Adding Quotable Signatures to the Transparency Repertoire in Data Journalism

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ABSTRACT

Fabricated content falsely attributed to reputable news sources is one of the significant challenges for journalism today. One of the manipulation methods is to copy the layout of news websites and substitute the original text. The manipulated version is then recirculated, making it hard to assess the reliability and trace the origin of such "information." Offering an exploratory, descriptive, and solution-oriented approach, we present examples of how this manipulation threatens news outlets and can escalate to data journalism and other specialized forms of news reporting. One reason for that is people's overreliance on numbers and data visualizations as cues to assess the trustworthiness of the content. Then, we suggest that news organizations and social media platforms incorporate a tool to make the digital information environment safer for users and readers. By presenting quotable signature schemes, a cryptography-based solution, we claim that the transparency repertoire in journalism can be improved and extended.

KEYWORDS

data journalism, transparency, disinformation, cryptography, digital signatures, quotable signatures

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1 INTRODUCTION

In this paper, we argue that using quotable signature schemes can enhance and extend the repertoire of transparency strategies in data journalism to prevent or combat mis- and disinformation spread. Our approach here is descriptive, exploratory, and solution-based. We start the study with a theoretical background, present examples of how manipulation impersonates reputable news brands, and offer a solution based on a cryptographic primitive called quotable signature schemes. Lastly, we offer a prototype to trace a publication's provenance when excerpts from it are shared on social media.

Our research is in line with literature that debates fabricated information that often mimics the format of news (Lazer et al., 2018), relies on numbers as cues to manipulate readers (Gehrke & Benetti, 2021; Peng, Lu, & Shen, 2023), and even recirculates journalistic products by taking them out of their original context (Soares & Recuero, 2021). Thus, our goal is to describe how disinformation spread is currently problematic to news organizations and has the potential to escalate to data journalism websites in the future, taking into account that numbers and data visualizations are potent cues to perceived credibility (Peng et al., 2023).

This study is part of the *Trust and News Authenticity* interdisciplinary project, connected with the Digital Democracy Centre (DDC) at the University of Southern Denmark (SDU). All in all, we suggest that data journalists use computational tools to make the information environment safer and more transparent for users and readers. As part of transparency strategies, quotable signature schemes can be extended to news sources inside the journalistic articles, which allows one to authenticate information's provenance. In the future, the mechanism can even be extended to multimedia forms, such as pictures and videos.

2 THEORETICAL BACKGROUND

2.1 Transparency in data journalism practices

Data journalism has ascended since the late 2000s in Europe and the United States, mainly due to the advance of Freedom of Information Access legislation (Coddington, 2015; Rogers, 2013). This data-driven journalism practice encompasses investigations that primarily rely on public databases, even though leaked documents can also be used as sources.

Since its theoretical roots trace back to Precision Journalism (Meyer, 2002), which aimed to posit journalism closer to the scientific method, data journalism investigations might start with a hypothesis to be tested, followed by data analysis, visualization, and communication of the reporting method – that is, methodological transparency. One of the most common requirements of openness is focused on the replicability and/or reproducibility of the analysis, allowing the audience to verify information and find the same results as the journalists (Gehrke, 2022; Gehrke & Mielniczuk, 2017; Meyer, 2002).

In summary, transparency means disclosing reporting practices and being clear about the origin of news sources and the methodology adopted. Almost a decade ago, transparency in digital journalism, which includes data-driven approaches, was seen by scholars as a way to establish credibility and reduce mistrust among audiences (Coddington, 2015; Karlsson, 2010). The optimism was mainly connected with the Web allowing the use of hypertext and, therefore, new layers of information. Recently, though, only a couple of investigations presented evidence that transparency could increase perceived credibility (Johnson & St. John III, 2021), and some scholars argue that trust is a prerequisite for openness to be effective (Karlsson, 2022).

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Despite the limitation of not being data producers, which makes them use sometimes opaque second-hand government data (Tong, 2023), data journalists believe that sharing their choices, work methodology, and even uncertainty with the audience improve information clarity. According to the perception of 36 Brazilian data journalists, transparency is not only a way for them to communicate their work method but also a path to establish a relationship based on honesty with the readership and combat misinformation (Gehrke, 2020).

2.2 Data as a cue to perceived credibility in the (dis)information landscape

Numbers, statistics, and data visualizations are potent cues in journalism and are often connected with straightforward communication of the facts. Fact-checkers also use data when verifying public claims, which implies that numbers are more accurate than discourse. Activating the same perception, mis- and disinformation narratives often use numbers and statistics to claim reliability.

Fabricated content related to the Covid-19 pandemic is an example of number manipulation as part of a misleading narrative. In a content analysis to explore 407 texts of false content that circulated during the first months of the pandemic in Brazil, Gehrke and Benetti (2021) identified that "data" was the third most recurrent category of the corpus analyzed, making up 19.66% of the cases. With the intent of minimizing the impact of the pandemic and arguing that the news media was creating terror, numbers and statistics were employed to construct a narrative that aimed to "demonstrate" that figures reported by the media were exaggerated. The examples included over-reported cases and deaths to the disease and allegedly empty hospitals.

Whereas pictures and videos are primarily adopted as evidence in disinformation narratives (Dan et al., 2021), numbers contained in data visualizations are part of what Peng et al. (2023, p. 228) calls "visual features as arguments" when discussing visual features of misinformation posts that might influence people's credibility perception.

Given that visual mis- and disinformation has been studied less than general forms of manipulation, it is hard to estimate the frequency with which the layout of a news website is copied and converted into false content. Nevertheless, Peng et al. (2023) list that aesthetics usually work as a heuristic by providing people with hints that suggest (or not) the message come from a professional and credible source. Moreover, a previous study developed in our project found that news brands/logos are a powerful cue for people to assess the news' reliability (Gehrke, Eggers, De Vreese, & Hopmann, 2023).

To exemplify this problem, we present fact-checked publications classified as "false" text and images that circulated online in 2022 mainly by mimicking the layout of news websites and logos of journalistic brands (see Figures 1 and 2). The content we use here was verified by fact-checking agencies that are signatories of the International Fact-checking Network (IFCN), which provides rigorous methodological and transparency premises that must be followed and shared with the audience.

Regarding Figure 1, the logo employed in the fabricated message (A) aims to attribute credibility to the content, by using the same shape and color as (B), which is the verified CNN Instagram account. Due to changes on Twitter (C), CNN's logo shape and verification batch are slightly different one year later. Still, a quick comparison between logos in different social media can easily generate confusion and mislead readers. The image and text (A) were verified and classified as false by the American fact-checking agency PolitiFact (Curet, 2022).

Figure 2 presents news falsely attributed to Deutsche Welle (DW) Brasil (A) in November 2022. Comparison it with the actual DW Brasil website (B), shows that a screenshot of the mobile website version was manipulated. The false text (A) claimed fraud in the Brazilian presidential elections and presented made-up statistics about the results. Besides the numbers, a fabricated news source with a "Ph.D. in Cybersecurity" was attributed within the text to contest the election results and mimic reporting procedures used in journalism, such as gathering information through sources. Brazilian fact-checking organization Agência Lupa classified the content as false (Schiochet, 2022).

2.3 Quotable signatures

This section first introduces the technical aspects of quotable signatures, and then gives a practical description of the prototype, and some related considerations.

Digital signature schemes are a classical and widely used tool in modern cryptography (Diffie & Hellman, 1976; Moody, 2023). In general, a digital signature scheme is a triple of algorithms KeyGen, Sign, and Verify. The algorithm KeyGen generates related pairs of a private and a public keys $(\mathsf{sk}, \mathsf{pk})$. The algorithm Sign signs any message m using a private key sk. This procedure produces a signature $s = \mathsf{Sign}_{\mathsf{sk}}(m)$ for m. The algorithm Verify verifies a message m and a signature s using the public key pk. Ignoring technicalities, the verification is successful only if *the signature was generated using* m *and the private key corresponding to* pk*, and neither the message* m *nor the signature* s *was altered.* We say that s is a signature for m signed with the private key sk. In other words, a secure signature scheme essentially ensures that only an entity in possession of the private key sk can produce a signature s for a message m, while the signature can be verified by anyone in possession of the public key pk.

This construction means that digital signatures ensure that (1) the message comes from a party that has a specific private key (identity), (2) the message has not been altered (integrity), and (3) a signer cannot lie about not signing a message, while also claiming that their private key remains private.

A newer concept is *quotable signature schemes* (Kreutzer, Niederhagen, Shrishak, & Fhom, 2019), which has been expanded upon by the authors (Boyar, Erfurth, Larsen, & Niederhagen, 2023). Summarizing, the main parts are as follows. A quotable signature scheme can be defined as digital signature schemes with an additional algorithm Quote. Given a message m and a quotable signature s, any third party can use Quote to extract a second quotable signature s' for a quote q from m, without knowing the secret key used to sign m or interacting with the party that signed m. This quotable signature s' is still signed with the private key used to sign m, and hence authenticates the original signing party as the author of the quote. In addition to having all the properties of standard digital

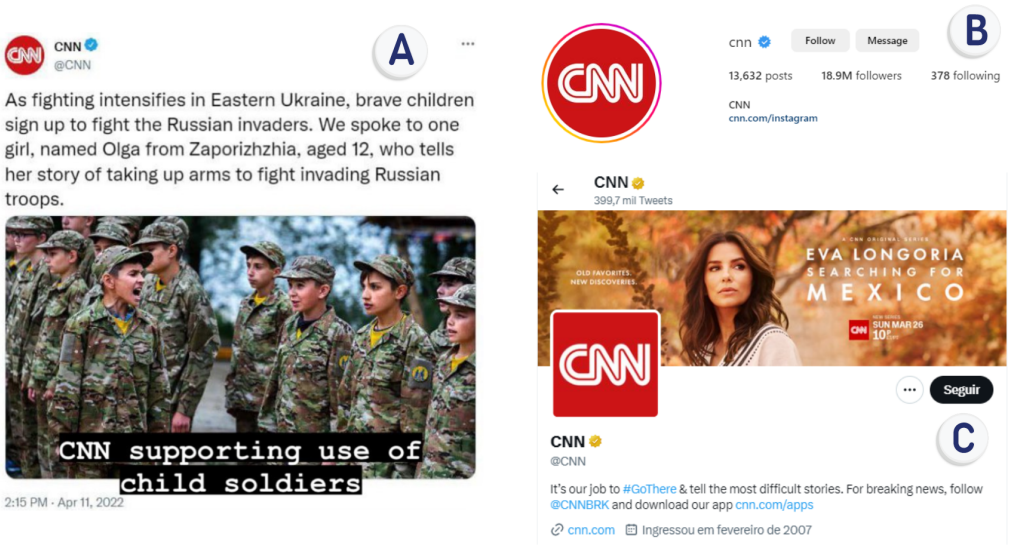

Figure 1: An Instagram post (A) with a screenshot of a manipulated tweet that was allegedly published by the American news organization CNN (B/C) on April 2022 concerning children's support of the Ukraine War.

Figure 2: Another type of manipulation consists of the complete copy (A) of a news website's original layout (B). In this example, the mobile version was adopted.

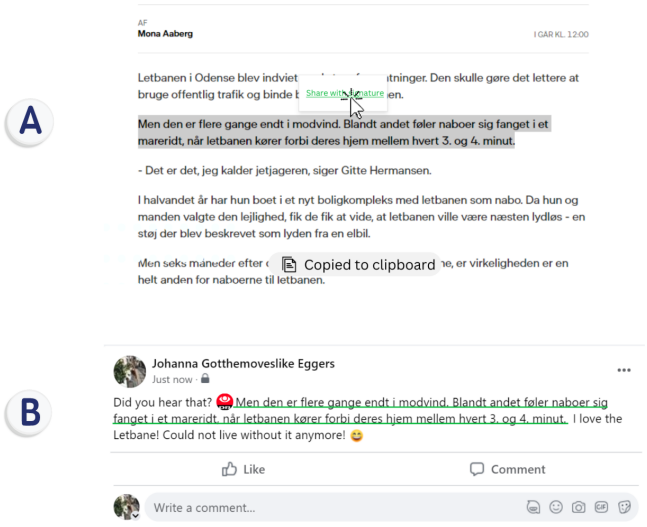

Figure 3: The user's journey when (A) reading and copying part of the news and (B) sharing the content on social media.

signatures, quotable signatures also allow deriving where parts of the message have been removed relative to the quote. A signature for a quote is again a quotable signature with respect to sub-quotes of the quote.

In the Trust and News Authenticity project, we have developed a prototype of a tool which aims to mitigate the effect of disinformation by authenticating quotes from articles using quotable signatures. This authentication is intended to complement the already existing flagging of problematic content. Since quotable signatures do not verify the truthfulness of the content, but rather authenticate its origin and inte)grity, this approach is different from fact-checking. Essentially, rather than aiming to prove that the statement is correct, it validates that a statement is extracted *ipsis litteris* from its provenance without falsification. Figure 3 illustrates the user journeys when using the prototype.

Figure 3 also shows that only the exact part copied and pasted is turned green (B), indicating that the quote, and only the quote, was authenticated, and that the excerpt comes from the original news media from which it was retrieved. The text added by the user is not highlighted. For our prototype, we used Facebook as social media since our project development occurred in Denmark, where 72% of the population use this platform for general purposes and 35% for news (Newman, Fletcher, Robertson, Eddy, & Nielsen, 2022). In addition, Facebook is browser-friendly, compared to other social media that prioritize app use.

The logo before the highlighted text (B) refers to DR, a public broadcaster highly trusted by the population (Newman et al., 2022), from which the quote originates. We decided to incorporate logos after our first project study with young Danes which indicated that news brands are, as a whole, a powerful cue for people to assess if a piece of news is trustworthy (Gehrke et al., 2023).

By clicking on authenticated content, a reader can summon a popup with more information, such as who signed it, when it was signed, an indication of where text was removed, and a link to the original article. Additionally, information about what (quotable) signatures are and what being authenticated means can also be provided bythis popup.

Relating the prototype to the general terms of quotable signatures, the original source of the quote (for example an article) is the message, and the author or distributor of the article (a news outlet, for instance) is the signing party. The party sharing the quote is the one extracting the signature for the quote, and the one reading the verified quote performs the verification. In practice, the act of extracting and including the signature for the quote, and of verifying the signature, would be completely automated, and happen in the background, requiring no additional user interaction.

Our prototype is separated into two parts: a library that can be used by media companies to sign their articles and a browser extension that allows users to quote with signatures and to verify signatures for quotes. The library contains implementations of the relevant algorithms, and it is intended that media companies can integrate it in their publishing workflow. The browser extension modifies websites such that both full articles and quotes with verified signatures are shown to be signed. It also allows the user to make quotes that include a signature when quoting from signed text. In addition, the browser extension provides more information for a quote to the user.

For our proposed approach to be effective, it would need to be widely adopted by news media, social media, and by users sharing and reading quotes from articles. Notably, if news media and social media integrate this solution into their websites, our approach can be employed without any explicit user awareness. With such integration, when a user copies a quote from a signed article, a signature for the quote is automatically generated, and an element including both quote and text is put into the clipboard, together with the plain text quote (in practice, this would be a `text/html` element and a `text/plain` element). When the user then pastes the quote, a website supporting signatures will use the clipboard element with a signature (W3C, 2021).

3 DISCUSSION AND CONCLUSION

Adding quotable signature schemes to the data journalism transparency repertoire might help to reduce mis- and disinformation spread. In this exploratory and descriptive study, we argue that fabricating content and falsely attributing it to news websites is a current problem that can mislead readers and, in the end, undermine journalism the perceived credibility .

Even though we have mapped cases in which legacy news media are mainly the object of manipulation, we argue that the disinformation impact can quickly be extended to highly specialized news coverage websites, such as data journalism. Since this data-driven practice deals with massive amounts of data, analysis, and visualization, it can quickly become a target of mis- and disinformation narratives once it provides cues people usually trust, such as statistics. Thus, quotable signature schemes are particularly promising to data journalism initiatives. Furthermore, emerging forms such as predictive journalism (Diakopoulos, 2022) could go in the same direction and suffer the consequences of a manipulative information environment.

Besides working as a resource to trace the origin of a text excerpt, quotable signatures schemes could be extended to validate pictures, videos, databases, and combinations of different formats. It would mean that data journalism, and other forms of journalism, could validate the provenance of different sources (including multimedia content) within news articles. Available to the readership, it improves and extends the transparency repertoires. Fact-checking agencies can also benefit from the same authentication structure by providing quotable signatures in pieces of verification to their readers. When analyzing claims, these agencies provide evidence of how they have checked them by providing the original sources used in the verification process. The method performed is crucial for fact-checking agencies to classify a claim as "false."

To make a difference in the future, media companies and users on social media need to adopt these quotable signatures. To have the best effect, social media platforms and news outlets should directly support quotable signatures, and the required extension should be natively integrated into browsers. Ultimately, this is also a way for platforms to engage in efforts to combat disinformation and protect democracy actively.

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REFERENCES

Boyar, J., Erfurth, S., Larsen, K. S., & Niederhagen, R. (2023). *Quotable signatures for authenticating shared quotes.* arXiv. Retrieved from https://arxiv.org/abs/2212.10963v2

Coddington, M. (2015). Clarifying journalism's quantitative turn: A typology for evaluating data journalism, computational journalism, and computer-assisted reporting. *Digital Journalism*, *3*(3), 331–348. doi: 10.1080/21670811.2014.976400

Curet, M. (2022). *CNN tweeted about "brave children" in Ukraine signing up to fight Russia.* PolitiFact. Retrieved 2023-03-15, from https://www.politifact.com/factchecks/2022/apr/19/instagram-posts/cnn-did-not-tweet-about-children-ukraine-signing-f/

Dan, V., Paris, B., Donovan, J., Hameleers, M., Roozenbeek, J., van der Linden, S., & von Sikorski, C. (2021). Visual mis- and disinformation, social media, and democracy. *Journalism & Mass Communication Quarterly*, *98*(3), 641-664. (See Introduction) doi: 10.1177/10776990211035395

Diakopoulos, N. (2022). *Predictive journalism: On the role of computational prospection in news media.* Columbia Journalism Review. Retrieved 2023-03-15, from https://www.cjr.org/tow_center_reports/predictive-journalism-on-the-role-of-computational-prospection-in-news-media.php/

Diffie, W., & Hellman, M. (1976). New directions in cryptography. *IEEE Transactions on Information Theory*, *22*(6), 644–654. doi: 10.1109/TIT.1976.1055638

Gehrke, M. (2020). Transparency as a key element of data journalism: Perceptions of brazilian professionals. In *Computation + Journalism Symposium conference proceedings.*

Gehrke, M. (2022). *Os elementos de transparência no jornalismo guiado por dados.* Insular.

Gehrke, M., & Benetti, M. (2021). Disinformation in brazil during the covid-19 pandemic: topics, platforms, and actors. *Fronteiras-Estudos Midiáticos*, *23*(2), 14–28.

Gehrke, M., Eggers, J., De Vreese, C., & Hopmann, D. (2023). What makes news (seem) authentic? indicators from a qualitative study of young adults. *Manuscript submitted to Digital Journalism.*

Gehrke, M., & Mielniczuk, L. (2017). Philip Meyer, the outsider who created Precision Journalism. *Intexto*(39), 4. doi: 10.19132/1807-8583201739.4-13

Johnson, K. A., & St. John III, B. (2021). Transparency in the news: the impact of self-disclosure and process disclosure on the perceived credibility of the journalist, the story, and the organization. *Journalism Studies*, *22*(7), 953–970. doi: 10.1080/1461670X.2021.1910542

Karlsson, M. (2010). Rituals of transparency: evaluating online news outlets' uses of transparency rituals in the united states, united kingdom and sweden. *Journalism Studies*, *11*(4), 535–545. doi: 10.1080/14616701003638400

Karlsson, M. (2022). *Transparency and journalism: a critical appraisal of a disruptive norm.* Routledge.

Kreutzer, M., Niederhagen, R., Shrishak, K., & Fhom, H. S. (2019). Quotable signatures using Merkle trees. In *Informatik 2019: 50 jahre gesellschaft für informatik* (Vol. P-294, pp. 473–477).

Lazer, D. M. J., Baum, M. A., Benkler, Y., Berinsky, A. J., Greenhill, K. M., Menczer, F., … Zittrain, J. L. (2018). The science of fake news. *Science*, *359*(6380), 1094–1096. doi: 10.1126/science.aao2998

Meyer, P. (2002). *Precision journalism: a reporter's introduction to social science methods* (4th ed.). Rowman & Littlefield Publishers.

Moody, D. (2023). *Digital signature standard (DSS)* (Tech. Rep. No. NIST FIPS 186-5). National Institute of Standards and Technology (NIST). doi: 10.6028/NIST.FIPS.186-5

Newman, N., Fletcher, R., Robertson, C. T., Eddy, K., & Nielsen, R. K. (2022). *Reuters institute digital news report 2022* (Tech. Rep.). Reuters Institute for the Study of Journalism.

Peng, Y., Lu, Y., & Shen, C. (2023). An agenda for studying credibility perceptions of visual misinformation. *Political Communication*, *40*(2), 225–237. doi: 10.1080/10584609.2023.2175398

Rogers, S. (2013). *Facts are sacred: the power of data.* Faber and Faber, Guardian Books.

Schiochet, A. (2022). *É falso que instituto alemão apontou fraude nas eleições do Brasil.* Retrieved 2023-03-15, from https://lupa.uol.com.br/jornalismo/2022/11/17/e-falso-que-instituto-alemao-apontou-fraude-nas-eleicoes-do-brasil

Soares, F., & Recuero, R. (2021). How the mainstream media help to spread disinformation about covid-19. *M/C Journal*, *24*(1). doi: 10.5204/mcj.2735

Tong, J. (2023). *Data for journalism: between transparency and accountability.* Routledge, Taylor & Francis Group.

W3C. (2021). *Clipboard api and events, W3C working draft, 6 august 2021.* https://www.w3.org/TR/2021/WD-clipboard-apis-20210806/. (See also https://w3c.github.io/clipboard-apis/)