CHAPTER 10

Battling information overload in military intelligence & security organisations

Tess Horlings, Roy Lindelauf & Sebastiaan Rietjens

Abstract

Military intelligence & security organisations are confronted with information overload as a result of continuously increasing amounts of data, high levels of uncertainty of the data, as well as multiple data formats. Information overload has serious consequences hampering the effectiveness and efficiency from the individual to the organisational level. Drawing upon insights from adjacent fields such as business administration, psychology, and communication science, this chapter analyses how people, practices and tools relate to information overload in military intelligence & security organisations. Findings of the chapter include a need for reevaluation of the type of personnel and their specific skillsets; the identification of several issues that hamper the organisational practices of information overload (collection outpacing analysis, data governance, distinguishing signals from noise, and changing intelligence processes); and a need to integrate appropriate tools (e.g., software packages, custom-made algorithms and automatisation scripts).

Keywords: Information overload; Intelligence & security organisations; Data governance

10.1. Introduction

In the current information age, military intelligence & security organisations are confronted with information overload, which is generally defined as a situation in which 'decision-makers face a level of information that is greater than their information processing capacity'.[1] Such information overload is not only the result of the continuously increasing amount of data that needs to be processed (e.g. due to the introduction of new technological platforms such as the F35, the MQ-9 Reaper or the advancement of the soldier modernisation program), but also of the high levels of uncertainty of the data, the increase in data that is available in real-time, as well as multiple data formats with structured and unstructured data from text, image, multimedia content, audio, video, sensor data or noise.[2]

Information overload has serious consequences hampering the effectiveness and efficiency of military intelligence & security organisations from the individual to the organisational level.[3] Despite this consequence 'it is surprising how little academic attention has been devoted to the changes that are taking place in the technology, management and integration of the intelligence systems that will underpin any Revolution in Military Affairs.'[4]

This chapter provides an understanding of the main components and processes leading to information overload in military intelligence & security organisations. In section 10.2 a conceptual framework of information overload is presented based upon literature from business administration, psychology, and communication science.[5] Section 10.2 concludes that people, practices and tools are the main components that influence information overload.

In section 10.3 this conceptual framework is used to analyse the concept of information overload within military intelligence & security organisations. Finally, section 10.4 discusses how a thorough understanding of the concept of information overload may benefit military intelligence & security organisations.

10.2. Information overload

10.2.1. Defining information overload

The attention for information overload in academic debate was at its highest level in the 1980s and 1990s, mainly focusing on the effects of wasted time, decreasing efficiency and health concerns, after which attention decreased in the 2000s.[6] Nearly thirty years after its initial peak, information overload research is regaining attention as the information age is exponentially increasing the amount of available data.[7] For organisations, information overload is regarded as one of the main challenges of the digital age.[8]

A broad spectrum of academic debates has been theorising on the issue of information overload. Especially management disciplines, such as accounting, organisational science, and marketing, but also studies in health care and psychology have been discussing the topic.[9] Regardless – or, as a result – of the broad spectrum of literature, recent studies indicate that a standardised definition of information overload is still lacking.[10] An often-used definition is that 'overload is regarded as that situation which arises when there is so much relevant and potentially useful information available that it becomes a hindrance rather than a help.'[11] A more practical representation of information overload is the short formula: *information processing requirements* > *information processing capacities*.[12]

This chapter uses the term *information overload* rather than *data overload*, and in the context of information components leading to knowledge. Following Meadow and Yuan (1997), data refers to 'a set of symbols that does not have meaning or significance to their recipient', whereas *information* does meet that requirement. The 'accumulation and integration of information received and processed by a recipient' is what constitutes *knowledge*.[13] Data can be seen as *potential information*; thus, an overload of data can be an important factor in the perceived information load.

Finally, multiple studies provide a schematic representation referring to the issue of information (over)load as an inverted U-curve, which is shown in Figure 10.1.[14] Here, the focus is on the relation between the performance (in this case the decision-making accuracy) of an individual and the information load he or she is exposed to. According to Eppler and Mengis (2004), 'the performance […] of an individual correlates positively with the amount of information he or she receives – up to a certain point. If further information is provided beyond this point, the performance of the individual will rapidly decline.'[15]

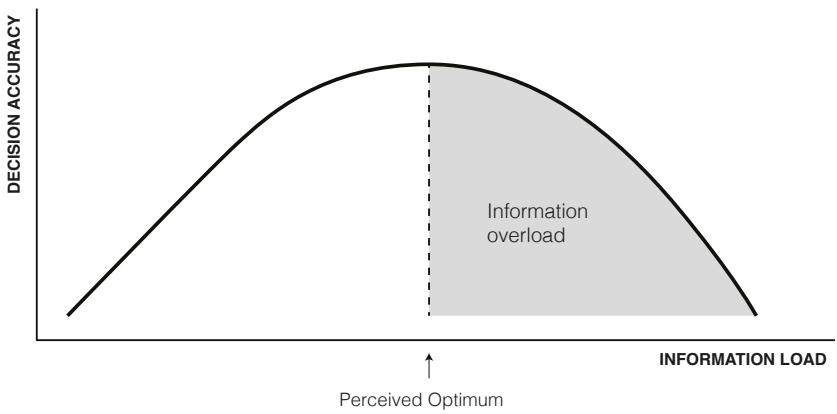

Fig. 10.1. Information overload as an inverted U-curve.[16]

Some approaches not only take into account the amount of information when discussing information load, but also the complexity of the information.[17] Indeed, as can be seen in Figure 10.1, the x-axis does not portray the *amount* of information. Rather, it portrays the *perception* of that amount, or *information load*. In order to improve decision-making accuracy, organisations need to find ways to process more information without increasing the experienced information load. Multiple facets are of influence to the experienced information load: people, practices and tools. The next section will discuss a framework for understanding these facets.

10.2.2. People, practices, and tools

The academic debate on information overload tends to make a distinction between an individual cognitive perspective and an organisational *equipment-related* perspective such as a limitation in time or budget.[18] Allen and Wilson (2003) describe these different perspectives as follows:

> *At the personal level, we can define information overload as a perception on the part of the individual (or observers of that person) that the flows of information associated with work tasks is greater than can be managed effectively, and a perception that overload in this sense creates a degree of stress for which his or her coping strategies are ineffective. Similarly, at the organisational level, information overload is a situation in which the extent of perceived individual information overload is sufficiently widespread within the organisation as to reduce the overall effectiveness of management operations.*[19]

Thus Figure 10.1, which presents information overload with respect to the individual cognitive dimension, can also be used to conceptually present information overload at the organisational level. In his research on information overload, Pijpers (2010) also recognises these different perspectives. His perspective proposes a triangular relationship between people, practices and tools.

> *For some scholars, information overload is concerned with the individual. Others contend that it is related to the organizations where people work. Some researchers, however, believe that information overload is caused by the limitations of computer hardware and software, and therefore the problem may be solved as specific technology becomes available. What is at least clear is that the ability to deal with information depends on the relationship between tools, people, and practices within organizations, rather than on an isolated outcome variable such as information overload.*[20]

According to Pijpers, people are an integral part of the information overload issue. He even argues that 'information only exists by the grace of human perception.'[21] The individual level of information overload has traditionally been the core component of this topic. In 1970, the book *Future Shock* by Alvin Toffler, introduced the phenomenon to a broad audience, describing it as 'causing both physical and physiological distress due to overloading of perception, cognition, and decision-making process.'[22] Even though individual and equipment barriers to information processing are two sides of the same coin, academic literature on information overload has primarily been focusing on cognitive (individual) issues.[23]

Despite the core focus on the individual perspective, cognitive overload does not occur in isolation. The practices within organisations, the second element in

Pijpers' trinity, shape the environment in which the individual encounters the information load. Think for instance of the organisational (information) culture or the way the organisation arranges its data governance practices.

Especially in knowledge-intensive organisations such as military intelligence organisations, there is a strong link between the information culture and the perception of information overload.[24] A positive information culture is one in which 'the value and utility of information in achieving operational and strategic success is recognised, where information forms the basis of organisational decision making and Information Technology is readily exploited as an enabler for effective Information Systems.'[25]

Finally, people within the organisation – to a greater or lesser extent – use tools to process the information they encounter. In this paper we use the term *tools* loosely to encompass a wide array of data processing technologies. Think of software packages like i2 Analyst notebook that aid in analysing networks, custom-made complex algorithms implemented using programming languages like Python and R but also scripts used to automate standard processes. The way these tools are integrated into organisational practices and the extent to which they meet the level of skill and demand of the individual using them, is the third major component of information overload.

Although the importance of information practices and technology in knowledge-intensive organisations is widely recognised, information technology is still often interpreted as a main *cause* of information overload, rather than an integral part of the solution.[26] Following Koltay (2017): 'The problem is not that there is too much information. In an information-driven society there cannot be too much information. Information overload represents the challenge to make effective use of information, thus instead of blocking or limiting, there is a need for finding appropriate tools for discovery.'[27]

As can be explained through the inverted U-curve graph in Figure 10.1, in order to counter information overload – shifting the perceived optimum to the right – processing capacities, among others, need to be improved. By doing so, the entity that processes information (being an organisation or an individual) can benefit from increasing *amounts* of information, without necessarily increasing the perception of the *load* of information, hence improving decision accuracy.[28] Algorithms from fields like data science and artificial intelligence can be a major asset in increasing processing capacities:

> *One major aspect of information processing is not in the focus of researchers yet: how information can be processed and evaluated by "intelligent" information systems. While decision support systems or decision aid are widely investigated, the wide field of machine learning, deep learning and artificial intelligence, which is one of the most important drivers of digitalization, is not linked with information overload literature yet.*[29]

The broad spectrum of information overload literature provides the necessary understanding of its main components in an organisation: the individual cognitive aspect (people), the organisational practices, and the tools used.

10.3. Information overload in military intelligence and security organisations

Making use of the trinity of people, practices and tools, this section reflects on the way military intelligence and security organisations can cope with information overload.

10.3.1. People

The observation that information overload is not only caused by the volume of data, but also by its complexity and the way that is experienced by an individual (or organisation), especially holds true for intelligence and security organisations.[30] Nicander (2011) points out that today's intelligence targets are 'smaller, more agile and mobile, and time-sensitive, [which] must be reflected in the management and requirement systems.'[31] Indeed, the type of personnel and specific skillsets need to be reevaluated on the basis of this expanding information load, to create the necessary conditions for creating a data-centric culture. According to Hare & Coghill (2016), this should eventually lead to the situation in which analysts will become a 'curator' or 'librarian' for information relevant to decision making. Data savviness must permeate the intelligence organisation if it is to become data driven, i.e., a minimum level of data literacy should be expected of every employee within such an organisation. Furthermore, in order to instigate these developments, management should become data literate to optimally integrate data methodologies within the intelligence process. Vogel et al. (2021) even expand the desired skillset for managers, quoting one of their interviewees who stated that a manager lacking 'the mathematical background necessary to understand the statistical meaning behind the probabilities of analytic results can be a serious detriment to achieving a reasonable analytic conclusion.'[32]

10.3.2. Practices

With regard to practices of information overload in military intelligence & security organisations, four main issues are identified. These are (1) collection outpacing analysis, (2) data governance, (3) distinguishing signals from noise, and (4) changing intelligence processes.

Collection outpacing analysis. This issue reflects on the role of data as something that may in fact hinder analysis. The cause of information overload is considered

to be found within the intelligence process: the combination of 'mass collection of data by technological means' with analysts not being able to match the pace to transform it into timely and relevant products, vividly called *analysis paralysis*.[33] Lieutenant General Deptula stated the problem as: "We're swimming in sensors and we need to be careful we don't drown in the data [...] the unavoidable truths are that data velocities are accelerating and the current way we handle data is really overwhelmed by this tsunami."[34] *Analysis paralysis* may result from a combination of factors of the functional chain (e.g. information sources, complexity of the effort, context, time pressure), organisational tools and practices dealing with these factors, and individual characteristics.

Data governance. Organisational practices are one of the main components influencing the problem of information overload. Similar to large, complex, private sector organisations, the intelligence community has to 'govern, manage, secure and use data' to enhance its organisational efficiency and results.[35] Approaching the importance of data governance through the lens of the conceptual framework, a number of elements appear to be related. Well-integrated data governance will decrease the perceived load of the information by assisting the analyst in efficiently searching the information that is already stored, assessing the source reputation, and merging data from different collection disciplines before presenting it to analysts (multi-INT fusion). Data governance, albeit in a limited scope, has surfaced as an essential theme in understanding information overload in an intelligence context. As Palfy (2015) explains: 'Regardless of the subject, a key to timely, relevant, and accurate intelligence output is an organization's intelligence processing and integration capacity, which in-turn depends heavily, though not exclusively, on its approach to data governance.'[36] He argues that organisations will experience information overload when they do not establish powerful processing capacities combined with the implementation of a data governance framework. In line with the presented conceptual framework, Palfy asserts that implementing IT tools to counter information overload would be inadequate without solid data governance.[37]

Distinguishing signals from noise. The third issue is the principle of distinguishing 'signals' from 'noise'. The challenge to only concentrate on the *right* pieces of information is not unique to the current information age. The difficulty of this issue was, for example, already found to be a fundamental obstacle leading to the 'intelligence failure of Pearl Harbor in 1941. Since then, however, the amount of both signals and noise has been ever-increasing.[38] According to Winston (2007), as both secret and open-source intelligence collection has been increasing, the role of the analyst has changed from being a *gatherer* to becoming a *hunter*, indicating the search for signals in the masses of the already collected data.[39] Following Pedersen and Jansen (2019), 'instead of trying to collect sparse information from a limited supply, one now needs to locate the right pieces of information in the increasingly

vast reservoir containing also large volumes of non-relevant information.'[40] Most of the aforementioned points refer to the large *amount* of signals and noise. Adding to the complexity of the effort, is the relevance of collected data that is judged by the analyst by using their understanding of the intelligence problem. Without a thorough understanding of the problem, it is impossible to correctly establish 'which pieces of collected intelligence are relevant (signals) and which are irrelevant (noise).[41]

Changing intelligence processes. In order to be beneficial to its customers, products of military intelligence and security organisations should adhere to certain principles. Well-known characteristics are that they should be timely, relevant, accurate and actionable.[42] In order to produce intelligence products that meet these requirements, intelligence organisations traditionally employ a process defined as the intelligence cycle, in which five sequential steps take place: planning and direction, collection, processing, analysis and dissemination. Recently, a considerable amount of literature has discussed to what extent the concept of the intelligence cycle is (still) accurate in the current information age, and suggestions have been made to adjust or 'move beyond' the intelligence cycle, or to change the way we conceptualise intelligence processes as a whole.[43] A data-driven approach to the intelligence process can provide intelligence and security organisations with the opportunity to both optimally use the large volumes of data *and* decrease their experienced information load. To 'discern general trends and anomalies in very large datasets – through anomaly detection and association algorithms—can help to identify potential intelligence targets, thus driving intelligence requirements.'[44]

10.3.3. Tools

There is a widely acknowledged need to integrate appropriate tools (software packages, custom-made algorithms, automatisation scripts, etc.) to deal with the problem of information overload. The unsurpassed amounts of information analysts are confronted with, require an immediate implementation of 'advanced analytic techniques.'[45] According to Eldridge et al., 'without the support of automated processes, analysts would simply be unable to cope with the deluge of information swirling around the ether.'[46] The intelligence literature suggests that the proposed tools should primarily be of assistance to the intelligence analyst, exemplifying the important connection between tools and people in an organisation. Along these lines, these tools should have the net consequence of narrowing down the information feed of the analyst.[47] Adding to this extraction of useful information, effective tools will 'present information to analysts in a way that minimizes their cognitive load […], this primarily means visualizing information where possible, through mapping, timelining, charting and other methods.'[48] Artificial Intelligence

(AI) is one of the suggested technologies to solve the information overload problem, as it is able to, for instance, 'pre-process raw data to offload human analysts.'[49] The integration of data science and artificial intelligence tools could have a major impact on the perception of information load to intelligence analysts. Tools may be used to assess the sources of information, extract relevant information, provide alternative hypotheses based on the available data, or visualise data to temper the information load as experienced by the analyst. An important consideration here is that these uses may be mentioned in the relevant literature, but most of them are not yet operationalised.

10.4. Discussion and recommendations

The objective of this chapter is to provide understanding of the main components and processes leading to information overload in military intelligence & security organisations.

To meet this objective, we first explored the literature on information overload in several adjacent literatures. We provided several definitions and representations of the concept of information overload and explored the main components underlying information overload in an organisation. These components are: the individual cognitive aspect (people), the organisational practices, and the tools used. Applying each of these components to military intelligence & security organisations provided understanding on the type of personnel needed, the challenges in operational practices (collection outpacing analysis, data governance, distinguishing 'signals' from 'noise', and changing intelligence processes) and what tools are appropriate to use.

While these components individually contribute to our understanding of information overload in military intelligence & security organisations, it is important to stress the mutual relationships between people, practices and tools as well. Two of these relationships stand out.

First, for using tools to decrease the experienced information load, these tools need to be effectively integrated into intelligence practice. Multiple challenges have been identified in this domain. In some cases a problem was misdiagnosed as being rooted in IT tool inadequacy, while in other cases tools treated the wrong symptoms without fully understanding the root causes.[50] Furthermore, according to Treverton, the development of tools in intelligence and security organisations has mostly been bottom-up, with little push from the top.[51] Here, problems for adoption arise 'when these (newly produced) bottom-up tools clash with older knowledge regimes, organizational structures, and insufficient support mechanisms.'[52] An insufficient analysis of how people experience their information load may leave intelligence and security

organisations with 'a renewed perception that their tools are both inadequate in meeting business needs and insufficient in helping analysts deal with exponential increases in data holdings relative to a given theme, network, or target set.'[53]

A second relevant issue regarding the relationship between people, practices, and tools is the extent to which people trust tools and how organisations learn to cope with information overload. The development of trust across users of the tools needs to be central and must be reflected in the policies and practices of the organisation.[54] Paramount to establishing people's trust in these tools is learning, consisting of multiple components. Laney, Chief Data Officer at Gartner, asserts that 'within organizations, as information starts to become recognized as an actual asset, we need a new language for businesspeople, for IT people—for information people—to be able to communicate effectively.'[55] The integration of tools will eventually be a core asset in decreasing the experienced information load, but in the phase prior to that integration 'the tension between exploitation and innovation can be a constant source of stress for managers. Do we focus on what we know, or do we create new products and services?'[56] Finally, Nicander (2011) stresses the importance of learning at both the organisational and individual level, as the memory of an organisation is 'derived from employees who act to adapt the *theory-in-use* that reflects an organization's past experience. [...] No organizational learning can exist without individual learning, although individual learning as a condition for organizational learning is by itself insufficient.'[57]

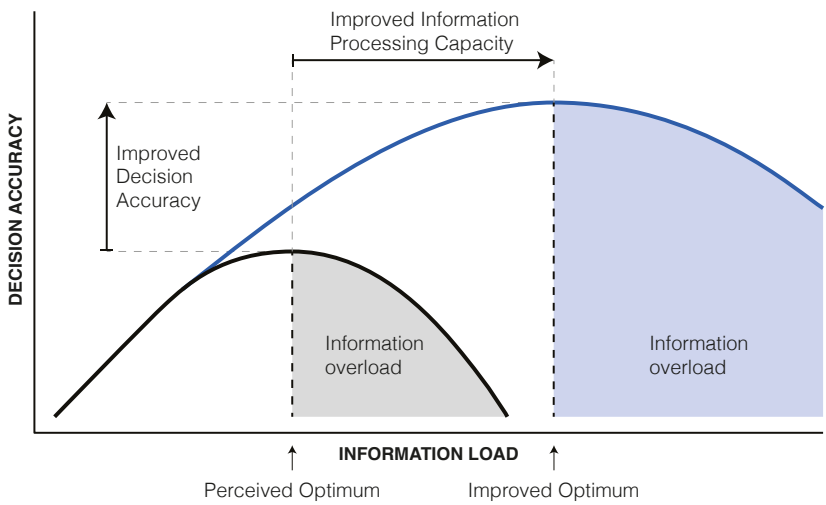

Fig. 10.2. The potential improvement of decision accuracy.

Finally, as we have seen, the individual components of information overload (people, practices, tools) as well as their mutual relationships provide several future avenues to address information overload. When being implemented, these avenues should result in an increase of information processing, leading to the ultimate goal of improving decision accuracy. In the intelligence domain this would mean to reach an improved optimum of providing timely, relevant, and actionable intelligence to gain decision advantage. Figure 10.2 presents the potential gain in decision accuracy when an organisation is able to adequately deal with information overload. The black curve in the figure portrays the initial situation, which can also be found in Figure 10.1. The blue curve shows the potential benefit when information load increases due to improved information processing capacities, leading to an improved optimum of decision accuracy. Indeed, more information can be processed before information overload sets in. This clearly visualises how intelligence & security organisations can benefit from the large volumes of information that is available to them, by dealing with the causes and effects of information overload on their people, practices, and tools.

Notes

1 Peter Gordon Roetzel, "Information overload in the Information Age: a review of the literature from business administration, business psychology, and related disciplines with a bibliometric approach and framework development", *Business Research* 12, no. 2 (December 2019): 480, https://doi.org/10.1007/s40685-018-0069-z.

2 Christopher Eldridge, Christopher Hobbs, and Matthew Moran, "Fusing algorithms and analysts: open-source intelligence in the age of "Big Data"', *Intelligence and National Security* 33, no. 3 (16 April 2018): 392, https://doi.org/10.1080/02684527.2017.1406677.

3 Anthony J. Cotton, 'Information Technology – Information Overload for Strategic Leaders' (U.S. Army War College, 18 March 2005), 1, https://doi.org/10.1037/e457182006-001.

4 Alan Dupont, "Intelligence for the twenty-first century", *Intelligence and National Security* 18, no. 4 (December 2003): 15, https://doi.org/10.1080/02684520310001688862.

5 Roetzel, "Information Overload in the Information Age", 481; Anne-Françoise Rutkowski and Carol S Saunders, *Emotional and Cognitive Overload: The Dark Side of Information Technology*, 2019, https://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=1776962.

6 Roetzel, 'Information Overload in the Information Age', 480.

7 Roetzel, 480–82; David Bawden and Lyn Robinson, "Information Overload: An Introduction", in *Oxford Research Encyclopedia of Politics*, by David Bawden and Lyn Robinson (Oxford University Press, 2020), 4, https://doi.org/10.1093/acrefore/9780190228637.013.1360.

8 Liia Lauri, Sirje Virkus, and Mati Heidmets, "Information cultures and strategies for coping with information overload: case of Estonian higher education institutions", *Journal of Documentation* 77, no. 2 (1 January 2020): 520, https://doi.org/10.1108/JD-08-2020-0143.

9 Martin J. Eppler and Jeanne Mengis, "The concept of information overload: a review of literature from organization science, accounting, marketing, MIS, and related disciplines", *The Information*

Society 20, no. 5 (November 2004): 325, https://doi.org/10.1080/01972240490507974; Roetzel, 'Information Overload in the Information Age', 481.

10 Bawden and Robinson, 'Information Overload', 3; Roetzel, 'Information Overload in the Information Age', 481.

11 Bawden and Robinson, 'Information Overload', 3.

12 Eppler and Mengis, 'The Concept of Information Overload', 326.

13 Charles T. Meadow and Weijing Yuan, "Measuring the impact of information: defining the concepts", *Information Processing & Management* 33, no. 6 (November 1997): 701, https://doi.org/10.1016/S0306-4573(97)00042-3.

14 Roetzel, 'Information Overload in the Information Age', 483; Eppler and Mengis, 'The Concept of Information Overload', 326; originally from: Harold M. Schroder, Michael J. Driver, and Siegfried Streufert, *Human Information Processing: Individuals and Groups Functioning in Complex Social Situations* (Holt, Rinehart and Winston, 1967).

15 Eppler and Mengis, 326.

16 Figure adjusted from: Eppler and Mengis, 'The Concept of Information Overload', 326.

17 Roetzel, 'Information Overload in the Information Age', 482–83.

18 Roetzel, 483.

19 David Allen and T. D. Wilson, "Information overload: context and causes", *The New Review of Information Behaviour Research* 4, no. 1 (December 2003): 34, https://doi.org/10.1080/14716310310001631426.

20 Guus Pijpers, *Information Overload: A System for Better Managing Everyday Data*, Microsoft Executive Leadership Series (Hoboken, N.J: Wiley, 2010), 23.

21 Pijpers, 8.

22 Bawden and Robinson, 'Information Overload', 9.

23 Roetzel, 'Information Overload in the Information Age', 483.

24 Lauri, Virkus, and Heidmets, 'Information Cultures and Strategies for Coping with Information Overload', 519.

25 Adrienne Curry and Caroline Moore, "Assessing information culture—an exploratory model", *International Journal of Information Management* 23, no. 2 (1 April 2003): 94, https://doi.org/10.1016/S0268-4012(02)00102-0.

26 See, for example: Bawden and Robinson, 'Information Overload', 12; Roetzel, 'Information Overload in the Information Age', 506; Eppler and Mengis, 'The Concept of Information Overload', 331.

27 Tibor Koltay, 'Information Overload in a Data-Intensive World', in *Understanding Information: From the Big Bang to Big Data*, ed. Alfons Josef Schuster, Advanced Information and Knowledge Processing. Springer International Publishing, 2017, 207.

28 Decision accuracy metrics deal with finding 'optimal solutions' and are widely analysed and discussed in data science literature, see for instance Mohammad et al., 2015.

29 Roetzel, 'Information Overload in the Information Age', 507.

30 This paragraph draws upon: Tess Horlings, "Dealing with data: coming to grips with the Information Age in intelligence studies journals", *Intelligence and National Security*, 3 August 2022, 1–23, https://doi.org/10.1080/02684527.2022.2104932.

31 Nicander, 'Understanding Intelligence Community Innovation in the Post-9/11 World', 547.

32 Vogel et al., 'The Impact of AI on Intelligence Analysis', 836.

33 Robert D Folker, "Arming the intelligence analyst for information warfare", *American Intelligence Journal* 30, no. 2 (2012): 13.

34 James L. Lawrence II, "Activity-based intelligence: coping with the "unknown unknowns" in complex and chaotic environments", *American Intelligence Journal* 33, no. 1 (2016): 17.

35 Jeffrey Drezner et al., 'Benchmarking Data Use and Analytics in Large, Complex Private-Sector Organizations: Implications for Department of Defense Acquisition' (RAND Corporation, 2020), 1, https://doi.org/10.7249/RRA225-1.

36 Arpad Palfy, "Bridging the gap between collection and analysis: intelligence information processing and data governance", *International Journal of Intelligence and CounterIntelligence* 28, no. 2 (3 April 2015): 366, https://doi.org/10.1080/08850607.2015.992761.

37 Palfy, 370.

38 Wesley K Wark, "Introduction: "learning to live with intelligence"', *Intelligence and National Security* 18, no. 4 (December 2003): 3, https://doi.org/10.1080/02684520310001688853.

39 Thomas Winston, "Intelligence challenges in tracking terrorist internet fund transfer activities", *International Journal of Intelligence and Counter Intelligence* 20, no. 2 (19 February 2007): 333, https://doi.org/10.1080/08850600600829833.

40 Tore Pedersen and Pia Therese Jansen, "Seduced by secrecy – perplexed by complexity: effects of secret vs open-source on intelligence credibility and analytic confidence", *Intelligence and National Security* 34, no. 6 (19 September 2019): 882, https://doi.org/10.1080/02684527.2019.1628453.

41 Christiaan Menkveld, "Understanding the complexity of intelligence problems", *Intelligence and National Security*, 8 February 2021, 11, https://doi.org/10.1080/02684527.2021.1881865.

42 Loch K. Johnson, ed., *The Oxford Handbook of National Security Intelligence* (Oxford, New York: Oxford University Press, 2012).

43 See, for example: Peter Gill and Mark Phythian, 'From Intelligence Cycle to Web of Intelligence: Complexity and the Conceptualisation of Intelligence', in *Understanding the Intelligence Cycle*, ed. Mark Phythian, 2014, 21–42; Patrick Biltgen and Stephen Ryan, *Activity-Based Intelligence: Principles and Applications*, Artech House Electronic Warfare Library (Boston: Artech House, 2016); Nelson J.M. Rêgo, 'Intelligence in NATO – Contextualising a Doctrinal and Structural Clash', *Revista de Ciências Militares* VI, no. 1 (May 2018): 135–61.

44 Damien Van Puyvelde, Stephen Coulthart, and M. Shahriar Hossain, "Beyond the buzzword: big data and national security decision-making", *International Affairs* 93, no. 6 (1 November 2017): 1407–8, https://doi.org/10.1093/ia/iix184.

45 Benjamin Bell and Michael Marks, "Composite Signatures Analyst Learning Tool (CSALT): Supporting the analyst with scenario-based methodology training", *The International Journal of Intelligence, Security, and Public Affairs* 18, no. 2 (2016): 158.

46 Eldridge, Hobbs, and Moran, 'Fusing Algorithms and Analysts', 401.

47 Nick Hare and Peter Coghill, "The future of the intelligence analysis task", *Intelligence and National Security* 31, no. 6 (18 September 2016): 867, https://doi.org/10.1080/02684527.2015.1115238.

48 Hare and Coghill, 868.

49 Hare and Coghill, 863.

50 Palfy, 'Bridging the Gap between Collection and Analysis', 369.

51 Gregory F. Treverton, 'New Tools for Collaboration: The Experience of the U.S. Intelligence Community' (Washington, D.C: Center for Strategic and International Studies, January 2016), 7, https://www.businessofgovernment.org/sites/default/files/New%20Tools%20for%20Collaboration.pdf.

52 Kathleen M. Vogel et al., "The impact of AI on intelligence analysis: tackling issues of collaboration, algorithmic transparency, accountability, and management", *Intelligence and National Security* 36, no. 6 (19 September 2021): 841, https://doi.org/10.1080/02684527.2021.1946952.

53 Palfy, 'Bridging the Gap between Collection and Analysis', 369.

54 See, for example: Treverton, 'New Tools for Collaboration: The Experience of the U.S. Intelligence Community', 3; Frank Strickland and Chris Whitlock, "Understanding and creating colocated, cross-functional teams", *Studies in Intelligence* 60, no. 1 (2016): 54.

55 Doug Laney, "Private-sector applications of data science", *Studies in Intelligence* 61, no. 1 (March 2017): 9.

56 Adrian Wolfberg, "How information overload and equivocality affect law enforcement intelligence analysts: implications for learning and knowledge production", *Journal of Intelligence and Analysis* 23, no. 1 (Winter 2017): 32.

57 Lars D. Nicander, "Understanding intelligence community innovation in the post-9/11 world", *International Journal of Intelligence and CounterIntelligence* 24, no. 3 (1 September 2011): 541, https://doi.org/10.1080/08850607.2011.568295.

Bibliography

Allen, David, and T. D. Wilson. "Information overload: context and causes". *The New Review of Information Behaviour Research* 4, no. 1 (December 2003): 31–44. https://doi.org/10.1080/14716310310001631426.

Bawden, David, and Lyn Robinson. 'Information Overload: An Introduction'. In *Oxford Research Encyclopedia of Politics*, by David Bawden and Lyn Robinson. Oxford University Press, 2020. https://doi.org/10.1093/acrefore/9780190228637.013.1360.

Bell, Benjamin, and Michael Marks. "Composite Signatures Analyst Learning Tool (CSALT): supporting the analyst with scenario-based methodology training". *The International Journal of Intelligence, Security, and Public Affairs* 18, no. 2 (2016): 157–72.

Biltgen, Patrick, and Stephen Ryan. *Activity-Based Intelligence: Principles and Applications*. Artech House Electronic Warfare Library. Boston: Artech House, 2016.

Cotton, Anthony J. 'Information Technology – Information Overload for Strategic Leaders'. U.S. Army War College, 18 March 2005. https://doi.org/10.1037/e457182006-001.

Curry, Adrienne, and Caroline Moore. "Assessing information culture—an exploratory model". *International Journal of Information Management* 23, no. 2 (1 April 2003): 91–110. https://doi.org/10.1016/S0268-4012(02)00102-0.

Drezner, Jeffrey, Jon Schmid, Justin Grana, Megan McKernan, and Mark Ashby. 'Benchmarking Data Use and Analytics in Large, Complex Private-Sector Organizations: Implications for Department of Defense Acquisition'. RAND Corporation, 2020. https://doi.org/10.7249/RRA225-1.

Dupont, Alan. "Intelligence for the Twenty-First Century". *Intelligence and National Security* 18, no. 4 (December 2003): 15–39. https://doi.org/10.1080/02684520310001688862.

Eldridge, Christopher, Christopher Hobbs, and Matthew Moran. "Fusing algorithms and analysts: open-source intelligence in the age of 'Big Data'". *Intelligence and National Security* 33, no. 3 (16 April 2018): 391–406. https://doi.org/10.1080/02684527.2017.1406677.

Eppler, Martin J., and Jeanne Mengis. "The concept of information overload: a review of literature from organization science, accounting, marketing, MIS, and related disciplines". *The Information Society* 20, no. 5 (November 2004): 325–44. https://doi.org/10.1080/01972240490507974.

Folker, Robert D. "Arming the intelligence analyst for information warfare". *American Intelligence Journal* 30, no. 2 (2012): 5.

Gill, Peter, and Mark Phythian. 'From Intelligence Cycle to Web of Intelligence: Complexity and the Conceptualisation of Intelligence'. In: *Understanding the Intelligence Cycle*, edited by Mark Phythian, 21–42, 2014.

Hare, Nick, and Peter Coghill. "The future of the intelligence analysis task". *Intelligence and National Security* 31, no. 6 (18 September 2016): 858–70. https://doi.org/10.1080/02684527.2015.1115238.

Johnson, Loch K., ed. *The Oxford Handbook of National Security Intelligence*. Oxford, New York: Oxford University Press, 2012.

Koltay, Tibor. 'Information Overload in a Data-Intensive World'. In: *Understanding Information: From the Big Bang to Big Data,* edited by Alfons Josef Schuster, 197–217. Advanced Information and Knowledge Processing. Springer International Publishing, 2017.

Laney, Doug. "Private-sector applications of data science". *Studies in Intelligence* 61, no. 1 (March 2017): 1–24.

Lauri, Liia, Sirje Virkus, and Mati Heidmets. "Information cultures and strategies for coping with information overload: case of Estonian higher education institutions". *Journal of Documentation* 77, no. 2 (1 January 2020): 518–41. https://doi.org/10.1108/JD-08-2020-0143.

Lawrence II, James L. "Activity-based intelligence: coping with the "unknown unknowns" in complex and chaotic environments". *American Intelligence Journal* 33, no. 1 (2016): 17–25.

Menkveld, Christiaan. "Understanding the complexity of intelligence problems". *Intelligence and National Security,* 8 February 2021, 1–21. https://doi.org/10.1080/02684527.2021.1881865.

Nicander, Lars D. "Understanding intelligence community innovation in the post-9/11 world". *International Journal of Intelligence and CounterIntelligence* 24, no. 3 (1 September 2011): 534–68. https://doi.org/10.1080/08850607.2011.568295.

Palfy, Arpad. "Bridging the gap between collection and analysis: intelligence information processing and data governance". *International Journal of Intelligence and CounterIntelligence* 28, no. 2 (3 April 2015): 365–76. https://doi.org/10.1080/08850607.2015.992761.

Pedersen, Tore, and Pia Therese Jansen. "Seduced by secrecy – perplexed by complexity: effects of secret vs open-source on intelligence credibility and analytic confidence". *Intelligence and National Security* 34, no. 6 (19 September 2019): 881–98. https://doi.org/10.1080/02684527.2019.1628453.

Pijpers, Guus. *Information Overload: A System for Better Managing Everyday Data.* Microsoft Executive Leadership Series. Hoboken, N.J: Wiley, 2010.

Rêgo, Nelson J.M. "Intelligence in NATO – contextualising a doctrinal and structural clash". *Revista de Ciências Militares* VI, no. 1 (May 2018): 135–61.

Roetzel, Peter Gordon. "Information overload in the information age: a review of the literature from business administration, business psychology, and related disciplines with a bibliometric approach and framework development". *Business Research* 12, no. 2 (December 2019): 479–522. https://doi.org/10.1007/s40685-018-0069-z.

Rutkowski, Anne-Françoise, and Carol S Saunders. Emotional and Cognitive Overload: The Dark Side of Information Technology, 2019. https://search.ebscohost.com/login.aspx?direct=true&scope=site&db=nlebk&db=nlabk&AN=1776962.

Schroder, Harold M., Michael J. Driver, and Siegfried Streufert. *Human Information Processing: Individuals and Groups Functioning in Complex Social Situations.* Holt, Rinehart and Winston, 1967.

Strickland, Frank, and Chris Whitlock. "Understanding and creating colocated, cross-functional teams". *Studies in Intelligence* 60, no. 1 (2016): 53–58.

Treverton, Gregory F. 'New Tools for Collaboration: The Experience of the U.S. Intelligence Community'. Washington, D.C: Center for Strategic and International Studies, January 2016. https://www.businessofgovernment.org/sites/default/files/New%20Tools%20for%20Collaboration.pdf.

Van Puyvelde, Damien, Stephen Coulthart, and M. Shahriar Hossain. "Beyond the buzzword: big data and national security decision-making". *International Affairs* 93, no. 6 (1 November 2017): 1397–1416. https://doi.org/10.1093/ia/iix184.

Vogel, Kathleen M., Gwendolynne Reid, Christopher Kampe, and Paul Jones. "The impact of AI on intelligence analysis: tackling issues of collaboration, algorithmic transparency, accountability, and management". *Intelligence and National Security* 36, no. 6 (19 September 2021): 827–48. https://doi.org/10.1080/02684527.2021.1946952.

Wark, Wesley K. "Introduction: 'learning to live with intelligence'". *Intelligence and National Security* 18, no. 4 (December 2003): 1–14. https://doi.org/10.1080/02684520310001688853.

Winston, Thomas. "Intelligence challenges in tracking terrorist internet fund transfer activities". *International Journal of Intelligence and CounterIntelligence* 20, no. 2 (19 February 2007): 327–43. https://doi.org/10.1080/08850600600829833.

Wolfberg, Adrian. "How information overload and equivocality affect law enforcement intelligence analysts: implications for learning and knowledge production". *Journal of Intelligence and Analysis* 23, no. 1 (Winter 2017): 19.