

# Less than 4% of Archived Instagram Account Pages for the Disinformation Dozen are Replayable

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## ABSTRACT

We examined the archived Instagram account pages of the “Disinformation Dozen”, a group of anti-vaccine conspiracy theorists, along with account pages of a set of health authorities. In the Internet Archive, we found that a majority of the archived web pages, or mementos, are actually redirections to the Instagram login page, and of the remaining replayable mementos, many are missing post images. In our combined dataset, over 83% of the archived account pages redirected to the Instagram login page, due to Instagram’s treatment of access by non-logged in users. For the Disinformation Dozen, 96.13% of their account page mementos redirect to the login page, and only 27.16% of the remaining replayable mementos contain every post image that was requested. Combined, these results reveal that merely 1.05% of mementos for the Disinformation Dozen account pages are replayable with complete post images. Furthermore, we found that the percentage of replayable mementos is decreasing over time, with a particular lack of replayable mementos for the years 2021 and 2022.

## CCS CONCEPTS

• **Information systems** → *Social networks*; **Digital libraries and archives**.

## KEYWORDS

social media, web archiving, Instagram, disinformation

## 1 INTRODUCTION

With over 2 billion monthly active users [22], Instagram is an attractive target for those who would spread disinformation. Disinformation is present on other social media platforms like Twitter and Facebook, but comparatively, it is both overlooked and understudied on Instagram. For example, the Internet Research Agency, a Russian group that attempted to influence American political discourse about the 2016 election with divisive social media campaigns, utilized all three platforms in their efforts. However, when the scandal went before the US Senate, only Twitter and Facebook were thoroughly discussed, even though the Instagram disinformation received more engagements than the Facebook and Twitter engagements combined [9].

Multiple factors play a role as to why Instagram is understudied. Instagram’s APIs [15, 16] are geared towards providing businesses

and creators insight into their own accounts, rather than allowing researchers to study others’ posts. This is in contrast to Twitter’s previously [24] open Developer API [25]. The nature of sharing on Instagram is also different than on other platforms. Instagram has no “retweet” or “share” analog, which changes the nature of how things “go viral”. Analyzing these retweet (Twitter) and share (Facebook) networks is a standard way that researchers study disinformation propagation networks [20, 21, 23], but this does not exist in Instagram. Instead, spread of information is largely controlled by the Instagram feed, which is tailored to an individual based on who they follow [7].

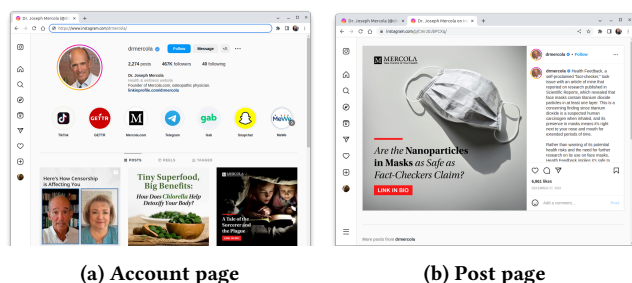
Due to the nature of the malicious content, many posts spreading disinformation are caught by fact-checking software and deleted. Similarly, accounts dedicated to disinformation are banned once they violate guidelines repeatedly. For example, the Center for Countering Digital Hate (CCDH) released a report in 2021 [6] on a group of content creators known as the “Disinformation Dozen,” who were responsible for 65% of anti-vaxx content online, receiving substantial coverage in the news media [3, 11, 17, 19]. Since the release of the CCDH’s report, Instagram has taken measures to address the group, and 10 out of 12 of the disinformation actors have been banned from Instagram [1, 10, 18], meaning their posts are no longer available on the live web. This leaves web archives as the only source material for scholars seeking to study disinformation spread by banned users on Instagram.

In this study, we quantify how well these archived captures, known as mementos, represent the content that was posted by the Disinformation Dozen and compare that to mementos from nine accounts classified as health authorities by the CCDH [7]. We evaluate the quality of the available mementos, similar to evaluating a memento’s damage, as investigated in a study by Brunelle et al. [4]. We find that over 83% of the archived Instagram account pages cannot be successfully replayed, which inhibits the study of them.

## 2 BACKGROUND AND RELATED WORK

Instagram was launched in 2010, and like other social networking platforms, it offers features including photo and video sharing, user account following, and interaction with other users’ content (likes and comments). Instagram has a site-specific URL structure. Figure 1a shows an example of an account page on Instagram with the URL structure <https://www.instagram.com/drmercola/> where drmercola is the account username of Joseph Mercola, one of the

Disinformation Dozen. Instagram posts are the photos or videos that a user chooses to share. These posts will make up the account page of the user, and each post will have its own URL. For example, Figure 1b shows a post by @drmercola with the URL structure <https://www.instagram.com/p/CmrJDJbPCXq/>. As can be seen, the individual post URL provides no information regarding the user account. To study the posts of the Disinformation Dozen in web archives first requires us to investigate the users' account pages.



**Figure 1: Instagram Account Page Showing Post Images and Individual Post Page for @drmercola**

Disinformation researchers are aware of the dissemination of false and misleading claims on Instagram, however banned accounts have been difficult to study. In one example, Baker et al. [2] intended to look into the strategies employed by the Disinformation Dozen to persuade mothers to join the anti-vaccine movement. However, as of July 2021 five of the Disinformation Dozen accounts had been suspended, so the authors were only able to examine the content of the remaining accounts. This points to the need for web archives to preserve this type of social media content for later analysis.

Many web archives support the Memento Protocol [26], which provides HTTP Content Negotiation in the time domain. In Memento terminology, a URI-R identifies an “original resource,” and a web archive’s capture of a URI-R at a specific time (Memento-Datetime) is a *memento*, which is identified by a URI-M. A TimeMap is a list of the URI-Ms of the original resource. Brunelle et al. [4, 5] established the idea “memento damage”, which provides a score for determining how well a webpage has been archived. A memento’s damage considers the importance of embedded resources that might be missing upon replay.

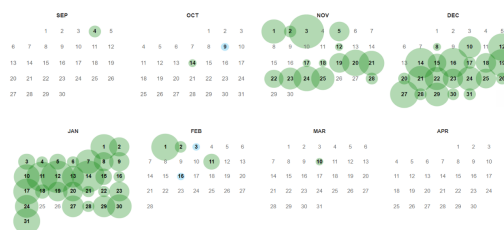
Anecdotally, web archivists have long known that Instagram is not well represented in web archives. One study [13] measured this phenomena by examining singer Katy Perry’s popular Instagram account. Jayanetti reported that only 32% of Perry’s individual posts were archived in public web archives. In this work, we use web archives to determine how many mementos are available for certain Instagram account pages – accounts that are far less popular than Katy Perry – and use the concept of memento damage to evaluate the quality of those account pages.

### 3 ANALYZING THE PERCENTAGE OF REPLAYABLE MEMENTOS

The first question to address is how many mementos are available for certain Instagram account pages. Because we want to highlight resources that are available for disinformation researchers to

study banned accounts, we use the Instagram account of Robert F. Kennedy, Jr. (@robertfkennedyjr), which was banned in February 2021 [8], as an example. This account has 598 Instagram account page mementos in the Internet Archive, the most of any of the members of the Disinformation Dozen.

A researcher studying disinformation and banned accounts might start with the web interface to the Internet Archive’s Wayback Machine. Figure 2 shows a combined view of the Wayback Machine’s calendar view for Robert F. Kennedy Jr.’s Instagram page (<http://instagram.com/robertfkennedyjr/>) during the last four months of 2020 and the first four months of 2021, leading up to his removal from Instagram. This visualization displays a circle around each day that the given URL was crawled by the Wayback Machine. The larger the circle, the more mementos available for that day (e.g., November 3 in Figure 2 has 32 mementos). The large quantity and size of the circles imply that this URL is well-archived. A green circle designates that a majority of the capture attempts received a HTTP 3xx response code, which indicates a redirect, whereas a blue circle designates that a majority of the capture attempts received a HTTP 2xx response code, which indicates that the request succeeded.



**Figure 2: Wayback Machine Calendar View 2020-2021 for @robertfkennedyjr’s Instagram Account Page**

In most TimeMaps, a redirect does not necessarily mean that the memento cannot be replayed. An archived redirect often just indicates that the content was available at a different URI-R, and sometimes is even just a redirect from a URI-R with <http://> as the scheme to one with <https://>. However, with Instagram, we have found that the large quantity of archived redirects are actually redirects to the Instagram login page, which contains no content related to the requested user’s account. Instagram has security measures in place so that any non-logged in user browsing the platform is eventually redirected to the login page. In this case, the Internet Archive’s crawler is acting as a non-logged in user and is diverted accordingly.

The Instagram login page is clearly not a capture of Robert F. Kennedy Jr.’s Instagram account and provides no information about the content he was posting. In contrast, following a successful link allows Wayback Machine users to see a capture of the past, as if they were viewing Kennedy’s account at the time. Figure 4c exemplifies one such successful memento with all post images intact. We note that mementos captured after Kennedy was banned will result in a redirection to the login page.

To study how prevalent this redirection to the Instagram login page was, we used the Internet Archive’s CDX API [12] to collect URI-Ms and associated archived status codes for the Instagram account pages of the Disinformation Dozen and nine Instagram

accounts for various health authorities listed in CCDH’s Malgo-rithm report [7].<sup>1</sup> We found 2,094 mementos for the Disinformation Dozen and 6,490 mementos for the health authorities, which we have combined in the analysis below.

The CDX information provides the same information as is displayed in the Wayback calendar view along with additional data. Upon inspection, we found that the CDX data for some mementos had a response code of - and a MIME type of warc/revisit. These indicate that the crawler discovered identical content as a previous capture. This includes both redirects to the login page and replayable mementos. We identified revisits to redirects by using curl to download the HTTP response and looking for “Got an HTTP 302 response at crawl time|Login” in the HTML. We classified mementos in the CDX data with 200 status codes as “success” and mementos with 3xx status codes as “redirect.”

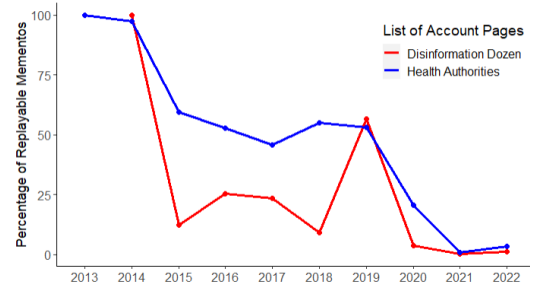
Table 1 summarizes our results. We found that 83% of the 8584 mementos in the combined CDX results were actually redirects to the Instagram login page. This includes 3xx status codes as well as warc/revisits that resolved to the login page. Only 17% of the total mementos, and less than 4% of the mementos for the Disinformation Dozen, actually resolved to a user account page. At first glance, it would appear that, with over 8500 mementos for these 21 accounts, that they have been well-archived. However, less than 1500 of these are replayable mementos to user account pages.

**Table 1: Redirects and Successes for Disinformation Dozen and Combined (with Health Authorities) Account Pages**

	Mementos (% of total)			
	Disinfo Dozen		Combined	
Identified Redirects	1932	(92.26%)	6444	(75.07%)
warc/revisit Redirects	82	(3.91%)	709	(8.26%)
Total Redirects	2012	(96.08%)	7151	(83.32%)
Identified Successes	73	(3.49%)	1419	(16.53%)
warc/revisit Successes	7	(0.33%)	12	(0.14%)
Total Successes	80	(3.82%)	1431	(16.67%)
Total Mementos	2094	(100%)	8584	(100%)

To investigate how these results change over time, we broke out our data by year. Figure 3 shows the data separately for the Disinformation Dozen accounts and the health authorities. Both data sets demonstrate a decrease in replayable mementos for their Instagram account pages over time. Furthermore, this decrease is not slight, but extreme; both lines begin at 100% and end with almost 0% replayable mementos. Additionally, there are two sharp decreases in each line: from 2014 to 2015, and from 2019 to 2020. We suspect that changes to Instagram policies during these years made archiving even more difficult for the Wayback Machine crawlers, resulting in more redirects to the login page. Overall, these results imply that while the spread of disinformation on Instagram is on the rise, our ability to archive it is on the decline.

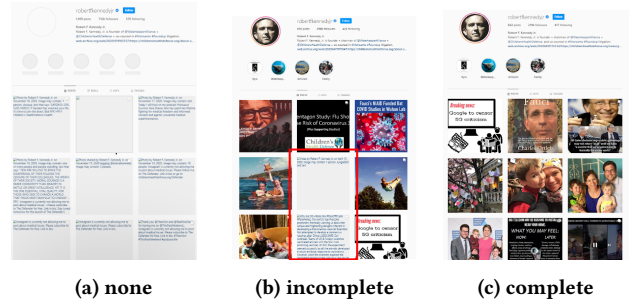
<sup>1</sup>The CCDH report lists 10 accounts for health authorities, but the account for Public Health England was no longer available at the time of our analysis.



**Figure 3: Percentage of Replayable Mementos Over Time**

## 4 ANALYZING THE QUALITY OF THE REPLAYABLE MEMENTOS

The next issue to address is to determine if replayability guarantees a complete capture that is fully representative of the content a user was posting. Since Instagram is centered around sharing images, quantifying the number of post images that are present in the memento is a relevant measure of this completeness. For example, three of the six replayable mementos for @robertfkennedyjr’s account have zero post images available, as seen in Figure 4a. Even though alternative text is available for some posts, the pictures, which are the very essence of this photo-sharing platform, are missing. Similarly, one of the six replayable mementos had only a partial number of photo images available (Figure 4b). While the quality of this memento is relatively better than the three with no loaded post images, it is still not a complete capture of the past. Overall, for Robert F. Kennedy’s Instagram page, only two mementos out of the original 598 are complete, replayable mementos. These two mementos with all viewable post images intact (one is shown in Figure 4c) are the only complete captures of Robert F. Kennedy’s Instagram account page as it once appeared on the live web.



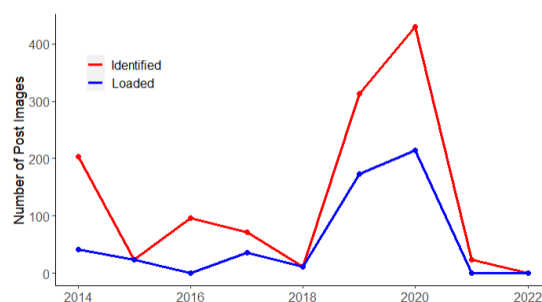
**Figure 4: Instagram Mementos with Different Levels of Memento Damage: (a) no loaded post images, (b) incomplete loaded post images, (c) complete loaded post images**

Since the number of post images that replay for a given memento is indicative of that memento’s quality, we want to be able to determine the number of post images that are replayable at scale. First, we inspected the Network Activity tab in Google Chrome to identify which resource requests corresponded with the post images. The post image resources each have a unique, identifying sequence of numbers and underscores. We found that from 2014,

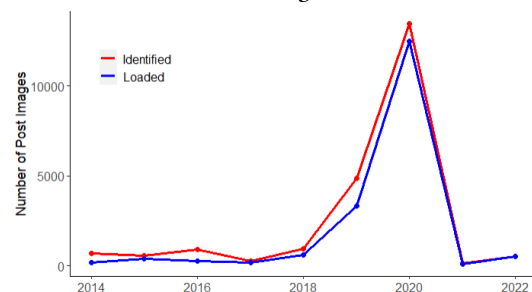
each ended in `_a.jpg`, which then changed to `_s.jpg` in early 2015, and then to `_n.jpg` in late 2015.

We used Selenium Wire [14] to capture the network requests made by the Chrome headless browser when rendering the mementos. We extracted the identifying sequence of numbers and HTTP status code for each post image. If the status code was 200, then we determined that image would display in the replayed memento. We captured the number of post images that replayed successfully and the total number of post images requested<sup>2</sup> for each memento.

Figure 5 illustrates the quality (in terms of number of replayable post images) of the replayable mementos for each group. The “Identified” lines represent the number of post images requested across all mementos for that year. The “Loaded” lines represent the number of post images that actually displayed correctly. For example, Figure 4b portrays 9 identified, or requested, post images, but only 7 loaded post images.



(a) Identified and Loaded Post Images for Disinformation Dozen



(b) Identified and Loaded Post Images for Health Authorities

**Figure 5: Quality of Replayable Mementos Over Time for (a) Disinformation Dozen and (b) Health Authorities**

As demonstrated by the disparity between the “Identified” and “Loaded” lines in Figure 5a, a large number of the identified post images for the Disinformation Dozen did not load per year, indicating significant memento damage. The years 2014, 2016, 2017, and 2020 are of particularly poor quality. Additionally, there is a lack of both identified and loaded post images for the years 2015, 2018, 2021, and 2022. When compared to the other years, 2019 was an improvement, with over half (55.27%) of the 300 identified post images loaded. Unfortunately, overall, 64.2% of replayable mementos for the Disinformation Dozen Instagram profiles had no loaded post images and

<sup>2</sup>We note that Instagram employs lazy loading and would request additional images if the page was scrolled. We did not set the headless browser to scroll the page.

72.84% had fewer post images loaded than identified. This means that only 27.16% of the replayable mementos, and only 1.05% of all mementos, from the Disinformation Dozen loaded as many post images as were requested, which we consider to be “complete.”

For the health authorities shown in Figure 5b, there is a noticeable spike in the number of post images in 2020. Because the CDC and the World Health Organization were posting vital information about COVID during March of 2020, these account pages were archived at an exceptional rate, resulting in this increase of complete mementos for the year 2020. Regardless, we see the same distinct lack of identified and loaded post images for the years 2021 and 2022 that we observed from the Disinformation Dozen data set. The years 2014 and 2016 stand out as having particularly poor quality mementos for this data set as well. Overall, we found that 33.91% of replayable mementos for the health authorities profiles had 0 replayable post images and 43% had fewer post images loaded than identified, indicating that there are still clear quality and completeness issues for these replayable mementos as well.

## 5 CONCLUSIONS AND FUTURE WORK

To extend this work, we would like to increase the number of Instagram accounts analyzed to see if this trend of redirects to the login page holds and to pinpoint when archiving Instagram became more difficult. We are also interested in investigating the quality of the archived posts themselves.

We investigated mementos at the Internet Archive for several Instagram accounts, and found that, especially recently, many of these mementos are not replayable, due to Instagram’s practice of redirecting non-logged in users to their login page. For the Disinformation Dozen, 96% of the mementos in the Internet Archive’s Wayback Machine redirect to the login page. Furthermore, we found that the mementos that do not redirect to the login page may not replay every post image; only 27.16% of replayable mementos for the Disinformation Dozen replay every post image requested. Overall, these results signify that only 1.05% of mementos for the Disinformation Dozen accounts are replayable with complete post images. The loss of around 99% of malicious content posted is a serious obstacle, because studying the tactics utilized by disinformation disseminators in the past is the key to preventing the spread of disinformation in the future.

## ACKNOWLEDGEMENTS

This work was supported by NSF CISE REU Site Award #2149607.

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