0mix”

So, ***do*** tags really serve as retrieval aids?

Tags certainly do not ***always*** function as memory cues, and our results suggest that retrieval may actually be an uncommon tagging motivation.

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Moving forward…

Refinement of modeling approaches
In-depth tag analyses
Item-level analyses
Other datasets?

jlorince@indiana.edu
https://pages.iu.edu/~jlorince