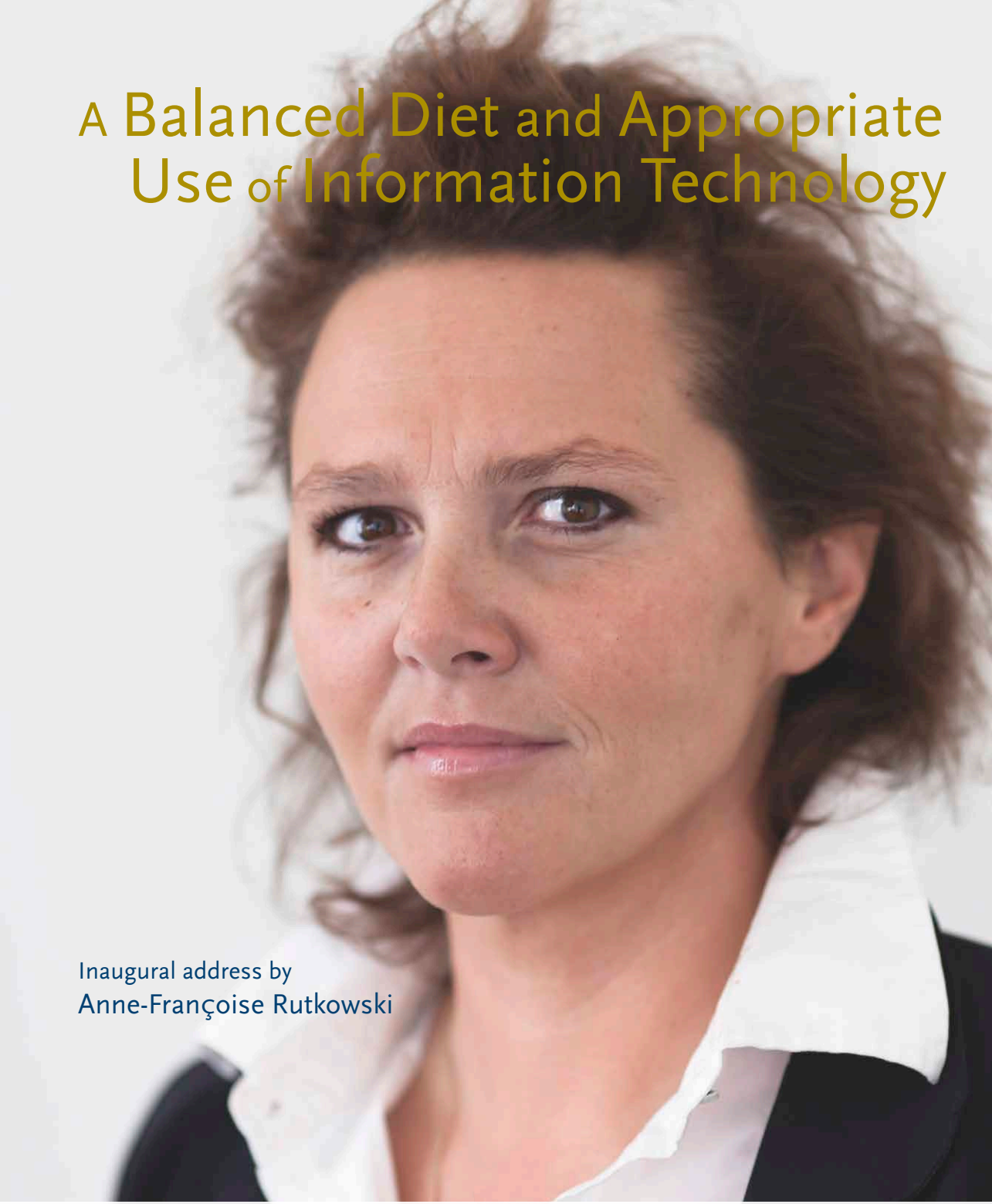
A Balanced Diet and Appropriate Use of Information Technology



Inaugural address by
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Understanding Society

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A Balanced Diet and Appropriate Use of Information Technology

Inaugural address,
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Mr Rector Magnificus,
Executive Board of Tilburg University,
Committee of Deans,
Ladies and Gentlemen,

More than four decades ago Simon (1971) pointed out the challenges of dealing with the wealth of available information. He wrote "What information consumes is rather obvious: it consumes the attention of its recipients. Hence a wealth of information creates a poverty of attention and a need to allocate that attention efficiently among the overabundance of information sources that may consume it" (pp.40-41). We now are deluged with information delivered by technologies as well as by requests for using new technologies and a myriad of services (e.g., diets online, online airplane check-in). We are continuously exposed to information and must decide whether we pay attention or not. Frequent updates, system migrations or requests to use new services are omnipresent in our hi-tech workplace. Never in history has the human brain been asked to track so many data points (Hallowell, 2005). And the "big data" trend is just starting to add even more.

There has always been a lot of data in the world. Not many of us have read all the books in a library. Most of us will not feel compelled to do so! Libraries are not causing any information overload problems. Similarly, we concluded from our research on Information Technology-related overload (Rutkowski and Saunders, 2010, 2011) that the amount or volume is not a problem in itself. Human information processing and therefore decision-making is the bottleneck. Information Technologies (IT) and the velocity at which it delivers information, have increased the pressure on data processing, and have opened our "hunger for information". Marketing ads regularly portray the "experience" of technology usage as worthwhile for the individual, organization and the society. They fulfill our emotional and social need so well, that we barely resist to new technological innovations. However, are we making the optimal and best use of IT for our society, organization or ourselves? Tech-addict, internet usage disorder, digital dementia, crackberry and digital gluttony are popular words in the press revealing the consequences of an unbalanced IT usage. Our bulimia for information and hunger for new technologies is crossing workplace and private sphere. Our hunger is proportional to our desire to be knowledgeable but also to our natural social instinct. Aristotle once wrote "Man is by nature a social animal". By nature, we ought to be connected and liked by others. Therefore, one can easily figure out how large that digital appetite is. It is simply Gargantuan. This huge digital appetite represents a downside of IT usage: "the dark side of IT" as coined by my some of colleagues from our field of Information Management (IM) present here today.

To the most techno-centric, the positive side of IT will not be well represented in my inaugural address. IT has brought us a lot of good and I am well aware of it. In the last decade, I took part in a few great innovations in education and healthcare. People across distances, national and professional cultures can be connected by the internet, collaborate, learn and solve problems (Rutkowski et al., 2002, 2007, 2008, Spanjers et al., 2005, Nobrega and Rutkowski, 2012). Parents can find the support of the technology to be connected to their baby during the difficult time of hospitalization (Spanjers et al., 2003). Also, search engines have made it easier for academics to stand on the shoulders of the giants of the past and email communication to those of the present. I could go on for a long time listing the benefits of IT. However, that is not the focus of my inaugural address. My interest in the "dark side" is triggered by the fact I do feel responsible for better understanding the possible effects of Information Technologies; both positive and negative. I lately realized that new challenges are posed by IT nowadays than adoption or implementation. Now is the right time to take a serious look at "responsible" IT regarding its usage and misusage. Do not misunderstand the word "responsible". The problem is not the innovation process or human creativity. Unbalance usage as well as defective management lead to problems. As Grinbaum and Groves (2013) underline any innovation creates ultimately new social practices and institutions transforming our day-to-day interaction with the world and each other. Those new practices and institutions will be the key in handling the dark side of IT. One may call my interest "neo-luddite". Luddites saw their jobs being lost to the machines, and assimilated it to greater class division in the early eighteenth century. The term luddites is nowadays used in a somehow pejorative or depreciative way. It refers to people disliking technological innovations perceiving these as potentially threatening for employment and imposing restriction regarding freedom e.g., personal privacy. Sykes and Macnaghten (2013) state about the luddites that "It would be nice to think that, 200 years on, we are more capable as a society of considering new technologies in a mature way, and thinking through some of the benefits, and also the potential inequity and downsides, in advance of their application (...) how to ensure the impact of new development creates a better world based on shared values, rather than just giving more money and power to the already powerful" (pp.85-86). We, neo-luddite, have some serious backing. Nobel Prize winner Paul Krugman recently published a column titled "Sympathy for the Luddites" in The New York Times[1] . He stated that "Today, however, a much darker picture of the effects of technology on labor is emerging. In this picture, highly educated workers are as likely as less educated workers to find themselves displaced and devalued, and pushing for more education may create as many problems as it solves." One example, work substitution with intelligent software systems (e.g., automation of knowledge work) is a concern at the moment in healthcare. These

[1] *http://www.nytimes.com/2013/06/14/opinion/krugman-sympathy-for-the-luddites.html?_r=0*

systems are taking over tasks involving unstructured commands and subtle judgment. The consequence of their usage is not trivial for patient safety. The Institute Of Medicine (IOM) reported in 2006 already an annual cost of $ 3.5 billion and 1.5 million patients harmed by incorrect usage of technologies such as automation systems. Better quality of management training would yield better outcomes (Aron et al., 2011).

How to innovate mindfully without causing major disruption to the balance of our society? While some are starving in the world and are far away from all knowledge and connectivity, a few marketers and designers are phagocyting our attention without "a lot" of resistance from the users. Nowadays, we are very aware and sensitive about the quality of the food we are eating, its origin, and effects on the organism. We look pretty well at what is on our own and our childrens' plates. No responsible parents would recommend junk food diet to their beloved child on a daily basis. When considering IT and information junk we are far from being responsible. How can I, as a responsible parent, decide about the digital diet of my children? I will not want them obese, neither would I want them brain dead and bulimic from online contacts. A pilot study demonstrated social and motivational advantages for children in using iPad[2] to increase their motivation to perform, and, consequently, boost their test score[3]. On the cognitive side, neural activity was found far more enhanced in children who had practiced printing by hand than in those passive ones who had simply looked at letters on screen[4]. While novelty and ease of use of a technology can boost motivation it should be used with parsimony in young children. The weaker ones are suffering from addiction and end up enrolled in digital detox programs. This summer, I read in the Volkskrant an article about the Ipad school ""Het nieuwe leren"[5]. The article reported the conclusion of Mandfred Spitzer a German psychiatrist who went as far as characterizing children's iPad usage within the new "Steve Jobs schools" as "child abuse". He recommended exposing children as little as possible to digital media, since they would get fat, dumb, aggressive, lonely, sick and unhappy. Recently, Strasburger and Hogan (2013) recommended parents in the policy statement of the American Academy of Pediatrics (AAP) to establish a family home use plan for all media. This will be to mitigate potential health risks and foster appropriate media use. They also report that social media, mainly facebook, offers opportunities and potential risks to young users.

At this stage, it is too early to arrive at a final verdict on the long term effect of all Information Technologies on our society. We lack the theories and the empirical data

[2] *http://www2.hull.ac.uk/ifl/ipadresearchinschools.aspx*
[3] *http://techland.time.com/2012/02/22/new-study-finds-ipads-in-the-classroom-boost-test-scores/*
[4] "How Hand Writing Boosts the Brain," Wall Street J., 5 Oct. 2010; *http://online.wsj.com/article/SB10001424052748704631504575531932754922518.html*
[5] De Volkskrant Wetenschap, Zaterdag 8 Juni 2013, V3.

for that.Tilburg mission statement is “Understanding Society”; understanding the impact of Information Technologies, disruptive innovation and IT-related overload fits well in the scope. Building better theories is a viable contribution I plan to make to the society through my research. We should protect the weaker in the society not only against the dangers around us, but also against dangers caused by our own technological creativity. We do not want to harm the mind and development of our children by exposing them to too much IT without understanding the consequences. They are the future of our society. That is surely why we, at Tilburg University, consider the education of our students as key. We also do not want to harm adults as ourselves; secretaries, researchers, nurses, managers, educators, surgeons, pilots or anesthetists. All of us at one point of our life are patients or passengers. All together, children, young and older adults, we are the society.

My inaugural address will focus on a particular dark side of technology usage, IT-related overload. I will first explain the overload problem in more detail, look at the research underway and finally discuss the impact at individual, organizational and societal level. My postulate is that a better understanding of IT-related overload will be a first step in helping deciding how to adopt IT mindfully and in a responsible way. We, indeed, have to better understand the impact of information usage and misusage on the individual, the organization and the society. The developed knowledge should benefit users, organizations and the society at large. Society also should be provided with the knowledge and regulation to better control marketing pressure. It is not about banning technologies but about informing the users and the organization rightfully. It is already and will be a responsibility of our digital society to provide better insight and regulation on technologies. We are right now in the conquest time, “the wild west”, enjoying the discovery of new land but we will need more norms and rules. Quoting Aristotle once more “At his best, man is the noblest of all animals; separated from law and justice he is the worst.”

Too much information and emotional filtering

Information is defined as “data endowed with relevance and purpose” (Pearlson and Saunders, 2013). Both terms “relevance” and “purpose” underline the necessity to “make sense”, in other words to arrange the data using human perspective. We are sense makers (Sutcliffe and Weick, 2008). We need to survive in environments that are often hostile. We, therefore, need to predict the emergence of events to decide “In-context”. In order to decide wisely among all the data which ones are pertinent, individuals will first use their perception and “past-experiences” stored in memory. They will then filter and process the information before adjusting their

attitudes and behaviors toward the information on the technologies delivering it. Filtering is a big part of information processing as it is required in evaluating the relevance and purpose of the data. It allows individuals to generate and manage information properly. We expect individuals to base their decision on rational arguments, formal logics and principles. However, they are not as efficient in solving-problem as we would like to believe (Tversky and Kahneman, 1973). Is that bad? Robert Frank (1988), an economist stated that "Many actions, purposely taken with full knowledge of their consequences are irrational" (see LeDoux, 1998, p. 36). Information processing is therefore conducted with the support of our human memory, including some rules of logic, as well as our experiences and the emotion attached to them. Logic and "gut feelings" co-exist side-by-side in the human mind to run information processing and assist our decisions. We are creating conscious memories embedded with emotional cues when we are making sense of the environment (Frijda, 1994). Those memories are built with information-content, organized in-context and colored by our emotional experiences. Accordingly, neuroscience research has demonstrated that the brain areas required for cognition and emotion are highly interconnected. Those memories are used to extract relevance and purpose of data, and make sense of the available information.

Nowadays, most information is delivered by Information Technologies. The accumulation of experiences and information, including our reflections about past-experience e.g., metacognition, structures our knowledge of the world. Conscious memories operate as "theoretical lenses". They enable making sense of data and information surrounding us, deciding upon pertinence and relevance. In our digital world, those theoretical lenses are keys in processing data delivered by IT and therefore also in managing usage and misusage of the technologies. Information processing with the support of conscious memories has, therefore, a direct implication on the decisions about Information Technologies: adoption and/or resistance. About four decades ago, decisions concerning the use or implementation of new technologies were reserved to IT experts in government e.g., military. Nowadays, we have to decide regularly about adopting or updating older technologies to newer ones e.g., mobile phone to smartphone. Conscious memories based on past-experiences determine the decision in evaluating how pertinent and purposeful the technology is to the users. Similar decisions have to be taken by organizations concerning the tasks a technology will facilitate or enable. Markus (1983) pointed out "When (the interest and intention of both users and designers) are very similar, resistance rarely occurs" (p.433). From a marketing perspective some companies and their designer have understand users' need for information, not to so say "hunger", pretty well. The advertizing industry also knows pretty well how to use emotional cues to persuade customers! (see LeDoux, 1998). Actually, I wonder if they let their customers a chance to evaluate their decision about IT usage: adopting or resisting mindfully to the

new products. Marketers would argue it is not their business. The "button" has been switched to "on" for the emotional system in our conscious memories. Why is it different for Information Technologies than it is for other products? My educated guess is that most of the time, we, customers are dealing with extremely relevant and purposeful information delivered by IT to the kingdom of our individualities, our ego. Usage of the technology mostly does not address therefore to our higher brain, but it is rather focused on our lower brain i.e., center of emotion. It is no wonder why adoption of technologies is associated with constructs such ease of use and enjoyment in the literature (Davis, 1989)

We earlier considered the impact of the "on" button on IT usage in young children at school. Observation in organizations, also trigger questions regarding the behaviors of some top managers at the workplace. Are those also at risk to turn "fat, dumb, aggressive, lonely, sick and unhappy" misusing technologies? Hallowell (2005) described a related epidemic in organizations: Attention Deficit Trait (ADT) among managers caused by brain overload. The core symptoms are distractibility, inner frenzy, and impatience undermining managers' performance. The same research demonstrated that managers also feel addicted to speed working non-stop, borderline with burnout, but also extremely motivated. The blackberry crash is now "legend". Managers end up missing the speed when they experience a third day of disruption to blackberry services. Users have eloquently shared their frustrations about their emails, and web crashes in the media. Resorts offer "detox" retreats with a 'BlackBerry crèche' "where you can give up your mobile devices". Advertising for such digital detox retreats have sprung up with such offers to disconnect, for... a consequent price.... Some managers need high velocity, high amount of information and connection to feel "alive" and on the top of everything. They are constantly connected to information headlines to keep their need for high control constant. Some may even experience underload and boredom when they are not online. Unbalanced usage of IT has also emotional and cognitive consequences i.e., IT-related overload, at the workplace on managers and employees. Employees working in high-technology industries have been found to demonstrate psychosomatic symptoms and reduced productivity related to high mental demands (Arnetz and Wiholm, 1997). One estimate places the cost of information overload due to "lowered productivity and throttled innovation" at $900 billion a year (Powers, 2010).

Theoretical lenses on IT-related overload

Overload is associated not only with the information being delivered, but also with the technologies that are delivering it. Too much information is often linked to IT since it is delivered by IT (Edmunds and Morris, 2000). The phenomenon has been defined as technology overload i.e., amount (Karr-Wisniewski and Lu, 2010), technostress i.e., emotional output (Tarafdar, et al., 2007) or IT-related overload i.e., process, emotional and cognitive output (Rutkowski and Saunders, 2011). IT-related overload situations are increasing and represent critical organizational challenges in our digital society by negatively impacting workers' decision-making, productivity and performance. IT-related overload has been associated with its emotional manifestations such as frustration and distractibility (Wickens, 1992). It also has been associated with cognitive manifestations such as making mistakes or shedding tasks (Shiv and Fedorikhin, 1999). When IT-related overload occurs, individual performance suffers and, consequently, so does organizational performance.

Our global society feels the harmful impact on a range of professions from corporate meeting rooms (Rutkowski and van Genuchten, 2008) to hospital operating rooms (Tollner, et al., 2005). The negative consequences can be seen in a number of ways including poor decisions and burnout. However, not all aspects of overload related to IT are negative. Perceptions of overload associated with autonomy were proven to be antecedents of innovation with IT in the workplace (Ahuja and Thatcher, 2005). However, creating more technologies to process the information to cope with data overload may reinforce an emotionally-dangerous spiral of distrust or rejection of the technologies (Woods, et al., 2002). Simplify most of it, through one magic button is also not the solution. While ever more is being written about overload, it is not always clear if the individuals researching the topic are talking about the same thing.

A review of the Management Information System literature demonstrated that conceptualizations of overload are mostly a-theoretical, or pieced together from disarticulated "bits of bits" of theoretical models borrowed from psychology. Most authors focus on the information *input* i.e., data smog, data junk. People are getting so much information that they cannot deal with all of it because of its complexity, lack of pertinence, or ambiguity (see Eppler and Mengis, 2004, for a review).

Overload also refers to symptoms, i.e., *outputs* such as defective decision making or stress in dealing with information, requests for processing it or IT use i.e., technostress (Tarafdar, et al., 2007). The output ranges from decreases in job satisfaction to the inability to cope, mental confusion, or increases in processing errors. Emotion is expressed as stress, the negative reaction of burnout, or damage to personal life and frustration (Farhoomand and Drury, 2002). In most business disciplines, overload is understood as the computational

excess of information which leads decision makers to employ compensatory decision rules (Newell and Simon, 1972, Iselin, 1993). Affective reactions to financial information appear to have greater persistence in memory (Rose, et al., 2004). In marketing research, Jacoby (1984) demonstrates that consumers chunk to reduce information load and avoid cognitive overload. Interestingly, results of lab experiments studying consumer behavior are controversial. On the one hand, Malhotra et al., (1982) purport "... consumers are capable of processing fairly large amounts of information. Yet the capacity of consumers to absorb and process information is not unlimited" (p.35). On the other hand, Jacoby (1984) concludes that consumers use cognitive strategies to limit the amount of information to enter into their decision making, "stopping far short of overloading themselves" (p.434). Schultz and Vandenbosch (1998, p. 132) stipulate that overload may be a "temporary affliction that they remedy almost immediately"

To conclude this short overview, the term 'overload' is often unthinkingly applied to the situations merely characterized by considerable data, messages or information. Confusion arises because emotions and cognitive capacities of the individuals facing these loads are not taken into account. In fact, individuals can overcome their information processing limitations and are pretty good at it.

Overcoming IT-related overload

The postulate of computational models is that the limited capacity of humans to process information (Miller, 1956a) automatically creates an overload situation when user has to deal with more information. Computational theories rely on Miller's (1956a) pivotal article "The Magical Number Seven, Plus or Minus Two: Some Limits on Our Capacity for Processing Information". Too often, it is omitted that Miller (1956b) also hypothesizes that the only way to extend the amount of information is "by organizing the stimulus input simultaneously into several dimensions and successfully into a sequence of chunks we managed to break ... the information bottleneck" (p.95). In other words, we can process much more than seven plus or minus two elements as they are not single bits of information but "chunks" of information. How the items are organized into chunks determines recall e.g., unitization hypothesis. We process data by filtering information based on conscious and unconscious memories. Particularly, there is evidence that these memories are personal mental frameworks which lead individuals to process information differently. Therefore, individual's experience overload differently, if at all. No wonder that some will experience overload when dealing with information delivered by IT, while others will enjoy chunking it.

Figure 1 presents the Emotional Cognitive Overload Model (ECOM see Rutkowski and Saunders, 2011 for full details).

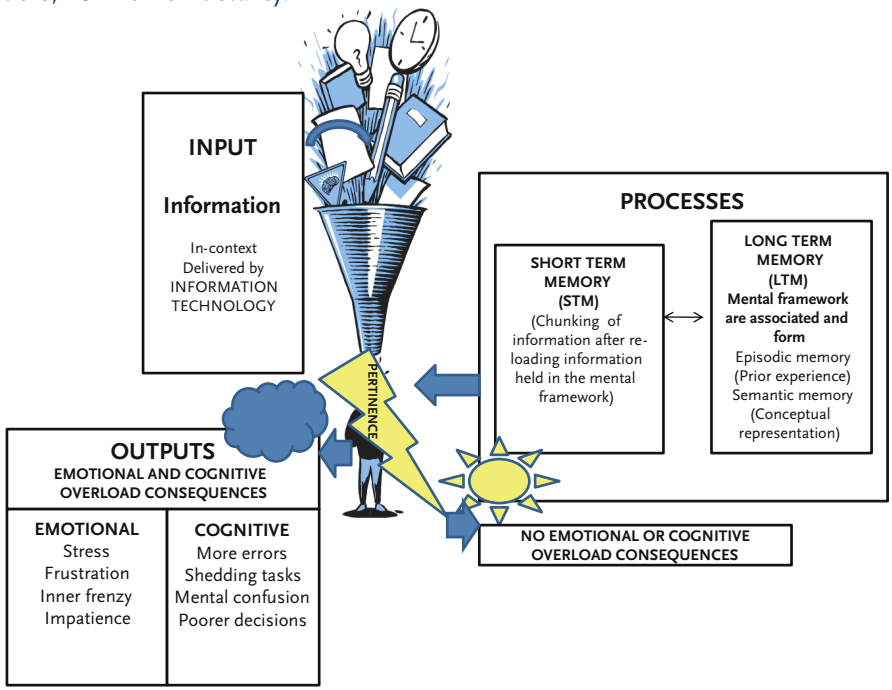

Figure 1: The Emotional Cognitive Overload Model (ECOM)

The model provided a different set of theoretical lenses from the computational approach. We draw upon Miller's (1956a,b) work, the three store model of memory by Atkinson and Shiffrin (1962), working memory (Baddeley and Hitch, 1974), cognitive load theory (Sweller, 1988), the theory of associative network of emotion (Bower, 1981, 2001) as well as the assumption of a division of Long-Term-Memory (see Tulving 1972, 2002). ECOM addresses the role of past-experience and emotion in finding relevance and purpose to information. Underlying ECOM is the premise that an individual's cognitive system responds to a stimulus e.g., data, information, and processes it for organization and storage in the Long-Term-Memory (LTM). The assumption of a division of LTM fuelled research about differences in individual information processing, specifying the role of the Episodic Memory as storage areas for autobiographical events and past-experiences. The organization of information in LTM is therefore subjective as it is based on past-experience and the emotion attached to it. Bower (1981) demonstrated that the memory activation spreads from emotions and concepts reinforcing information organization in memory. Emotions and moods support information processing and can lead to biased judgements that favour affect-congruent material as demonstrated by Tversky and

Kahneman (1973). In short, organization of information in memory is therefore personal, varying in respect to its information-content, organized in-context, and colored by our emotional experiences. Information processing of individual differs as well when making decisions! Therefore, responding to mental load involves reloading, activating and matching information encoded in LTM to overcome the STM limitation (See Sweller, 1988). An explanation of individual differences in experiencing overload relates to this reloading and updating of the personal mental framework in memory. Overcoming mental load requires cognitive resources (i.e., rich mental framework such as those of expert) and physiological resources. Those resources are treated as fuel that runs the process and also as cognitive structure (Hirst, 1986). When time is lacking or resources are exhausted, information will be more difficult to process.

The memory is a dynamic place where we reorganize and create new connections enriched with past-experiences. Individual differences in experiencing overload relates therefore to their experiences. Memories can permanently affect decisions and judgments about technology. The experience of using technology is part of cognitive schemata held in memory. It is a post-adoptive experience that is associated negatively, positively, or not at all to the schemata of prior experience of IT-related overload. Through emotional cognitive network activation, those schemata held in LTM are used to evaluate requests to use a new technology. Research has pointed to the importance of prior experience and also emotion in adoption (see Jasperson et al., 2005; Ortiz de Guinea and Markus, 2009).

Applications: Individual, Organizational and Societal

Over the last years, we have studied the impact of IT-related overload at the individual, organizational and societal level. Some examples will be discussed.

Individual: Introducing online streaming technologies A bank asked us to look into the potential of a new technology to interact with their customers. We decided to investigate to what extent the customers were interested in adding yet another technology to their diet. The results of a survey in which 1857 participants responded show that 61% of the participants were concerned about being cognitively overloaded with too much information when they use new information technologies. About half of them (42.3%) felt cognitively and emotionally overloaded with requests to use new information technologies (Rutkowski and Saunders, 2010). To better understand the findings, we compared the very same technologies (video streaming technology) to contact family bankers or physicians. The results show that the participants express less interest in using the technology for their banker than their physician. The difference was bigger for those respondents that had experienced IT-related overload in the past.

In another project, we implemented an Online Baby System (OBS), a similar video streaming technology, in the Departments of Neonatology in two Dutch hospitals. The OBS allows parents to virtually visit their hospitalized premature infant in intensive care using live video streaming over the Internet (Spanjers et al., 2003, Spanjers, 2012). It is available on the PC and the mobile phone. Some parents had concerns about privacy and security using the technology. Nevertheless, a large majority adopted the system. Further results of interviews and surveys of parents who used the system indicated that 100% of them would recommend it; 77.7% judged it to add value to healthcare services, and, 85% used it daily. The OBS was a success. In one case an enthusiastic mother reported at a workshop for nurses and users that "I can still remember the day my husband forgot the laptop at the first floor of our house and went to work. I crawled up the stairs even though I was forbidden to move...to be able to see my baby...I could not resist... the OBS is so great...It is a marvelous technology." Only a very few parents refused to use the system. They explained that they could not afford to be confronted by the hospitalization of their baby without experiencing serious stress. Was their decision based on previous experience of IT misusage? Were the parents more aware of the fact their emotions maybe driving their usage? The theoretical lens we previously presented, suggests that past-experience of IT-related overload may explain a part of their decision.

Pertinence and relevance are key to information processing and associated decision. People will put more resources in understanding and using a technology when information matters to them. Increase in connectivity and our social nature will not stop us from jumping higher and higher in using such streaming technologies. Use of mobile technologies has affected work/life balance. Problems are arising from temporal servitude and personal compulsions (see Sarker et al., 2012). It is predicted[6] that 2-3 billion more people will have access to the internet in 2025 and that there are 4.3 billion of people remaining to be connected to the internet, potentially through mobile internet. There is research ahead on the consequences for our work/life balance.

Organizational and email overload From an organizational perspective, it is important to arm managers with the knowledge that IT-related overload is based on the ability of individuals to process information and not on the amount of information that individuals receive. Counter-measures to IT-related overload can also be managed. Actions such as changing the culture of organization, increasing screening skills, developing shared norms of communication using IT, disseminating information and roles attached to a system, providing enough time to learn, and avoiding qualitative overload, can be taken. Formal structures, rules and regulations, can be created which encourage coordination and the coordination across units to more effectively process information

6 *McKinsey Global Institut analyse report 2013*

(Galbraith, 1974). Ahuja and Thatcher (2005) consider characteristics of organizations as causes of overload. Organizations should clearly develop strategies to support their employees in developing expertise in handling information that is important for their job performance.

Let's take email as an example. We tracked e-mail pollution of members of a team within a large multinational (Rutkowski and van Genuchten, 2008). The data showed that many of the emails were from within the organization. One could call it internal spamming. Based on the data, three guidelines were given to the team to impact pollution awareness (1) stop using the 'reply to all' button, (2) no more copies than originals, (3) no more email fights. The goal was to make employees ask themselves the question who really needed to receive an email and not spam internally. The one to action to the group resulted in limiting e-mail pollution by 27 percent by limiting the number of recipients on outgoing emails. This allowed the team to focus their attention on more important emails from customers and other tasks than responding to internal email. Following the publication we received supporting emails from software developers and managers. It seems some have taken our recommendations literally and disabled the 'reply-to-all' button on the screen. Andrew Cawood the CIO of global information and measurement firm Nielsen" explained in a memo to 35,000 employees the reason behind his decision to eliminate "bureaucracy and inefficiency" disabling the "reply to all" button on the screen[7].

Managers may wish to structure the work setting so that their employees can receive the pertinent information that they need to complete their assigned tasks, while at the same time limiting superfluous information. The organizational structure can be designed to reflect the necessary flow of information. Further, social norms can be established within the organization to discourage the use of mobile devices in meetings and encourage limiting the number of channels used to convey information.

Expertise and underload Managers should also not ignore underload and its consequences. In the context of the operating room, we have been observing signs of overload among surgeons handling multiple sources of information delivered by multiple screens and technologies (Pluyter, 2012). We also have witnessed sign of underload in other medical professions. An anesthetist summarized it all on the phone during a consultation when she said: "*Ask your question to Anesthetist X, he is in the operation room so he has time*". Managers need to make sure that experts are challenged by their workload and that technological developments do not leave them with tasks that are too simple and boring to perform. It is important to tap in expertise and knowledge. Managers should ensure that expert employees can fulfill the task they are expert at in the most efficient way for the organization. One can imagine experts "playing" with available technologies

[7] *http://www.businessweek.com/articles/2012-11-21/eradicating-reply-all*

to keep their minds and attention busy. This was maybe the case of the pilots of an Airbus A320 who simply overshot its destination and forgot to land. The two experienced pilots had never been reported for an accident, incident or violation. They claimed they were using their laptops and lost track of time and location while talking about the new monthly crew flight scheduling system[8]. It is not hard to believe! Such experienced pilots were simply bored, and need to focus their attention. They are super trained, and end up sleeping, or pushing on buttons in a long boring flight.

Immersive team training It is estimated that in 2025, robots will perform 200 million major surgeries in countries with developed health care systems, saving 60.000-180.000 lives per year, and resulting in 50% reduction in sick and in patient days[9]. In spite of actual and prospective improvements in surgical robots and techniques, the rate of adverse events remains high in laparoscopic surgery. Minimal access surgery and single incision laparoscopic procedures are challenging and demanding for the surgeon performing the procedure. It is disturbing that such trendy technologies have literally killed patients in hospitals (Sharkey and Sharkey, 2013). In some cases, operating surgeons lacked skills in using these innovative tools. The consequences of overload are recognized factors hampering operating room safety (Tollner et al., 2005, Carswell, 2005). It is therefore key to train surgeons using advanced surgical technologies in a realistic context close to clinical practice. Indeed, the use of surgical simulators to train laparoscopic skills improves surgical skills significantly (Schijven and Jakimowicz, 2004). Providing novices with training for these skills is of paramount importance in safeguarding quality of care. Recently, we have been working on immersive training of surgeons and their teams. How to deal with associated IT-related overload has been incorporated into the training process. Surgeons and teams should not train their skills in a bubble but in a realistic context so that they can learn to alleviate mental stress. In the short term, the high level of vigilance and attention focus needed to process multidimensional information may result in "IT-related overload". Mental strain may accumulate when not coped with successfully and it creates a state of burnout in the long term.

Managers may wish to consider creating teams where the cognitive abilities and resources of some of their employees can balance those with less cognitive ability or less experience with experts. Training as a team can help reinforce how the teams work together as they create transactive memories of the training process and the roles of the team members (Liang et al., 1995).

8 http://edition.cnn.com/2009/US/10/26/airliner.flyby/

9 Id. 6.

Assessing IT-related overload How do you measure mental strain caused by overload? We used triangulation method approach, i.e., a multitrait-multimeasure method (Campbell and Fiske, 1959) capturing IT-related overload as well cognitive absorption in the operating room. One cannot rely solely on self-reported measurements when dealing with such a sensitive topic. Would you recognize being overloaded right now, if I would ask? Self-reported measures are subject to a range of biases that might threaten the reliability and validity of empirical study. It is for example not part of the medical culture to accept stress as an inevitable part of practice. We have been collecting physiological markers using thermal imaging cameras (peri-orbital and frontal temperature) and sense wear body media systems (energy expenditure in Metabolic Equivalent of Task scores) in the medical context (Pluyter et al., 2012). We also used eye-tracking devices to measure foci of attention within a virtual environment as function of the directionality embedded in the design (see Saunders et al., 2011 for the theory). Results are under analysis.

Updating and force compliance Finally, managers should think careful before enforcing new information technologies in an organization. The old technologies with which employees are familiar may be very similar to new ones, but different enough to be confusing. Overload is created when individuals try to match the new functionalities of the software or services with the technology they already know. Remember, for those the information is pretty well organized in memory. If it differs they have to intentionally forget how they used to interface with the technology. Intentionally forgetting is cognitively taxing and also contributes to feelings of burnout and rejection of new technologies. During an interview, an anesthetist stated **"***When they released a new version of the anesthetics machine, I was frightened at the beginning because they changed the pitch of the pulses. To me it sounded like the patient was not doing well, but instead he was stable*." It is important to get the employees involved in the decision when selecting technologies and giving them certain "decision right" and appropriated training. What looks like simple and fancy IT to an innovative manager maybe the nightmare of his employees, hampering their work process as way too cumbersome to use.

Future research

In the coming years, I intend to pursue my actual line of research to better grasp the impact of IT at the individual, organizational and societal level. The challenge will be to elaborate the best theoretical lenses to make sense of the data and propose a healthy digital diet to users. I expect this to be multi-disciplinary efforts at the crossing of research fields. Assessing efficiently IT-related overload and associated cognitive and emotional aspects will be important to reach my goal. New measurement methods are required in our digital world. We ought to research the consequences of Information Technologies mindfully; "for the rich and the poor" at the workplace and

in our private sphere. I do believe that we as researchers should act as a warrant, not as "slave" of the markets and industries. Knowledge and intellectual freedom should benefit our society in building solid foundations. This rather than surfing on the wave of technologies built and designed for the financial profit of a few. We, academic, should convince the industry of the relevance of our research for their business. Not only the other way around.

Here five examples of the research I intend to conduct in the coming years to illustrate my point.
In collaboration with M. Olivos and S. Rincon, I am developing new ideas on the proper usage of IT in education to reduce the economical gap. Online education and virtual teams can for example be a benefit to learn intercultural skills for the poor in developed nations as well as the rising middle class in developing countries. Research addressing the positive effects of IT and connectivity should also address the bottom of the pyramid. "It is the billions of aspiring poor who are joining the market economy for the first time" wrote Prahalad and Hart (2002). If we are to get obese let's share the good food at least!

In another line of research I am also focusing on the top of the pyramid addressing to expert knowledge. For example, with H. Medina (MDA), we are mapping knowledge and task complexity of the anesthetist profession. As a good neo-luddite I am particularly interested in the impact of IT on job re-design and curriculum change. Also we are testing a good balance of information technologies to improve performance of the surgical team in the operating room.

With J. Jakimowicz (surgeon) we are investigating how to improve immersive training design with the support of virtual reality environment and serious gaming. The design of this new technology to reduce IT-related overload in the OR and improve learning also consume part of my attention. Virtual worlds mimic or augment physical space in such a convincing way that the brain fails to differentiate between virtual and real experiences. The user's brain experiences cognitive absorption within the environment transcending reality itself. However, to reach that point the brain has to cognitively adapt to the technology's features. If it takes the users too much mental efforts to cognitively adapt to the new environment he may never return to it. Serious care has to be given to the design of such applications when entering the medical floor. In this context, I plan to further test the "Virtual space and place theory" as well as the "Emotional and Cognitive Model" both developed and written with C. Saunders.

In order to reduce the complexity of the world, we may need to take a partial view at it. The most efficient way to help size reality is to use theory. Researchers know that having no theoretical lens is the warrant of a lack of perspective on reality itself. Having too many impairs focus. Having the wrong lens may blur researcher's mind or make him feel dizzy. The challenges of studying the impact of Information Technologies rose from the very fact that most technologies and systems have been designed and are the products of the human brain. Making sense of it is a methodological and theoretical challenge. That challenge has often kept me awake. "Developing and testing new theoretical lenses developed from multi-disciplinary angle we will", master Yoda would have said. The Los Angeles Time recently reported the results of a study that demonstrated that "Facebook is a bummer that makes us feel worse about our lives"[10] . Freud (1886) connected on the unconscious would say, "The more I want you to like me, the less I like myself". Descartes (1644) connecting to the reason earlier could have brought up to date "Cogito ergo sum" (i.e., I think therefore I am) as "Twitto ergo sum" (i.e., I tweet therefore I am). I am actually elaborating with my A-team a new set of theoretical lens to better understand such addiction phenomena link to IT misusage and improve the balanced diet.

Before to conclude, I want to trigger your attention on a very particular observation. One of the most striking results from the survey panel mentioned before was the effect of the social classes and the level of education on the experience of IT-related overload. People from lower social classes and the less educated ones are more prone to experience IT-related overload. One should be aware that the IT-related problem is not simply an aging or gender phenomenon. It is somehow proportional to a lack of knowledge and education. I intend to make sense of the exact nature of the relations between those economical variables and IT-related overload, improving educational plans.

[10] *http://www.latimes.com/news/science/sciencenow/la-sci-sn-facebook-bummer-20130814,0,3655078.story).*

Conclusion

When addressing Information Technologies usage there is one popular idea circulating in our digital society I particularly dislike. I perceive it mostly as the product of marketing efforts to make us feel "outdated" (see Rutkowski et al., 2013). Marketers want us to believe that problems of IT mastery will fade away with the new generations of users replacing the older ones. However, there will always be a new generation of software developers to overload the next generation of users! Indeed, software economic growth is led by hungry IT developers and marketers. Indeed, technologies are marketed as outsmarting us, requiring us to update constantly and to stay tuned with the world of modernity. Resisting to the marketing pressure vehiculated through social peers is the most difficult (see figure 2).

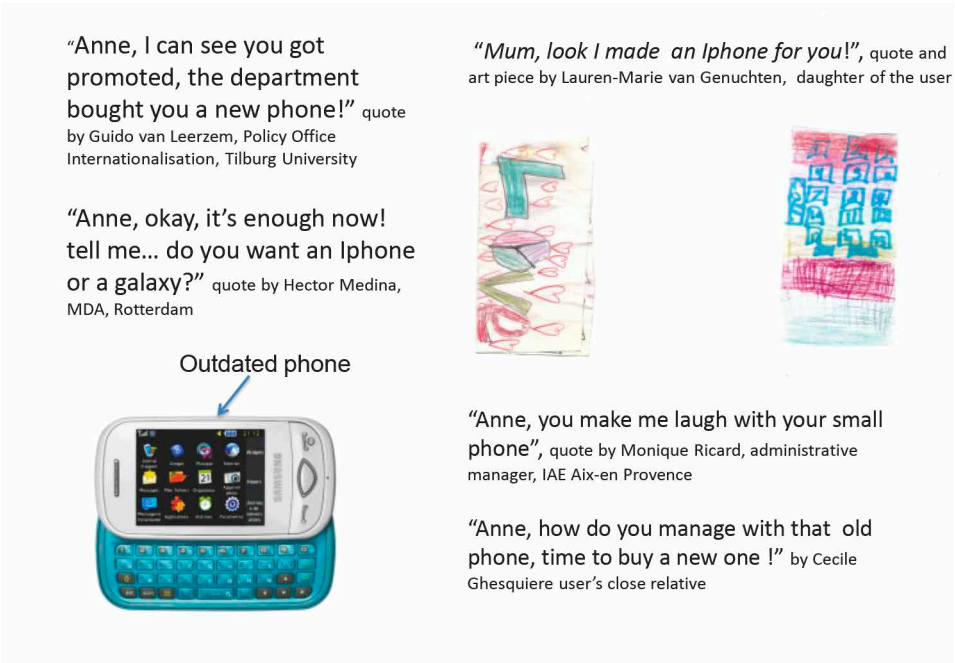

Figure 2 Pressure on an outdated phone and its user

So far industry and marketing focus on keeping us hooked. Many may feel in a situation of temporal servitude at the workplace (Sarker, et al., 2012). We feel we have only little choice else than surrender to the technologies in our organization. The software industry is swamping us with requests to use IT. It is also trying to sell us more and more updates, services and make more profit. IT-related overload is therefore "more" than merely input or output. It is an experience encoded in our brain. Our brain is failing us lately in making the right decision. Most of us are acting like addicts, unable to push the "off" button.

No wonder why topics such as tech-addiction are flourishing in the press. Responsible IT innovation....we ought to understand the consequences before running after more connectivity and technologies. Of course Information Technology has also brought us many benefits at the individual, organizational and societal level. However, IT has become too pro-eminent in our life to allow it to "attack" its users without any checks and balances. I shared with you what my research led me to believe. A balanced diet and appropriate use of Information Technology will be healthier for our society.

Epilogue

First of all I want to thank Tilburg Executive University Board and particularly our Rector Magnificus, Prof. dr. Philip Eijlander for promoting me to this prestigious position. I am honored and grateful. I am also thankful to the previous and current Faculty Management Teams; our dean Prof. dr. Lex Meijdam as well to the heads of our department, old and new!

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