

# Understanding Temporal Query Dynamics

Anagha Kulkarni

Jaime Teevan

Krysta M. Svore

Susan T. Dumais

Carnegie Mellon University  
anaghak@cs.cmu.edu

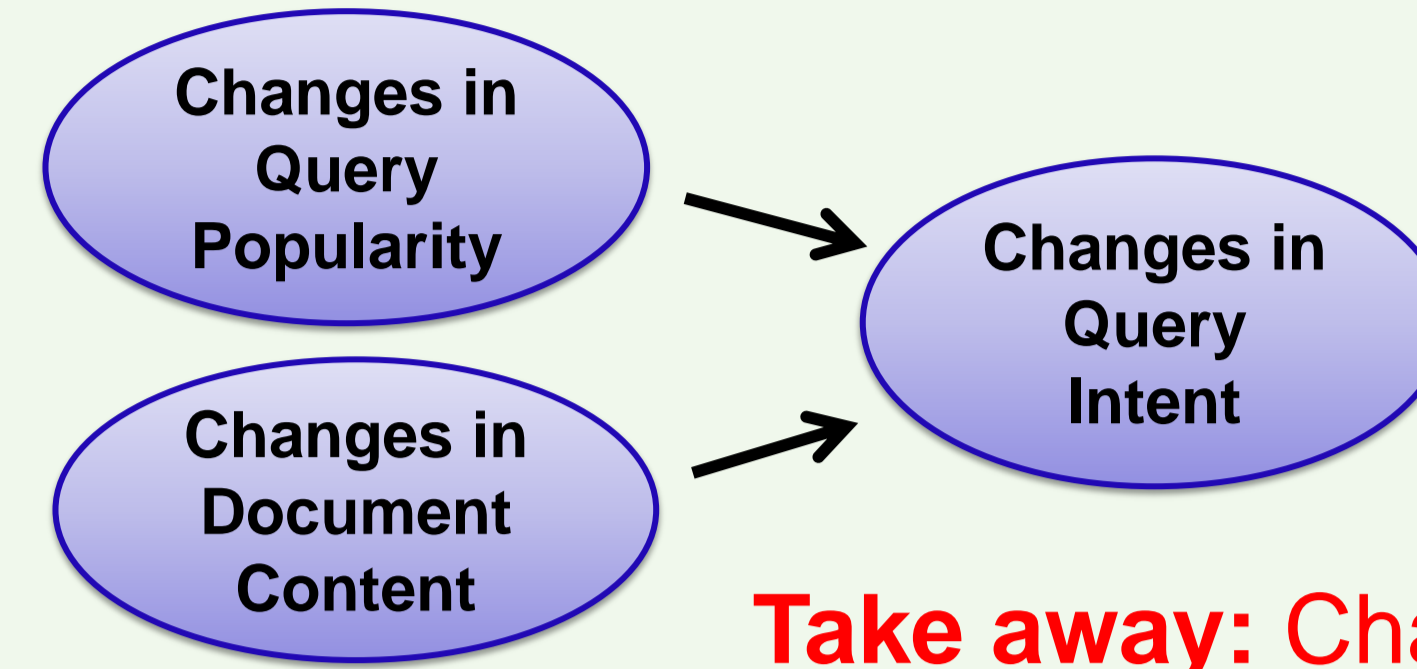
Microsoft Research, USA  
ksvore@microsoft.com

Microsoft Research, USA  
ksvore@microsoft.com

Microsoft Research, USA  
ksvore@microsoft.com

## Motivation and Research Goal

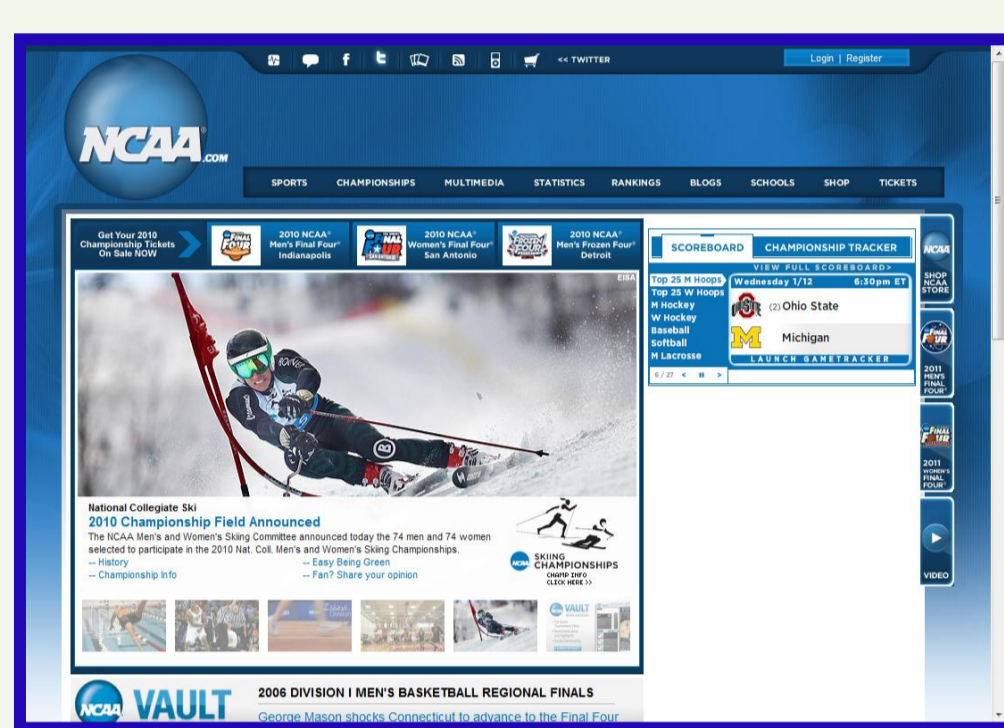
- Web search is strongly influenced by time
  - o Queries popularity change over time
  - o Document content changes over time
  - o What's relevant (intent) changes over time
- Goal: Infer changes in query intent using changes in popularity, content and interaction



**Take away:** Changes in popularity and content can signal changes in user intent.

## Example: *march madness*

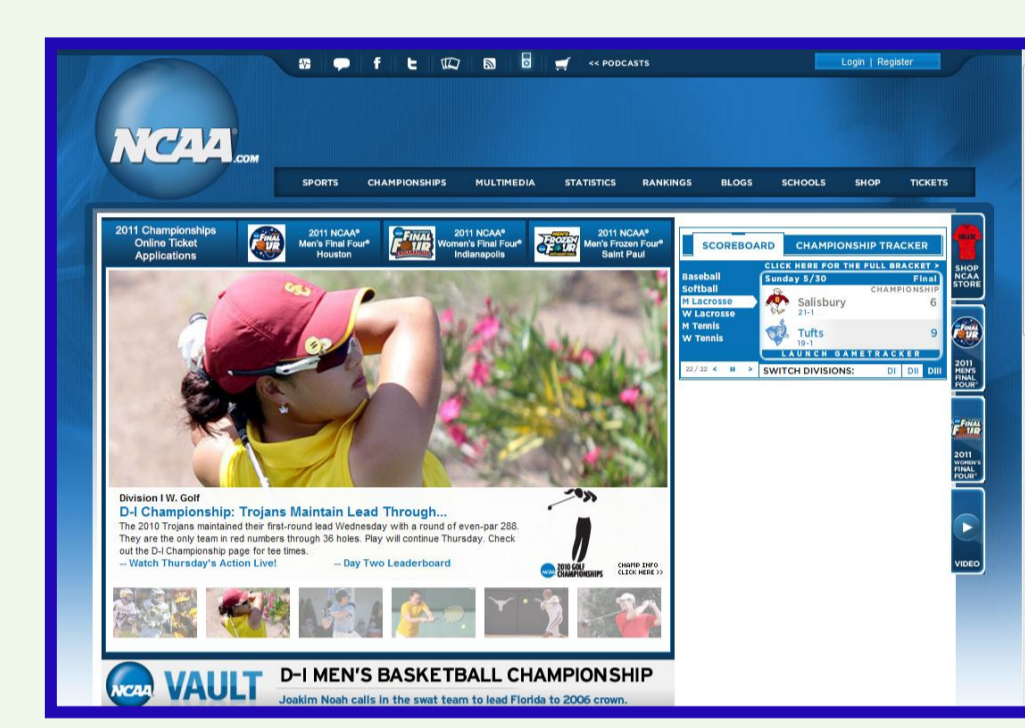
<http://ncaa.com> becomes relevant *during* the basketball tournament but is not *before* or *after*



Before



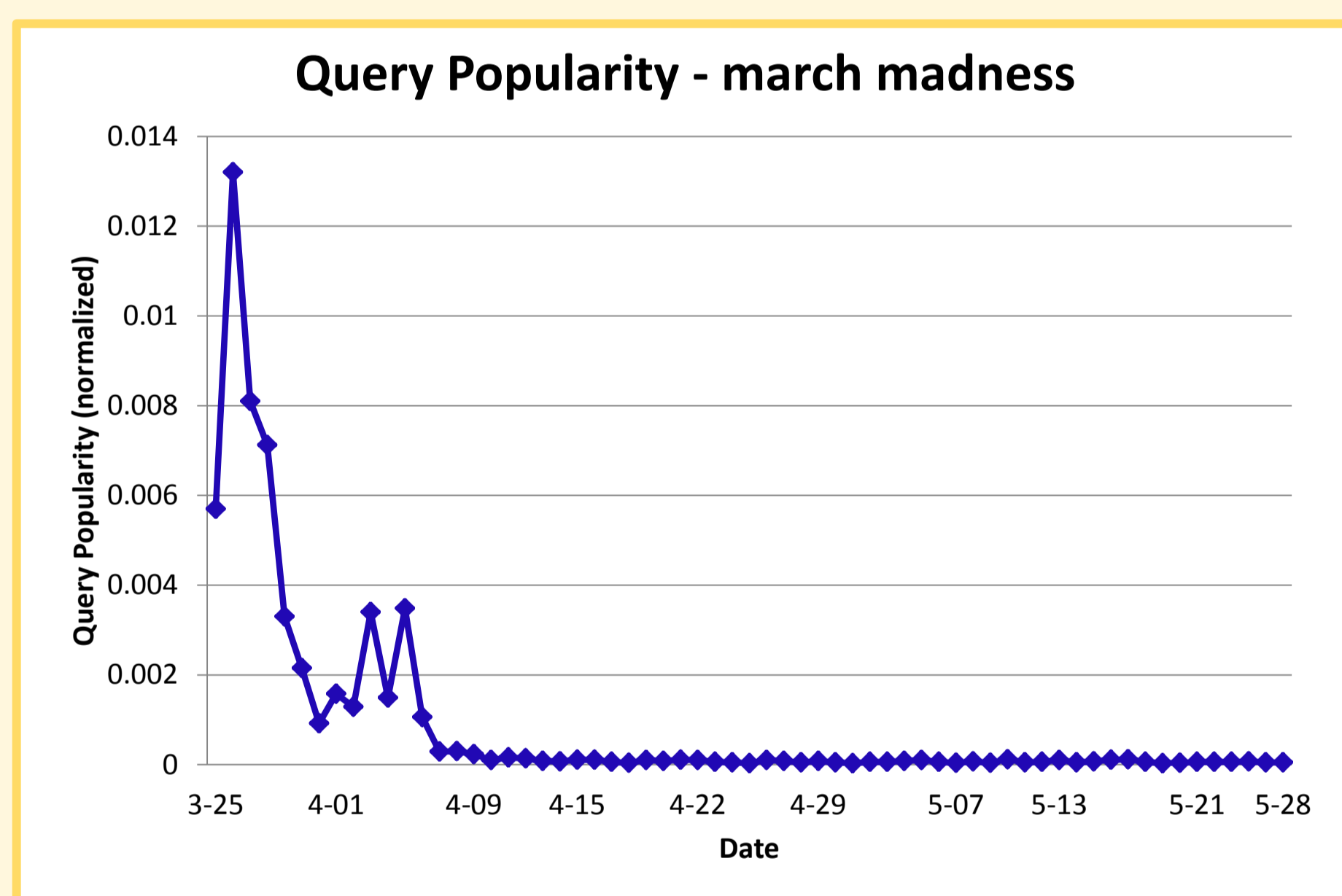
During



After

<http://mahalo.com/march-madness> is always about March Madness and is relevant *before* and *after*

## Changes in Query Popularity



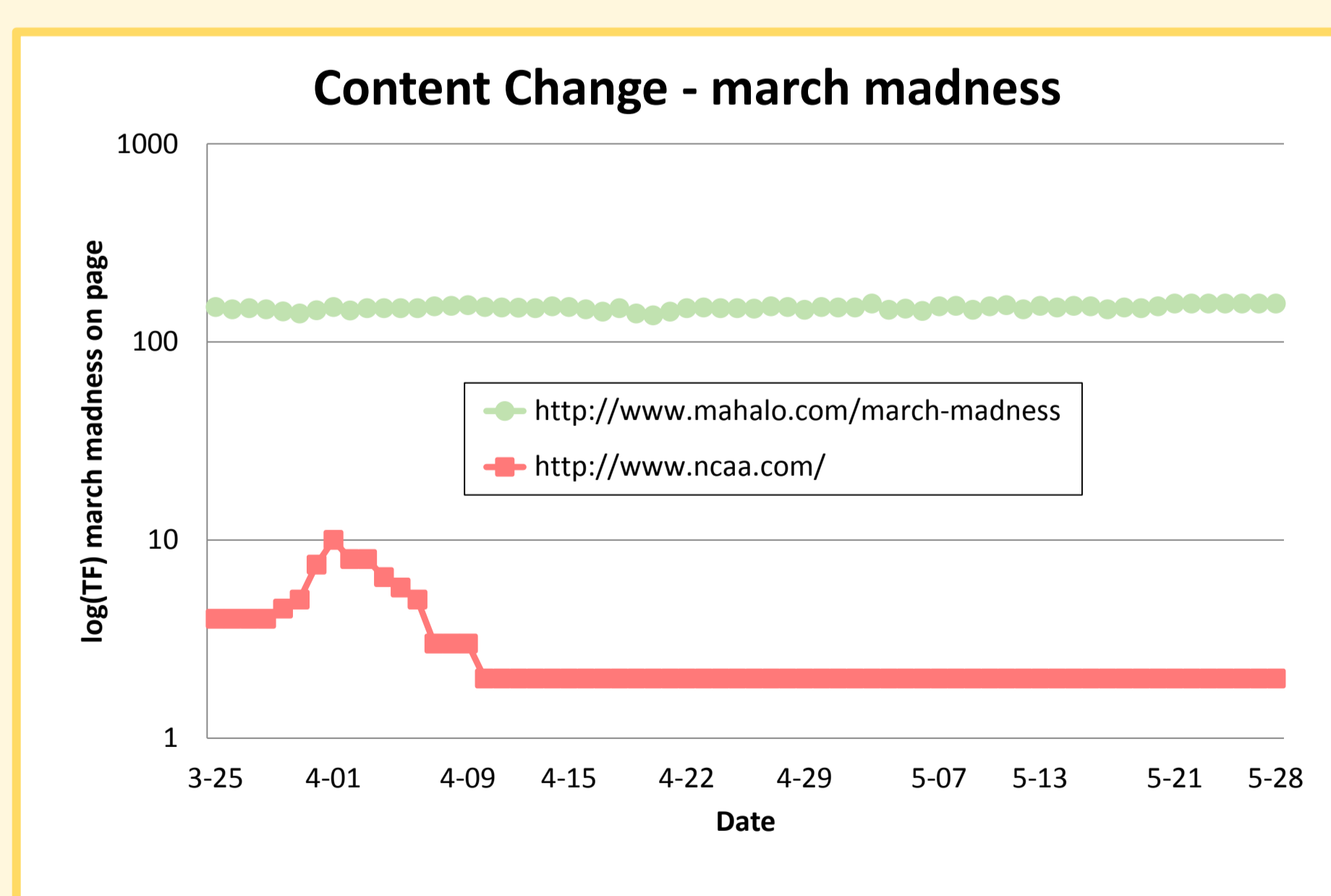
### Methods:

- Measure query popularity over time

### Findings:

- Characterize query popularity curves with shape features
  - o Number of spikes / Periodicity / Shape / Trend
- Most queries
  - o One or more spikes / not periodic / wedge / show temporal trend
- *march madness*
  - o Multiple spikes / not periodic / castle shape / downward trend

## Changes in Document Content



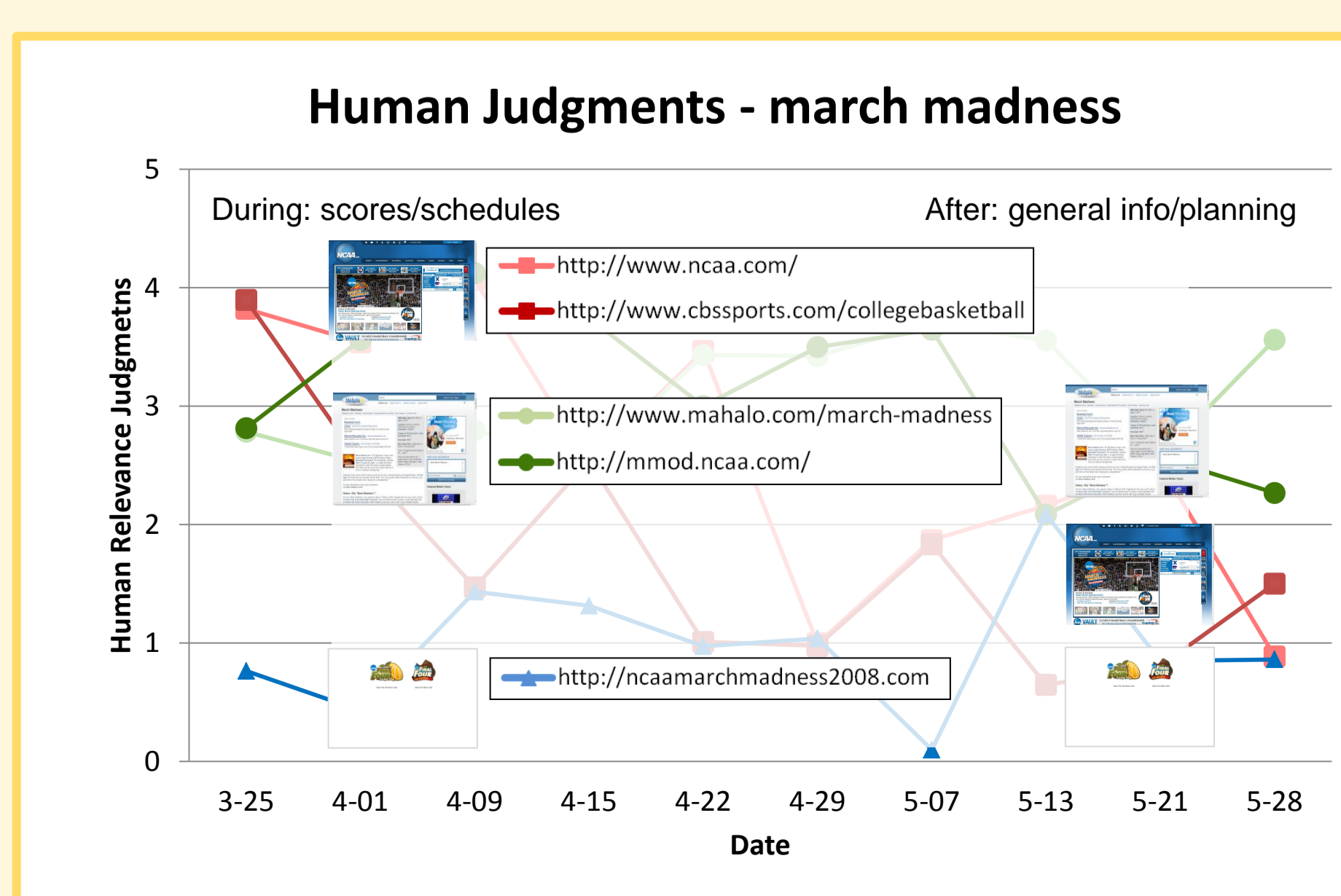
### Methods:

- Crawl pages every day
- Measure page content change
  - o Query-dependent: Term frequency (TF)
  - o Query-independent: Dice coefficient over words

### Findings:

- 61% pages show query-related (TF) change
- 95% pages changed by less than 15% (Dice)
- Periodic and multiple-spike queries are more likely to have changed documents

## Changes in Query Intent



### Methods:

- Estimate query intent change
  - o Explicit human relevance judgments (top HR Count)
  - o Entropy of clicked results

### Findings:

- Top HR count and CE are negatively correlated
- Click entropy correlated with multiple-spike queries and downward-trend queries