Censorship’s Effect on Incidental Exposure to Information: Evidence From Wikipedia

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Abstract
The fast-growing body of research on internet censorship has examined the effects of censoring selective pieces of political information and the unintended consequences of censorship of entertainment. However, we know very little about the broader consequences of coarse censorship or censorship that affects a large array of information such as an entire website or search engine. In this study, we use China’s complete block of Chinese language Wikipedia (zh.wikipedia.org) on May 19, 2015, to disaggregate the effects of coarse censorship on proactive consumption of information—information users seek out—and on incidental consumption of information—information users are not actively seeking but consume when they happen to come across it. We quantify the effects of censorship of Wikipedia not only on proactive information consumption but also on opportunities for exploration and incidental consumption of information. We find that users from mainland China were much more likely to consume information on Wikipedia about politics and history incidentally rather than proactively, suggesting that the effects of censorship on incidental information access may be politically significant.

Keywords
censorship, Wikipedia, China, information consumption

Introduction
Wikipedia—a wiki-based website where users collaboratively modify content and structure—is one of the most widely viewed sites in the world. As of November 2018, Wikipedia had more than 49 million pages in nearly 300 languages. Although Wikipedia content is user generated and changes over time, studies have consistently shown Wikipedia to be an accurate source of a very wide variety of information.

In this article, we use China’s complete block of Chinese language Wikipedia (zh.wikipedia.org) on May 19, 2015, to understand how coarse censorship—censorship that is not selectively aimed at suppressing one specific type of content—influences the overall consumption of information. We distinguish between two ways in which people consume information—proactive consumption, when users know what information they want and actively seek it out, and incidental consumption, when users encounter and consume information they were not proactively seeking. We find that censorship not only affects information that users seek out proactively but also has dramatic effects on incidental consumption of information—in this case, information that Wikipedia users accessed through the homepage. Furthermore, we show that Wikipedia users from mainland China were more likely to encounter political and historical information incidentally rather than proactively. These results imply that coarse censorship can have long-range consequences by cutting off opportunities for exploration and by-chance encounters with information, and can suppress consumption of political information that people may not know they demand. These results join an emerging strand of research on the broader consequences of censorship (Chen & Yang, 2019; Roberts, 2018) that augments studies of the effects of selective censorship of political information (Edmond, 2013; Enikolopov et al., 2011; Kalathil & Boas, 2010; Lessig, 1999; MacKinnon, 2012; Morozov, 2011; Pierskalla & Hollenbach, 2013; Rød & Weidmann, 2015) and the unintended consequences of entertainment-related censorship (Hobbs & Roberts, 2018; Zuckerman, 2015).

We construct a timeline of page views for each of 372,208 pages on Chinese language Wikipedia that allows us to...
approximate the total number of page views for each page accessed through proactive consumption and the number accessed through incidental consumption through the Wikipedia homepage. Although our data do not allow us to differentiate directly between mainland and nonmainland consumption of information, we use the sudden nature of the Wikipedia block to estimate the number of proactive and incidental page views originating from mainland China as opposed to other locations around the world. Using automated methods to analyze the content of these Chinese Wikipedia pages, we find that exploration on Wikipedia via the homepage inspired mainland users to incidentally consume a broad array of information, particularly about the cultures, histories, and politics of countries beyond China. In contrast, proactive consumption of information on Chinese Wikipedia brought mainland users largely to entertainment and scientific pages.

The next section describes the background of China’s block of Wikipedia and the impact of the block on overall page views. In the section “Homepage Effects on Page Views,” we describe the impact of the homepage on page views. Then, we describe how we decompose views of an individual page into proactive views and views that were generated incidentally by the homepage as opposed to other locations around the world. Using automated methods to analyze the content of these Chinese Wikipedia pages, we find that exploration on Wikipedia via the homepage inspired mainland users to incidentally consume a broad array of information, particularly about the cultures, histories, and politics of countries beyond China. In contrast, proactive consumption of information on Chinese Wikipedia brought mainland users largely to entertainment and scientific pages.

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Overall Impact of Wikipedia Censorship in China

Chinese language Wikipedia was launched in 2001. Although media in China is tightly controlled (Shirk, 2011; Stockmann, 2012), Chinese language Wikipedia pages were largely available in mainland China until May 2015. From 2004 to 2008, China occasionally blocked all access to Chinese language Wikipedia with the Great Firewall. During these blackouts, which ranged from a few days to a few months, it was not possible to access Wikipedia from mainland China IP addresses. After 2008, Wikipedia pages with politically sensitive content—such as pages related to the 1989 Tiananmen Square protests, political activists, or controversial historical events—were selectively blocked. The majority of Chinese language Wikipedia pages remained accessible to users from mainland China, including the preponderance of political and historical information.

In 2011, Wikipedia added support for Hyper Text Transfer Protocol Secure (HTTPS), which allows data to be transferred with encryption. HTTPS prevents internet service providers (ISPs) and governments that control ISPs from seeing what specific page users are visiting in any particular web domain. This prevented the Chinese government from selectively blocking particular Wikipedia pages for users who were using the HTTPS version. In response, China began blocking access to the HTTPS version of Chinese Wikipedia in 2013 while allowing the unencrypted Hyper Text Transfer Protocol (HTTP) version to remain available. Because the HTTP version was not encrypted, the government could see what pages were being visited and continue to selectively block the pages they deemed objectionable.

In 2015, Wikipedia made encryption mandatory by redirecting all HTTP requests to the corresponding HTTPS addresses. As a result, Chinese authorities could no longer determine what pages users were viewing and could no longer selectively block pages. On May 19, 2015, China began a wholesale block of Chinese language Wikipedia that continues as of the end of 2018.

News reports mention only that the block occurred on May 19, 2015, but hourly page view data made available by the Wikimedia Analytics team clearly show that the block occurred sometime within the hour of 3:00 p.m. China time on May 19. Figure 1 shows views of Chinese Wikipedia by hour from May 16 through May 21. Between May 16 and May 18, we see the usual daily pattern in Chinese language Wikipedia views, which drops during the early hours of the morning (between 1 a.m. and 5 a.m. China time) and then rises during the day and evening. This pattern is interrupted midday—between 3 p.m. and 4 p.m. China time—on May 19, when page views experience a sudden decrease and continue at a much lower rate through the end of May.

The page views of Chinese language Wikipedia pages that remain after the block represent page views generated by Chinese speakers in areas not affected by China’s Great Firewall, such as Hong Kong and Taiwan. Although some page views of Chinese language Wikipedia after the block may originate from mainland Chinese users who “jump” the Great Firewall by using a Virtual Private Network (VPN), this number is likely small for two reasons. First, there are...
few VPN users in mainland China (Chen & Yang, 2019; Roberts, 2018), and second, the Wikipedia block did not (unlike China’s block of Instagram) lead to an increase in VPN downloads or installations in mainland China (Roberts, 2018).

The Wikipedia block had an enormous impact on the number of page views, indicating that the block significantly affected the number of people from mainland China reading material on Chinese language Wikipedia. There were 664,694 page views of Chinese language Wikipedia pages between 2 p.m. and 3 p.m. on May 19, directly before the block. In comparison, there were 421,663 total page views between 4 p.m. and 5 p.m. on May 19, resulting in a decrease of 243,031 page views between these two hourly segments. These numbers suggest that around 35% of the Chinese language Wikipedia page views before the block originated from mainland China. The block decreased views of Chinese language Wikipedia originating from mainland China on the order of 3 million page views per day. If this same trend had continued through the end of 2018, that would mean it has decreased page views cumulatively in the order of 3 billion page views.

**Homepage Effects on Page Views**

We can use the sudden nature of the block of Wikipedia from mainland China to better understand the content that mainland China users were viewing on Wikipedia and how they arrived at this content. Because the full block of Wikipedia was motivated by a technological change to the platform of Wikipedia rather than by any particular event, we expect that users were using Chinese language Wikipedia as they normally would on the day of the block. Thus, the full block of Wikipedia on May 19, 2015, provides us with a unique opportunity to estimate how mainland Chinese users were consuming information and, by extension, evaluate the impact of this coarse censorship on information consumption.

To do this, we focused our analysis on a subset of 372,208 pages that were viewed on at least 2 days in the 2 p.m. to 3 p.m. hour the week prior to the block. We do this to exclude many pages in the Wikipedia data set that are blank pages, which are likely to be viewed less than twice in the week before the block.11 For a preliminary, cursory idea of the pages that mainland viewers were looking at most on May 19, 2015, we generate a list of the pages most affected in terms of total page views by the block. We computed the per page difference between page views in the hour before the block (2–3 p.m. on May 19) and after the block (4–5 p.m. on May 19) and selected the 100 pages with the largest page view decreases. Although the top pages only provide a partial picture of the Wikipedia content affected by the block, the 100 pages (0.026% of all pages) that lost the most views account for more than 10% of the total page view loss, or a loss of almost 30,000 views over the hour. A table of these pages is provided in the appendix (Figure A1).

At first glance, many of the pages most affected by the block are surprisingly unrelated to ongoing events and not facts that we would have expected to be of widespread interest during this time period to anyone in mainland China. For example, the page for “Susan B Anthony” lost 139 views between the hours of 3 p.m. and 5 p.m., and was the 47th most affected page in the data set. “Ghost marriage” a traditional custom lost 196 views, the 25th most affected page in the data set. However, the common feature of many of the pages most affected by the block is that they were all pages shown to users through the Chinese Wikipedia homepage on May 19, 2015. The Wikipedia homepage features a collection of highlighted articles, related to events that happened on the same date in history, random facts in a “did you know?” section, people and places that are in the news, and sets of images.12

In total, 65 out of the 100 most affected pages by the block were linked from the homepage—11 pages were linked directly to the homepage, 26 were linked to links from the homepage, and 28 were links of links from the homepage, suggesting that exploration of Wikipedia content through the homepage was an important source of page views from mainland China and that censorship had an important impact on incidental consumption of information in mainland China.

To systematically estimate the impact of the homepage on mainland views on Wikipedia, we document all pages in our data set that were linked to the homepage on May 19. Unfortunately, we cannot recover the complete content of Wikipedia homepages and other browsing-related pages because their main content is not user generated (user edits only apply to the formatting of these pages). However, some of the sections of the home page are archived in other Wikipedia pages, allowing us to recreate almost all of the May 19 homepage of Chinese Wikipedia. Specifically, Chinese Wikipedia has a “Good Entries” archive (Wikipedia: 優良條目/2015年5月) that lists featured articles by day from March 1, 2012, onward, as well as a “Special Entries” archives (Wikipedia: 特色條目/2015年5月) that does something similar. Wikipedia maintains a list of events that happened “on this day” in history that are then used on the homepage, Wikipedia:历史上的今天/5月, as well as an archive of facts of newly created Wikipedia pages from the “Did you know section”: Wikipedia:新条目推荐/2015年5月.

In addition to identifying links of articles from the Wikipedia homepage, we collect secondary and tertiary links to the homepage. Given that the Wikipedia homepage was associated with large declines in page views, we should expect that links to the links included in the Wikipedia homepage and links of the links in the Wikipedia homepage may also have been disproportionately affected by censorship. If mainland users were finding content to consume on Wikipedia through the homepage, then they may follow links within those linked pages. Therefore, in addition to documenting pages that were linked to the homepage, we
no links from homepage −0.29 45
links of links of links −0.58 115,353
links from homepage −45.07 45
over time only beginning in July 2015.14 For the month of
likely type of agent—user, spider, bot—accessing each page
mented above.
Each linked page, which could explain the patterns we docu-
the Chinese Wikipedia homepage each day and then go to
vided above.
we find these statistics in Table 1. We find that the average loss
in page views is largest for pages linked to the homepage,
second largest for those linked to links on the homepage, and
third largest for those linked to links. For pages without a
link from the homepage, the average decrease in page views
is smallest. Overall, pages that are directly or indirectly
linked to the homepage account for 51% of the decrease in
page views, suggesting that a significant portion of page
views of Wikipedia originating from mainland China could
have been driven by the homepage.

Could These Effects Be Due to Crawlers?

In using page view data, one may be concerned that page
views are generated by random crawlers rather than real indi-

cally viewed as a result of the homepage. It could be that some
of these pages were popular in mainland China independent
of their appearance of the homepage. In this section, we use
the time series of each page linked to the homepage to esti-
mate the extent to which the decrease in page views for each
page was driven by its appearance on the homepage—which
we call incidental page views—versus the page’s popularity
outside of its appearance on the home page—which we will
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We use the example of the Chinese language page for the
US$1 coin (1 美元硬币) as an illustrative example of how we
can estimate which views were generated by the homepage
and which views reflect the popularity of the page outside of
the homepage. Overall, the US$1 coin was not a very popu-
lar page on May 18, with total page views hovering around
10 per hour the day before it was featured on the homepage.
However, on May 19, the page was featured on the homepage
and was viewed a whole lot more—150 times in the 2 to 3
p.m. hour before the block. Assuming that nothing else
changed except its placement on the homepage, the differ-
ce between the hourly page views per page i on May 19 in
the 2 to 3 p.m. hour (\(V_{i,2p.m.,5/19}\)) and May 18 in the 2 to 3 p.m.
hour (\(V_{i,2p.m.,5/18}\)) is an estimate of the total increase in page
views for the US$1 coin page because of the homepage—
page views driven by incidental consumption—for the 2 to 3
p.m. hour (\(V_{i, incidental}\)), as shown in Equation 1. (Note: Because
views cannot be negative, we take the maximum of this dif-
ference and zero.)

\[
V_{i, incidental} = \max (V_{i,2p.m.,5/19} - V_{i,2p.m.,5/18}, 0) \tag{1}
\]
Finally, we can estimate total proactive consumption from linked directly or indirectly to the homepage. To ensure that we complete the decomposition, we do not allow the estimated number of incidental consumption from mainland China to exceed our estimate of total mainland consumption. We impose the restriction

\[
V_{i,\text{ incidental, } m'} = \min(V_{i,\text{ total, } m}, V_{i,\text{ incidental, } m})
\]

(5)

Finally, we can estimate total proactive consumption from mainland China \(V_{i,\text{ proactive, } m'}\) by subtracting incidental mainland consumption \(V_{i,\text{ incidental, } m'}\) from total mainland consumption \(V_{i,\text{ total, } m}\).

\[
V_{i,\text{ proactive, } m'} = V_{i,\text{ total, } m} - V_{i,\text{ incidental, } m'}
\]

(6)

Altogether, we can roughly estimate the total page views of each page coming from mainland China, as well as decompose views of each page into page views generated by the homepage (incidental consumption) versus page views that were accessed through other means (proactive consumption). We acknowledge that what we count as proactive consumption may also include incidental consumption, through means outside the homepage. For example, it is possible for someone to arrive at a Wikipedia page because they were reading a blog post that linked to that same Wikipedia page. Because our results are focused on incidental consumption, this bias in the data is more likely to work against us.\(^{15}\)

From this decomposition, we estimate that approximately 42% of the loss in page views due to the block were page views based on incidental consumption—views above and beyond what the page generally received on the day it was linked to the homepage. This indicates that although censorship may have an impact on limiting the information users were proactively looking for, its impact on incidental consumption of information was also very important, accounting for almost half of total page views.

**Topical Differences in Proactive Versus Incidental Consumption**

We now turn to the question of the types of content mainland viewers were seeking out proactively, in comparison with the types of content that mainland viewers were consuming incidentally because of what was featured on the homepage. We find that although on average mainland viewers proactively sought out information about entertainment and scientific facts, the Wikipedia homepage facilitated page views of political and historical information as well as information about other countries and cultures.

To identify the topics that mainland users were proactively consuming versus those they were incidentally consuming, we use a topic model to describe the topics of the pages that were being viewed before and after the block and to estimate which topics were most associated with incidental versus proactive page views. The idea behind statistical topic models is that they can inductively identify clusters of words, or “topics,” within the text that are commonly used together (Blei et al., 2003; Blei and Lafferty, 2006; Grimmer, 2010; Quinn et al., 2010). Each document is then made up of a combination of topics. Thus, the two main outputs of the model are the words likely to appear in each topic (topical content) and the amount each topic appears in each document (topical prevalence).

Using a topic model to describe the content of the pages that were viewed before and after the block allows us to group the pages into topics or themes that were most affected by the block.\(^{16}\) Using the entire text of each Wikipedia page as an input to the topic model would give us a very different amount of text per page. Instead, we used the Wikipedia API for
to extract the summary information for the pages in our data set. The summary information for each Wikipedia page is the first paragraph of the page and exists for the majority of content pages. The summary information is ideal for our setting because it is relatively consistent in length across pages and typically contains the key information about the content of the page.

We queried the API for all pages within our data set that were viewed in the hour directly before or after the May 19 block. We excluded any pages that did not have any content or were too short to contain summary information. We also excluded pages that were not viewed in the hour before or hour after the block. In total, our analysis contains 158,611 summaries. We used the structural topic model (STM) to describe the topics of these summaries (Roberts et al., 2014). We used an automated method to select the number of topics (Lee & Mimno, 2014). In total, our model identified 78 total topics across the 158,611 pages, which we labeled after reading the highest probability words within the topic and example documents from each topic.

The topic model describes the kinds of pages that mainland Chinese readers of Wikipedia were viewing before versus after the block. Because the list of topics is extensive, we refer the reader to the appendix for full details on the topics (Table A1), where we report the highest probability words, estimated total page views originating from mainland China per hour, and the proportion of the page views for each topic from browsing. The 78 topics are mostly organized around substantive and entertainment-related content, outside of two general word topics, and one topic about Wikipedia entries. Sixteen topics are mainly related to entertainment, including television, celebrities, music, sports, novels, video games, and pornography. The remaining 50 topics are substantive topics unrelated to entertainment—for example, European history, computer systems, Qing and Ming dynasty history, and business and the stock market. In the appendix, we also report the estimated total page views per hour from mainland China \( V_{\text{total,m}} \). Outside of general word topics, the most popular topics in mainland China include many topics about history and politics, including the Chinese Communist Party, democracy, region statistics, and the government and legal system in China.

But were the most popular topics viewed by mainland users of Wikipedia sought out proactively or happened upon incidentally? For each page \( i = 1, \ldots, N \), the topic model outputs the proportion of the summary in each of the 78 topics, \( \theta \). To measure, on average, how many page views in each topic were generated from incidental consumption, we multiply the topic proportions for each page \( \theta \) by the estimated incidental page views from the mainland for that page \( V_{i,\text{incidental,m}} \). We do the same for proactive page views, multiplying the topic proportions for each page \( \theta \) by the estimated proactive page views from the mainland for that page \( V_{i,\text{proactive,m}} \). We then take the mean of all proactive and incidental page views weighted by topic to estimate the proportion of incidental page views in each topic:

\[
\bar{T}^{\text{incidental}} = \frac{\sum_{i=1}^{N} \theta_i \times V_{i,\text{incidental,m}}}{\sum_{i=1}^{N} V_{i,\text{incidental,m}}}
\]

and the proportion of proactive page views in each topic:

\[
\bar{T}^{\text{proactive}} = \frac{\sum_{i=1}^{N} \theta_i \times V_{i,\text{proactive,m}}}{\sum_{i=1}^{N} V_{i,\text{proactive,m}}}
\]

We take the difference \( \bar{T}^{\text{incidental}} - \bar{T}^{\text{proactive}} \) to describe which topics are disproportionately viewed incidentally versus proactively. Figure 2 shows the topics most associated with proactive page views, and Figure 3 shows the topics most associated with incidental page views. Overall, we find that proactive page views were disproportionately driven by entertainment, including information about Japanese celebrities, animated movies, music, and sports. Incidental page views, however, were disproportionately focused on pages that talked about politics and history, ranging from the histories of countries around the world to the politics and geography of other countries.

Our analysis suggests that views of pages discussing political and historical topics in mainland China were driven largely by incidental consumption, likely facilitated by the fact that the Wikipedia homepage includes many links to political and historical topics. This evidence suggests that users became interested in political and historical information when they happened upon it on Wikipedia, even when they did not seek this information out directly.

This has several important implications. First, political information might be disproportionately affected by censorship that affects exploration and happenstance encounters with information, and coarse censorship of a broad website such as Wikipedia has political implications above and beyond what users actively seek out on the internet. Much of the demand for political information may be endogenous, facilitated by the platform, rather than sought out by the user. This points to the importance of general exploratory platforms that point users to new topics.

Second, this could mean that users could do little to compensate for the political and historical content censored by the Wikipedia block. It is straightforward for users to seek out information that they queried proactively on Wikipedia on other websites. However, users would not know what information they would have arrived at on Chinese language Wikipedia incidentally, and as a result this information would be very difficult to seek out from other websites without Wikipedia. Even when there are substitutes (in this case, the website Baidu Baike in China), the value added of sites with exploratory pages goes above and beyond specific information users seek out.
Conclusion

In this article, we use China’s complete block of Chinese language Wikipedia on May 19, 2015, to examine the impact of coarse censorship. We disaggregate proactive consumption from incidental consumption of information on Wikipedia, and we find that coarse censorship affects consumption of information by cutting off opportunities for exploration and incidental consumption of information. This decrease is important because users were much more likely to consume information about politics and history incidentally rather than proactively. Proactive consumption of information focused on entertainment topics, as well as scientific topics. We speculate that the proactive consumption of scientific information may be related to either students needing specific information for assignments and projects or working professionals needing specific information for their jobs.

These results have implications for how censorship can limit the creation of an informed and critical public. People do not know what they do not know, and cannot demand or search for information they are unaware of. Coarse censorship impeding access to platforms that facilitate incidental consumption of information limits the public’s ability to encounter previously unknown information. Given internet users’ impatience on the web and unwillingness to overcome the costs of censorship to seek out information (Chen & Yang, 2019; Roberts, 2018), greater impediments to exploration may endogenously decrease a proactive demand for certain types of information because users are less likely to come across a greater variety of information incidentally.
**Appendix**

| Page Name                      | Direct Link to Homepage | Indirect Link to Homepage | Page View Decrease |
|-------------------------------|-------------------------|---------------------------|--------------------|
| 虚拟化                        | 0                       | 0                         | -376               |
| 英语                          | 0                       | 0                         | -342               |
| Wikipedia:可供查证            | 0                       | 1                         | -332               |
| Wikipedia:关于                | 0                       | 0                         | -312               |
| Special:页面分类              | 0                       | 0                         | -298               |
| Portal:新闻动态              | 0                       | 1                         | -291               |
| Wikipedia:特色条目            | 0                       | 1                         | -260               |
| Wikipedia:列明来源            | 0                       | 1                         | -257               |
| 河北省地区生产总值           | 0                       | 1                         | -247               |
| Special:最近更改             | 0                       | 0                         | -242               |
| 草榴社区                     | 0                       | 0                         | -238               |
| 周迪                         | 1                       | 0                         | -237               |
| AV女优列表                   | 0                       | 0                         | -235               |
| 碳酸钙                       | 0                       | 1                         | -232               |
| 美国                          | 0                       | 1                         | -218               |
| Help:目录                     | 0                       | 1                         | -212               |
| Wikipedia:可靠来源            | 0                       | 1                         | -209               |
| Wikipedia:社群首页            | 0                       | 0                         | -207               |
| File:Tango-nosources.svg      | 0                       | 0                         | -205               |
| Wikipedia:方针与指引          | 0                       | 1                         | -203               |
| Wikipedia:互助客栈            | 0                       | 1                         | -199               |
| Wikipedia:IRC聊天频道/IRC     | 0                       | 0                         | -188               |
| Wikipedia:知识问答            | 0                       | 0                         | -188               |
| 国际饭店                      | 1                       | 0                         | -183               |
| Running\_Man                 | 0                       | 0                         | -178               |
| Wikipedia:联络我们            | 0                       | 0                         | -177               |
| Wikipedia:字词转换            | 0                       | 0                         | -176               |
| 5月19日                       | 0                       | 1                         | -170               |
| 台湾                          | 0                       | 1                         | -169               |

(continued)
| Page Name                  | Direct Link to Homepage | Indirect Link to Homepage | Page View Decrease |
|---------------------------|-------------------------|----------------------------|--------------------|
| 中国                      | 1                       | 0                          | -156               |
| 细川尚春                 | 1                       | 0                          | -152               |
| 克里斯蒂安·斯特赖希     | 1                       | 0                          | -148               |
| Special:Search            | 0                       | 0                          | -145               |
| 陈用彩                    | 0                       | 0                          | -144               |
| Wikipedia:上传             | 0                       | 0                          | -141               |
| 苏珊·安东尼银元         | 0                       | 1                          | -139               |
| 1美元硬币                 | 1                       | 0                          | -138               |
| 游说集团                 | 1                       | 0                          | -138               |
| Special:特殊页面          | 0                       | 0                          | -137               |
| Special:统计              | 0                       | 0                          | -137               |
| 苏珊·安东尼             | 1                       | 0                          | -137               |
| Wikipedia:欢迎             | 0                       | 0                          | -134               |
| 美国铸币局                | 1                       | 0                          | -133               |
| Wikipedia:特色条目/存档     | 0                       | 1                          | -132               |
| 德国足球年度最佳教练     | 1                       | 0                          | -132               |
| Wikipedia:什么是条目      | 0                       | 1                          | -131               |
| Wikipedia:新手入门/主页   | 0                       | 0                          | -131               |
| 新西兰                    | 0                       | 1                          | -131               |
| Wikipedia:沙盒             | 0                       | 0                          | -130               |
| Wikipedia:特色条目候选     | 0                       | 1                          | -130               |
| Wikipedia:VPA              | 0                       | 0                          | -129               |
| Portal:首页               | 0                       | 1                          | -128               |
| Wikipedia:联系我们/捐款    | 0                       | 0                          | -128               |
| 自由内容                  | 0                       | 1                          | -128               |
| 自由女神                  | 1                       | 0                          | -127               |
| Wikipedia:特色列表        | 0                       | 1                          | -126               |
| 香港                      | 0                       | 1                          | -124               |
| 计算机科学家             | 0                       | 0                          | -119               |
| 中华民国                  | 0                       | 1                          | -112               |
| 普林斯顿大学诺贝尔奖得主列表 | 0                  | 1                          | -111               |
| 香港博物馆列表           | 0                       | 1                          | -110               |
| 铃木一朗                  | 0                       | 1                          | -109               |
| 武娓娘传奇               | 0                       | 1                          | -106               |

(continued)
| Page Name                                      | Direct Link to Homepage | Indirect Link to Homepage | Page View Decrease |
|-----------------------------------------------|-------------------------|---------------------------|-------------------|
| 圣路易斯华盛顿大学诺贝尔奖得主列表             | 0                       | 1                         | -105              |
| 俄罗斯                                         | 0                       | 1                         | -101              |
| 英国                                           | 0                       | 1                         | -97               |
| 成县                                           | 0                       | 1                         | -95               |
| Template:Fact                                   | 0                       | 1                         | -92               |
| 奇怪的保姆                                     | 0                       | 0                         | -88               |
| 武则天                                         | 0                       | 1                         | -85               |
| Wikipedia:免责发布                               | 0                       | 0                         | -84               |
| Wikipedia:小作品                                 | 0                       | 1                         | -84               |
| 第二次世界大战                                 | 0                       | 1                         | -80               |
| 新加坡                                         | 0                       | 1                         | -79               |
| 爱·回家\_（电视剧）                           | 0                       | 0                         | -77               |
| 李承乾                                         | 0                       | 1                         | -74               |
| 法国                                           | 0                       | 1                         | -74               |
| 日语                                           | 0                       | 1                         | -73               |
| 未知艺术家                                     | 0                       | 0                         | -72               |
| 未知艺术家\_（artist）                         | 0                       | 0                         | -72               |
| 通用串行总线                                   | 0                       | 0                         | -71               |
| Special:最新页面                                 | 0                       | 0                         | -70               |
| 鸡奸                                           | 0                       | 1                         | -70               |
| 唐高宗                                         | 0                       | 1                         | -68               |
| Who\_Are\_You－学校2015                        | 0                       | 0                         | -67               |
| 习近平                                         | 0                       | 1                         | -67               |
| 日语假名                                       | 0                       | 1                         | -67               |
| 慕尼黑                                         | 0                       | 1                         | -66               |
| 中国大陆                                       | 0                       | 1                         | -64               |
| 3000安打俱乐部                                 | 0                       | 0                         | -63               |
| 中国人民解放军海军                             | 0                       | 1                         | -63               |
| 姚文智                                         | 0                       | 0                         | -63               |
| 平文式罗马字                                   | 0                       | 1                         | -63               |
| AV女优                                         | 0                       | 1                         | -62               |
| 金正恩                                         | 0                       | 1                         | -62               |

**Figure A1.** Pages most affected by censorship, May 19, 4 to 5 p.m. − May 19, 2 to 3 p.m.

*Note.* Direct link to homepage is whether or not the page was linked directly from the Wikipedia homepage on May 19. Indirect link to homepage is whether or not the page was linked to a link or linked to a link of a link from the Wikipedia homepage on May 19.
Table A1. Topics Estimated by Topic Model.

| Label                                | Translated highest probability words                                                                 | Estimated mainland views/hour | Estimated proportion browsing |
|--------------------------------------|------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------|
| Video games                          | Games, games, series, launch, player, platform, translation                                           | 1,744                        | .08                           |
| Animation and comics                 | Works, animation, publishing, comics, Japanese, girls, serial                                         | 2,943                        | .09                           |
| Japanese celebrities                | Born, female, born, real name, male, Japanese, av                                                    | 2,866                        | .10                           |
| TV shows                             | Show, TV, host, host, radio, wireless TV, production                                                  | 2,255                        | .10                           |
| TV series                            | Starring, TV series, airing, story, premiere, English                                                  | 2,655                        | .10                           |
| Movies                               | Movie, release, English, starring, director, film                                                    | 2,826                        | .11                           |
| Animated movies                     | Hero, animation, series, English, Disney, sci-fi, comics                                              | 1,321                        | .11                           |
| Korean pop                           | Korea, Korean, members, debut, combination, group                                                    | 3,392                        | .12                           |
| Chinese TV shows                    | Broadcast, play, TV, show, TV station, first                                                          | 1,798                        | .12                           |
| Wikipedia entries                   | Utc, entry, article, wiki, Wikipedia, hope, message                                                    | 2,839                        | .13                           |
| Chinese novels                      | Series, character, story, protagonist, novel, appearance                                               | 2,336                        | .13                           |
| Software programs                   | Software, programs, systems, design, files, languages, users                                          | 2,072                        | .13                           |
| Computer systems                    | System, program, technology, computer, windows, can, function                                        | 2,792                        | .14                           |
| Music                               | Music, singer, song, album, record, release, popular                                                  | 3,103                        | .15                           |
| Actors and actresses                | Actor, performance, movie, best, protagonist, play, nomination                                       | 2,989                        | .16                           |
| Information technology              | System, information, technology, data, network, standard, computer                                   | 2,278                        | .19                           |
| Hong Kong actors and actresses      | Hong Kong, English, special, age, miss, executive                                                    | 2,943                        | .19                           |
| Math                                | Display style, function, representation, can, equation, space, math                                  | 2,250                        | .20                           |
| Weapons                             | Weapon, tank, millimeter, pacific, design, production, launch                                        | 1,486                        | .20                           |
| Japan                               | Japan, Japanese, Tokyo, Meiji, one, Hokkaido                                                          | 3,194                        | .21                           |
| Music, movie, and TV awards         | Film, actor, get, music, album, release, director                                                    | 2,612                        | .21                           |
| Business and stock market           | Company, limited, group, shares, established, affiliated, listed                                      | 2,668                        | .22                           |
| Diseases                            | Disease, possible, patient, infection, virus, cause, symptoms                                         | 2,700                        | .23                           |
| Animals                             | Animals, creatures, discoveries, oceans, scientific names, them, species                             | 2,258                        | .24                           |
| Consumer products                   | Brand, product, market, industry, technology, automotive, global                                     | 1,778                        | .24                           |
| U.S. and U.K.                       | America, English, UK, first, age, one, become                                                        | 2,614                        | .24                           |
| Soccer                              | Football, champion, Spain, professional, team, effective, Brazilian                                  | 3,008                        | .24                           |
| Biology                             | Biology, cells, genes, proteins, effects, food                                                        | 1,937                        | .24                           |
| Locations in Hong Kong and Macau    | Located, Macau, architecture, Hong Kong, center, park, hotel                                         | 2,151                        | .25                           |
| Transportation                      | Station, highway, road, system, located, railway, km                                                  | 1,639                        | .26                           |
| Logic                               | Different, can, usually, generally, called, for example, therefore                                   | 7,260                        | .27                           |
| Aviation                            | Aviation, airport, airplane, airborne, built, code                                                   | 2,142                        | .27                           |
| Categories                          | Including, other, part, of which, all, and, in addition to                                             | 3,183                        | .27                           |
| Taiwan                              | Taiwan, Republic of China, Taipei, North City, located in Kaohsiung City                             | 2,966                        | .27                           |

(continued)
| Label                               | Translated highest probability words                                                                 | Estimated mainland views/hour | Estimated proportion browsing |
|------------------------------------|------------------------------------------------------------------------------------------------------|------------------------------|-------------------------------|
| Physics                            | Physics, particle, theory, energy, action, can, direction                                            | 2,046                        | .27                           |
| Public transit                     | Service, public, offer, bus, traffic, tunnel, route                                                 | 915                          | .28                           |
| Written languages                  | Use, English, representation, letters, text, Chinese, representative                                 | 2,624                        | .28                           |
| General words                      | Mainly, one, taken from, currently, initially, to date, named                                        | 387                          | .28                           |
| General words II                   | Yes, different, called, this, due, some, because                                                    | 5,661                        | .28                           |
| Chemistry                          | Reaction, material, chemistry, element, molecule, compound, atom                                    | 2,735                        | .28                           |
| U.S., U.K., Australia, Canada      | United States, English, United Kingdom, Canada, Royal, Australia, London                              | 2,604                        | .29                           |
| Tragic events and crimes           | Event, occurrence, court, death, cause, police, crime                                               | 2,303                        | .29                           |
| Plants                             | Plant, scientific name, animal, distribution, species, region, forest                                | 2,388                        | .29                           |
| Military                           | Navy, liberation army, troops, missiles, military, army, combat                                     | 2,101                        | .29                           |
| Space and astronomy                | Earth, planet, space, universe, rocket, galaxy, star                                                 | 1,520                        | .30                           |
| Country statistics and domain names| World, country, Europe, international, Singapore, region, global                                    | 2,903                        | .30                           |
| Banks                              | Group, corporate, international, service, market, product, bank                                     | 2,204                        | .30                           |
| Taiwan politics                    | Republic of China, politics, figures, middle school, current, member, born in                       | 2,656                        | .31                           |
| Culture and society                | Culture, history, development, influence, modern, society, tradition                               | 3,310                        | .31                           |
| Dialects                           | India, nationality, language, pinyin, official, dialect                                             | 2,554                        | .32                           |
| Research                           | Research, science, theory, method, field, analysis, presentation                                   | 2,150                        | .32                           |
| Labor and the economy              | Bank, management, work, government, institution, economy, business                                  | 2,495                        | .33                           |
| English novels                     | Famous, works, writer, novel, one, character, art                                                   | 2,870                        | .33                           |
| Education and university           | Education, university, school, college, ranking, research, Sweden                                  | 1,788                        | .33                           |
| History of the military            | ——, war, second, first, military, battle, troops                                                   | 2,775                        | .33                           |
| International sports               | Football, NBA, championship, league, club, match, athlete                                          | 2,200                        | .34                           |
| East Asia                          | China, Vietnam, North Korea, one, region, ancient                                                  | 2,041                        | .34                           |
| Organization of societies          | Society, ism, sports, activity, believes, organization, law                                        | 2,461                        | .34                           |
| Materials                          | Use, can, cause, speed, increase, glass, form                                                       | 2,051                        | .34                           |
| Regions statistics                 | City, located, population, region, capital, center, place                                           | 3,998                        | .35                           |
| Ancient history                    | Century, history, period, Egypt, times, BC, ancient                                                | 2,617                        | .36                           |
| Religion                           | Religion, Buddhism, Christianity, Faith, Catholicism, One, Christ                                 | 2,373                        | .36                           |
| European history                   | Italy, dynasty, empire, king, monarch, Rome, German                                               | 2,352                        | .38                           |
| China scenic areas                  | China, Beijing, Shanghai, Zhejiang, Scenic Area, Taiwan                                            | 3,199                        | .38                           |
| Democracy                          | Government, politics, freedom, democracy, policy, institution, revolution                           | 3,623                        | .38                           |
| Highways and high speed railway    | Railway, high speed, kilometers, traffic, highway, train, subway                                 | 1,862                        | .39                           |
| Japanese history                   | Age, period, emperor, after, later, father, son                                                     | 3,293                        | .39                           |

(continued)
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Notes

1. Based on Alexa top sites rankings, Wikipedia has consistently ranking among the top 10 most trafficked websites globally over the past decade (https://www.alexa.com/topsites).
2. See https://stats.wikimedia.org/EN/TablesWikipediaZZ.htm
3. For example, a 2005 study in Nature found Wikipedia content to be almost as reliable as that of Encyclopedia Britannica (Giles, 2005), and a 2014 study in PLOS ONE found that Wikipedia content related to pharmacology was 99.7% accurate compared with a pharmacology textbook, and more than 80% complete (Kräenbring et al., 2014).
4. The Great Firewall of China blocks foreign websites from Chinese IP addresses, including a wide range of websites and social media sites (for a list of blocked websites, see Great Fire.org).
5. See https://en.greatfire.org/search/wikipedia-pages, for blocked Wikipedia sites.
6. See Welinder et al. (2015) and Oberhaus (2017).
7. Smith (2017); “Censorship of Wikipedia,” Wikipedia. https://bit.ly/2QGQEwp.
8. See https://dumps.wikimedia.org/other/pagecounts-raw/
9. See Roberts (2018) for plots of total daily page views during this week.
10. Detailed information on the geolocation of users is frequently collected by for-profit internet companies that can monetize these types of data. However, Wikipedia is hosted by the Wikimedia Foundation, a U.S.-based nonprofit organization that does not sell user information. Based on our conversations with the Wikimedia Foundation, historical data on page views by geography for the regions we are interested in studying are not available.
11. We also merge together simplified and traditional pages because they redirect to one another. This is the subset of pages that we use for all of our remaining analyses.
12. The homepage is not the only page that provides these curated sets of links. Other such pages include topical and temporal indexes.
13. For links of links of links from the homepage, we only used links of those links of links that were viewed during this time period to count only page views that were possibly generated initially from the homepage.
14. See https://wikimedia.org/api/rest_v1/
15. Another limitation of our method is that we cannot adjust for hourly differences between 2 to 3 p.m. and 4 to 5 p.m. We assume that the types of pages viewed between these 2 hr are not systematically different.
16. An alternative way of approaching this would be to use Wikipedia categories instead of topics. However, Wikipedia categories themselves number in the tens of thousands and are

| Label | Translated highest probability words | Estimated mainland views/hour | Estimated proportion browsing |
|-------|-------------------------------------|------------------------------|-----------------------------|
| French geography | Population, French, French, area, square kilometers, Paris, de | 2,488 | .39 |
| Economic development | Economy, development, country, production, region, trade, world | 2,567 | .39 |
| Soviet history | State, federation, Russia, Soviet, president, organization, government | 2,986 | .40 |
| Government and legal system of China | People, China, Republic, government, administration, Republic of China | 3,106 | .40 |
| World military history | War, Germany, period, end, start, happen, become | 3,065 | .41 |
| Education, professors, and students | University, college, school, student, engineering, education, professor | 1,816 | .41 |
| Ming and Qing dynasty history | Qing Dynasty, Ming Dynasty, Mongolia, Emperor, thirteen, minister, Qing Dynasty | 2,875 | .42 |
| Chinese Communist Party | Central, CCP, committee, Communist Party, representative, chairman | 2,718 | .42 |
| Geography | Located, area, kilometers, area, north, south, square kilometers | 3,209 | .43 |
| Tang Dynasty history | Emperor, incumbent, Tang Dynasty, Queen, Princess, period, monarch | 4,881 | .48 |
| International heritage and cultural sites | City, center, architecture, located, culture, history, one | 3,017 | .48 |

Note. NBA = National Basketball Association.
organized in a tree structure. The topic model has the advantage of obtaining clusters specific to the data at hand, which may not be reflected in the Wikipedia categories.

17. We used the Python package Wikipedia-API to do this.

18. For a different metric, we also report the estimated proportion of page views due to browsing by topic in the appendix.

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