Information Overload: an overview

David Bawden and Lyn Robinson

Summary

For almost as long as there has been recorded information, there has been a perception that humanity has been overloaded by it. Concerns about 'too much to read' have been expressed for many centuries, and made more urgent since the arrival of ubiquitous digital information in the late twentieth century. The historical perspective is a necessary corrective to the often, and wrongly, held view that it is associated solely with the modern digital information environment, and with social media in particular. However, as society fully experiences Floridi's Fourth Revolution, and moves into hyper-history (with society dependent on, and defined by, information and communication technologies) and the infosphere (a information environment distinguished by a seamless blend of online and offline information actvity), individuals and societies are dependent on, and formed by, information in an unprecedented way, information overload needs to be taken more seriously than ever.

Overload has been claimed to be both the major issue of our time, and a complete non-issue. It has been cited as an important factor in, *inter alia*, science, medicine, education, politics, governance, business and marketing, planning for smart cities, access to news, personal data tracking, home life, use of social media, and online shopping, and has even influenced literature

The information overload phenomenon has been known by many different names, including: information overabundance, infobesity, infoglut, data smog, information pollution, information fatigue, social media fatigue, social media overload, information anxiety, library anxiety, infostress, infoxication, reading overload, communication overload, cognitive overload, information violence, and information assault. There is no single generally

accepted definition, but it can best be understood 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. Its essential nature has not changed with changing technology, though its causes and proposed solutions have changed much.

The best ways of avoiding overload, individually and socially, appear to lie in a variety of coping strategies, such as filtering, withdrawing, queuing, and 'satisficing'. Better design of information systems, effective personal information management, and the promotion of digital and media literacies, also have a part to play. Overload may perhaps best be overcome by seeking a mindful balance in consuming information, and in finding understanding.

Keywords: information overload; information anxiety; information literacy; satisficing; big data; fake news; post-truth; digital media; infosphere

Introduction

It is a very sad thing that nowadays there is so little useless information

Oscar Wilde

(A few maxims for the instruction of the over-educated, *Saturday Review*, 17 November 1894)

Distringit librorum multitudo [the abundance of books is distraction]

Seneca

(Epistles, Book 1, 1st century CE)

Although information overload is a much-discussed concept, there is no single generally accepted definition or explanation of the concept. In this article, the most widely-accepted approach is taken, and 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 (Bawden, Holtham and Courtney 1999, Bawden and Robinson 2009). Originally seen as a problem primarily affecting scholars and academia, it was then claimed to afflict business and the information-intensive professions such as medicine, and from the late twentieth century has been seen as affecting the whole of society, including education, government, home life and leisure, and citizenship.

It is not a new problem, although, as James Gleick (2011) points out, it has always *felt* new. As Rosenberg (2003, p. 1-2) puts it:

> "The notion of information overload appears everywhere in our popular media as a characterization of something specific and emblematic of our era, of life in a time of cell phones and web browsers and fax machines and innumerable other "information appliances".... [it] so much defines our self-understanding today that it is hard to remember that it has a history that stretches back to Vannevar Bush and the 1950s, much less to Samuel Johnson and the 1750s or to Conrad Gessner and the 1550s ... Equally strange is the persistence of the rhetoric of novelty that accompanies so old a phenomenon"

As will be discussed in detail in this article, there have been complaints about there being too much to read from classical times onwards, the idea of overload in a modern sense began only with the advent of the digital information environment. More specifically, the problem,

on its modern guise, first came to prominence in the 1990s, with a series of reports showing the waste of time, decrease in efficiency, and even ill-health, allegedly caused by information overload. It has, of course, been given an impetus by the focus on 'big data' since the late 1990s (McAfee et al. 2012, Floridi 2014B, Gupta and Rani 2018, Merendino et al. 2018).

Information overload has been claimed to be both the major issue of our time, and a complete non-issue. It has been cited as an important factor in, *inter alia*, science, medicine, education, politics, governance, business and marketing, planning for smart cities, access to news, personal data tracking, home life, use of social media, and online shopping. It has even influenced literature (Stephens 2015, Groes 2017).

 A perspective may be gained by setting information overload in the framework provided by Luciano Floridi's concept of the 'Fourth Revolution' (Floridi 2014A). Floridi's scheme has three periods in humanity's development: pre-history, before recorded information; history, when society was assisted by recorded information; and 'hyper-history', with society dependent on, and defined by, information and communication technologies. The move to hyper-history is paralleled by the development of the condition of 'on-life', whereby life is lived simultaneously online and off-line in an 'infosphere'. This is a dramatic change, and one which occurs only once in the life-time of a species. For the generation which has lived through it, it is hardly surprising to find new problems and issues arising, and information overload can be understood as one of these.

The phrase *information overload* is attributed to the American social scientist Bertram Gross (1964), who used it to refer to the state when the information inputs to any system exceed its information processing capabilities. Although this term has been the most commonly used,

the phenomenon has been referred to by other names: *information overabundance*, *infobesity*, *infoglut*, *data smog*, *information pollution*, *information fatigue*, *social media fatigue*, *social media overload*, *information anxiety*, *library anxiety*, *infostress*, *infoxication*, *reading overload*, *communication overload*, *cognitive overload*, and more. Bawden and Robinson (2009), Gleick (2011), Johnson (2012), Hartog (2017), and Jones and Kelly (2018) explain and exemplify some of these. It has, most dramatically, been discussed in terms of *information violence*, of which Piotr Chrzastowski wrote ".. Information is merciless. It fills each gap it can penetrate, using every moment of our carelessness to encroach and occupy space wherever it can" (cited in translation by Babik 2018). Similarly, R.S. Wurman, originator of the idea of *information anxiety*, wrote of an *information assault* (Hartog 2017). The topic has been reviewed over time and from various perspectives; see, for example, Wilson (1996), Bawden, Holtham and Courtney (1999), Edmund and Morris (2000), Eppler and Mengis (2004), Hall and Walton (2004), Levy (2008), Bawden and Robinson (2009), Hargittai, Neuman and Curry (2012), Benselin and Ragsdell (2015), Case and Given (2016, pp.122-127), Koltay (2017), Batista and Marques (2017), Roetzel (2018) and Jones and Kelly (2018).

This article is based on a highly selective literature analysis. Selectivity is necessary because searching for materials on the subject of information overload gives an immediate demonstration of the phenomenon. In January 2019, a Google search for the phrase "information overload" produces over three million items. A search in the *Web of Knowledge* database of academic literature retrieved over 3,000 articles, while searches in bibliographic databases of subjects such as business, psychology and social sciences typically each found a thousand items. For the most part therefore, only a small number of relevant references are cited on any particular point; that the reference list is still lengthy shows the extent of

research and commentary on the subject, and the breadth and diversity of issues with which it is associated.

The article considers the historical perspective, since overload has been experienced and lamented over a very long period. This should help place 21st century ideas of information overload into context, since overload is often, and wrongly, held to be associated solely with the modern digital information environment, and with social media in particular.

There are nine sections in this article, followed by references to items cited in the text, and recommendations for further reading. After this introduction, the sections deal with these aspects of information overload: its history; its nature; its causes; to what extent it is real; its opposite, information poverty; its consequences. The article concludes with sections on solutions to overload, and brief conclusions.

History of Overload

The history of the concept of information overload has been discussed by a number of writers, particularly detailed and scholarly treatment, not confined to the Western context, being provided by Blair (2003, 2010), and by the contributors to a special issue of the *Journal of the History of Ideas* (Rosenberg 2003). See also Gleick (2011), Neill (1992), and Bawden and Robinson (2009). The concept, though not the phrase, is usually taken as originating at the end of the 19th century, with George Simmel, a German sociologist and philosopher, being the first to analyse it in modern terms (Klapp 1986, Savolainen 2007), but its roots can be traced much further back.

Almost from the beginning of writing in the ancient and classical world, as the opening quotation from Seneca illustrates, there were complaints of too many books, and too much to read. Solutions immediately began to appear, in the form of summaries of texts, and lists of collection holdings. In the European medieval age of handwritten manuscripts the problem was perceived to become more serious, with Vincent of Beauvais lamenting "the multitude of books, the shortness of time, and slipperiness of memory" in 1255. "By the middle of the thirteenth century", writes Blair (2010, p. 45), "the principle ingredients both of a perception of overload and of solutions to it were in place". The solutions included reference works, compilations, indexes, concordances, and structured design of text.

The introduction of printing to Europe in early modern times exacerbated the problem many-fold. A tremendous acceleration in the production of texts throughout the 16th and 17th centuries, amounted to a kind of information explosion (Rosenberg 2003), with Leibnitz giving a typical lament in 1680 about "the horrible mass of books which keeps on growing". This was a time when what might be seen as the first systematic solutions to overload became widely used: skim reading, browsing, cutting and pasting, and annotating (Blair 2003, 2010).

A further great increase in the volume of published material throughout the 18th century led to more innovations to control the flood. The first modern encyclopaedias and dictionaries appeared (Yeo 2003), together with indexes to periodicals, and a greater use of summaries and reviews. The first approaches to systematic documentation practices appeared, in the sciences. The great volume of descriptive natural history published in the 16th and 17th centuries (Ogilvie 2003), were systematised by Linnaeus, through the intellectual means of his nomenclature and classification, together with his documentary innovations of filing systems, index cards, and structured text annotation (Müller-Wille and Charmantier 2012).

This century also saw the beginning of a much criticized trend, a reliance on *skim reading*: "the late eighteenth century boom in the number of publications … encouraged rapid scanning and skimming rather than intensive study of a few" (Secord 2014, p.128).

Overload in its modern sense began to be recognised with the communications revolution of the 19th century, with steam-powered presses multiplying the volume of material available, and the widespread adoption of newspapers and magazines, learned journals, textbooks, and other new formats (Edmund and Morris 2000). Around the beginning of the 20th century, the documentation movement, and the development of tools for bibliographic control, such as abstracts, bibliographies, subject indexing, cataloguing rules, and classification schemes for the paper-based world reached its peak (Csiszar 2013, Wright 2014).

Around the mid-twentieth century, complains about overload in dealing with scientific information in particular reached a peak. Vannevar Bush's influential 1945 *Atlantic Monthly* article noted that scientists were bogged down by a growing mountain of research.

Overload was explicitly acknowledged (though not under that name) at the Royal Society's Scientific Information Conference in 1948, which was highly influential in dictating the pattern for academic and professional information services at the start of the digital age. At that conference "not for the first time in history, but more acutely than ever before, there was a fear than scientists would be overwhelmed, that they would no longer be able to control the vast amounts of potentially relevant material that were pouring forth from the world's presses" and that "torrents and rivers of current literature pour themselves into libraries, adding, without cease, to what is already there" (Bawden, Holtham and Courtney 1999; Bawden and Robinson 2009).

The first scientific treatment of the overload phenomenon is ascribed to the American psychologist George Miller (1956, 1962), who detailed many examples of what would come to be called overload, based on psychological studies of the limits to human capacity to deal with information. See Galbraith (1974) for an early reflection on the relevance of these kinds of studies to dealing with practical problems of overload.

Information overload first became noted as a potential problem for business and government in the 1960s, summed up by Wilensky (1968, p. 331):

> "Information has always been a source of power, but it is now increasingly a source of confusion. In every sphere of modern life, the chronic condition is a surfeit of information, poorly integrated or lost somewhere in the system"

Alvin Toffler's influential book *Future Shock* (1970) first brought the phenomenon to wide attention. He described overload as causing both physical and physiological distress due to overloading of perception, cognition and decision-making process, by the technological advances transforming industrial society. By 1984, the leading scientific publisher Eugene Garfield was writing of "the already well-defined disease *information overload*".

Up to the 1970s, overload was largely a matter of journal and report literature for academics and professionals, and of consumer choice for the general public. It became a major and general issue of concern and focus in the 80s and 90s, with the widespread adoption of digital sources and then the internet. It was realised a transformation had occurred; the fundamental

problem was no longer finding information, but filtering and controlling it (Tenopir 1990). As Popova (2011, p. 5) put it:

> "While the old media fought against the scarcity of information, new media are fighting the overabundance of information."

A widely-noted Reuters report, based on a survey of 1,300 business managers worldwide, and dramatically entitled *Dying for Information*, revealed a number of startling statistics (Lewis 1996). Two-thirds of the respondents believed that information overload had caused loss of job satisfaction, a similar proportion that it had damaged their personal relations, and one-third that it had damaged their health. Nearly half believed that it damaged the decision-making process, by delays and poor decisions. This report was a major factor in bringing overload to general attention, since when it has never been out of public consciousness.

It may be concluded that a perception of information overload has existed for almost as long as information has been recorded, though its nature and causes have changed drastically over time.

Nature of Overload

There is no single generally-accepted definition of information overload. It is a slippery and contested concept. It is easy to give numbers to show increasing volumes of information, but the problem is not just amount. It is also to do with diversity, complexity, choices, confusion, and with harm caused by information. It is notable that these factors are present in metaphors often used for overload: *flood, deluge*, *smog*, *explosion.*

There is a recurring question as to what exactly everyone is overloaded with. Is it information? data? documents? ideas? ideologies? It has been usual for commentators to suggest that people are drowning in information (or data) but lacking knowledge, and often quoting T.S Elliot's lines *Where is the wisdom we have lost in knowledge? /Where is the knowledge we have lost in information?* This is not a new question. It has been pointed out that the information explosion in early modern Europe in the 16th and 17th centuries was variously regarded as a dramatic increase in the number of books, the amount of descriptive facts, and the number of authoritative voices (Rosenberg 2003).

It may be noted that overload has generally been explained and defined in rather pragmatic and informal terms; Edmund and Morris (2000) and Eppler and Mengis (2004) give typical lists for their date, mainly characterized as an unmanageable volume of information; see Bawden and Robinson (2009), Spier (2016), and Jones and Kelly (2018) other explanations, drawing on the 21st century context.

Relatively few have discussed the topic invoking a formal or philosophical approach. One of the latter is Floridi (2014a; 2014b), who analyses aspects of overload in terms of his Philosophy of Information, in writings referenced in this article. Another is Spier (2016), who examines overload using the ideas of Horkheiner and Adorno, concluding that overload is a feature of a capitalist culture industry, whereby "the increase in standardised cultural messages in the media leaves individuals with fewer capacities for reflection and critical thinking" (p.394), and whereby individuals are active agents in their own overloading, in that they actively consume more information artefacts than they can interpret or understand. A third is Capurro (2013, 2014), whose analysis refers in part to Heidegger and Foucault.

A 2017 statement by the International Federation of Library Associations suggests that:

"The exponential growth in the availability of information brought to us by technological advances brings not only promise, but for many a sense of information overload and frustrations linked to a lack of confidence in using digital tools" (IFLA 2017).

Overload is here taken as being caused by technology bringing us too much information, made worse by a sense that there is not adequate control over the flood.

More precisely, information overload can best be seen as the situation which arises when an individual's efficiency and effectiveness in using information (whether for their work, studies, citizenship, or life generally) is hampered by the amount of relevant, and potentially useful, information available to them. The information must be of value, or it could simply be ignored, and it must be known about and must be accessible, or the overload will only be potential; although that latter situation could certainly cause anxiety or FOMO (fear of missing out).

Przybylski et al. 2013, Jones and Kelly 2018, Dhir et al. 2018). The feeling of overload is usually, though not invariably, accompanied by a perceived loss of control over the situation, and often by feelings of being overwhelmed. Savolainen (2006, 2007) points out that these feelings are often related to a perceived lack of time to deal with all the information to hand; earlier Wilson (1995) defined overload as the situation in which someone knows that relevant information exists, but knows that they cannot access and use it properly because of time constraints. Time pressures have been mentioned as a specific cause of overload in numerous

studies, for example among health service managers (MacDonald, Bath and Booth 2011) and board level directors (Merendino et al. 2018).In the extreme, it seems clear that information overload may lead directly to problems of mental and physical health, as well as loss of efficiency at whatever tasks are being undertaken. Its significance should not be underestimated.

Information overload has generally been regarded as an issue by definition affecting the individual, but some authors have understood it as a problem affecting an organization, a city, or even a society, albeit the summation of individual situations. For example, Wilson (2001, p.113) wrote of overload at the organizational level as "a situation in which the extent of perceived individual information overload is sufficiently widespread within the organization as to reduce the overall effectiveness of management operations"; see also Eppler and Mengis (2004) and Davis (2011).

Causes of Information Overload

  The causes of overload have been analysed in a number of publications; see the reviews cited in the introduction. Eppler and Mengis (2004) give a detailed list of causes of information overload for the management disciplines in the early years of the millennium, categorized as: personal factors; information characteristics; task and process parameters; organizational design; and information technology. In general, it can be said that the definition and perceived effects of overload have not changed much, if at all, over time, but its potential causes have multiplied with the arrival of new technologies and new information formats.

Hartog (2017, p.46) makes the perceptive point that "information overload is a bridging concept that merges the surplus of information (an external reality) with a psychological response of feeling overwhelmed (an internal reality)". Little progress will be made in assessing the causes of, and solutions to, overload if only the objective amount and nature of information and data, or only the subjective individual response to it, are considered; the two must be considered together.

The causes of overload can be considered under four headings: too much information; diversity, complexity, and novelty of information; pervasive and pushed information; personal factors and individual differences,

Too Much Information

Too much information (TMI) is a phrase often associated with overload, together with *information explosion*, *information inundation*, *information excess*, and *information tsunami* Rudd and Rudd (1986), Tenopir (1990) Johnson (2014) Hartog (2017). It is easy to quote statistics and examples to support this idea. To just give a few examples:

- a weekly edition of the *New York Times* in the early years of the 21st century contained more information than the average person was likely to come across in a lifetime in seventeenth century England (Bawden and Robinson 2009)
- more information was created in the last three decades of the 20th century than in the previous 5000 years (Bawden and Robinson 2009)
- in 2012 about 2.5 exabytes of data were created each day, with the amount doubling every 3 years, and more data were transmitted across the Internet each second that were stored in the whole internet 20 years previously (McAfee et al. 2012)

- In the late 1970s, it was estimate that it would take seven hundred years to read one year's research literature in one subject (chemistry) (Bernier 1978)

- by 2012, enough data was being generated each day to fill all the libraries in the United States eight times over (Floridi 2014B).

A striking example of the TMI problem, from a medical context, but which may stand for many other settings, is given by Fraser and Dunstan (2010), who show that it is literally impossible to read all relevant material, even within a narrow speciality. They envisage a trainee in the speciality of cardiac imaging setting out to read the directly relevant medical literature. Reading 40 papers a day five days a week, they would require over 11 years to bring themselves up to date. By the time they had finished, another 82,000 relevant papers would have been published, requiring another 8 years reading. Although it is unlikely that anyone in the past several decades has tried to read everything related to their speciality, and the calculation is therefore not realistic, it does give a flavour of the TMI concern.

In quite a different context, personal informatics systems, which track users and collect data relating to life elements such as health, well-being, diet, finance productivity or reminiscence may also be a cause of overload. This may be by virtue of the sheer amount of data collected, as well as the many possible correlations between data elements; e.g. quality of sleep correlated with the weather, with amount of physical activity that day, and with the duration and nature of music which the user had listened to; see Jones and Kelly (2018) and references therein.

It is worth noting that feelings of TMI in the 21st century, which is generally attributed to email, social media, big data, a publication explosion, and other manifestations of digital

technology, bear a striking resemblance to the feelings evoked in early modern times by the development of printing. This era is analyzed by Blair (2003), who notes that a time of Gutenberg there were thirty thousand handwritten books in Europe, while fifty years after his death there were ten million printed books. She quotes Conrad Gessner complaining of a "confusing and harmful abundance of books" in 1545, and Adrien Baillet a century later lamenting that "we have reason to fear that the multitude of books which grows every day in a prodigious fashion will make the following centuries fall into a state as barbarous as that of the centuries that followed the fall of the Roman Empire".

Diversity, Complexity, and Novelty

The phrase *data smog* (Shenk 1997) is very telling, as it conjures up an image of a lack of clarity and accurate perception of what is there. The diversity and complexity of information, formats and media are generally hidden by the homogenization provided by the ubiquitous, and of course highly convenient, web browser. This homogenizing effect makes it difficult to distinguish between information which is useful and useless, accurate or inaccurate, reliable or unreliable. Hence it increases the potential for overload (Bawden and Robinson 2009, Cooke 2017, Schmitt, Debbeit and Schneider 2018, Gamble, Cassenti and Buchler (2017). It is, writes Donnelly (1986, p. 186) "the unconnected, excited nature" of information which causes overload. The more diverse and complex a collection of information is, and the more alternatives it offers, or appears to offer, the more likely it is to cause overload (Eppler and Mengis 2004, Bawden and Robinson 2009, Roetzel 2018, Li 2017). Interdisciplinary work, requiring an individual to deal with information from a variety of disciplines, has long been recognized as posing a particular overload problem (Wilson 1996)

As regards the novel content of incoming information, there is a 'sweet spot' in relation to the amount of information presented and the decision made on it: adding information beyond that point leads to overload and a decline in the quality of decisions Chewning and Harrell 1990, Jones and Kelly 2018). Kuhlthau (1993) expresses the same idea in slightly different terms. The balance between redundant (already known) information and unique new information is crucial: too much uniqueness leads to anxiety and overload, too much redundancy leads to boredom.

Pervasive and Pushed Information

'Push' services, particularly on ambient mobile devices, have added greatly to the perception of overload, with information being constantly 'imposed' without being sought (Walsh 2012). The ubiquity of mobile devices has added to the *always-on* syndrome, often associated with information overload.

Email was originally held to be a major cause of overload, if not the major cause, and is still often noted as a part of the problem (Bawden and Robinson 2009, Waller and Ragsdell 2012, Benselin and Ragsdell 2015, Terra 2017). Social media, such as Facebook and Twitter, are now often considered to be the main 'overwhelming' media, and responsible for much, if not most, overload, because of the ease with which they allow the creation, duplication and sharing of information (Hargittai, Neuman and Curry 2012, Jones and Kelly 2018, Rader and Grey 2015, Bontceva, Gorrell and Wessels 2013, Sasaki, Kawai and Kitamura 2015, Sasaki, Kawai and Kitamura 2016, Liang and Fu 2017, Nawaz et al. 2018).

Doubt has been expressed as to whether push technology, because of its potential to send people the information they need, sparing them having to search for it, might be a solution to

overload, as much as a cause; see, for example, Edmund and Morris (2000) and Savolainen (2007). With hindsight, it seems that it is largely a part of the problem.

The effect on overload of the use of mobile devices, particularly smartphones, has been examined by numerous researchers; see, for example, Feng and Agosta (2017) and Kneidinger-Müller (2017). Specific overload issues with mobile devices include a perceived constant need to check for new information, especially from social media, problems with easy assimilation of information on small screens. Mobile devices also encourage multi-tasking, and attempting to process information in short periods of time while travelling or between other tasks; inefficient behaviours which may add to the perception of overload. The pervasive technologies and ambient information flows intrinsic to 'smart cities' may also be associated with overload (Batista and Marques 2018).

Individual Differences

Savolainen (2007) found some indications that overload might affect older people most, as younger people would be more skilled in the use of information technologies, an assumption made by many at that time. Later studies have shown that this is not generally the case, and overload affects all age groups. With older people this is often due to problems with using technology, but younger people are just as likely, if not more likely, to be affected by overload, because they are less familiar with various information environments; for example, that of online news, and because they may lack information literacy; see, for example, Benselin and Ragsdell (2015) and Schmitt, Debbeit and Schneider (2018).

There is some limited evidence that individual and personality factors, such as self-efficacy, may play some part in if, and how, a person perceives overload, but there is certainly no

indication that there is such a thing as an overload-prone personality type; see, for example, Ge (2010), Johnson (2014), Haase et al. (2014), Kominiarczuk and Ledinska (2014), Li (2017), Schmitt, Debbeit and Schneider (2018).

Self-confidence may be a factor preserving an individual from the perception of overload. A study of senior politicians found that they do not worry about possibly missing relevant information, nor suffer from the uncertainty that contributes to overload (Walgrave and Dejaeghere 2017).

Is Overload Real?

Running alongside the expressed concerns about overload, there has always been a parallel stream of opinion to the effect that these are not 'real' problems, that they are, at the least, exaggerated. This exaggeration, it is sometimes suggested, may be encouraged by professional groups seeking to magnify a problem to which they claim to have a solution; this has been a potential concern for the library/information professions relating to information overload (Bawden and Robinson 2009).

Among the sceptics, Wilson (1976) at an early stage. regarded overload as a "phantom". Tildline (1999) argued, at the point when the modern conception of overload was being established, that overload was unevidenced, and a "myth of modern culture". While this is an extreme view, there is considerable evidence that many people are quite untroubled by the idea of overload. Rudd and Rudd (1986) suggested that, while there was a confusion between potential overload, due to the amount of available information, actual overload was rare, occurring only in unusual circumstances. Bawden, Holtham and Courtney (1999) note a

number of rebuttals of overload at the end of the last century. Savolainen (2007, p.614) points out that "information overload does not seem to exist for many people since the tend to ignore what they do not need or that which is seen as irrelevant ... simply avoiding or ignoring the excessive supply of information [or] may adopt a highly selective approach and seek information that supports their customary decision choices and practices". Others have noted much the same over a long period; see, for example, Wilson (1976), Neill (1992), Hargittai, Neuman and Curry (2012), Thompson (2013), Shachaf, Aharony and Baruchson, (2016), Feng and Agosta (2017), and Jones and Kelly (2018).

It also has to be admitted that there is an element of fashion, of being on-trend, in expressing concern about these issues. The idea of 'TMI' (too much information) was much discussed in popular sources around the turn of the millennium, but seems to have receded from popular consciousness since (Bawden and Robinson 2009). Maria Popova (2013) in a review of Clive Thompson's *Smarter than you think* (2013) described information overload as "painfully familiar and trite-by-overuse". This is not an argument for rejecting the whole idea of overload as mythical; rather as one for a clearer analysis of its nature and applicability.

Others have tried to deny overload by saying that the problem is real, but due to other factors. One widely-publicised example of this is the American writer Clay Shirky's dictum that "it's not overload, it's filter failure", since the problem is not the amount of information *per se*, but our inefficiency in dealing with it; however. It is perhaps more helpful to regard filter failure as an intrinsic part of the wider phenomenon of overload (Davis 2011).

In the context of big data, the information philosopher Luciano Floridi remarks that "Big data refers to an overwhelming sense that we have bitten off more than we can chew, that we are

being force-fed like geese, that our intellectual livers are exploding" (Floridi 2014B, p. 305). But rather, Floridi goes on to argue, we should regard ourselves as seated at a banquet where there is more food than we could ever eat; why should we have cause for complaint. There is no easy technological solution; we must instead think hard about issues of the purposes for which the data is created, and for which it will be used, and on that basis focus on information quality.

Similarly, Capurro (2013, 2014) regards overload as a paradoxical condition, since information to hand is always the product of some selection process, guided by what an individual perceives they need. The paradox, for Capurro, lies in the great number of options provided by available information, and hence for the need to choose the criteria for selection. Spier (2016) expresses this paradox more generally: if we live in an information society, whose main feature is, by definition, a growing informatization, how can such a society suffer from over much information?

One answer to this paradox may another; the paradox of choice, as enunciated by American psychologist Barry Schwartz (2004). Put simply, while having little choice in some matter may be problem, having too much choice may be equally, or even more, problematic. Too wide a choice may cause anxiety, and lead to a paralysis of decision-making, and to irrational decisions; very much the features, in an information context, of overload. And indeed, studies of online shopping behaviour have shown that an increased choice of brand alternative causes feelings of overload among shoppers, see, for example, Li (2017).

A closely related viewpoint is that overload, assuming that it exists, is not really caused by TMI, since there is never a necessary for anyone to absorb all relevant information; rather it

is caused by "filter failure", an inability, which may be due to a variety of causes, to identify from the mass of available information what is useful to us to any particular time; for a clear identification of this ides in the context of health information, see Klerings, Weinhandl and Thaler (2015).

As guests at Floridi's banquet, we may feel it does not matter if we cannot consume all the food, or even try a majority of the different dishes, as long as we get enough to eat. For most of us, most of the time, that may be a reasonable assumption; hence the studies showing that many people cope with overload, perhaps not even noticing its existence. But that does not mean that we should not be mindful about what, and how, we consume, whether food or information.

Information Poverty

It may seem odd for an article on information overload to devote space to what may seem seem its diametric opposite, *information poverty*. But in fact, information poverty is in a sense the evil twin of information overload, and the two are in many ways connected.

Information poverty, which in its simplest terms means that individuals, organizations or communities have insufficient information to enable them to be effective, is a contested concept, which has been, and is, understood in different ways (Bawden and Haider 2007, Britz 2004, Chatman 1996, Lee and Butler 2019). It is closely connected with the concept of the *digital divide*, the idea that some individuals and groups are disconnected from an ability to access and use digital information (Bawden and Robinson 2009, Flanagan 2018).

Information poverty is not solely a feature of economically impoverished or ill-educated groups. It was, for example, found to be a factor in a study of health service managers; either because the required information did not exist, or they were unable to get access to it, or could not get it in time for it to be useful. (MacDonald, Bath and Booth 2011).

The particular relevance of information poverty to overload is that, seemingly paradoxically, the two problems may be identified in the same setting; this was the case in the study of MacDonald, Bath and Booth. The two pathologies may also have much the same effect. Those suffering from information poverty are unable make good decisions or take effective action because they lack the information and data to enable them to do so; the overloaded suffer the same fate because the surfeit of information causes fatigue and anxiety (Goulding 2001). Overload and poverty may, again seemingly paradoxically, be confused, since their consequences are much the same.

As with overload, there have been concerns that these may be false, or at least exaggerated, phenomena, focused on by professional groups wishing to offer solutions (Bawden and Robinson 2009). At all events, the solutions for the two problems may have at least something in common.

Consequences of Overload

Consequences of overload have been enumerated by many writers. Eppler and Mengis (2004) give a detailed list of observed consequences in management disciplines to the early years of the millennium, categorized as: limited information search and retrieval strategies, arbitrary information analysis and organization; suboptimal decisions; and strenuous personal

circumstances. They will now be summarized under three headings: effects on health; inefficiency; misinformation and fake news.

Effects on Health

One of the concerns which began to expressed from the 1980s onwards was that information overload could directly damage mental and physical health.

The idea of *information anxiety* was introduced by Wurman in 1989; for later treatment, see Wurman (2001), Girard and Allison (2008), and Hartog (2017). It is a condition of stress caused by worries about the ability to find, access, understand, or use necessary information. It is related to pathologies such as *technological anxiety*, *computer anxiety*, *library anxiety*, and *techno-stress*. but is focused on the information itself, rather than the technology by which, or the environment within which, the information is accessed (Hartog 2017). Overload is not the sole cause, but it is a major contributor. Anxiety in handling information is closely related to uncertainty; the problem may therefore not be the volume of information, but rather the extent of novel information, which cannot easily be understood, or related to what is already known (Kuhlthau 1993).

Infobesity is a term used to denote the harm caused by a surfeit of information, analogous to that caused by over-indulgence in unhealthy food, and with a clear connection to overload. It is to be cured by a 'diet' of good information in the right quantity (Bell 2004, Rogers, Puryear and Root 2013, Johnson 2012, Serrano-Puche (2017)

Fatigue is often mentioned as a health consequence of overload. This generally means a physical or mental tiredness in the usual sense of the word, although the phrase *information*

fatigue syndrome was coined in 1996 to imply something more specific, involving sleeplessness, a paralysis of the capacity for thought, anxiety, and self-doubt (Goulding 2001). The related *technostress* (West 2007) produces the same symptoms as other forms of stress, notably headache, anxiety, depression, stomach problems, high blood pressure, and heart disease.

Mental health problems associated with overload, which may cause physical symptoms, include *attention deficit trait* (Hallowell 2005), and *cognitive overload* (KIrsch 2000).

In short, while there may be room for debate as to the exact cause and effect (too much information or too much work? information anxiety or social anxiety?), the general consensus is summed up by Kominiarczuk and Ledinska (2014) : people with a high level of information overload will experience lowered well-being, and the more information stress someone feels the less happy they are with their life.

Inefficiency

Inefficiency, waste of time, and loss of productivity has been one of the longest standing concerns about overload. The validity and seriousness of these concerns is a matter of debate.

There is concern that the availability of information and communication sources leads to an inability to focus or concentrate : a state termed *continuous partial attention* (Rose 2010). This has led to a number of commentators to bemoan the increasing superficial way in information and knowledge is handled; Carr (2010) is one early and well-publicised example. It is alleged that deep engagement with information and knowledge – reading a book from

start to finish, for example – has been largely supplanted by a scanning of snippets: articles are supplanted by blog postings are supplanted by tweets.

Certainly more reliance is placed by academic and professional readers on abstracts and summaries, as opposed to a reading of the full document; see, for example, Nicholas, Huntington and Jamali (2007). Whilst a reasonable, and long-standing, way of coping of an excessive number of potentially useful things to be read, this is potentially troubling, as studies have shown that typically 20% of abstracts contain significant inaccuracies (see, for example, Hartley and Betts 2009); usually presenting the subject matter of the main document in an unreasonably positive light. the same must surely be true of policy makers and administrators.

Misinformation and Fake News

> "In the past, censorship worked by blocking the flow of information. In the twenty-first century, censorship works by flooding people with irrelevant information. We just don't know what to pay attention to, and often spend our time investigating and debating side issues. In ancient times having power meant having access to data. Today having power means knowing what to ignore." (Harari 2017, p.462)

Arguably the main difference between the influence of overload in the 21st century and in previous times is the way in which overload is now perceived to cause problems for social cohesion and political action, including loss of social social cohesion, political polarization, and a loss of vitality of the public sphere (Hargittai, Neuman and Curry 2012).

There is a particular issue with people finding reliable information from news sources, when there are so many more online and social media sources, many of dubious validity, competing for the limited time and attention of their users (Kovach and Rosenstiel 2011, Anderson and Raine (2017), Schmitt, Debbeit, and Schneider 2018). Popkin (1993) found that voters in US elections used a variety of shortcuts in obtaining and evaluating news and information about parties, candidates and issues, even in pre-internet days. The same applies even more strongly in the age of the internet and social media, with simple and unreliable rules for selection being applied, and with information being avoided through *filter bubbles*, in which people seek only the political information and news which confirms their existing views (Cooke 2017, Case and Given 2016 pp.115-116). Overload also leads to unhelpful communication behaviour, such as sharing information, and links to information, without reading it carefully, if at all: TLDR (too long, didn't read) has become a popular acronym.

Solutions to Overload

"... there is no cure [for information overload]. Information breeds information as one thought leads to another and as answers lead to questions" (S.D. Neill 1992, p. 117).

From the earliest times, perceptions of overload have been accompanied by suggestions, and practical actions, towards overcoming it, as noted in the section of the history of overload and the references given there. It seems reasonable to suggest that there has always been a balance: as the forces creating overload have increased, so have solutions been developed, so that overload has been kept in check while never being banished. In the manuscript age, the solutions included silent reading, punctuation, and the codex format. The early part of age of

print added indexes, reference books, bibliographies, note taking, criticism and reviews. Solutions have continued to chase technologies and information formats to the present day.

Bawden and Robinson (2009) summarise the solutions proposed since the modern worries about overload surfaced in the 1990s. Most often these have involved either good organisational or personal information management and/or the promotion of information and digital literacy.

While solutions to overload have generally be proposed at the level of the individual, there has been a recognition that they may sometimes need to be applied by the organisation, in circumstances as different as information for senior politicians (Walgrave and Dejaeghere (2017), and big data in the hospitality industry (Saxena and Lamest (2018). There have been numerous management-oriented proposals, generally based on the idea that overload is solved by processes and systems to give people the right information at the right time to make a decision; see Rogers, Puryear and Root (2013) and Merendino et al. (2018) for typical examples. Hartog (2017) reviews pragmatic cures for information anxiety, several of which, mainly involving some form of information filtering, are equally cures for information overload.

Solutions to overload will be discussed under six headings: coping strategies (further divided into avoiding and with drawing, filtering, and satisficing); information architecture; technical solutions; information management and literacy; slowing down and understanding; forgetting and destroying.

Coping Strategies

Two general pragmatic strategies for coping with information overload have been identified: *filtering* information; and *avoiding*, or *withdrawing* from, information. Taken together, these may be regarded as a *satisficing* strategy, although this is treated by some writers as a distinct third approach. Manheim (2014) argues that all three may be seen as a kind of *non-seeking for information*. Certainly they are used for the most part instinctively, and not by an conscious strategy formulation. For overviews of coping strategies, see Bawden and Robinson (2009), Manheim (2014) and Jones and Kelly (2018).

Avoiding and Withdrawing

The rather crude heuristic of *information avoidance* relies on simply ignoring potentially useful information, and sources of information, either because there is just too much to deal with, or because it is incongruent, difficult to fit with the user's existing knowledge (Sweeny et al. 2010, Neben 2015). The quotation from Savolainen (2007) above exemplifies the former. As Johnson (2014), and the sources which he quotes, point out, avoidance, or *escape*, may be a perfectly rational response to overload, if one cannot make any use of the information obtained. Manheim (2014), somewhat similarly, argues, that *not* seeking for information may be a perfectly reasonably course of action in some circumstances, and will certainly prevent, or at least minimize, overload.

However, more negatively, avoidance may lead to avoiding disquieting or discordant information, which can lead to *escaping,* seeking simple solutions to complex issues by avoiding information which may be challenging or unsettling, or even by turning to demagogues (Johnson 2014). Case and Given (2016 pp.115-116) use *selective exposure* for much the same strategy.

A more nuanced approach, identified by Savolainen (2007) is *information withdrawal*, a conscious decision to keep to a minimum the number of sources to be considered, ideally combined with a filtering of intake, and a rapid weeding of relevant material of limited usefulness. This strategy has been noted by other researchers; see, for example, Shachaf, Aharony and Baruchson, (2016), Sasaki, Kawai and Kitamura (2016), Liang and Fu (2017), Feng and Agosta (2017), and Saxena and Lamest (2018). The senior politicians studied by Walgrave and Dejaeghere (2017) placed much reliance on this approach, focusing on information matching their ideology (party leaders) or their specialist brief (ministers).

Examples of withdrawal are: customising social media to limit the number of notification received; unfriending or unfollowing social media accounts; turning off mobile devices, or ignoring email or social media, for a period; focusing solely on information matching existing knowledge or frame of reference; leaving a social media platform entirely.

Filtering

Filtering, understood as leaving certain types of information unprocessed, appears to have first been mentioned by Miller (1962), and is one of the most frequently observed ways of reducing overload.

Savolainen (2007), as noted earlier, identifies filtering as a valuable mechanism for reducing overload. He denoted a filtering strategy as a disciplined and systematic attempt to focus on relevant information from chosen sources, by specifying criteria for immediately removing items from consideration. These criteria will necessarily be different for each source, and may be applied intellectually or algorithmically. Manheim (2014), Shachaf, Aharony and Baruchson, (2016), Feng and Agosta (2017), Saxena and Lamest (2018) and Jones and Kelly

(2018) also identify filtering as a major strategy for avoiding overload. The behavioral decision theory literature in essence also assumes that decision makers do not consider everything in making choices (Lau, 2019).

Filters determine whether information is relevant to a user according to some scheme of importance/priority, and weed out information presumed to be irrelevant or of less importance: the intention is to draw attention to the most valuable or interesting information, and hence use time, which necessarily limited, more effectively. It may involve a variety of processes for selecting, omitting, and ranking information (Belkin and Croft 1992, Rader and Grey 2015, Saxena and Lamest (2018). A distinction is sometimes made between *active filtering*, seeking useful information and drawing it to the user's attention, and *passive filtering*, omitting less useful material from that presented to the user.

Filtering may be done automatically on the basis of explicitly asking for user preferences. Alternatively, it may be done algorithmically , by simple means, such as by noting what kinds of email messages are deleted unread, or by more complex means, using techniques such as machine learning; for examples of the latter, see Jones and Kelly (2018). It can be achieved by means of organizational procedures; elite politicians, for example, were noted to filter incoming information through procedures and the use of assistants as information intermediaries Walgrave and Dejaeghere (2017).

Filtering is always a trade-off. It helps reduce overload by allowing users to concentrate on useful information, but may cause them to miss serendipitous encounters with novel information, and may discourage exploration. There is also an ethical question about who, or what, is controlling what information a user sees. An antidote to this may be to ensure that

filtering is always done transparently transparently (Jones and Kelly 2018, Raderand Grey 2015). Examples of filtering are: ignoring emails and social media notifications from certain people and about certain topics; unfollowing accounts on social media; examining only the most recent, or the most relevant, items from a long list; and examining only items in languages in which one is fluent, rather than seeking a translation for others.

Satisficing

Satisficing, also termed bounded rationality, is a way of making decisions and choices when it not feasible to fully compare the benefits of possible options; in essence, a way of efficiently getting something that, while not necessarily optimal, is good enough for the purpose (Simon 1955, Gigerenzer and Selten 2001; Stevens, 2019). In the information context, provided that there is a good rationale for the decisions made, this can be a good heuristic for getting good enough information without being overloaded. Indeed, such behaviour, often quite sophisticated and usually involving withdrawing and filtering approaches, is commonly observed; see, for example, Agusto (2002), Prabha et al. (2007), Mansouran and Ford (2007), Savolainen (2007), Warwick et al. (2009), MacDonald, Bath and Booth (2011), Manheim (2014), and Shachaf, Aharony and Baruchson, (2016). It is sometimes clearly the predominant means of avoiding overload, as with the Belgian politicians studied by Walgrave and Dejaeghere (2017). It is often suggested that satisficing is an expression of Zipf's Principle of Least Effort, but Mannheim produces examples to show that this may not always be so; people do not always follow, in information terms, the path of least effort.

Bawden and Robinson (2009) distinguish *good satisficing* from *bad satisficing.* The former requires a clear (to its user) rationale for why decisions are being taken; the latter reduces to

an essentially random and contingent selection of sources and material, and to an avoidance of information. The former is a good solution to perceived overload; the latter, while it may easy anxiety, is unlikely to be effective where the information carries any real significance for its user, life, work or study. Cooke (2017) points to the danger of bad satisficing in relation to problems of post-truth and alternative facts, and in particular to the spreading of fake news.

Information Architecture

Information architecture can help prevent overload by structuring information spaces (Davis 2011, Koltay 2011A). This is essentially done through the medium of user experience (UX) interface design, in such a way as to minimise the chances that the user will be subjected to, particularly on a single screen, too much information (too much text, too many images, too many messages, etc.) or too much choice (too many features, too many options). This is a particular issue on the small screens of mobile devices. Information architecture and design initiatives to help overcome overcome will be most effective should be based on, and support users' natural coping strategies.

Through clear signposting, and use of taxonomies, the architecture may help the user to effectively filter their information. Interactive dashboards for presenting filtered information streams have been widely adopted as a way of coping with big data (see, for example, Saxena and Lamest 2018). Principles of information design, and its newer sibling information visualization, may also be applied to prevent overload. The prescriptions here are typically practical, and arguably self-evident, but frequently not observed. A typical set of summary recommendations is to: keep the displayed information simple, relevant, and clear; provide

supporting and balanced information; and make it clear what should be done with the information, and how a user can take action (Interaction Design Foundation 2018)

Technical Solutions

As Floridi (2014B) points out, better technical capabilities are likely, first and foremost, to produce a greater amount of data. This echoes the early warnings of Postman (1992, p.72) that when technology increases the amount of available information, control measures intended to help this situation are typically themselves technical, and in turn further increase the supply of information.   A specific instance of this is given by Shapiro (2018), in the specific context of the introduction of web-scale discovery systems in academic libraries. "Librarians efforts at using technology to tame information overload", writes Shapiro, "are mostly futile and counterproductive". A better approach would be for librarians to focus on library instruction, to improve the information and digital literacies of their users, to help them deal with the information tsunami (Shapiro 2018, p. 672).

This is not a new idea. In relation to the indexes, bibliographies and encyclopaedias created in the 16th and 17th centuries, Rosenberg (2003, p.9) writes that "it may be that the very devices created to "contain" information overload are the devices that "create" it in the first place". The widespread use of reviews of books in the new periodicals of the 18th century removed a necessity to read the original, but created its own form of overload (Blair 2010, p. 167), while Linnaeus' innovations in documentation increased, and well as ameliorated, overload for natural historians (Müller-Wille and Charmantier 2012).

However, technical solutions, terms of more effective information systems, are still recommended see for example (Klerings, Weinhandl and Thaler 2015). By the end of the

20th century, 'intelligent agents' were being regarded as a useful tool for overcoming overload Edmund and Morris (2000). Filtering and recommender systems based on artificial intelligence are a newer generation of this kind of tool; the extent to which they will reduce, and not at the same time add to, overload is yet to be seen.

Information Management and Literacy

In an influential and much-quoted report, Paul Zurkowski noted on the first page that "We experience an overabundance of information whenever available information exceeds our capacity to evaluate it. This is a universal condition today" (Zurkowski 1974, p1). His recommended solution was a national programme to achieve universal *information literacy*; the first time the phrase had been used. Ever since then, there has been a close relation between the problem of information overload, and the proposed solution of information literacy.

There is a somewhat confusing array of what might be called 'literacies of information', of which the most commonly cited are *information literacy*, *digital literacy* and *media literacy* (Bawden 2001, Koltay 2011B). These literacies are frequently recommended, particularly in the context of library and information management, as providing personal solutions to overload, by improving an individual's ability to control their own information; see, for example, Hall and Walton (2004), Bawden and Robinson (2009, 2011), Koltay (2011A), and IFLA (2017).

A typical formulation of this is given by Ge, in a discussion of ways to help college students overcome information overload: "Effective searching requires planning, attention to detail, and successful search strategies. faced with an overload of information, it is important to find

out which sources are useful, and to discover effective and simple search procedures" (Ge 2010, p. 449). Such commendable recommendations for good rational information practice may perhaps be naive, and doomed to failure in the face of the attractions of satisficing, and the lure of the Google search box.

If people have confidence in their information sources, they are less likely to suffer from overload even with a high volume of information (Gamble, Cassenti and Buchler 2017). Choosing reliable sources is a key aspect of information literacy, especially for dealing with news (Kovach and Rosenstiel 2011). Cooke (2017) recommends this aspect of digital literacy and critical information literacy as a way of ameliorating the effects of fake news, while (Klerings, Weinhandl and Thaler 2015) recommend it for health literacy to help patients manage their treatment.

Good *personal information management* practice has often been recommended as a solution to overload, by taking control of one's information environment, combining the kind of coping strategies mentioned in this article with rather traditional techniques for time and desk management, and for delegation (Bawden, Holtham and Courtney 1999, Bawden and Robinson 2009). For a detailed example of what this might mean in practice, integrating several of the strategies already noted into a coherent plan for avoiding overload, see Harzing (2018). A shorter list of pragmatic solutions is given by the Interaction Design Foundation (2018): feel free to ignore information; feel free to take action without having all the facts; create an information queue and tackle it regularly; filter information ruthlessly; delegate information responsibly; learn to skim read.

The last of those recommendations is a reminder that skimming and scanning have been regarded as a solution to overload for centuries, and have been joined over time by excerpts and abstracts, speed reading, quick reads, microblogs, and the rest. As has been noted, there are concerns about reliance on this form of information access, and a surmised loss of close reading, but there is little doubt that this is now more than ever a part of a personal information management approach to avoiding overload.

Slowing Down and Understanding

As noted in previous sections, time factors are often mentioned in connection with information overload; most obviously because of the time which has to be taken to deal with any large volume of information, but also sometimes because the need, actual or perceived, for rapid decision-making means that the necessary information cannot be processed quickly enough.

Perhaps seemingly paradoxically, slowing things down has been proposed as a means of defeating overload. This was first suggested by Miller (1992), who proposed a strategy of *queuing*, delaying dealing with at least some information to a less busy time. Wilson (1995) incorporated the idea into a priority-based information strategy which also incorporated avoidance, with information categorised as: to be dealt with immediately; to be dealt with when time permits; to be filed for use when needed; and to be ignored. Queuing as a strategy has been observed by Feng and Agosta (2017), while the politicians studied by Walgrave and Dejaeghere (2017) commonly adopted a *wait and see* strategy, avoiding immediate action, even on relevant information. There are some similarities with the information diet idea (Johnson 2012), and with the time management aspects of personal information management.

Examples of queuing include: putting materials into 'read later' areas, and using lists on social media; adopting a policy of always waiting a specified time before acting on information.

More ambitiously, it has been suggested that overload may be prevented by adopting some of the tenets of the Slow movement, allowing a mindful approach to information handling; see, for example, Poirier and Robinson (2013). This involves taking control of information, taking time to comprehend and use it, establishing a balance in taking in and using information, (analogous to the 'sweet spot' already mentioned and generally acting as a rational consumer of information.

Connected with this is the idea of using information to create a connected understanding, which will necessarily develop over time, rather than simply processing individual information items. Lack of an overall understanding has been noted as a feature of overload (Spier 2016), and means for enhancing understanding will be an antidote to overload (see, for example, Bawden and Robinson 2016),

Forgetting and Destroying

"We have shifted from the problem of what to save to the problem of what to erase. Something must be deleted or never recorded in the first place (Floridi 2014B, p.307).

One way of dealing with a surfeit of information is to forget it, or to destroy it. Like so many ideas relating to overload, this is not a new idea. In the 18th century, luminaries such Samuel Johnson and Edward Gibbon were contemplating the destruction of books as to some degree a good thing (Yeo 2003).

In the digital age, the issue is made more pressing by the possibility of *perfect remembering*, brought about by the preservation of our thoughts and actions in digital media. Mayer-Schönberger (2009) extols the virtues of forgetting, and advocates an explicit place for it in a digital world, while Johnson (2014) and Kluge and Gronau (2018) recommend careful and thoughtful discarding of information from consideration as a tool for overcoming overload, in personal and organizational contexts respectively.

Conclusions

Information overload is real. It is not a myth or a phantom. For almost as long as there has been information, there has been a perception that humanity has been overloaded by it. The essential nature of overload has not changed with changing technology, though its causes and proposed solutions have changed very much. The people, and the mechanisms, which suffer from overload are by and large the same those which cause it. The problem has never completely overwhelmed individuals, organizations or societies, but equally it has never gone away. The best ways of avoiding overload, individually and socially, appear to lie in a variety of coping strategies to enable satisficing, and in seeking a mindful balance in consuming information and finding understanding.

The difference in the 21st century is that, with the move to hyper-history and the infosphere, individuals and societies are dependent on, and formed by, information in an unprecedented way. Information overload needs to be taken more seriously than ever.

Further Reading

Bawden, D. & Robinson, L. (2009). The dark side of information: overload, anxiety and other paradoxes and pathologies. *Journal of Information Science*, 35(2), 180-191.

Blair, A.M. (2010). *Too much to know: managing scholarly information before the modern age*. New Haven and London: Yale University Press.

Cooke, N.A. (2017). Posttruth, truthiness and alternative facts: information behavior and critical information consumption for a new age. *Library Quarterly*,87(3), 211-221.

Floridi, L. (2014). *The fourth revolution: how the infosphere is reshaping human reality*. Oxford: Oxford University Press.

Floridi, L. (2014), Big data and information quality. In L. Floridi and P. Illari (Eds.), *The Philosophy of Information Quality* (pp. 303-315). Heidelberg: Springer.

Koltay, T. (2017). Information overload in a data-intensive world. In A.J. Schuster (Ed.), *Understanding information: from the big bang to big data* (pp. 197-218). Cham: Springer.

Marques, R.P.F. & Batista, J.C.L. (Eds.). *Information and communication overload in the digital age*. Hershey PA: IGI Global.

Merendino, A., Dibb, S., Meadows, M. Quinn, L. Wilson, D., Simkin, L. & Canhoto, A. (2018). Big data, big decisions: the impact of big data on board level decision making. *Journal of Business Research*, 93 (December 2018), 67-78.

Poirer, L. & Robinson, L. (2013). Informational balance: slow principles in the theory and practice of information behaviour. *Journal of Documentation*, 70(4), 687-707.

Walgrave, S. & Dejaeghere, Y. (2017). Surviving information overload: how elite politicians select information. *Governance*, 30(2), 229-244.

References

Agusto, D.E. (2002). Bounded rationality and satisficing in young people's web-based decision-making. *Journal of the American Society for Information Science and* Technology,

53(1), 16-27.

Anderson, J. & Raine, L. (2017). The future of truth and misinformation online. Pew Research Centre. Retrieved from http://www.pewinternet.org/2017/10/19/the-future-of-truth-and-misinformation-online/.

Babik, W. (2018), Information and knowledge ecology: a field for research in knowledge organization. In F. Ribeiro & M.E. Cerveira (Eds.), *Challenges and opportunities for knowledge organization in the digital age* (pp. 290-299). Baden-Baden: Ergon Verlag.

Batista, J. & Marques, R.P.F. (2017). An overview on information and communication overload. In R.P.F. Marques & J.C.L. Batista (Eds.), *Information and communication overload in the digital age* (pp. 1-19). Hershey PA: IGI Global.

Batista, J. & Marques, R.P. (2018). Considerations on information and communication overload issue in smart cities. In O. Mealha, M. Divitini & M. Rehm (Eds.), *Citizen, territory and technologies: smart learning contexts and practices* (pp.129-136). Cham: Springer.

Bawden, D. (2001). Information and digital literacies; a review of concepts. *Journal of Documentation*, 57(2), 218-259.

Bawden, D., Holtham, C, & Courtney, N. (1999). Perspectives on information overload. *Aslib Proceedings*, 51(8), 249-255.

Bawden, D. & Robinson, L. (2009). The dark side of information: overload, anxiety and other paradoxes and pathologies. *Journal of Information Science*, 35(2), 180-191.

Bawden, D. & Robinson, L. (2011). Digital literacy and the dark side of information: enlightening the paradox. In L.H. Stergioulas & H. Drenoyianni (Eds.), *Persuing digital literacy in compulsory education* (pp. 47-58). New York: Peter Lang.

Bawden, D. & Robinson, L. (2016). Information and the gaining of understanding. Journal of Information Science, 42(3), 294-299.

Bell, S. (2004), The infodiet: how libraries can offer an appetizing alternative to Google, *The Chronicle of Higher Education*, 50(24), B15. Retrieved from https://www.chronicle.com/article/The-Infodiet-How-Libraries/4458.

Belkin, N.J. & Croft, W.B. (1992). Information filtering and information retrieval: two sides of the same coin? *Communications of the ACM*, 35(12), 29-38.

Benselin, J.C. & Ragsdell, G. (2015). Information overload: the differences that age makes. *Journal of Librarianship and Information Science*, 48(3), 284-297.

Bernier, C. (1978). Reading overload and cogency. *Information Processing and Management*, 14(6), 445-452.

Blair A. (2003). Reading strategies for coping with information overload, ca 1550-1700. *Journal of the History of Ideas*, 64(1), 11-28.

Blair, A.M. (2010). *Too much to know: managing scholarly information before the modern age*. New Haven and London: Yale University Press.

Bontceva, K., Gorrell, G. & Wessels, B. (2013). Social media and information overload: survey results. [eprint] arXiv:1306.0813. Retrieved from http://arxiv.org/abs/1306.0813.

Britz, J.J. (2004). To know or not to know? A moral reflection on information poverty. *Journal of Information Science*, 30(1), 192-204.

Bush, V. (1945). As we may think. *Atlantic Monthly*, 176, 101-108.

Capuro, R. (2013). Medicine in the information and knowledge society. Keynote address to the European Summit for Clinical Nanomedicine and Targeted Medicine, Basel, June 23 2013. Retrieved from http://www.capurro.de/Medicine2_0.html.

Capurro, R. (2014). Medicine 2.0: reflections on a pathology of information society. *Infopreneurship Journal*, 1(2), 31-47.

Carr, N. (2010). *The Shallows: how the Internet is changing the way we think*. London: Atlantic Books.

Case, D.O. & Given, L.M. (2016). *Looking for Information, 4th edn.* Bingley: Emerald.

Chatman, E.A. (1996). The impoverished life-world of outsiders. *Journal of the American Association of Information Science*, 47(3), 193-206.

Chewning, E.G. & Harrell, A.M. (1990). The effect of information load on decision makers' cue utilization levels and decision quality in a financial distress decision task. *Accounting, Organizations and Society*, 15(6), 527-542.

Cooke, N.A. (2017). Posttruth, truthiness and alternative facts: information behavior and critical information consumption for a new age. *Library Quarterly*,87(3), 211-221.

Csiszar, A. (2013). Bibliography as anthropometry: dreaming scientific order at the fin de siècle. *Library Trends*, 62(2), 442-455.

Davis, N. (2011). Information overload, reloaded. *Bulletin of the American Society for Information Science and Technology*, 37(5), 45-49.

Dhir, A., Yossatorn, Y., Kaur, P & Chen, S. (2018). Online social media fatigue and psychological wellbeing - a study of compulsive use, fear of missing out, fatigue, anxiety and depression. *International Journal of Information Management*, 40, 141-152.

Donnelly, W. (1986). *The confetti generation: how the new communications technology is fragmenting America*. New York: Henry Holt and Company.

Edmund, A. & Morris, A. (2000). The problem of information overload in business organisations: a review of the literature. *International Journal of Information Management*, 20(1), 17-28.

Eppler, M.J & Mengis, J. (2004). The concept of information overload: a review of literature from organizational science, accounting, marketing, MIS and related disciplines. *The Information Society*, 20(5), 325-344.

Feng, Y. & Agosta, D.E. (2017). The experience of mobile information overload: struggling between needs and constraints. *Information Research*, 22(2), paper 574. Retrieved from http://www.informationr.net/ir/22-2/paper754.html.

Flanagan, P. (2018), Digital divide. In M. Khosrow-Pour, M. (Ed), *Encyclopedia of Information Science and Technology, 4th edn.* (pp. 4619-4628). Hershey PA: IGI Global.

Floridi, L. (2014A). *The fourth revolution: how the infosphere is reshaping human reality*. Oxford: Oxford University Press.

Floridi, L. (2014B), Big data and information quality. In L. Floridi & P. Illari (eds.), *The Philosophy of Information Quality* (pp.303-315). Heidelberg: Springer.

Fraser, A.G. & Dunstan, F.D. (2010). On the impossibility of being expert. *British Medical Journal*, 341:c6815.

Galbraith, J.R. (1974). Organization design: an information processing view. *Interfaces*, 4(3), 28-36.

Gamble, K.R., Cassenti, D.N. & Buchler, N. (2017). Effects of information accuracy and volume on decision making. *Military Psychology*, 30(4), 311-320.

Garfield, E. (1984). Iatrogenic information overload. *Journal of Information Science*, 8(1), 39.

Ge, X. (2010). Information-seeking behavior in the digital age: a multidisciplinary study of academic researchers. *College and Research Libraries*, 71(5) 435-455.

Gigerenzer, G. & Selten, R. (2001). *Bounded rationality*. Cambridge MA: MIT Press.

Girard, J. & Allison, M. (2008). Information anxiety: fact, fable or fallacy. *The Electronic Journal of Knowledge Management*, 62(11), 111-124.

Gleick, J. (2011). *The information: a history, a theory, a flood*. London: Fourth Estate.

Goulding, A. (2001). Information poverty or overload. *Journal of Librarianship and Information Science*, 33(3), 109-111.

Groes, S. (2017). Information overload in literature. *Textual Practice*, 31(7), 1481-1508.

Gross, B. (1964). *The managing of organizations: the administrative struggles*. New York: Free Press of Glencoe.

Gupta, D. & Rani, R. (2018). A study of big data evolution and research challenges. *Journal of Information Science*, DOI 10.1177/0165551518789880.

Haase, R.F., Jome, L.M., Ferreira, J.A., Santos, E.J.R., Connacher, C.C. & Sendrowitz, K. (2014). Individual differences in capacity for tolerating information overload are related to differences in culture and temperament. *Journal of Cross-Cultural Psychology*, 45(5), 728-751.

Haider, J. & Bawden, D. (2007). Conceptions of 'information poverty' in library and information science: a discourse analysis. *Journal of Documentation*, 63(4), 534-557.

Hall, A. & Walton, G. (2004). Information overload within the health care system: a literature review. *Health Information and Libraries Journal*, 21(2), 102-108.

Hallowell, E.M. (2005). Overloaded circuits: why smart people underperform. *Harvard Business* Review, 83(1), 54-62.

Harari, Y.N. (2017). *Homo Deus. A brief history of tomorrow*. New York: Vintage.

Hargittai, E., Neuman, W.R. & Curry, O. (2012). Taming the information tide: perceptions of information overload in the American home. *Information Society*, 28(3), 161-173.

Hartley, J. & Betts, L. (2009). Common weaknesses in traditional abstracts in the social sciences. *Journal of the American Society for Information Science and Technology*, 60(10), 2010-2018.

Hartog, P. (2017). A generation of information anxiety: refinements and recommendations. *The Christian Librarian*, 60(1), 44-55, article 8. Retrieved from https://digitalcommons.georgefox.edu/tcl/vol60/iss1/8/.

Harzing, A-W (2018). How to keep up with the literature but avoid information overload, *LSE Impact blog*. Retrieved from http://blogs.lse.ac.uk/impactofsocialsciences/2018/05/18/how-to-keep-up-to-date-with-the-literature-but-avoid-information-overload/.

IFLA (2017). IFLA statement on digital literacy. International Federation of Library Associations, 18 August 2017. Retrieved from https://www.ifla.org/publications/node/11586.

Interaction Design Foundation (2018). Information overload, why it matters and how to combat it. Retrieved from https://www.interaction-design.org/literature/article/information-overload-why-it-matters-and-how-to-combat-it.

Johnson, C.A. (2012). *The information diet: a case for conscious consumption*. Sebastopol CA: O'Reilly.

Johnson, J.D. (2014). Controlling the flood: when more of a dose is less. *Journal of Documentation*, 70(3), 330-345.

Jones, S.L. & Kelly, R. (2018). Dealing with information overload in multifaceted personal informatics systems. *Human-Computer Interaction*, 33(1), 1-48.

Kirsch, D. (2000). A few thoughts on cognitive overload. *Intellectica*, 30, 19-51.

Klapp, O.E. (1986). *Overload and boredom: essays on the quality of life in the information society*. Westport CT: Greenwood Press.

Klerings, I., Weinhandl, A.S. & Thaler, K.J. (2015). Information overload in healthcare: too much of a good thing? *Zeitschrift für Evidenz, Fortbildung und Qualität im Gesundheitswesen*, 109(4-5), 285-290.

Kluge, A. & Gronau, N. (2018). Intentional forgetting in organizations: the importance of eliminating retrieval cues for implementing new routines. *Frontiers in Psychology* DOI 10.3389/fpsyg.2018.0051.

Kneidinger-Müller, B. (2017), Perpetual mobile availability as a reason for communication overload experiences and coping strategies of smartphone users. In R.P.F. Marques & J.C.L.Batista (Eds.), *Information and communication overload in the digital age* (pp.93-119). Hershey PA: IGI Global.

Koltay, T. (2011A). Information overload, information architecture and digital literacy. *Bulletin of the American Society for Information Science and Technology*, 38(1), 33-35.

Koltay, T. (2011B). The media and the literacies: media literacy, information literacy, digital literacy. *Media, Culture and Society*, 33(2), 211-221.

Koltay, T. (2017), Information overload in a data-intensive world. In A.J. Schuster (Ed.), *Understanding information: from the big bang to big* data (pp. 197-218). Cham: Springer.

Kominiarczuk, N. & Ledinska, M. (2014). Turn down the noise: information overload, conscientiousness and their connection to individual well-being. *Personality and Individual Differences*, 60(supplement 1), article S76, DOI 10.1016/j.paid.2013.07.343.

Kovach, B. & Rosenstiel, T. (2011). *Blur - how to know what's true in the age of information overload*. New York: Bloomsbury.

Kuhlthau, C.C. (1993). A principle of uncertainty for information seeking. *Journal of Documentation*, 49(4), 339-355.

Lau, R. R. (2019). Decision strategies in political decision making. In D. Redlawsk (ed.) The Oxford research Encyclopaedia of Political Decision Making. Oxford University Press.

Lee, M. & Butler, J. (2019). How are information deserts created? a theory of local information landscapes. *Journal of the Association for Information Science and* Technology, 70(2), 101-116.

Levy, D.M. (2008), Information overload. In K. Himma & T. Herman (Eds.), *Handbook of Information and Computer Ethics* (pp.497-515). Hoboken NJ: John Wiley.

Lewis, D. (1996). *Dying for information*. London: Reuters Business information.

Li, C-Y (2017). Why do online consumers experience information overload? An extension of communication theory. *Journal of Information Science*, 43(6), 835-851.

LIang, H. & Fu, K-W. (2017). Information overload, similarity and redundancy: unsubscribing information sources on Twitter. *Journal of Computer-Mediated Communication*, 22(1), 1-17.

MacDonald, J., Bath, P. & Booth, A. (2011). Information overload and information poverty: challenges for healthcare information managers. *Journal of Documentation*, 67(2), 238-263.

Manheim, L. (2014). Information non-seeking behaviour. *Information Research*, 19(4), paper ISIC18. Retrieved from http://www.informationr.net/ir/19-4/isic/isic18.

Mansourian, Y. & Ford, N. (2007). Search persistence and failure on the Web: a 'bounded rationality' and 'satisficing' analysis. *Journal of Documentation*, 63(5), 680-701.

Mayer-Schönberger, V. (2009). *delete: The virtue of forgetting in the digital age*. Princeton NJ: Princeton University Press.

McAfee, A., Brynjolfsson, E., Davenport, T.H., Patil, D.J. & Barton, D. (2012). Big data: the management revolution. *Harvard Business Review*, 90(1), 61-67.

Merendino, A., Dibb, S., Meadows, M. Quinn, L. Wilson, D., Simkin, L. & Canhoto, A. (2018). Big data, big decisions: the impact of big data on board level decision making. *Journal of Business Research*, 93 (December 2018), 67-78.

Miller, G.A. (1956). The magical number seven, plus or minus two: some limits on our capacity for processing information. *Psychological Review*, 63(2), 81-97.

Miller, G.A. (1962), Information input overload. In M.C. Yovits (Ed.), *Self-organizing systems* (pp. 61-78). Washington DC, Spartan Books.

Müller-Wille, S. & Charmantier, I. (2012). Natural history and information overload: the case of Linnaeus. *Studies in the History and Philosophy of the Biological and Biomedical Sciences*, 43(1), 4-15.

Nawaz, M.A., Shah, Z., Nawaz, A., Asmi, F., Hassan, Z. & Raza, J. (2018). Classifying SNS discontinuance intentions. *Journal of Cogent Psychology*, 5(1), Article 1515584.

Neben, T. (2015). A model of defensive information avoidance in information systems use. *International Conference on Information Systems 2015*. Retrieved from https://aisel.aisnet.org/icis2015/proceedings/ConferenceTheme/3/.

Neill, S.D. (1992), The dilemma of information overload: managing in the information society. In S.D. Neill, *Dilemmas in the study of information: exploring the boundaries of information science* (pp.99-121), Westport CT: Greenwood Press.

Nicholas, D., Huntington, P. & Jamali, H.R. (2007). The use, users, and role of abstracts in the digital scholarly environment. *Journal of Academic Librarianship,* 33(4), 446-453.

Ogilvie, B.W. (2003). The many books of nature: Renaissance naturalists and information overload. *Journal of the History of Ideas*, 64(1), 29-40.

Poirer, L. & Robinson, L. (2013). Informational balance: slow principles in the theory and practice of information behaviour. *Journal of Documentation*, 70(4), 687-707.

Popkin, S.L. (1993), Information shortcuts and the reasoning voter. In B. Grofman (Ed.), *Information, participation and choice: an economic theory of democracy in perspective* (pp. 17-35). Ann Arbor: University of Michigan Press.

Popova, M. (2011). In a new world of informational abundance, content curation is a new form of authorship. *Brainpickings*. Retrieved from http://www.niemanlab.org/2011/06/maria-popova-in-a-new-world-of-informational-abundance-content-curation-is-a-new-kind-of-authorship/

Popova, M. (2013). "Tip-of-the-tongue syndrome", transactive memory, and how the internet is making us smarter. *Brainpickings*. Retrieved from https://www.brainpickings.org/2013/09/13/clive-thompson-smarter-than-you-think/.

Postman, N. (1992). *Technopoly: the surrender of culture to technology*. New York: Alfred A. Knopf.

Prabha, C., Connaway, L.S., Olszewski, L. & Jenkins, L.R. (2007). What is enough? Satisficing information needs. *Journal of Documentation*, 63(1), 74-89.

Przybylski, A., Murayama, K., deHann, C. & Gladwell, V. (2013). Motivational, emotional and behavioral correlates of fear of missing out. *Computers in Information Behavior*, 29(4), 1841-1848.

Rader, E. & Grey, R. (2015). Understanding user beliefs about algorithmic curation in the Facebook news feed. In B. Begole, K. Jinwoo, K Inkpen & W Woo (Eds.), *Proceedings of the CHI 2015 Conference on Human Factors in Computing Systems* (pp. 173-182). New York: ACM.

Roetzel, P.G. (2018). 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*, DOI 10.1007/s40685-018-0069-z.

Rogers, P., Puryear, R. & Root, J. (2013), *Infobesity: the enemy of good decisions*, Amsterdam: Bain. Retrieved from https://www.bain.com/insights/infobesity-the-enemy-of-good-decisions/.

Rose, E. (2010). Continuous partial attention: reconsidering the role of online learning in the age of interruption. *Educational Technology*, 50(4), 41-46.

Rosenberg, D. (2003). Early modern information overload. *Journal of the History of Ideas*, 64(1), 1-9.

Rudd, M.J. & Rudd, J. (1986). The impact of the information explosion on library users: overload or opportunity. *Journal of Academic Librarianship*, 12(5), 304-306.

Sasaki, Y., Kawai, D. & Kitamura, S. (2015). The anatomy of tweet overload: how number of tweets received, number of friends, and egocentric network density affect perceived information overload. *Telematics and Informatics*, 32(4), 853-861.

Sasaki, Y., Kawai, D. & Kitamura, S. (2016). Unfriend or ignore tweets? a time series analysis on Japanese Twitter users suffering from information overload. *Computers in Human Behavior*, 64, 914-922.

Savolainen, R. (2006). Time as a context of information seeking. *Library and Information Science Research*, 28(1), 110-127.

Savolainen, R. (2007). Filtering and withdrawing: strategies for coping with information overload in everyday contexts. *Journal of Information Science*, 33(5), 611-621.

Saxena, D. & Lamest, M. (2018). Information overload and coping strategies in the big data context: evidence from the hospitality sector. *Journal of Information Science*, 44(3), 287-297.

Secord, J.A. (2014). *Visions of science: books and readers at the dawn of the Victorian age*. Oxford: Oxford University Press.

Serrano-Puche, J. (2017). Developing healthy habits in media consumption: a proposal for dealing with information overload. In R.P.F. Marques & J.C.L. Batista (Eds.), *Information and communication overload in the digital age* (pp. 202-222). Hershey PA: IGI Global.

Schmitt, J.B., Debbeit, C.A & Schneider, F.M. (2018). Too much information? predictors of information overload in the context of online news exposure. *Information, Communication and Society*, 21(8), 1151-1167.

Schwartz, B. (2004). *The paradox of choice*. New York: Ecco.

Shachaf, O., Aharony, N & Baruchson, S. (2016). The effects of Information overload on reference librarians. *Library and Information Science Research*, 38(4), 301-307.

Shenk, D. (1997). *Data smog: surviving the information glut*. New York: HarperEdge.

Shapiro, S. (2018). Academic librarians, Information overload, and the Tao of discovery. *Journal of Academic Librarianship*, 44(5), 671-673.

Simon, H. (1955). A behavioral model of rational choice. *Quarterly Journal of Economics*, 6991), 99-118.

Spier, S. (2016), From culture industry to information society: how Horkheimer and Adorno's conception of the culture industry can help us examine information overload in the capitalist

information society. In M. Kelly & J. Bielby (Eds.), *Information cultures in the digital age: a festschrift in honor of Rafael Capurro* (pp. 385-396). Wiesbaden: Springer Fachsmedia.

Stephens, P. (2015). *The poetics of information overload: from Gertrude Stein to conceptual writing*. Minneapolis: University of Minnesota Press.

Stevens, D. (2019.) Satisficing in political decision making. In D. Redlawsk (ed.) The Oxford research Encyclopaedia of Political Decision Making. Oxford University Press.

Sweeny, K., Melnyk, D, Miller, W. & Shepperd, J.A. (2010). Information avoidance: who, what, when and why. *Review of General Psychology*, 14(4), 340-353.

Tenopir, C. (1990). Online information anxiety. *Library Journal*, 115(3), 62-65.

Terra, A.L. (2017), Email overload: framing the concept and solving the problem - a literature review. In Marques, R.P.F. and Batista, J.C.L. (Eds.), *Information and communication overload in the digital age* (pp. 20-43). Hershey PA: IGI Global.

Thompson, C. (2013). *Smarter than you think: how technology is changing our minds for the better*. New York: Penguin.

Tidline, T. (1999). The mythology of information overload. *Library Trends* 47(3), 485-506.

Toffler, A. (1970). *Future Shock*. New York: Bantam Books.

Walgrave, S. & Dejaeghere, Y. (2017). Surviving information overload: how elite politicians select information. *Governance*, 30(2), 229-244.

Waller, A. & Ragsdell, G. (2012). The impact of e-mail on work-life balance. *Aslib Proceedings*, 64(2), 154-177.

Walsh, A. (2012). Mobile information literacy: a preliminary outline of information behaviour in a mobile environment. *Journal of Information Literacy*, 6(2), 56-69.

Warwick, C., Rimmer, J., Blandford, A., Gow, J. & Buchanan, G. (2009). Cognitive economy and satisficing in information seeking: a longitudinal study of undergraduate information behaviour. *Journal of the American Society for Information Science and Technology*, 60(2), 2402-2415.

West, J. (2007), Technophobia, technostress and techorealism. In R.S. Gordon (Ed.), *Information tomorrow: reflections on technology and the future of public and academic libraries* (pp. 203-215). Medford NJ: information Today.

Wilensky, H.L. (1968). Organizational intelligence. In D.L. Sills (Ed.), *International Encyclopedia of the Social Sciences* (pp. 319-334). New York: Free Press.

Wilson, C.E. (1976). Information discrimination: a human habit. *Canadian Journal of Information Science*, 1(1), 59-64.

Wilson, P. (1995). Unused relevant information in research and development. *Journal of the American Society for information Science*, 46(1), 45-51.

Wilson, P. (1996). Interdisciplinary research and information overload. *Library Trends*, 45(2), 192-203.

Wilson, T.D. (2001). Information overload: implications for healthcare services. *Health Informatics Journal*, 7(2), 112-117.

Wright, A. (2014). *Cataloging the world: Paul Otlet and the birth of the information age*. Oxford and New York: Oxford University Press.

Wurman, R.S. (1989). *Information anxiety*. New York: Doubleday.

Wurman, R.S. (2001). *Information anxiety 2*. New York: New Riders Publishers.

Yeo, R.R. (2003). A solution to the multitude of books: Ephraim Chambers's Cyclopaedia as "the best book in the universe". *Journal of the History of Ideas*, 64(1), 61-72.

Zurkowski, P.G. (1974). *The information service environment relationships and priorities. Related paper no.5*. Washington DC: National Commission of Libraries and Information Science.