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The Networked Utilisation of Satellite Images and Geospatial Technology in Journalism

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Introduction: Satellite Journalism Relies on Networks

Satellite data (i.e. geospatial data collected by satellite-borne sensors) is becoming increasingly accessible to journalists and laypeople alike. This has prompted an increase in what we call *satellite journalism* and expanded the involvement of citizen and “pro-am” (Bruns 2010) journalists in otherwise traditional journalistic processes. Despite the proliferation of satellite journalism, its academic research rests still on the launch pad. Mark Corcoran's (2018) report is one of the few available. Work practices and collaboration networks of satellite journalists are not well known, including the possibilities and limits to their work. Another understudied area is ethics.

In this chapter we investigate the contemporary work practices of satellite journalists and demonstrate its ‘networked’ nature (e.g. Heinrich 2011). We use satellite journalism as an example of the (technological) conditions which might promote-or preclude-the development of networked journalism.

We argue that journalist-audience collaboration has the potential to deepen further as satellite technology develops, thereby rewarding organisations that are able to participate in networked co-creation. Developing technologies, however, will also introduce new ethical considerations. Theoretically, we investigate how satellite journalism practices fit into the ideas of networked journalism. Finally, we offer some directions for future development of satellite journalism.

To outline contemporary satellite journalism praxis, we interview six journalists and one earth observation expert with close ties to journalists (Finland, Germany, Norway, UK and US). We also analyse the case of the Bellingcat group and the Syrian Archive platform. Their success is indicative of the benefits of networked journalism, as many mainstream newsrooms still lack even basic skills needed in satellite journalism. At the end of the chapter, we review briefly the literature on satellite journalism ethics, an under-studied area with crucial implications for the future of the practice.

Before exploring satellite journalism, we will briefly discuss the technological developments of geospatial technology, and introduce the concept of networked journalism.

Geospatial Technology and Networked Journalism

Satellites have enabled global communication systems since the 1950s. First developed for military purposes during the Cold War era's space race, they were soon also adopted for civilian uses. The first weather satellite, Vanguard 2, was launched in February 1959 by the United States, and satellite data has constantly increased the accuracy of weather forecasts (Manuel 1992; Datta 2016).

The satellite era in journalism began in 1962 with the US-British-French TV agency collaboration Telstar: it enabled television programmes to be sent across the Atlantic Ocean (Liseblad 2020, p. 27). Another phase began in the 1970s when satellite dishes and cable enabled receiving multichannel television. The Cable News Network (CNN) was one of the innovative outlets that began using inexpensive satellite links during the 1980s. It became famous during the first Gulf War in 1991, being the only international TV broadcaster providing live coverage from Baghdad, making it the first live TV war (Liseblad 2020, p. 27).

During the 1980s, many media companies started to consider launching their own satellites, leading to the development of the Mediasat concept. However, at that time the costs were overwhelming, with an average satellite image costing between \$35,000 and \$73,000. Although the news media did not invest in their own satellites, they started to use satellite images in their hundreds for news stories from 1985 to 1989. For example, in 1986, satellite images finally revealed the seriousness and extent of the Chernobyl nuclear plant disaster (Manuel 1992, pp. 418–422).

At the start of 2021, there were around 3,372 satellites in space, launched by about 40 countries (Union of Concerned Scientists 2021). Although satellites are still primarily for military use, the miniaturisation and diminishing costs of satellite technology have widened the scope of their civilian use. There is an increasing supply of high-resolution images via public institutions such as the European Earth Observation programme Copernicus, as well as images from commercial operators like Maxar Technologies and Planet. Satellites are enabling remote sensing and Earth observation for various environmental and land-use monitoring purposes (Emery & Camps 2017; Liang & Wang 2020), as well as global position, navigation and time (PNT) services for a range of applications via Global Navigation Satellite Systems (Teunissen & Montenbruck 2017). Consequently, their use in journalism has expanded.

Contemporary satellite technology's combination of a low access threshold and a high skill ceiling have created suitable conditions for a mode of journalistic co-creation called networked journalism (Jarvis 2006; Beckett 2008; Russell 2011, 2016) or network journalism (Heinrich 2011). Originally, with "networked journalism", Jarvis wanted to develop the much-hyped concept of "citizen journalism" into a more collaborative model. Here we use Russell's (2011, p. 1) definition that comprises "publics acting as creators, investigators, reactors, (re)makers and (re)distributors of news and where all variety of media, amateurs and professional, corporate and independent products and interests intersect at a new level".

This collaborative, networked nature of contemporary journalistic work has been noted in the contexts of journalistic expertise (Anderson 2013), journalistic startups (Deuze 2017), cooperation between industry and networked amateurs (Bruns 2010), describing the transformation of journalism (Deuze & Witsche 2018), as well as in more specific areas such as satellite journalism (e.g. Corcoran 2018, pp. 31-33), data journalism, and news in social media (Russell 2016).

Satellite Journalism

Our definition of satellite journalism is journalism that utilises data collected by satellites as a part of storytelling or as a source of information. This includes the use of satellite imagery and other geospatial data produced by satellites, such as for mapping or location purposes.

Manuel (1992 p. 410) uses the term "remote sensing", by which he means "the gathering of information about the Earth from satellites using special sensors as they orbit the planet". With the advent of drones and smartphones, the term remote sensing might be ambiguous, despite it still being used in relation to satellite imagery (Lawrence 2020). Sensors are ubiquitous, and these other sensor types are used in citizen journalism, crowdsourced journalism, human rights activism and by officials and security personnel. Weiss (2016)

advocates the term “sensor journalism” to denote journalism using any kind of remote or local sensors. Therefore, using the term satellite journalism distinguishes it from other types of remote sensing or sensor use; for example, when using open-source data from social media, a journalist can remotely “sense” happenings.

An insightful early example of the contemporary era of satellite journalism is a story published by ProPublica, a non-profit US investigative reporting website. *Losing Ground*, an environmental story about the erosion of the Louisiana coastline, used archived satellite images to demonstrate the negative effects of climate change and drilling and dredging for oil and gas (ProPublica 2014).

Environmental journalism seems to particularly benefit from the use of satellite images. Powerful contrasts created by juxtaposing two or more pictures from different times allows for an instant appraisal of the extent of an event or a longer process. Examples include Brazilian forest fires (Lai, Lu & Migliozzi 2019), drought issues at Lake Aral in Russia and in Australia (D’Amore 2020) and the extent of “silence” due to Covid-19 lockdowns and the shutdown of large sectors of society, as evidenced using pictures of cities and ports (Roston 2020).

Practices of Satellite Journalism: Interviews with Trailblazers

In order to gain an overview of contemporary satellite journalism praxis we interviewed six journalists, and one Earth observation expert with close ties to journalists, from Finland, Germany, Norway, the United Kingdom and the United States. We conducted both open and country-specific web and database searches using keywords pertaining to satellites (in English, Finnish, German and Norwegian). These searches brought up over 100 news articles that used satellite images. From this sample, we chose articles that varied in their length, depth of analysis and use of data. We then used the bylines to identify suitable journalists, who were then contacted and interviewed. All but one of the interviews were conducted live over the internet, recorded and transcribed. The other interview was conducted by email. All interviews were semi-structured and utilised the same questioning framework.

The interviewees emphasised that the overall process of producing satellite-based journalism is not radically different from other journalistic work. While many spend their free time enthusing over newly released footage or skimming through databases, most topics are discovered conventionally through the journalists’ own intuition, tip-offs or other media. Thereafter, the journalistic process diverges according to the goals and nature of the investigation; simply relaying interesting images or information (often shared free of charge by an image provider) takes a matter of mere minutes, but investigative projects may take months to follow through. In this sense, satellite-borne remote-sensing technology is just another “tool” in the journalists’ kit. That being said, it is a tool that makes possible what was previously beyond the reach of most journalists: vividly illustrating large-scale changes in landscapes, investigating faraway or hostile areas and maintaining regular (even retroactive) surveillance of a target.

Satellites, like all journalistic tools, have their limitations and drawbacks in terms of utility. While a cornucopia of satellite data is freely available, high-resolution images tend to cost

more than newsrooms are willing to pay. Only one of our interviewees had purchased specific satellite images, and all agreed that freely available images are generally sufficient. These include, for example, those disseminated by the Copernicus programme and the various images disseminated by Google Earth. Urban areas are usually well-covered by timely and high-resolution images, but journalists run into issues in rural areas, especially if they need high-quality data from a specific date. Dispatching a satellite on a bespoke flyover costs thousands of dollars, and even then it takes days or weeks for the newsroom to receive their order. Some investigations can afford this, but most daily journalism cannot. This was seen by the interviewees as the most significant barrier to increasing the use of satellite images.

Using satellite data in journalism requires the journalist to possess some basic skills, but most interviewees suggested this threshold is low. Freely available images and increasingly user-friendly database interfaces make it easy to begin exploring and experimenting. Yet the use of satellite data in journalism, especially in a sophisticated manner, still appears limited. As one of the interviewees put it:

Right now it just feels really kind of insular and niche, and only a few outlets really understand how to do it well. (...) [T]here are other colleagues who can work with satellite imagery, but there's some trepidation about it. They don't, maybe they don't know where to look or who to ask.

This state of affairs was lamented by several interviewees, and many suggested that all journalists should acquire at least a basic understanding of satellite journalism's possibilities. One interviewee described this learning process as eye-opening:

Once you have a bit of knowledge about "okay what is out there", in terms of satellite imagery and satellite data, it kind of opens up the way you think about your story.

One reason for practitioners' trepidation about satellite journalism may stem from the non-negligible danger of misinterpreting data. The interviewees considered it one of the biggest issues in satellite journalism, along with the cost and limited availability of certain images.

Bellingcat, Syrian Archive, and the Networked Nature of Satellite Journalism

Overall, satellite journalism has made it much more difficult to conceal ongoing large-scale abuses from mainstream media. Examples include visual evidence of stories such as the bombing of Aleppo in Syria (Woody 2016), Uighur re-education camps in China (Doman, Hutcheon, Welch & Taylor 2018) and Russian self-propelled howitzers in Ukraine (Higgins 2015). This work is also done outside traditional newsrooms.

Bellingcat is an organisation founded by Eliot Higgins that came to public attention in 2014 when its open-source investigation uncovered critical information about the downing of flight MH17, a commercial aircraft shot down over Ukraine by Russians (Bellingcat.com 2020). Since then, both mainstream media and researchers have cited Bellingcat and its investigations, and it now involves contributors from over 20 countries. It has come to be recognised as an expert in verification of information. For example, Bellingcat proved the

existence of Nana Alabed, a Syrian girl who was writing about the Syrian conflict (Waters 2016).

By being involved in networks with both data sources on the ground, such as human rights organisations, and traditional newsrooms, and by being itself an investigative collective, Bellingcat embodies networked journalism (Russell 2016). Satellite technology provides tools and material for investigative collaborations that would otherwise be inaccessible to most. The basic open-source techniques used by Bellingcat are available to laypeople and require few more resources than an internet-connected computer and disposable time.

One focus for Bellingcat is using open-source data, including satellite data, in the verification of human rights violations committed by authoritarian states. It also regularly fact-checks stories that employ visual evidence circulating on social media platforms such as YouTube.

An organisation affiliated with Bellingcat, Syrian Archive, also employs networking with journalists and data sources on the ground as well as satellite journalism (Deutch & Habal 2018). It is a legitimate human rights actor in its own right, and human rights organisations like it are becoming recognised experts in the use of visual data (Ristovska 2019). In networking with both journalists and sources on the ground, establishing a trusted collection of sources is of paramount importance, as emphasised by Bellingcat and Syrian Archive (Deutch & Habal 2018).

Syrian Archive mainly uses eyewitness evidence, but also combines this with satellite imagery (Deutch & Habal 2018, pp. 65, 71). By using satellite data and crowdsourced data from social media, areas traditionally out of the reach of journalism can be reached. Traditional journalism has followed suit; for example, *The New York Times* video unit, with no on-site presence, used satellite images in conjunction with drone photo footage and Facebook videos to unveil a story about the shipment of bombs from Italy to Saudi Arabia (Browne, Marcolini & Tiefenthäler 2017; Ristovska 2019, p. 333).

Going back to our interviews, we find similar networked practices. According to the interviews, satellite journalism stories are created by individual journalists, by teams or with the help of outside experts. While some interviewees were confident in their skills in their preferred techniques, most told of regularly seeking outside help with demanding projects. Journalists reach out to their colleagues, researchers, satellite operator companies, think-tank analysts and other experts to help interpret the data or validate in-house analyses. Being in contact with sources and experts is standard fare in journalistic work, but much of satellite journalism is heavily dependent on networks (c.f. Beckett, 2008 p. 46). First, satellite data is relayed through a network of operators and service providers. Second, journalists use their networks to find inspiration, discover stories and material and solicit technical help. Third, journalists use formal and informal networks of experts to make sense of the data, and to avoid making false assumptions. Journalists may also use citizen-supplied material or commission local freelancers to verify satellite data from the ground.

The use of experts, from either the satellite image providers or interested third parties like NGOs, has been noted as a recurring feature in satellite journalism stories (Corcoran 2018: pp. 31–33, 39–40, 54–55, 59–61, 67). Crowdsourcing is also an option (Corcoran 2018: pp. 62–63). Thus, the concept of networked journalism (Russell 2011, 2016) fits the processes co-opted by the journalists interviewed for this study.

Ethical Issues in Satellite Journalism

As noted, ethics of satellite journalism require attention from researchers and journalists alike. Issues include access, privacy, censorship, misleading information and the development of AI.

It has been claimed that satellite data, and by extension satellite journalism, is a key factor in the “golden age of surveillance” (Livingston & Risse 2019, p. 143). In this age, basically anyone can make use of satellite data and the billions of sensors around the world in the form of smartphones to hold authoritarian regimes and warlords accountable. Of course, authoritarian regimes are also capable of making quick use of these new technological affordances (Livingston & Risse 2019).

Manuel (1992 p. 413) was among the first to raise the question of privacy in terms of remote sensing by satellites. The discourse around satellites and privacy has since then changed towards both global transparency as well as clandestineness, and satellite technology has raised security concerns (Lawrence 2020). In recent years, there has been a growing sensitivity among the general public regarding geospatial data and privacy. Several provisions of the European General Data Protection Regulation (GDPR) are relevant in processing personal data in a satellite data context. However, the EU has not issued a specific opinion or statement regarding satellite data, or geospatial data more generally.

It is not (yet) possible to “track” movements of individuals in real-time using Earth observation technology. Still, satellite data may be combined with other datasets, and the final products or services may indeed raise privacy concerns, even if the raw or pre-processed input data itself does not. This may have implications for the future of networked satellite journalism: will journalists be able to share potentially sensitive data with outside experts or crowdsource its analysis?

As our interviews earlier in this chapter showed that access to images is one of the main barriers for satellite journalists’ work, one should also consider the effects of censorship of satellite data. As remote sensing develops and satellite image quality improves, it also poses threats to national security interests of governments. Examples of this include the "Shutter Control" policy of the US (Corcoran 2018, p. 10) as well as the artificially reduced resolution of images available from Israel by US satellite imagery companies (Keysar 2020).

For this chapter, we also interviewed an expert in the commercial space industry. The expert noted that machine learning, artificial intelligence and deep learning impact the field. This in turn creates a host of new ethical and legal considerations to ponder (Livingston & Risse 2019; Maas 2019). It should be noted that machine learning and algorithmic applications already feature in most satellite journalism. Most of the time, users acquire data that has involved machine learning applications, and less often raw data (e.g. GeoTIFF files). Due to this, ethical considerations must also include the ethics of AI in addition to issues of privacy, control and ownership of the data. AI could, in theory, replace crowdsourcing analyses of large satellite data sets, but its use might also lead to unexpected inaccuracies or oversights. Journalists could also crowdsource the AI’s training data from the satellite journalism network. In the latter case even the mere composition of the group who train the AI, has ethical implications.

Transparency of satellite data has increased over time (Livingston & Risse 2019; Lawrence, 2020), and satellites have empowered journalists, citizens and activist groups to better hold governments and corporations accountable. However, visual evidence can also be misleading, with severe consequences. This was the case with the satellite evidence of the Iraqi “weapons of mass destruction” presented by the US Secretary of State Colin Powell at the UN as a precursor to the second Gulf War. The case also revealed media complicity, as the pictures were widely presented without alternative interpretations in 2003, thus creating public approval for the invasion (Mardura 2020, p. 5424). This is just one case that highlights the importance of proper verification and interpretation processes.

Conclusion: Prospects and Threats to Networked Satellite Journalism

The journalist-audience collaboration has the potential to deepen further as satellite technology develops, thereby rewarding organisations that are able to participate in networked co-creation. Developing technologies, however, will also introduce new ethical considerations.

It seems that journalists in general do not yet possess the basic knowledge that would enable them to make use of satellite data. According to our interviews with journalists and tentative scanning of satellite stories from around the world, satellite images are the most commonly used form of data, and the use of other satellite data, such as global positioning, is rare. There is certainly a need for satellite journalism education. Today, satellite data is a relatively easy-to-use tool in journalism, and the availability of high-quality images up to a resolution of 30cm per pixel from around the world has made it very appealing. Using images from commercial and public image providers, journalists can tell stories from inaccessible locations and highlight changes in our environment. However, as our interviews show, gaining access to suitable images remains one of the most significant barriers to journalists using satellite data. In many cases, newsrooms cannot afford to buy the most fitting images. This all demonstrates that satellite journalism still has room to grow towards more advanced and resource-intensive projects.

Satellite data is a valuable and relatively low-threshold tool for journalists, activists and basically anyone with an internet connection. Therefore, it easily enables networked journalism processes where reporters work together with people outside their newsroom to gather, analyse and verify information. On the other side of the coin, some in-depth investigations require sophisticated techniques and knowledge. In some other contexts of networked and citizen journalism, cooperation of journalists with people outside the newsrooms have mostly been related to citizens witnessing news events and sending in images. With satellite data, most cooperation is instead needed in the demanding area of analysis: when making conclusions based on satellite data. Also, in this case, connections to outside expertise and cooperation become necessary for all but the most skilled journalists and well-resourced newsrooms. It remains to be seen how this dynamic between journalists and their networks develop, if or when newsrooms gain know-how on satellite journalism.

As the accessibility of satellite data increases we can expect to see more journalists and laypeople alike acquiring expertise in satellite journalism. As one of our interviewees formulated:

I expect satellite images to become more prevalent in journalism. Not only because we have a growing number of satellites delivering data, but especially because access to satellite data has become easy thanks to open-data policies and services that pretty much deliver you a processed image of your area of interest. With all of that, I also expect satellite images to be used like any other news source [...]

Improved access will further enrich the soil for cultivating wider and stronger networks; the Bellingcat group and various activist groups are indicative of this trend. Whether professional journalism will be able and chooses to involve itself in these networks is yet to be determined. Gaining sophisticated in-house satellite data analysis capabilities would require significant investments in training or new personnel from newsrooms. In a time of financial hardship (e.g. Nielsen 2016), this path might appear risky and pursuing networked co-creation tempting. However, developments in technology, policy and regulations may raise legal and ethical questions that dissuade journalists from networked collaboration.

Currently, the journalists we interviewed do not see ethical issues as major barriers to their work. They feel it is important to be accurate and transparent, to show the audience how the analysis was done and explain what the satellite data aims to prove. In general, interpretation and verification of data are of paramount importance. As the resolution of images presumably improves in the future, matters such as privacy will become a greater concern. Ethical use of satellite data merits further discussion among both scholars and practitioners: careless utilisation of geospatial data in journalism could incentivise further regulation and censorship on one hand and stoke audiences' suspicions on the other.

Future prospects for satellite journalism include, for example, real-time imaging and videography, the use of satellite data in local journalism and using machine learning to detect news from big (satellite) data. Whether, and how, these possibilities are realised will have much to do with access and future regulation, which in turn should build upon thorough ethical deliberation. Future research should consider these issues, for example by investigating key incidents (e.g. Uskali et al. 2020). What pioneering satellite journalism networks practice today may decide what becomes possible tomorrow. This alone should be reason enough for established news organisations not to recuse themselves from engaging with those networks - even if their resources would so permit.

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