Reverse Engineering Chinese Censorship\textsuperscript{1}

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(Talk at ESRC Research Methods Festival, 8 July 2014)

\textsuperscript{1}Based on joint work with Jennifer Pan and Margaret Roberts
\textsuperscript{2}GaryKing.org
Papers

- An Observational Study:

- Experimental and Participatory Studies:
  *Reverse Engineering Chinese Censorship* (Under review)

Copies at GaryKing.org
Chinese Censorship

The largest selective suppression of human expression in history: implemented manually (within a few hours of posting), by \( \approx 200,000 \) workers, located in government and inside social media firms. A huge censorship organization: (obviously) designed to suppress information (paradoxically) very revealing about the goals, intentions, and actions of the Chinese leadership.
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(Plus 59% from Sina Blog)
The Goals of Censorship make Social Media Actionable

What Could be the Goal?

1. Stop collective action

Right

Implications: Social Media is Actionable!

Chinese leaders: measure criticism: to judge local officials
censor: to stop events with collective action potential

Thus, we can use criticism & censorship to predict:

- Officials in trouble, likely to be replaced
- Policies that generate dissent (& interest of leaders)
- Government action outside the Internet
- Dissidents to be arrested; peace treaties to sign; emerging scandals
- Disagreements between central and local leaders

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A big prize, but payable only if we have the goals right

6/29
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Our Observational Research Design: 5 Steps

1. Monitor 85 content areas over 6 months
2. Download each social media post, the instant it appears
3. Revisit each later to check if it was censored (carefully, from computers all over the world)
4. Repeat 13,822,221 times
5. Analyze with new methods of computer-assisted text analysis
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Censorship is not Ambiguous: Example Error Page

Sorry, the host you were looking for does not exist, has been deleted, or is being investigated.
Censorship is not Ambiguous: BBS Error Page

The page you requested is temporarily down. How about you go look at another page.

Jingjing, one of China’s cartoon internet police
The Censors are Fast; Our Automated Methods are Faster
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Example: Shanghai Subway Crash
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Post Volume & Censorship are “Bursty”

Found 87 volume bursts in our 85 topic areas

Identified real world event associated with each burst

Our hypothesis: The government censors all posts in volume bursts associated with events with collective action potential (regardless of how critical or supportive of the state).
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![Graph showing collective support for environmental lottery with bursts in volume and censorship]

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Observational Test 1: Post Volume

Begin with our 87 volume bursts in 85 topic areas. For each burst, calculate change in % censorship inside to outside each volume burst within topic areas – censorship magnitude.

If the goal of censorship is to stop collective action, we expect:

1. On average, % censored should increase during volume bursts.
2. Some bursts (associated with politically relevant events) should have much higher censorship.

Censorship Magnitude vs. Density

<table>
<thead>
<tr>
<th>Censorship Magnitude</th>
<th>Density</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.2</td>
<td>0</td>
</tr>
<tr>
<td>0.4</td>
<td>1</td>
</tr>
<tr>
<td>0.6</td>
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</tr>
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Classification of Events Generating the Bursts

Event classification (each category can be +, −, or neutral comments about the state)

1. Protest or organized crowd formation outside the Internet
2. Individuals who have organized or incited collective action on the ground in the past;
3. Topics related to nationalism or nationalist sentiment that have incited protest or collective action in the past.

(Inter-coder reliability: 98.9%)
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What Types of Events Are Censored?

![Chart showing the distribution of censorship magnitude and density for different types of events: Policy, News, Collective Action, Criticism of Censors, and Pornography.](chart.png)
What Types of Events Are Censored?

Censorship Magnitude

- Protests in Inner Mongolia
- Pornography Disguised as News
- Baidu Copyright Lawsuit
- Zengcheng Protests
- Pornography Mentioning Popular Book
- Ai Weiwei Arrested
- Collective Anger At Lead Poisoning in Jiangsu
- Google is Hacked
- Localized Advocacy for Environment Lottery
- Fuzhou Bombing
- Students Throw Shoes at Fang BinXing
- Rush to Buy Salt After Earthquake
- New Laws on Fifty Cent Party
- U.S. Military Intervention in Libya
- Food Prices Rise
- Education Reform for Migrant Children
- Popular Video Game Released
- Indoor Smoking Ban Takes Effect
- News About Iran Nuclear Program
- Jon Hunstman Steps Down as Ambassador to China
- Gov't Increases Power Prices
- China Puts Nuclear Program on Hold
- Chinese Solar Company Announces Earnings
- EPA Issues New Rules on Lead
- Disney Announced Theme Park
- Popular Book Published in Audio Format

Policies
News
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Criticism of Censors
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-0.2 0 0.1 0.3 0.5 0.7

Censorship Magnitude
Censoring Collective Action: Riots in Zencheng
Censoring Collective Action: Ai Weiwei’s Arrest

Ai Weiwei arrested
Low Censorship on Policy: One Child

Speculation of Policy Reversal at NPC

Count Published
Count Censored

Jan Feb Mar Apr May Jun Jul

Speculation of Policy Reversal at NPC

Count

0 10 20 30 40

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Low Censorship on News: Power Prices

Power shortages
Gov't raises power prices to curb demand
We adapted "ReadMe" (Hopkins-King) methodology to the content of censored posts in Chinese.

- Standardize encoding of Chinese text
- Eliminate punctuation and stop words
- Experiment with segmenting characters into words
- Calculate the quantity of interest (% censored by category)

- Code a validation set

ReadMe estimates: % of posts in each category
Quantity of interest: % of posts censored in a category

\[
P(\text{Censored} \mid \text{Category}) = \frac{P(\text{Category} \mid \text{Censored}) P(\text{Censored})}{P(\text{Category})}
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- Calculate the quantity of interest (% censored by category)
  - Code a validation set
  - ReadMe estimates: % of posts in each category
Content of Posts

We adapted “ReadMe” (Hopkins-King) methodology to the content of censored posts in Chinese

- Standardize encoding of Chinese text
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\[
P(Censored|\text{Category}) = \frac{P(\text{Category}|Censored)P(Censored)}{P(\text{Category})}
\]
“ReadMe” Algorithm Validated in Chinese
“ReadMe” Algorithm Validated in Chinese

Example: Labor Strikes, 2010 (Training set: 100; Test set: 900)
“ReadMe” Algorithm Validated in Chinese

Example: Labor Strikes, 2010 (Training set: 100; Test set: 900)
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Example: Labor Strikes, 2010 (Training set: 100; Test set: 900)
Uncensored: Non-Collective Action Posts
Uncensored: Non-Collective Action Posts

Regardless of whether Supportive or Critical
Uncensored: Non-Collective Action Posts

Regardless of whether Supportive or Critical

One Child Policy

Corruption Policy

Food Prices Rise

Percent Censored

0.0 0.2 0.4 0.6 0.8 1.0

Criticize Support Criticize Support Criticize Support
Censored: Collective Action Posts
Censored: Collective Action Posts
Regardless of whether Supportive or Critical
Censored: Collective Action Posts

Regardless of whether Supportive or Critical
Additional Research Designs

1. Randomized Experiment (for causal inferences)
   - Selected 100 top social media sites (∼87% of blogs, >500M Users, geographically diverse)
   - Created 2 accounts on each (from inside China all over the country)
   - Wrote 1,200 unique social media posts (CA/not CA, Pro/Anti)
   - Submitted posts randomly assigned to type
   - Checked on censorship (from computers in many countries)

2. Participatory Study (for descriptive inferences)
   - Our goal: change our sources' incentives
   - Current method of learning how they censor: ask (carefully!)
   - Procedure: create our own social media website in China
     - Bought URL; contracted with firms for servers & software; posted and censored ourselves
     - To learn: we tried every software option, read the documentation, and called customer support(!)
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Mechanisms of Censorship
Mechanisms of Censorship

1. Submit text for posting
   - Immediately held for review before publication
   - Administrator has set up review for new topics, your post will be shown after it has passed review.

2. Publish immediately
   - Post remains online
   - Post is removed (within 24 hours)

3. Publish
   - Post is published after review
   - Post deleted during review

4. Censored
   - You have been silenced by the administrator, the type of silence is forever!

PUBLISHED

Sorry, the host you were looking for does not exist, has been deleted, or is being investigated

By 2020 China will have 30 million bare branches (extra men), this is a critical situation. Behind it is the fact that every year more boys than girls are born, which is due to the one-child policy. Over the years, the one-child policy has created many social problems...
Mechanisms of Censorship

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Submit text for posting

Immediately held for review before publication

Administrator has set up review for new topics, your post will be shown after it has passed review.

Post published after review

Post is published

Post deleted during review

(Post reviewed then deleted)

Account blocked

You have been silenced by the administrator, the type of silence is forever!

CENSORED

PUBLISHED

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PUBLISHED

The government goes on about anti-corruption everyday, but is it doing anything? Today, it’s Guo Yongxiang from Sichuan... All officials are corrupt, it’s only those who have offended someone that are investigated...

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Obser-vational study
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7. Post is published after review
8. Post is removed (within 24 hours)
9. Post remains online

10. Publish immediately
11. PUBLISHED
12. Observed study
13. 64% of websites review some content
14. 40% of all submissions reviewed

The government goes on about anti-corruption everyday, but is it doing anything? Today, it’s Guo Yongxiang from Sichuan…All officials are corrupt, it’s only those who have offended someone that are investigated…

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Posts For v. Against Government: Zero Causal Effect
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Panxu Protest
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Panxu Protest

Tibetan Self-Immolations

Censorship Difference (Pro – Anti)
Posts For v. Against Government: Zero Causal Effect

-0.5 0.0 0.5 1.0
Censorship Difference (Pro − Anti)

Panxu Protest
Tibetan Self−Immolations
Ai Weiwei Album
Posts For v. Against Government: Zero Causal Effect
Posts For v. Against Government: Zero Causal Effect

Censorship Difference (Pro − Anti)

-0.5 0.0 0.5 1.0

- Panxu
- Protest
- Ai Weiwei
- Album
- Corruption
- Policy
- Tibetan
- Self–Immolations
- Protests
- in
- Xinjiang

25/29
Posts For v. Against Government: Zero Causal Effect

Censorship Difference (Pro − Anti)

Panxu
Protest

Ai Weiwei
Album

Corruption
Policy

Tibetan
Self−Immolations

Protests
in
Xinjiang

Eliminate
Golden
Week

25/29
Posts For v. Against Government: Zero Causal Effect

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Ai Weiwei
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in
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Corruption
Policy

Eliminate
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Rental
Tax

25/29
Posts For v. Against Government: Zero Causal Effect

Censorship Difference (Pro − Anti)

Panxu Protest
Ai Weiwei Album
Corruption Policy
Tibetan Self-Immolations
Protests in Xinjiang
Eliminate Golden Week
Yellow Light Fines
Rental Tax

Rental Tax
Posts For v. Against Government: Zero Causal Effect

Censorship Difference (Pro − Anti)

-0.5 0.0 0.5 1.0

Panxu Protest
Ai Weiwei Album
Corruption Policy
Tibetan Self-Immolations
Protests in Xinjiang
Eliminate Golden Week
Yellow Light Fines
Rental Tax
Stock Market Crash

25/29
Posts For v. Against Government: Zero Causal Effect

Censorship Difference (Pro − Anti)

-0.5 0.0 0.5 1.0

Panxu Protest
Ai Weiwei Album
Corruption Policy
Tibetan Self-Immolations
Protests in Xinjiang
Eliminate Golden Week
Yellow Light Fines
Stock Market Crash
Rental Tax
Investigation of Sichuan Vice Governor

25/29
Posts For v. Against Government: Zero Causal Effect

![Graph showing the censorship difference (Pro - Anti) for various topics such as Panxu Protest, Ai Weiwei Album, Tibetan Self-Immolations, Protest in Xinjiang, Corruption Policy, Eliminate Golden Week, Yellow Light Fines, Stock Market Crash, Investigation of Sichuan Vice Governor, Gender Imbalance, Rental Tax. The horizontal line at 0 indicates no difference.]
Posts For v. Against Government: Zero Causal Effect

The diagram shows the difference in censorship between pro- and anti-government posts for various topics. The x-axis represents the topics, and the y-axis represents the censorship difference (Pro - Anti). Topics include Tibetan Self-Immolations, Protests in Xinjiang, Corruption Policy, Eliminate Golden Week, Yellow Light Fines, Rental Tax, Stock Market Crash, Investigation of Sichuan Vice Governor, Gender Imbalance, Li Tianyi Scandal, Panxu Protest, Ai Weiwei Album, and Cases of Rental Tax and Yellow Light Fines.
Collective Action Events: Large Causal Effect
Collective Action Events: Large Causal Effect
Collective Action Events: Large Causal Effect
Collective Action Events: Large Causal Effect

Panxu Protest

Censorship Difference (CA Event - Non-CA Event)
Collective Action Events: Large Causal Effect
Collective Action Events: Large Causal Effect
Collective Action Events: Large Causal Effect

Censorship Difference (CA Event − Non-CA Event)

- Panxu Protest
- Tibetan Self-Immolations
- Ai Weiwei Album
- Protests in Xinjiang
Evading Automated Review

Example Substitution 1: Homograph
- 自 由
  - "Freedom"
- 目 田
  - "Eye field" (nonsensical)

Example Substitution 2: Homophone (both sound like "hexie")
- 和 谐
  - "Harmonious [Society]" (official slogan)
- 河 蟹
  - "River crab" (irrelevant)

They can't follow the conversation; our new keyword methods can!

The same task:
1. the analyst's job,
2. language drift
   - #BostonBombings ⇝ #BostonStrong,
3. People hiding in plain sight,
4. Look-alike modeling,
5. Starting point for sophisticated automated text analysis
Evading Automated Review

Example Substitution 1:
Evading Automated Review

Example Substitution 1:

自由

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Evading Automated Review

Example Substitution 1:

自由 “Freedom”
Evading Automated Review

Example Substitution 1:

自由 “Freedom”

目 “Eye field”

例 Substitution 2:

Homophone (both sound like “hexie”)

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Example Substitution 1:

自 由

“Freedom”

自 由

目 田

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Evading Automated Review

Example Substitution 1:

自由 自由
目田 目田
“Freedom” “Eye field”

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Evading Automated Review

Example Substitution 1:

自由  自由  “Freedom”  [CENSORED]
目  田  目  田  “Eye field”  (nonsensical)
Evading Automated Review

Example Substitution 1: Homograph

自由 自由
“Freedom” “Freedom” (nonsensical)
目田 目田
“Eye field” “Eye field” (nonsensical)
Evading Automated Review

Example Substitution 1: Homograph

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“Eye field” (nonsensical)
Evading Automated Review

Example Substitution 1: Homograph

自由
目田
“Freedom”
“Eye field” (nonsensical)

Example Substitution 2:
Evading Automated Review

Example Substitution 1:  Homograph

自由  "Freedom"  (censored)
目田  "Eye field"  (nonsensical)

Example Substitution 2:

和谐
Evading Automated Review

Example Substitution 1: Homograph

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Example Substitution 2:

和諧 “Harmonious [Society]” (official slogan)
Evading Automated Review

Example Substitution 1: Homograph

自由
“Freedom”
目
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和谐 
“Harmonious [Society]” (official slogan)  (censored)

河蟹
Evading Automated Review

Example Substitution 1:  **Homograph**

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目田  目田  “Eye field”  (nonsensical)

Example Substitution 2:

和諧  和諧  “Harmonious [Society]”  (official slogan)
河蟹  河蟹  “River crab”
Evading Automated Review

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Conclusions

The Goals of Chinese Censorship:
For the Chinese people: Individually free, Collectively in Chains

Unambiguous evidence from: observational study, participant observation, & randomized experiments

Makes Social Media Actionable for us:
Enables detailed, continuous, predictive monitoring of every Chinese government, leader, policy, dissident, scandal, company, etc.
Predicts state actions when other sources are silent
Applicable to some other countries

New methods developed for:
Following conversations when people try to evade censors
Automated keyword recommender for government analysts
Predicting action on the ground from censorship
Understanding large volumes of unstructured text
Conclusions

- The Goals of Chinese Censorship:
Conclusions

- The Goals of Chinese Censorship:
  - For the Chinese people: *Individually free, Collectively in Chains*
Conclusions

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For the Chinese people: Individually free, Collectively in Chains

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  - Predicting action on the ground from censorship
Conclusions

- **The Goals of Chinese Censorship:**
  - For the Chinese people: Individually free, Collectively in Chains
  - Unambiguous evidence from: observational study, participant observation, & randomized experiments
  - Makes Social Media Actionable for us:
    - Enables detailed, continuous, predictive monitoring of every Chinese government, leader, policy, dissident, scandal, company, etc.
    - Predicts state actions when other sources are silent
    - Applicable to some other countries

- **New methods developed for:**
  - Following conversations when people try to evade censors
  - Automated keyword recommender for government analysts
  - Predicting action on the ground from censorship
  - Understanding large volumes of unstructured text
For more information

GaryKing.org

j.mp/JenPan

j.mp/MollyRoberts
Appendix
Censorship to Preempt Collective Action: Ai Weiwei’s Arrest
Censorship to Preempt Collective Action: Ai Weiwei’s Arrest

Placebo Test: Most extreme of all effects

Mar. 29, 5 days prior

Apr. 3, Ai Weiwei Arrested

% of Posts Censored

Actual % censorship

Predicted % censor trend based on 3/19–3/29 data
Censorship to Preempt Collective Action: Ai Weiwei’s Arrest

Mar. 29, 5 days prior
Apr. 3, Ai Weiwei Arrested

Actual % censorship
Predicted % censorship trend based on 3/19−3/29 data

Placebo Test:
Censorship to Preempt Collective Action: Ai Weiwei’s Arrest

Mar. 29, 5 days prior

Apr. 3, Ai Weiwei Arrested

Actual % censorship

Predicted % censorship trend based on 3/19–3/29 data

Placebo Test: Most extreme of all effects
Predicting the South China Sea Peace Agreement
Predicting the South China Sea Peace Agreement

Jun. 20, 5 days prior
Jun. 25, Peace Agreement

Predicted % censorship trend based on 6/10–6/20 data

Actual % censorship
Predicting the South China Sea Peace Agreement

Jun. 20, 5 days prior

Jun. 25, Peace Agreement

Predicted % censor trend based on 6/10–6/20 data

Actual % censorship

Placebo Test:
Predicting the South China Sea Peace Agreement

Jun. 20, 5 days prior
Jun. 25, Peace Agreement

Predicted % censorship trend based on 6/10–6/20 data

Actual % censorship

Placebo Test: Most extreme of all effects
Censorship Pre-empting Collective Action: Wang Lijun’s Demotion
Censorship Pre-empting Collective Action: Wang Lijun’s Demotion

Jan. 28, 5 days prior
Feb. 2, Wang Lijun demoted

Actual % censorship

Predicted % censor trend based on 1/18–1/28 data
Censorship Pre-empting Collective Action: Wang Lijun’s Demotion

Jan. 28, 5 days prior

Feb. 2, Wang Lijun demoted

Actual % censorship

Predicted % censorship trend based on 1/18–1/28 data

Placebo Test:
Censorship Pre-empting Collective Action: Wang Lijun’s Demotion

Placebo Test: Most extreme of all effects
Uncensored Posts (w/o Collective Action Potential)  
Critical of the State
Uncensored Posts (w/o Collective Action Potential)
Critical of the State

State Critique

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Uncensored Posts (w/o Collective Action Potential)
Critical of the State

This is a city government [Yulin City, Shaanxi] that treats life with contempt, this is government officials run amuck, a city government without justice, a city government that delights in that which is vulgar, a place where officials all have mistresses, a city government that is shameless with greed, a government that trades dignity for power, a government without humanity, a government that has no limits on immorality, a government that goes back on its word, a government that treats kindness with ingratitude, a government that cares nothing for posterity...
Censored Post (with Collective Action Potential)
Supporting the State
Censored Post (with Collective Action Potential)
Supporting the State

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The bombing led not only to the tragedy of his death but the death of many government workers. Even if we can verify what Qian Mingqi said on Weibo that the building demolition caused a great deal of personal damage, we should still condemn his extreme act of retribution. ... The government has continually put forth measures and laws to protect the interests of citizens in building demolition. And the media has called attention to the plight of those experiencing housing demolition. The rate at which compensation for housing demolition has increased exceeds inflation. In many places, this compensation can change the fate of an entire family.