

## Earth Observation and International Security: The Role of Uncertainty in Satellite Imagery Analysis by Non-State Actors<sup>1</sup>

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*While satellite imagery analysis has for a long time been the realm of national intelligence, its commercialisation has allowed non-state actors to produce new forms of policy-relevant knowledge. This ESPI Perspective reflects on the practices of knowledge production based upon satellite imagery and its wider ramifications. Satellite imagery analysts experience considerable technical and interpretational uncertainties when producing politically sensitive security knowledge. This has implications for the handling of “fact-based” information by security policy actors and the media. The findings of this Perspective aim to contribute to a necessary debate on the legitimacy of knowledge claims based upon satellite imagery in the field of international security.*

### 1. Introduction

In his speech to the UN Security Council in 2003, former Secretary of State Colin Powell referred to satellite imagery analysis among other sources to make a case for the existence of hidden chemical weapons production in Iraq. Ultimately, these claims could not be proven. In retrospect it can be said that the ‘facts’ presented were no facts. However, this consequential misrepresentation of security knowledge has not slowed down the proliferation of satellite imagery analysis on the international stage. Nor has it prompted an extensive theoretical debate on how satellite imagery experts produce analyses that are

accepted as authoritative and used to legitimise certain policies or humanitarian action.<sup>2</sup> This Perspective aims to launch this debate by investigating how current non-governmental satellite imagery analysts produce knowledge in the context of international security.

Satellite imagery has been described as “hard to interpret” but a powerful resource in security discourses.<sup>3</sup> Nevertheless, hardly any research has been conducted on how non-governmental experts deal with the challenges of analysing satellite images in an oftentimes politically sensitive context.<sup>4</sup> Using an original set of seven in-depth interviews, this Perspective investigates the epistemic practices of non-governmental satellite

<sup>1</sup> This ESPI Perspective is based on the chapter “Blurry Pictures, Clear Evidence? Non-Governmental Satellite Imagery Analysts as an Epistemic Community in Security Discourses” in C. Günay & J. Pospisil (eds.), *Add-On 14/15: Legitimacy Beyond Normative Orders?* (facultas.wuv, 2015), 115-128.

<sup>2</sup> For exceptions see: Herscher, A. (2014). *Surveillant Witnessing: Satellite Imagery and the Visual Politics of Human Rights*. *Public Culture*, 26(3), 469-500; or Shim on how satellite imagery constructs distant places as imaginations in world politics in Shim, D. (2014). *Remote Sensing Place: Satellite Images as Visual Spatial Imaginaries*. *Geoforum*, 51(2014), 152-160; or Hong on the misrepresentation of North Korea by satellite imagery in Hong, C. (2013). *The Mirror of North Korean Human Rights: Technologies of Liberation, Technologies of War*. *Critical Asian Studies*, 45(4), 561-592.

<sup>3</sup> Florini, A. M., & Dehqanzada, Y. (2006). *Commercial Satellite Imagery Comes of Age*. In R. Z. George & R. D. Kline (Eds.), *Intelligence and the National Security Strategist: Enduring Issues and Challenges* (pp. 159-168). Lanham: Rowman & Littlefield.

<sup>4</sup> Aday, S., & Livingston, S. (2009). *NGOs as intelligence agencies: The empowerment of transnational advocacy networks and the media by commercial remote sensing in the case of the Iranian nuclear program*. *Geoforum*, 40(4), 514-522.

imagery experts who mainly focus on matters of non-proliferation and human rights in North Korea, Iran and Pakistan. Following this, we raise a number of issues regarding the function and impact of remote sensing in an international security context. While these reflections are by no means exhaustive, they are intended to contribute to the discussion on the wider ramifications of an increased use of commercial satellite imagery by non-state actors.

## 2. Techno-Political Developments in Remote Sensing Technologies

The privatisation and advancement of satellite technology have led to novel implications for international politics. In the aftermath of 9/11, many states have further restricted information in the public domain and expanded their use of surveillance technology to control their own and other citizens. However, applications like Google Earth and commercial satellite technology also allow spaces to be seen that governments had wanted to keep secret from civil society.<sup>5</sup> The increasing availability of commercial and open source satellite imagery has begun to challenge governments' interpretational sovereignty by opening up spaces for new expert groups to play an influential role in security discourses that is based on their "authoritative claim to policy-relevant knowledge".<sup>6,7,8</sup> Indicative for this is the growing amount of international organisations, freelance experts and non-governmental organisations (NGOs) that use commercial satellite imagery to augment assessments of global security and human rights.

For instance, non-governmental satellite imagery experts closely observe North Korea's nuclear weapons program and publicly report any development on the ground of its Punggye-ri nuclear test site. In 2002, experts discovered hitherto undisclosed nuclear facilities in Iran and pressured the Bush administration to publicly acknowledge an Iranian enrichment programme it had known about for over a year.<sup>9</sup> NATO has used commercial imagery to prove that Russian military forces were involved in operations inside Ukraine in 2014. Lastly, the Satellite Sentinel Project collects satellite imagery as evidence of war atrocities or threats to civilians in Sudan and South Sudan and passes them on to policymakers and

the press. These examples also show that remote sensing data is particularly valuable in situations of uncertainty. Especially when it comes to countries that are hard to access due to political restrictions, security reasons or their vast size, which results in there being only very poor public information available.

In the above cases, public observation satellites function as epistemic technologies. These can be understood as "systematic procedures or processes which amplify human epistemic capacities".<sup>10</sup> Remote sensing technologies are epistemic technologies in that they provide new information and thereby offer opportunities to acquire new knowledge about nearly any location without geopolitical or legal constraints. Techno-political advancements have made satellite technologies accessible to a community of transnational non-state actors. They have been able to not only produce policy-relevant knowledge, but also to directly disseminate it globally without time or cost constraints. This has had the effect of assigning them a control function for state information. We argue that these developments have opened up new opportunities for non-governmental expert groups to play an influential role in shaping security discourses. At the same time, this raises questions about the accuracy and authority of their public analyses as well as the motivations, conditions and broader repercussions of their knowledge production.

## 3. Non-Governmental Satellite Imagery Experts as Epistemic Community

Essentially, the concept of epistemic communities offers a way to examine the growing role of non-state experts to exert influence on issues of international politics. These communities are commonly defined as "network[s] of professionals with recognised expertise and competence in a particular domain and an authoritative claim to policy-relevant knowledge within that domain or issue-area".<sup>11</sup> In the following, we make use of Haas' four categories of epistemic communities as point of departure to better understand the group of transnational non-governmental satellite imagery analysts working on issues of non-proliferation and human rights in North Korea, Iran and Pakistan in order to test whether they share (1) normative

<sup>5</sup> Perkins, C., & Dodge, M. (2009). Satellite Imagery and the Spectacle of Secret Spaces. *Geoforum*, 40(2009), 546-560.

<sup>6</sup> Haas, P. (1992). Introduction: Epistemic Communities and International Policy Coordination. *International Organization*, 46(1), 1-35.

<sup>7</sup> Antoniadou, A. (2003). Epistemic Communities, Epistemes and the Construction of (World) Politics. *Global Society*, 17(1), 21-38.

<sup>8</sup> Cross, M. K. D. (2013a). Rethinking Epistemic Communities Twenty Years Later. *Review of International Studies*, 39(1), 137-160.

<sup>9</sup> Aday, S., & Livingston, S. (2009). NGOs as intelligence agencies: The empowerment of transnational advocacy networks and the media by commercial remote sensing in the case of the Iranian nuclear program. *Geoforum*, 40(4), 514-522.

<sup>10</sup> Hooker, C. A. (1987). *A Realistic Theory of Science*. Albany: State University of New York Press.

<sup>11</sup> Haas, P. (1992). Introduction: Epistemic Communities and International Policy Coordination. *International Organization*, 46(1), 1-35.

principles, (2) causal beliefs, (3) notions of validity and (4) a common policy enterprise.

The interviewed experts stated that the most pressing motivation behind their commitment to analyse satellite imagery is to enhance transparency for civil society about issues of human rights and international security. More substantially, some share specific values in that they relate their work to the fight against human rights abuses in North Korea and to the promotion of non-proliferation, which they perceive as a threat to international peace. In many cases they draw a clear distinction between their work and governmental analysis and highlight the importance of societal knowledge about issues of international security, as this quotation indicates: “Our point of view is that civil society needs access to information about nuclear weapons in order for those societies to have a voice. If you don’t know what’s going on and what the basic parameters are in terms of nuclear deterrence then society can’t have much of a say, it’s all left to the privileged decision makers with access to classified information. It’s a tool to have that influence in the public domain”.<sup>12</sup>

The imagery analysts share the causal belief that since most of the investigated countries are very difficult to access satellite imagery provides one of the very few entry points to their relevant sites. Furthermore, they experience that governments and intelligence actors are not willing to share much of their information, which leads to a culture of speculation and rumours about possible threats, e.g. from North Korea’s nuclear capabilities. Therefore, they draw on commercial remote sensing to enhance the amount of publicly accessible information. All interviewees expect satellite imagery analysis to continue to become more relevant. They base this prediction on the belief that now that satellite technologies have made their way into the commercial domain, there will be greater financial support to spur technological development and increasing international competition that will positively influence the availability and prices of commercial high-resolution imagery.

The expert group implicitly agrees on shared notions of validity in that they employ several strategies to validate their knowledge claims. While all analysts concur that a multiplication of sources is necessary to ensure the correctness of specific sightings on a satellite image, most of them also consult with their peers on how to interpret an image. By including other sources than satellite

imagery in the process of interpretation, they attempt to reduce possible errors and misinterpretation.<sup>13</sup> Furthermore, they all see the process of communicative validation as a central element for making legitimate knowledge claims and state that they never publish results before they have been checked by other colleagues, regardless of how much experience they have in a subject. Furthermore, imagery analysts adhere to a shared notion of validity through visibility which was succinctly formulated by one interviewee: “I don’t have to believe your word if you can prove it to me with an image”. This is often reinforced by the inability to actually visit the areas of interest and difficulties in assessing the accuracy of eyewitness reports or statements by parties involved in a conflict. This notion of validity implies a strict hierarchy in what is eligible as evidence when making a claim about developments on the ground and puts visuality first.

Analysts expressed criticism of states’ information supremacy via satellite technologies because it hampers the transparency of decisions in foreign and security policy. As a consequence, the group shares a common policy enterprise insofar as they follow an open source policy for their own publications with the objective of enhancing the transparency of methods and security knowledge. Interviewees shared the assumption that developments in North Korea regarding its nuclear proliferation activities and human rights abuses are unacceptable, threatening the North Korean people as well as the international community. As one interviewee states, “[s]atellite imagery is a tool to try and effect change. The change we want to effect is raising public awareness of events that relate to human rights or nuclear security, communicating more effectively about these issues by the use of satellite imagery, generate new knowledge in the open domain that has previously been only in the classified domain”. To further promote this cause, analysts call for improvements regarding access to satellite imagery for non-state actors in terms of quantity and quality. Particularly the latter would involve changes in U.S. legislation that currently regulates the resolution of commercial imagery. More generally, the government still has various instruments to limit or restrict access to commercial satellite imagery on account of national security concerns.<sup>14</sup>

#### 4. Practices of Knowledge Production Based on Satellite Imagery

process that was quite often described as assembling different pieces of a puzzle.

<sup>14</sup> Herscher, A. (2014). Surveillant Witnessing: Satellite Imagery and the Visual Politics of Human Rights. *Public Culture*, 26(3), 469-500.

<sup>12</sup> Haas, P. (1992). Introduction: Epistemic Communities and International Policy Coordination. *International Organization*, 46(1), 1-35.

<sup>13</sup> These sources include 3D modelling of buildings and facilities, GIS databases, ground reference information, refugee accounts, reports, propaganda videos, press reports, interviews with defectors, statements by foreign and domestic officials – a

In the following section we will briefly outline the different steps of imagery interpretation as described by the interviewed analysts. Understanding the technical side of this process is necessary when it comes to grasping the uncertainties that emerge in the process of interpretation.

As opposed to Colin Powell's assertions during his (in)famous speech at the UN Security Council meeting in 2003, satellite imagery analysis in most cases does not involve "poring over a light table for hours and hours."<sup>15</sup> Instead, the process can be roughly divided into four steps: first, detection refers to determining the absence or presence of a particular feature in the image based on differences in contrast. Second, identification involves the specification of that particular feature or object. Third, measurement of the feature, which defines the physical dimensions in terms of size, spatial arrangements, shadows and relation to other objects. Fourth, classification pays attention to the qualitative character of the object. Analysts integrate their findings into the broader context of their previous analyses and experience – in this case into a political, historical and social context – and attempt to place the object in its surroundings.

Every step of this process also involves technical uncertainties that are most often related to the resolution or currency of the imagery, but also to weather and light conditions at the moment the picture was taken. Referring to an analysis of North Korea's west coast missile launching site, one interviewee stated that it was impossible to discern whether a specific building had a concave or convex dome because the sunlight was reflected in an unfavourable way at the moment the image was taken.<sup>16</sup> Some also raised the potential problems arising from customers' expectations in the context of commissioned work. While it is possible to answer the question whether a village was burnt down or not, the case becomes more complicated when asking for the culprit: "You can provide information on what you see and what is happening, and possible meaning to it, but the customer wants you to say 'Yes, they're committing outrageous atrocities!' I can't do that".<sup>17</sup> One coping strategy is to use quantifiable approximations of probability based on historical evidence that looks for similarities in the image itself.

Another important factor of uncertainty is the varying amount and necessity of background knowledge about technical facilities on the ground, e.g. when assessing nuclear power plants, factories or military installations. Aside from the technical tool kit for conducting satellite imagery analysis, the expert requires substantial knowledge

about the object of observation and how it appears on aerial imagery. If this is insufficient, an imagery analyst will not be able to track and understand the changes in pictures. Lastly, non-governmental analysts have to cope with certain institutional difficulties that vary significantly among our interviewees, such as financial constraints and associated availability of imagery.

## 5. Potential of and Points of Discussion for the Use of Commercial Satellite Imagery

Analysts aim to cope with these uncertainties responsibly. A growing amount of individuals, NGOs and other non-state actors make use of the possibility to observe any place on Earth via space-based surveillance as is stipulated in the UN Principles on Remote Sensing. Arguably, this can lead to greater transparency and promote more effective norm compliance on the international stage in at least two distinct modes. First, in the deterrence mode conscious actors who are aware of their constant surveillance are likely to shy away from committing norm or law violations in the first place. They fear that unlawful actions such as human rights or treaty violations might be captured on satellite imagery and publicised right away. Apprehending these consequences they might refrain from following through with their action. As Herscher points out, the Satellite Sentinel Project (SSP) has operated on this reasoning.<sup>18</sup> By constantly 'spying on' all factions in the Sudan and South Sudan conflicts, SSP attempts to deter threats to civilians in the region. By the same token, the consciousness of surveillance might also lead to the employment of strategies of Camouflage, Concealment and Deception (CCD) to confuse the observers. Second, in the documentation mode when the norm violation has already occurred, archived satellite imagery allows for re-constructing the events. In these cases, Earth observation data often needs to be corroborated by additional evidence such as eye-witnesses in order to credibly identify the perpetrators and activities on the ground. Moreover, to reinforce the violated international norm, further action needs to be taken such as naming and shaming by NGOs or sanctions by governments and international organisations. Examples include public reports using satellite imagery about the on-going construction at North Korea's nuclear facilities or rocket launching sites that are regularly followed by calls from the international community to refrain from these activities.

Going beyond individual cases, there are several ways to approach the role of remote sensing in bolstering global transparency regarding matters of

<sup>15</sup> Powell, C. (2003). Full text of Colin Powell's speech. *The Guardian* Retrieved November 20, 2014, from [www.theguardian.com/world/2003/feb/05/iraq.usa](http://www.theguardian.com/world/2003/feb/05/iraq.usa)

<sup>16</sup> Ibid.

<sup>17</sup> Ibid.

<sup>18</sup> Ibid.

international security. What follows from the growing commercial availability of satellite imagery is that access is theoretically possible for every individual and group which essentially can be called a democratisation of data. However, since – as pointed out above – satellite imagery analysis is an acquired skill that requires training and experience, it needs experts to translate this data into information or knowledge and to publicly distribute it. The experts under study use various communication channels to make available their knowledge to a large audience such as open-source internet outlets, academic publications, TV or collaboration with journalists. Non-governmental organisations are empowered to challenge other actors' interpretations of events or raise their own issues that a government wanted to hold back or keep secret.

In other instances, however, civil society actors enter into cooperative relationships with international organisations or governments to merge resources for the purpose of efficacy. This is most often the case in times of humanitarian crises such as the earthquakes in Haiti in 2010 or Nepal in 2015. However, since these instances often require a great amount of satellite imagery, one crucial issue to consider is that more often than not non-state actors are reliant on free access to Earth observation data provided by commercial imagery providers or governments. Due to the high prices of current imagery most NGOs cannot afford purchasing large amounts of imagery necessary to monitor an area of interest. This severely qualifies their independence in deciding which issues to cover and research. Lastly, when monitoring an active conflict or its effects, analysts need to weigh the unintended consequences of making their information public in order to protect already vulnerable populations and not provide increased situational awareness to parties to the conflict.<sup>19</sup>

## 6. Conclusion

The commercialisation and advancement of satellite technology has made possible the emergence of a new group of non-governmental experts that employs satellite imagery analysis to produce policy-relevant knowledge about issues of international security. We have empirically shown that the satellite imagery analysts under review form an epistemic community (1) that is committed to enhancing transparency for civil society about issues of human rights and international security;

(2) that considers satellite technologies suitable to gain access to remote places and to ascertain or compensate for state information; (3) that includes as many diverse sources as possible and consults with their peers to increase the validity of their analyses; and (4) that aims at advocating greater transparency on issues of international security by providing society with politically sensitive knowledge on regions and countries that are hard to access.

Satellite imagery understood as an epistemic technology can be a constitutive element of the emergence and establishment of epistemic communities. Remote sensing facilitates new modes of knowledge production and dissemination and at the same time limits the number of individuals capable of producing that knowledge to a group of specialised experts. This calls for a closer look at the process of knowledge production itself as it is the basis of the authority and influence of satellite imagery analysts. In doing so, we empirically reconstructed the technical and interpretational uncertainties that members of the analysed epistemic community experience in their daily practice. The former, such as low resolution, high-priced imagery or negative weather conditions, considerably affect the latter. Interpretational uncertainties can arise from insufficient knowledge about the specific object of observation on the part of the analyst. While most interviewees stated that they act responsibly with these difficulties, it is important to be aware of their existence in order to correctly assess the legitimacy of analysts' knowledge claims. This is even more important regarding "fact-based" statements by security policy actors and the media that build upon satellite imagery analysis without sufficient knowledge about the above outlined constraints and limitations of that kind of analysis. Furthermore, the findings in this Perspective point towards some of the current limits and ethical implications of non-governmental satellite imagery interpretation. This especially involves data dependency of non-state actors as well as the potential wider ramifications when providing information to conflicting parties. Finally, this ESPI Perspective recommends paying greater attention to the uncertainties that are inherent to the process of (security) knowledge production so as to foster a constructive and necessary debate on the legitimacy of knowledge claims in the field of international security discourses.

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<sup>19</sup> Raymond, N. A., & Card, B. (2015). Applying Humanitarian Principles to Current Uses of Information Communication Technologies: Gaps in Doctrine and Challenges to Practice Retrieved July 25, 2015, from

<http://hhi.harvard.edu/publications/applying-humanitarian-principles-current-uses-information-communication-technologies>



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