Reverse Engineering Chinese Censorship$^1$

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Institute for Quantitative Social Science
Harvard University

(Pi Sigma Alpha Lecture at University of South Carolina, 2/28/2014)

$^1$Based on joint work with Jennifer Pan and Molly Roberts
$^2$GaryKing.org
Papers

• An Observational Study:

• Experimental and Participatory Studies:
  *A Randomized Experimental Study of Censorship in China*

Copies at GaryKing.org
Chinese Censorship

The largest selective suppression of human expression in history
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The largest selective suppression of human expression in history:

- implemented *manually*,
- by \( \approx 200,000 \) workers,
- located in government and inside social media firms
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Theories of the Goal of Censorship
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Either or both could be right or wrong.
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Chinese Social Media: Fractured over 1,400+ sites
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(Plus 59% from Sina Blog)
Observational Study

Collect 3,674,698 social media posts in 85 topic areas over 6 months

Random sample: 127,283

(Repeat design; Total analyzed: 11,382,221)

For each post (on a timeline in one of 85 content areas):

Download content the instant it appears

(Carefully) revisit each later to determine if it was censored (from computers all over the world)

Use computer-assisted methods of text analysis (some existing, some new, all adapted to Chinese)
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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.
The Censors are Fast; Our Automated Methods are Faster
The Censors are Fast; Our Automated Methods are Faster

Example: Shanghai Subway Crash
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For 2 Unusual Topics: Constant Censorship Effort

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Students Throw Shoes at Fang BinXing

Pornography Criticism of the Censors

10/29
For 2 Unusual Topics: Constant Censorship Effort

**Pornography**

**Criticism of the Censors**

Students Throw Shoes at Fang BinXing

10/29
All other topics: Censorship & Post Volume are “Bursty”
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We monitored 85 topic areas (Jan–July 2011) and found 87 volume bursts in total. We identified real-world events 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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Observational Test 1: Post Volume

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

Density

-0.2 0.0 0.2 0.4 0.6 0.8
0 1 2 3 4 5
Censorship Magnitude

12/29
Observational Test 1: Post Volume

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Censorship Magnitude

Density

Censorship Magnitude
Observational Test 2: The 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%)
Observational Test 2: The Events Generating the Bursts

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What Types of Events Are Censored?
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- 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
- Chinese Solar Company Announces Earnings
- Popular Book Published in Audio Format

Censorship Magnitude

- Policies
- News

Collective Action
Criticism of Censors
Pornography
Censoring Collective Action: Ai Weiwei’s Arrest

![Graph showing count of published and censored articles over time.](chart.png)

Ai Weiwei arrested

- **Count Published**
- **Count Censored**

Jan | Mar | Apr | May | Jun | Jul

0 10 20 30 40

15/29
Censoring Collective Action: Protests in Inner Mongolia

Protests in Inner Mongolia

Count Published
Count Censored

Count
Jan Feb Mar Apr May Jun Jul

Protests in Inner Mongolia
Low Censorship on One Child Policy

![Speculation of Policy Reversal at NPC](chart.png)

- **Count Published**
- **Count Censored**

- Graph shows counts from January to July with spikes indicating speculation of policy reversal at the NPC.
Low Censorship on News: Power Prices

Power shortages
Gov't raises power prices to curb demand

Count
Jan Feb Mar Apr May Jun Jul
Count Published
Count Censored

Count
0 10 20 30 40 50 60 70

Count Published
Count Censored

Power shortages
Gov't raises power prices to curb demand
Observational Test 3: Content of Posts

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

\[
P(Censored | \text{Category}) = P(\text{Category} | \text{Censored}) P(Censored) / P(\text{Category})
\]

19/29
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  - Quantity of interest: % of posts censored in a category

\[
P(\text{Censored}|\text{Category}) = \frac{P(\text{Category}|\text{Censored})P(\text{Censored})}{P(\text{Category})}
\]
“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

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“ReadMe” Algorithm Validated in Chinese

Example: Labor Strikes, 2010 (Training set: 100; Test set: 900)
Uncensored: Non-Collective Action Posts (that Support or Oppose the State)

<table>
<thead>
<tr>
<th>Percent Censored</th>
<th>Criticize</th>
<th>Support</th>
<th>Criticize</th>
<th>Support</th>
<th>Criticize</th>
<th>Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>0.0</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
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<tr>
<td>0.2</td>
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<td>0.4</td>
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<tr>
<td>0.6</td>
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</tr>
<tr>
<td>1.0</td>
<td></td>
<td></td>
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<td></td>
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<td></td>
</tr>
</tbody>
</table>

One Child Policy  
Corruption Policy  
Food Prices Rise
Uncensored: Non-Collective Action Posts (that Support or Oppose the State)
Censored: Collective Action Posts (that Support or Criticize the State)
Censored: Collective Action Posts (that Support or Criticize the State)

- Ai Weiwei
- Fuzhou Bombing
- Inner Mongolia

Percent Censored

<table>
<thead>
<tr>
<th></th>
<th>Criticize</th>
<th>Support</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ai Weiwei</td>
<td>0.5</td>
<td>1.0</td>
</tr>
<tr>
<td>Fuzhou Bombing</td>
<td>0.3</td>
<td>0.7</td>
</tr>
<tr>
<td>Inner Mongolia</td>
<td>0.4</td>
<td>0.6</td>
</tr>
</tbody>
</table>
Addional Research Designs

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)

Participatory Study (for descriptive inferences)

Current method of learning how they censor: ask (carefully!)

Our goal: change our sources’ incentives

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 (!)
Additional Research Designs

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Mechanisms of Censorship

- Submit text for posting
  - Immediately held for review before publication
  - Post published after review
  - Post deleted during review
  - Post remains online
  - Publish immediately
  - Post is removed (within 24 hours)

- Published
- Censored

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...

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...

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

1. Submit text for posting
   - Immediately held for review before publication

2. Publish immediately
   - Post remains online

3. Post is published after review
   - Post is published after review

4. Post is removed (within 24 hours)
   - Post is removed (within 24 hours)

5. Account blocked
   - Account blocked

6. 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...

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

8. Published
   - 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...

9. Published
   - (Post reviewed then deleted)

10. Published
    - You have been silenced by the administrator, the type of silence is forever!
Mechanisms of Censorship

- Post remains online
  - Publish immediately
  - Submit text for posting
- Post is removed (within 24 hours)
  - 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 is published after review
  - Post deleted during review
  - (Post reviewed then deleted)
  - Account blocked
  - You have been silenced by the administrator, the type of silence is forever!

- 64% of websites review some content
- 40% of all submissions reviewed

Observational study

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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Censorship Difference (Pro − Anti)

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

Censorship Difference (Pro - Anti)

Panxu
Protest

Tibetan
Self-Immolations
Posts For v. Against Government: Zero Causal Effect

Censorship Difference (Pro − Anti)

-0.5 0.0 0.5 1.0

Panxu
Protest

Tibetan
Self-Immolations

Ai Weiwei
Album
Posts For v. Against Government: Zero Causal Effect

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

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

![Graph showing the comparison of censorship difference for various topics: Panxu Protest, Ai Weiwei Album, Corruption Policy, Tibetan Self-Immolations, Protests in Xinjiang. The x-axis represents the censorship difference (Pro - Anti), and the y-axis ranges from -0.5 to 1.0.](image-url)
Posts For v. Against Government: Zero Causal Effect

![Graph showing the comparison of posts for and against the government with zero causal effect.](image)
Posts For v. Against Government: Zero Causal Effect
Posts For v. Against Government: Zero Causal Effect
Posts For v. Against Government: Zero Causal Effect
Posts For v. Against Government: Zero Causal Effect

Censorship Difference (Pro − Anti)

Panxu Protest
Ai Weiwei Album
Corruption Policy
Eliminate Golden Week
Stock Market Crash
Yellow Light Fines
Investigation of Sichuan Vice Governor
Rental Tax
Protests in Xinjiang
Tibetan Self-Immolations
Posts For v. Against Government: Zero Causal Effect

Censorship Difference (Pro - Anti)

-0.5 0.0 0.5 1.0

-0.5 0.0 0.5 1.0

Panxu Protest
Ai Weiwei Album
Corruption Policy
Eliminate Golden Week
Yellow Light Fines
Stock Market Crash
Investigation of Sichuan Vice Governor
Gender Imbalance

Tibetan Self-Immolations
Protests in Xinjiang
Rental Tax

Protests
in
Xinjiang

Corruption
Policy

Panxu
Protest

Ai Weiwei
Album

Corruption
Policy

Eliminate
Golden
Week

Yellow
Light
Fines

Stock
Market
Crash

Investigation
of Sichuan
Vice
Governor

Gender
Imbalance
Posts For v. Against Government: Zero Causal Effect

![Graph showing the comparison of posts for and against government with various events mentioned such as Tibetan Self-Immolations, Panxu Protest, Ai Weiwei Album, Corruptions Policy, Eliminate Golden Week, Yellow Light Fines, Stock Market Crash, Gender Imbalance, Li Tianyi Scandal, and Rental Tax. The X-axis represents the Censorship Difference (Pro - Anti), ranging from -0.5 to 1.0. Each event is marked on the graph with a vertical line indicating the difference in posts.](image-url)
Collective Action Events: Large Causal Effect
Collective Action Events: Large Causal Effect

Censorship Difference (CA Event − Non-CA Event)
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

Panxu Protest

Tibetan Self-Immolations

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

- Panxu Protest
- Tibetan Self-Immolations
- Ai Weiwei Album

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

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

Censorship Difference (CA Event − Non-CA Event)
Censorship to Preempt Collective Action: Ai Weiwei’s Arrest

<table>
<thead>
<tr>
<th>Date</th>
<th>% of Posts Censored</th>
<th>Actual % Censorship</th>
<th>Predicted % Censorship</th>
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</thead>
<tbody>
<tr>
<td>Mar 19</td>
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<tr>
<td>Mar 29</td>
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<td>0.2</td>
</tr>
<tr>
<td>Apr 08</td>
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<tr>
<td>Apr 18</td>
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<td>0.6</td>
<td>0.6</td>
</tr>
<tr>
<td>Mar 29, 5 days prior</td>
<td>0.2</td>
<td>0.2</td>
<td>0.2</td>
</tr>
<tr>
<td>Apr 3, Ai Weiwei Arrested</td>
<td>0.8</td>
<td>0.8</td>
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</tr>
</tbody>
</table>

**Placebo Test:**

Most extreme of all effects
Censorship to Preempt Collective Action: Ai Weiwei’s Arrest

Mar. 29, 5 days prior

Apr. 3, Ai Weiwei Arrested

% of Posts Censored
Actual % censorship
Predicted % censorship trend based on 3/19–3/29 data

Placebo Test: Most extreme of all effects 27/29
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

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Mar. 29, 5 days prior

Apr. 3, Ai Weiwei Arrested

Actual % censorship

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

Placebo Test: Most extreme of all effects
Concluding Remarks
Concluding Remarks

- Chinese people’s speech: Individually Free, Collectively in Chains
Concluding Remarks

- Chinese people’s speech: Individually Free, Collectively in Chains
- The Chinese Censorship Program:
Concluding Remarks

- Chinese people’s speech: Individually Free, Collectively in Chains
- The Chinese Censorship Program:
  - Stops collective action, not criticism
Concluding Remarks

- Chinese people’s speech: Individually Free, Collectively in Chains
- The Chinese Censorship Program:
  - Stops collective action, not criticism
  - Reveals government intentions; predicts actions
Chinese people’s speech: Individually Free, Collectively in Chains

The Chinese Censorship Program:
  - Stops collective action, not criticism
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Our methodology:
Concluding Remarks

- Chinese people’s speech: Individually Free, Collectively in Chains
- The Chinese Censorship Program:
  - Stops collective action, not criticism
  - Reveals government intentions; predicts actions
- Our methodology:
  - Observational, Experimental, Participatory
Concluding Remarks

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- The Chinese Censorship Program:
  - Stops collective action, not criticism
  - Reveals government intentions; predicts actions
- Our methodology:
  - Observational, Experimental, Participatory
  - Automated text analysis methods validated in Chinese (without translation)
Concluding Remarks

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  - Enables continuous time measurement of Chinese government censorship activities
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  - Enables continuous time measurement of Chinese government censorship activities
  - Reveals information about state action when traditional media is silent
  - Possibly applicable to other countries
For more information

GaryKing.org

j.mp/JenPan

j.mp/MollyRoberts
Predicting the South China Sea Peace Agreement
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
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

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 % censorship 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

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Jan. 28, 5 days prior
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Actual % censorship

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

Placebo Test: Most extreme of all effects

% of Posts Censored

Jan 23 Jan 30 Feb 06 Feb 13
−0.2 0.0 0.2 0.4 0.6 0.8 1.0
2012
Uncensored Posts (w/o Collective Action Potential)
Critical of the State
Uncensored Posts (w/o Collective Action Potential)
Critical of the State

<table>
<thead>
<tr>
<th>State Critique</th>
<th>Collective Action</th>
</tr>
</thead>
<tbody>
<tr>
<td>yes</td>
<td>Free</td>
</tr>
<tr>
<td>no</td>
<td>CENSORED</td>
</tr>
<tr>
<td>yes</td>
<td>Free</td>
</tr>
<tr>
<td>no</td>
<td>CENSORED</td>
</tr>
</tbody>
</table>
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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</tr>
<tr>
<td>yes</td>
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</tr>
<tr>
<td>no</td>
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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.