

# Using a national web archive for the study of web defacements? A case-study approach

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# Using a national web archive for the study of web defacements? A case-study approach

*Michael Kurzmeier*

*Abstract: The study of web defacements offers valuable insights into hacktivist and political communication practices. This article focuses on political web defacements, which are often short-lived and challenging to archive due to their ephemeral nature and perceived nuisance value. While such defacements hold significance for understanding the history of online activism and subaltern political communication, they remain underutilized in research. This paper examines the potential of national web archives to address this gap through a case-study approach.*

*Web defacements, occurring as expressions of political views or disruptions against perceived adversaries, are vulnerable to deletion and restoration by site administrators. The challenge lies in their preservation for systematic analysis. Although community-maintained cybercrime archives and occasional inclusions in large web archives exist, they lack the contextualization required for comprehensive research. This study aims to bridge this gap by investigating the overlap between a community archive and a national web archive in order to assess the likelihood of locating defaced pages in the latter. A collection of defaced pages from the .dk domain serves as comparative material. The study also explores the feasibility of automated solutions for identifying defacements within large web archives.*

*Through the case-study approach, this research seeks to determine the extent of overlap between community-maintained archives and national web archives. Additionally, it explores the effectiveness of automated methods in uncovering political defacements. By evaluating these factors, this study contributes to a better understanding of web defacements as historical artifacts and the potential of national web archives to enhance research in the domain of hacktivism and online political expression. Furthermore, the findings may offer insights into optimizing archival practices for preserving and studying transient online phenomena.*

*Keywords: web defacements, hacktivism, web archives, political communication, digital history*

## INTRODUCTION

Web defacements in the context of this article are alterations or replacements of websites by an unauthorized third party. This unauthorized access is usually achieved through compromising the target system (here very broadly named hacking). Of the thousands of websites defaced every day, some are defaced for the purpose of propagating political expression of whatever quality, while others are defaced as part of a campaign to disrupt the digital communication channels of a perceived enemy.<sup>1</sup> Both of these types of defacements are broadly labeled political and are what this article focuses on. These web defacements are part of the larger realm of hacktivist and web defacement practices. As defaced pages are generally short-lived, research cannot rely on larger, unspecified Internet archiving services to obtain copies, nor can it follow events in real time. Where web defacements are preserved, it is in community-maintained archives of varying scope and quality.

Defacements are at a double disadvantage in regard to their preservation. On a technical level, defacements are more ephemeral than most other types of websites. Seen as unwanted and often illegal intrusions into computer systems, defaced pages tend to be restored or taken offline before large Internet archiving crawls can find them. Socially, defacements are often regarded as nuisances rather than artifacts worthy of cataloging and consideration. Consequently, and despite their significance, political web defacements remain an under-utilized resource for research on both the history of activism on the web as well as subaltern political communication. According to Niels Brügger,

Web content may have been changed, moved, or deleted for various reasons, and sometimes in the hope of not being found out. (Brügger 2019)

This is most certainly true for web defacements, which are usually deleted and the original page restored as quickly as possible. While understandable from the perspective of the admin or domain owner, these defacements nevertheless form a part of digital history.

Web defacements as a form of hacktivism are rarely archived and thus mostly lost for systematic study. When they find their way into web archives, it is often more as a by-product of a larger web archiving effort than as the result of a targeted campaign. Aside from large collections such as the Internet Archive, which might pick up a few hacked pages during a crawl, there also exists a small scene of community-maintained cybercrime archives that archive hacked websites, some of which are hacked in a hacktivist context and may involve web defacements. While community archives exist, no source is available

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1. For an overview of the use of hacking in the public sphere, see Fuchs (2014) and Salem (2014). For the conceptual positioning of hacking in relation to capitalism, see Söderberg and Maxigas (2022). The argument developed by Söderberg and Maxigas can be extended to include the use of state-sponsored hacking groups for political and strategic goals.

to serve research needs. These research needs are characterized, amongst others, by a need for contextualization of the defacement. Very generally speaking, defacements can interact with the original page on a content level (as a parody), on an infrastructure level (as part of a cyberwar campaign) or be only marginally or not at all related (a target picked at random or for ease of access). As generally, community-maintained web defacement archives do not feature snapshots of the original page and traditional web archives are understandably not overly receptive towards defacements, the combination of sources to contextualize defacements is hard to achieve.

The short-term network stay therefore had two main goals:

- verify the overlap between sites from one of these community archives against a national web archive. This would allow an approximation of the likelihood of finding copies of defaced pages in a national archive. For the purpose of the visit, I compiled a collection of defaced pages from the .dk domain from 1999 to 2001 as material for such a cross check. This will be an important step in assessing the usability of large, national web archives for the study of political web defacements.
- Investigate the usability of automated solutions for finding defacement in large web archives. In a first step, this includes the search for novel material based on known political defacement groups. In a second step, this may include a search for sudden, and quickly restored changes in a web site.

During the visit, it was to be confirmed:

- What, if any, overlap between the two sources could be found
- If no overlap could be found, what the closest available snapshot for the URL was.

As some of the defaced pages on the Danish web date back to pre-2001, and thus predate the establishment of the Danish Web Archive, their incorporation into the Web archive may also be a chance to add to the collection.

This Short-Term Network Stay would not have been possible without the generous support and help from Anders Klindt Myrvoll and Thomas Egense from the Royal Danish Library.

## **DATA SOURCE**

Most data sources on defacements have already disappeared from the Web. Alexandra Samuel in her 2014 dissertation finds that:

Thanks to the volume of defacements, the biggest mirrors (Attrition and alldas) have stopped archiving defacements. alldas has gone offline entirely; Attrition stopped maintaining its archive in April 2001 [...] but has preserved its records of defacements from 1995-2001. (Samuel 2014)

Related work on political web defacements found that in 2020, 9 out of 12 surveyed defacements archives were offline, with only one still collecting new content (Kurzmeier 2021). The reason for this decline is unclear. A larger analysis of web defacements suggests web defacements have lost some of their appeal as a political tool (Balduzzi et al.



2018). While this is likely to be one factor, a change towards web content being distributed through centralized platforms rather than individual web pages is certainly another.

One of the mirrors mentioned by Samuel - Attrition - will be the data source for this article. While Attrition stopped accepting defacements in 2001 (“ATTRITION: Evolution” 2021), they have preserved their archive and made it available to the public in 2021. This opening up of the archive (research access before that was granted on a case-by-case basis, but only to the front end) shows the awareness of the Attrition admins towards the value of the archived material. This is also expressed in the statement accompanying the re-opening of the archive:

Back in the day we had so many ideas for analyzing the mirror data. Extensive analysis of the HTML, language, heat maps, graphing the "greetz" and "hates", and more. This data is extremely challenging to do any of that for a variety of reasons. Twenty years later, data processing tools and methodology is considerably more advanced though, so we hope someone will do just that. (“Attrition.Org Web Page Defacement Mirror” n.d.)

But it is not only the relative ease of access that makes Attrition a valuable object of the study of web defacements. Attrition started collecting material in 1999, incorporating older material “copied from other defacement mirrors that ran before us” (“Attrition.Org Web Page Defacement Mirror” n.d.), going back as far as 1996. At the time of closure in 2001, around 14.000 defaces websites were preserved in the archive. This offers exceptional access to very old web material and thus provides resources for research on early days web activism and political expression. See the original GitHub repository. However, the data available is anything but easily accessible. An upcoming article in the *Journal of Digital History* describes the workflow in detail. For the context of this paper, I refer to the table of extracted .dk defacements.

id	path	date	url	tid	text
102	/home/michael/Desktop/attrition_analysis/2000/11/19/www.hitachi.dk/mirror.html	2000-11-19	www.hitachi.dk/	dk	prime suspectz ownz! @%#\$ @# prime suspectz ownz#@ A dm : nothing was del
103	/home/michael/Desktop/attrition_analysis/2000/11/19/www.hitachi.dk/index.html	2000-11-19	www.hitachi.dk/	dk	Multiple Domains! Multiple domains were hit with the same web page defacement.
129	/home/michael/Desktop/attrition_analysis/2000/11/21/www.manowar.dk/index.html	2000-11-21	www.manowar.dk/	dk	prime suspectz ownz! @%#\$ prime suspectz ownz A dm : nothing was deleted.. or
869	/home/michael/Desktop/attrition_analysis/2000/11/16/www.extreme.dk/index.html	2000-11-16	www.extreme.dk/	dk	NITR8 was here ... Owned By Quit Crew ... Peace to : Butcher, BioWin, MrsPara,
1173	/home/michael/Desktop/attrition_analysis/2000/07/18/www.dskif.dk/index1.html	2000-07-18	www.dskif.dk/	dk	Dansk Skiforbund
1174	/home/michael/Desktop/attrition_analysis/2000/07/18/www.dskif.dk/index.html	2000-07-18	www.dskif.dk/	dk	EL Pulpo Hacker Strike Again !!! QUIENES SOMOS: El Pulpo Hacker es solo un A
1178	/home/michael/Desktop/attrition_analysis/2000/07/18/www.digisigner.dk/index1.html	2000-07-18	www.digisigner.dk/	dk	digI2
1179	/home/michael/Desktop/attrition_analysis/2000/07/18/www.digisigner.dk/index.html	2000-07-18	www.digisigner.dk/	dk	EL Pulpo Hacker Strike Again !!! QUIENES SOMOS: El Pulpo Hacker es solo un A
1516	/home/michael/Desktop/attrition_analysis/2000/04/23/www.wild-life.dk/oldindex.html	2000-04-23	www.wild-life.dk/	dk	Velkommen
1517	/home/michael/Desktop/attrition_analysis/2000/04/23/www.wild-life.dk/index.html	2000-04-23	www.wild-life.dk/	dk	You fools!!! Fight the Euro

Figure 1: Part of the table of extracted .dk defacements.

As with all national web archives, it is of course likely that Danish content or content relating to Denmark is hosted on tlds other than .dk. As Figure 1 shows, the content of the defaced pages does not necessarily relate to Denmark in all cases. The text preview suggests that ID 1517 (“you fools!!! Fight the Euro”) might relate to Danish politics, while the other previews visible in Figure 1 do not show obvious relation to Denmark. Where Danish is used (ids 1516 and id 1173), these are the original index.html files the defacer chose to rename rather than overwrite.

The distribution of relevant content in the Attrition.org archive is as follows:

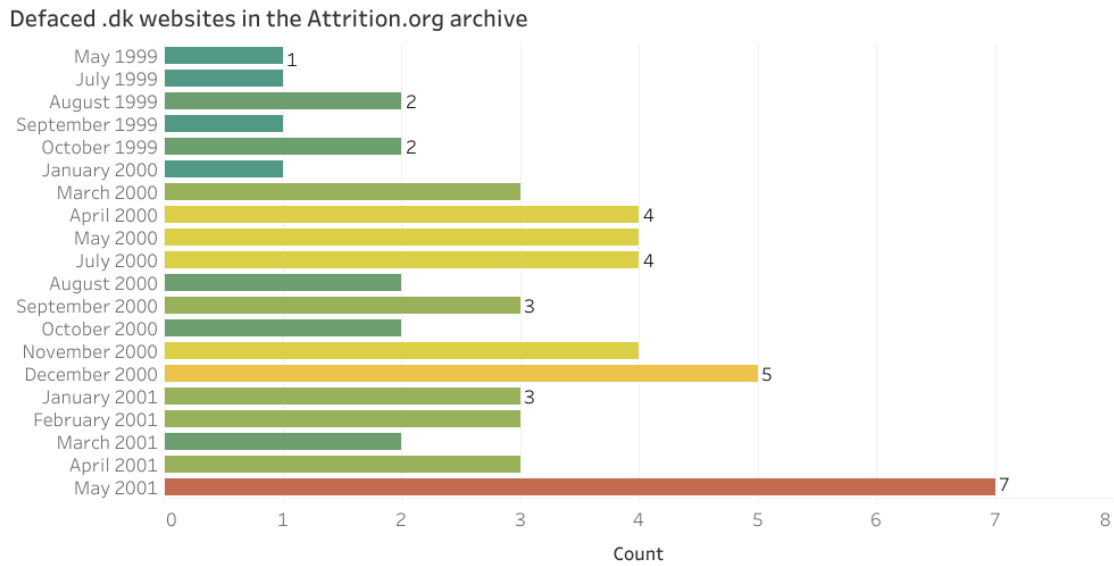


Figure 2: Defaced .dk websites in the Attrition.org archive

The distribution of content largely follows the collection practice of Attrition.org, which was active from 1999 to 2001. There is a general increase in the number of defacements over time. In relation to the over 14.000 defaced pages, the low number of 59 defacements on the .dk domain shows that the .dk domain was not a primary target for defacers. However, due to the unusual content and the age of the defacements, these 59 pages can nevertheless help to complement the historical record and make available new material for a national web archive.

## ANALYSIS

For the purpose of comparing the extracted information from the Attrition.org dataset with a national web archive, the extracted list of Danish URLs was checked against the collection of the Danish web archive Netarkivet. The goal of this was to determine the overlap between the two collections. The below table gives the results of this operation:

Defaced page in both collections	0
Defaced page not in Netarkivet	10
Defaced page in Netarkivet, but not as defacement	49

Table 1: Overlap between both data sources

There was no case found of a defacement archived in Netarkivet. It is not clear whether this is due to collection practices and the deliberate excursion of defaced pages. As some of the URLs predate the start of collection at Netarkivet, the Danish web archive had no influence on the collection practices of these older records.

10 pages were not found in Netarkivet at all. These are likely all HTML files created by the defacer, indicated by names such as .index2.html and mirror.html. It seems plausible that these files were eventually deleted and/or are not referenced by the “original” index.html and thus never discovered by web crawlers.

For the remaining pages, the closest capture date was found. This capture date might pre-date the defacement date. Where this is the case, the difference between defacement date and post-defacement capture is greater than between defacement and pre-defacement date. This time difference is then visualized in the below figure:

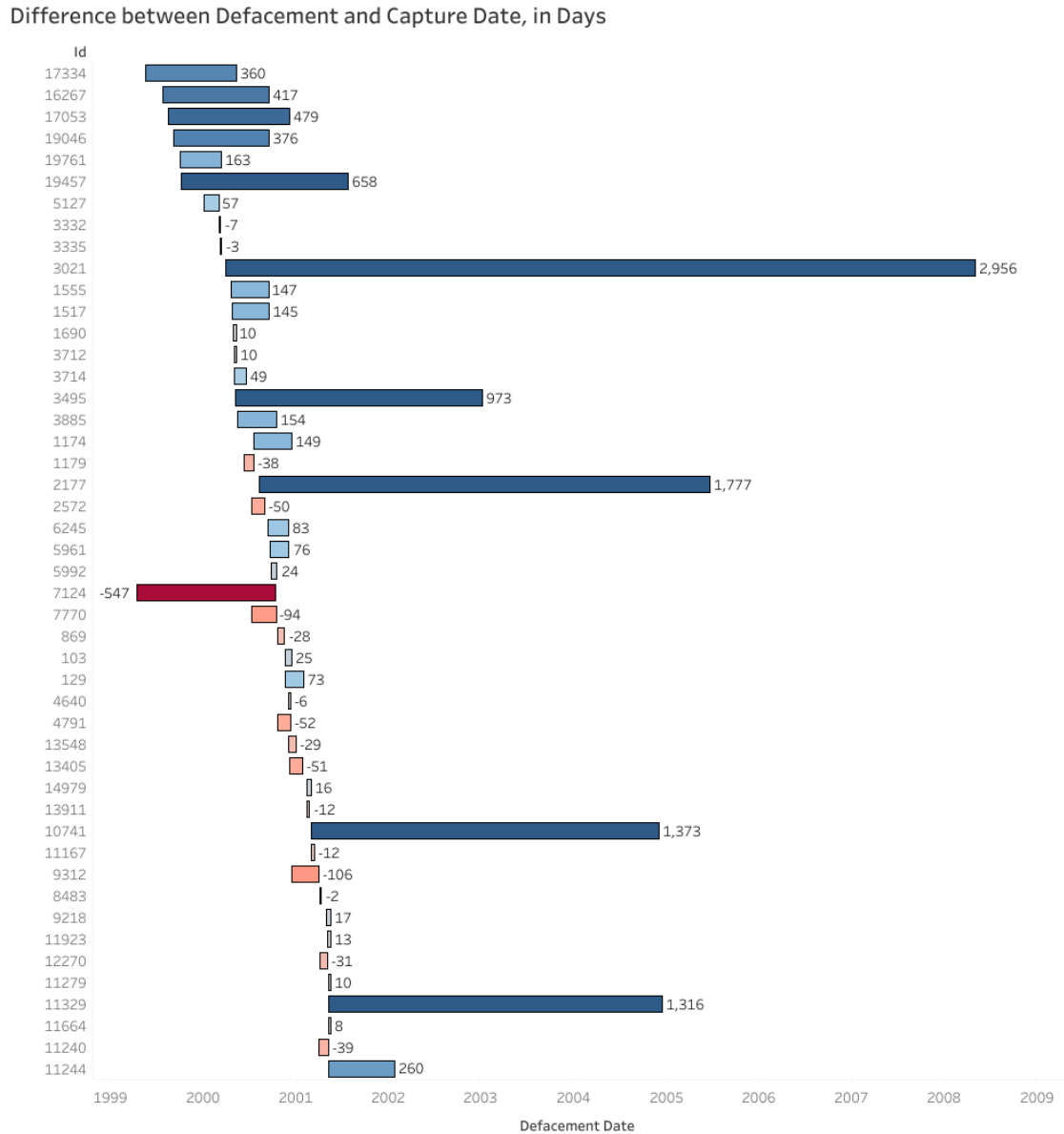


Figure 3: Difference between Defacement and Capture Date, in Days

This figure shows the difference between defacement and capture date in days, ordered by the time of defacement. It shows that the difference between defacement and closest capture date varies between -2 and 2956 days. The difference varies more in the pre-2000 period than in the post-2000 period. Most web sites in the defaced data set have close copies in the Danish web archive with the closest snapshot being less than 100 days away. Some web sites were not archived until over 8 years post-defacement. To illustrate these results further, the average difference between defacement and capture date per quarter is shown in the below figure:

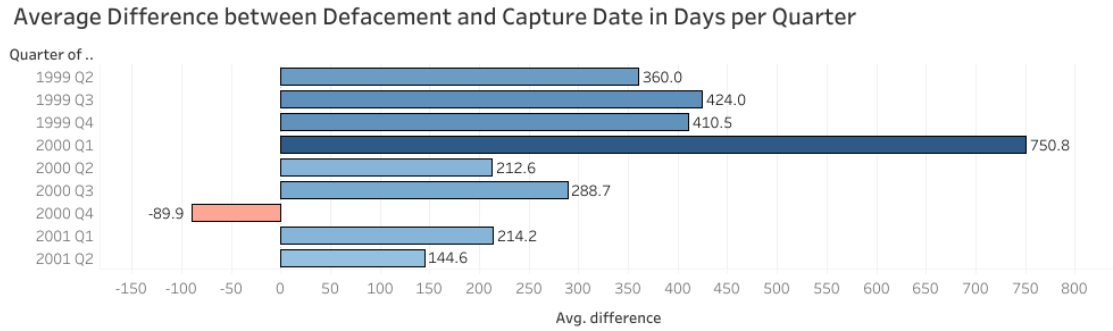


Figure 4: Average difference between defacement and capture date in days, per quarter

This figure allows us to trace the average difference between defacement and capture over time. Peaking in Q1 2000, the amplitude generally decreases from thereon. This is indicative of increased web archiving activity (and eventually the start of Netarkivet actively collecting sites). Even with this increased coverage, the average difference in Q2 2001 is barely under six months. Looking past the average difference, the distribution of difference between defacement and capture date confirms that in most cases, a copy was found within a range between -300 and +300 days:

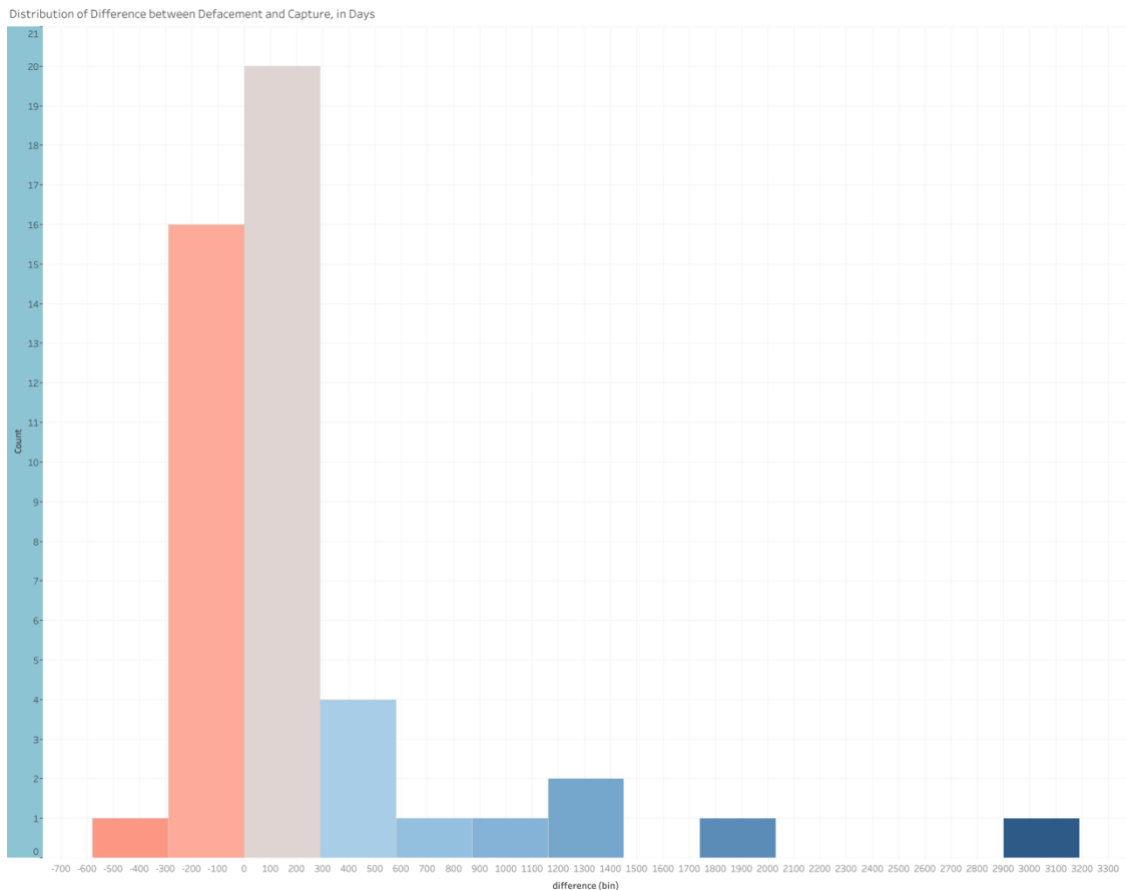


Figure 5: Distribution of difference between defacement and capture date, in days

This figure shows that while no direct copy of a defaced web site was found, the Danish web archive is likely to hold a sufficiently close version of a given Danish website to allow contextualization of the defacement. This contextualization can include the overall content of a now defunct website to understand whether the defacement was in relation to the original content. It may also help to identify defacements in the form of parodies of a website (similar to Adbusting). Especially with older defacements, it is necessary to see the original content to reliably identify parody defacements.

## DEFACEMENTS IN NETARKIVET

In line with the second objective of the STNS, the potential use of a national web archive as a source for the study of web defacements was investigated. As there was no direct overlap between the two sources, this step cross-referenced known defacer groups from the attrition.org archive. Additionally, Thomas Egense and Anders Myrvoll from the Royal Danish Library provided a list of known defacements in the Danish web archive. The list, focussing on the same 1999-2001 time period, is shown below:

<b>url</b>	<b>wayback_date</b>
http://www.stormpro.dk:80/	2000-12-04
http://www.stormpro.dk:80/default.html	2000-12-04
http://hacked.dk:80/hackedindk/www.toyota-esbjerg.dk.html	2001-08-04
http://hacked.dk:80/hackedindk/www.aaben.iteu.dtu.dk.html	2001-08-04
http://hacked.dk:80/hackedindk/www.komud.dk.html	2001-08-04
http://hacked.dk:80/hackedindk/www.rts-webdesign.dk.html	2001-08-04
http://hacked.dk:80/hackedindk/www.bhi.dk.html	2001-08-04
http://hacked.dk:80/hackedindk/www.peugeot.dk.html	2001-08-04
http://hirtshalsbynet.dk:80/link/byportaler/default.asp	2001-04-06
http://hirtshalsbynet.dk:80/link/byportaler/default.asp	2001-06-04
http://www.hirtshalsbynet.dk:80/link/byportaler/default.asp	2001-08-14
http://www.1klik.dk:80/artikel/default.asp?id=IT/917	2001-05-31
http://www.1klik.dk:80/artikel/default.asp?id=IT/917	2002-09-17
http://www.1klik.dk:80/artikel/default.asp?id=IT/917	2003-03-17
http://www.1klik.dk:80/nyt/default.asp?id=13079	2001-06-22
http://hacked.dk:80/hackedindk/www.powerdata.dk.html	2001-08-04
http://www.attrition.org/mirror/attrition/2000/01/05/www.eud.dk/	2006-04-07
http://www.poetic-world.dk:80/	2001-10-20

Table 2: Selected defacements in Netarkivet

These defacements can be divided into two groups: The first group, marked in white, are original defacements harvested either through the Internet Archive or Netarkivet. These include three different domains which were not part of the Attrition.org dataset. The second group, marked in gray, are news pages (1klik.dk) reporting on defaced pages and featuring parts of it. These news pages are relevant as they usually fall within the collection scope for most web archives (whereas defaced sites often do not) and still allow insight into some, usually more high-profile, defacements. The other sites in the second group are Attrition.org itself, indicating that Netarkivet at some point crawled the site and might hold more content from there, and the now-defunct site hacked.dk. Similar to Attrition.org, hacked.dk was a Danish cybercrime archive, where defacers would have their defacements archived to stabilize their work and increase their impact. While hacked.dk is offline, Netarkivet holds excerpts which may help reconstruct both the defacements and the site itself.

## **CONCLUSION AND OUTLOOK**

The first objective of this research visit was to investigate the overlap between defacements on the .dk domain from the Attrition.org archive and Netarkivet. The results show that out of 59 defaced pages, 49 were found in Netarkivet either before or after the defacement. In no case did the Netarkivet collection include the defaced page. The average difference between the two sources varies from 750 to -90 days. It was suggested that the absence of defaced pages in the Danish web archive is due to collection practices and the short lifespan of web defacements.

As a second step, defacements found in Netarkivet were briefly analyzed. This showed a low number of “original” defacements and three cases where websites reporting on or collecting defacements were archived. In a recursive loop, Netarkivet archived Attrition.org which archived a defaced Danish page.

As an outlook for further research, this Short-Term-Network Stay has shown that:

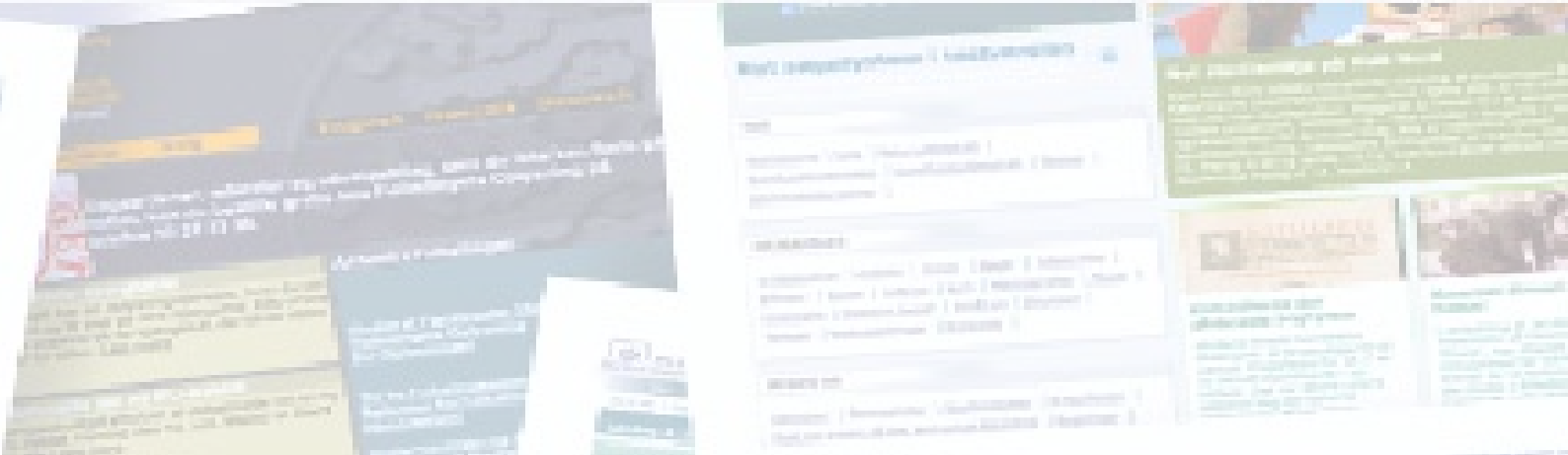
- While the urls were usually found in both datasets, no defacements were found in both the Attrition.org dataset and Netarkivet. Regarding the study of political activism and the history of web pages, this shows the value that an academically usable archive of web defacements can provide. While the difference between capture date and defacement date was high, a combination of the two data sources can nevertheless help to produce a more complete picture of a web site and at the same time help to contextualize the defacement.
- While the number of found defacements in Netarkivet is low, another type of source emerged in the form of websites reporting on or collecting information about defacements. In the light of collection practices, this kind of website may prove to be an interesting source of information on defacements.

Further research will focus on the implementation of such an academically usable archive of web defacements which is able to contextualize by finding the nearest capture in one or many web archives. The defaced websites on the .dk domain were shared with the Royal Danish Library to complement their web archive.



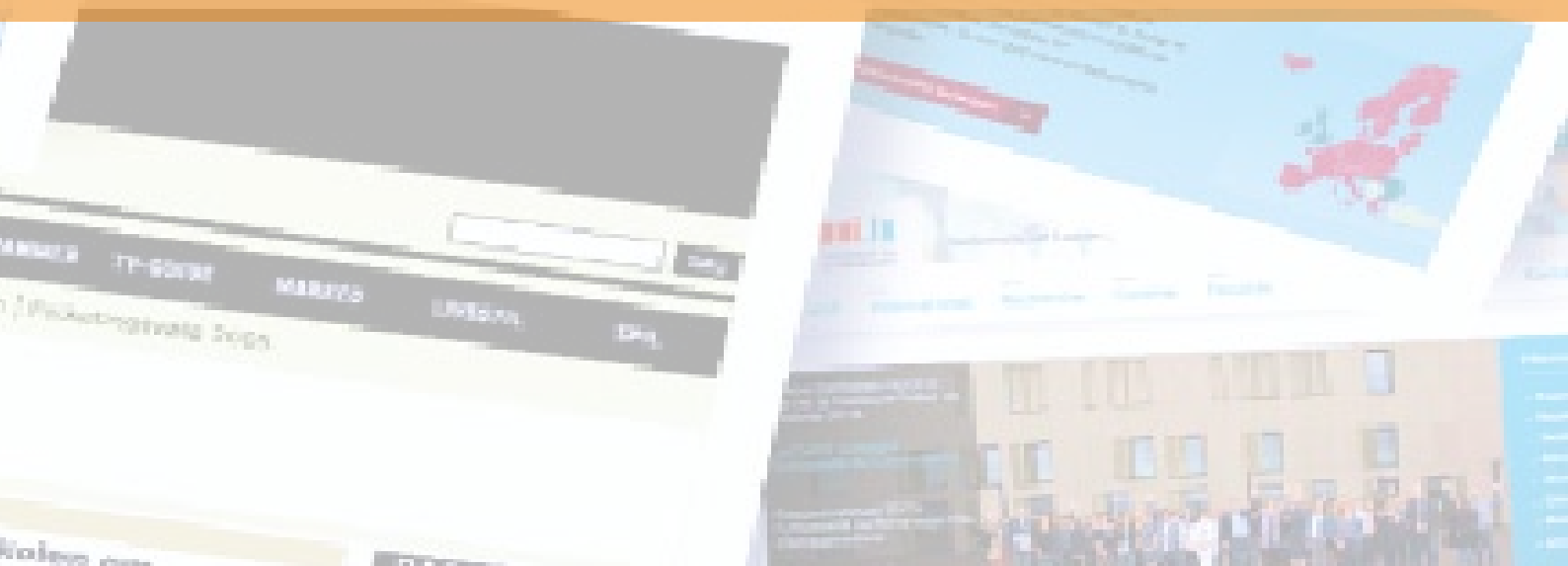
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The aim of the WARCnet network is to promote high-quality national and transnational research that will help us to understand the history of (trans)national web domains and of transnational events on the web, drawing on the increasingly important digital cultural heritage held in national web archives. The network activities run in 2020-22, hosted by the School of Communication and Culture at Aarhus University, and are funded by the Independent Research Fund Denmark | Humanities (grant no 9055-00005B).



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