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Aversion to Loss and Information Overload: An Experimental Investigation

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AVERSION TO LOSS AND INFORMATION OVERLOAD: AN EXPERIMENTAL INVESTIGATION

Completed Research Paper

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Abstract

The negative consequences of information overload are well understood across a range of disciplines even though the causative factors that contribute to it have not been coherently researched. We apply the concept of 'aversion to loss' from prospect theory and explore its effects in the context of information processing for decision making. A controlled laboratory experiment was performed to test the hypothesis that humans acquire and process relatively more information under the threat of information unavailability. Our results indicate strong support for the hypothesis. Further, we show that despite processing more information, people are less satisfied with their decisions than those who have free and continuous access to information. Implications and extensions of the study are presented.

Keywords: Information overload, aversion to loss, decision satisfaction, decision confidence, prospect theory.

Introduction

The negative consequences of information overload have been recognized at least from mid-15th century when the printing press first came to be established. However, some of the recent developments in information and communications technologies (ICT) such as the internet, World Wide Web, and mobile computing (among others) and the applications associated with them have tended to exacerbate its effects. Despite the large volume of extant research into the phenomenon, there is an emerging consensus that our understanding of the specific causal factors that contribute to information overload is somewhat sketchy and inadequate. There is, ironically, an over-abundance of published literature on this topic from a number of disciplinary perspectives ranging from Management and Marketing to Cognitive Psychology and Information Systems/Science. The primary thrust of much of this research has been on characterizing information overload and documenting its symptoms and effects. Information Systems research and scholarship pertaining to information overload has generally tended to address counter-measures and mitigation strategies largely at a normative level (Eppler and Mengis 2004). Our proposed research program seeks to draw on the multi-disciplinary research perspectives to develop robust models of information overload and their effects on human decision making. These models will be tested under controlled laboratory conditions in order to explicate the key causal factors. This research program is informed by the premise that a careful delineation of valid causal factors constitutes the correct basis for exploring and proposing effective counter-measures and mitigation strategies. We present the details and results of the first of these controlled experiments which tested the effects of aversion to loss on the amount of information processed in the context of a decision making task.

The overall aims of the research program are to:

1. Develop robust models of information overload and its effects on human decision performance incorporating theoretically sound independent variables based on a comprehensive review of the multi-disciplinary literature on the topic.
2. Test specific hypotheses suggested by the model under controlled laboratory conditions based on rigorous experimental designs and robust measurement regime. Enhance the quality of data and measurements through the use of web technologies.
3. Use the experimental evidence and results obtained to recommend valid and appropriate counter-measures to ameliorate the effects of information overload and to contribute to enhanced information worker productivity.

Review of the Relevant Literature

While information is useful and necessary for survival at the level of individual organism, group, or organization, over-abundance of information can engulf and diminish the entity's control of the situation. There is a general consensus in the literature that the socio-technical advances of the 20th century have contributed to a situation in which humans are inundated with irrelevant or unnecessary information beyond what we can process and use effectively. The perils of this situation have been highlighted by several authors (Wurman 1990, 2001; McKinnon and Bruns 1992; Castells 1996; Shenk 1997; Abbot 1999, among others). Some of the perils can be psychopathological such as withdrawal, absurdity, helplessness, and alienation leading to critical loss of knowledge, impairment of judgment, and poor quality decisions (Miller 1960). Others are economic consequences including wasted human resources that act as a drag on information worker productivity (Joelle et al 2007).

One of the most cogent and succinct characterizations of information overload was articulated by Herbert Simon when he wrote that ".. in an information-rich world, the wealth of information means a dearth of something else: a scarcity of whatever it is that information consumes. 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 over-abundance of information sources that might consume it (Simon 1971, pp. 40-41). This highlights the key cost associated with information volume beyond a certain threshold – that of attention which is a constrained resource for humans and organizations. He has argued that many information systems designers represented their design problem as one of information scarcity rather than attention scarcity. The upshot is that systems excelled at providing more and more information instead of systems designed to filter out unimportant and irrelevant information. The limit of information processing capacity at the organizational level was highlighted by Galbraith (1974) and Tushman and Nadler (1978). Our ability to design IT solutions to optimize the

limited cognitive resources at our disposal is critically dependent on an in-depth understanding of the phenomenon at a causal level.

The inverted U-curve relationship between the volume of information inputs and the amount of information that can be integrated into the decisions has been recognised by Schroeder et al. (1967) and subsequently replicated by Griffeth et al (1988) and Chewning and Harrell (1990). The information inputs beyond the point of inflection in Fig.1 below will not be processed effectively leading to drop in decision accuracy as shown in this figure. Keller and Staelin (1987) found a similar relationship to hold even when the X-axis was replaced by information quality while holding quantity constant. The quality measure has been further expanded to consider information's characteristics such as the level of novelty, ambiguity, uncertainty, intensity, and complexity (Schneider, 1987). The negative effects of information overload on consumer decision making have been a recurring theme in Marketing research from the 1970's (Jacoby, Speller et al. 1974; Malhotra 1982, among others).

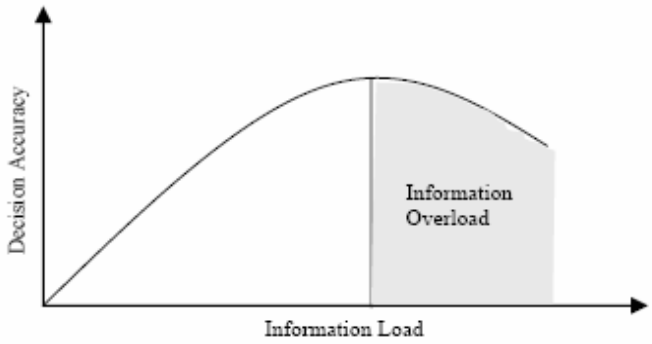


Figure 1. Information load and decision accuracy (Source: Eppler and Mengis 2004)

The emphasis of many of the researchers in the Management field has been on the subjective dimension of the phenomenon. In this perspective, some of the symptoms such as feelings of stress, confusion, pressure, anxiety, withdrawal, cognitive strain and stress, greater tolerance of error, low motivation and job satisfaction were identified and analyzed (O'Reilly 1980; McCune 1998; Haksever and Fischer 1996). The methodological approach of this strand of research was primarily interview and survey-based. Feldman and March (1981) presented an intriguing perspective supported by case studies that contested the rational models of information as substantive inputs to decision making by emphasizing its role in symbolic aspects of information acquisition and disposition in organizations. Popular press is replete with discussions of many of the deleterious effects and syndromes associated with information overload (e.g, McCune 1998).

Several systems theory-related studies have dealt with the factors that contribute to the overload problem. They can be grouped into the following three categories: i) characteristic of the information inputs and information technologies, ii) features of the processing subsystem, and iii) and personal factors. Ackoff (1967) demonstrated that information overload has more to do with the overabundance of redundant and irrelevant information and showed that decision making can be significantly improved through effective filtering and summarization. Attributes of input information inputs such as ambiguity, novelty, and complexity were highlighted by Schneider (1987) and dimensionality by Schroeder et al (1967). Spier et al (1999) showed that the effects of the interaction between information and task characteristics (such as frequent interruptions) can contribute to overload. The effects of information technology applications such as push systems, email, etc have been discussed by Bawden (2001), and the very low cost of processing, storage, and duplication by Schultze and Vandenbosch (1998). Personal factors such as cognitive limitations, personality types, age, experience and skill levels have all been proposed as contributory factors to information overload (Herbig and Kramer 1994; Hiltz and Turoff 1985).

The extensive literature on information overload from a diverse range of disciplinary perspectives bears testimony to the criticality of the problem at both individual and organizational levels. However, the voluminous yet poorly integrated research and scholarly writing on the topic, a large part of which is discursive, has created a situation in which the research community does not have many good answers to the questions that arise as to what are the fundamental causes of the problem and what guidelines and suggestions can be provided to individuals and organizations that recognize information overload to be a serious problem. The diverse disciplines include Accounting, Engineering, Medicine, Marketing, Law, Psychology, Information Systems, and Library and Information Science (Edmunds and Morris 2000). Yet, truly inter-disciplinary research which integrates across disciplines and between conceptual and empirical analyses is rare. Multi-disciplinary research in the absence of such integration and cross-fertilization is a recipe for increased degree of information overload for the researchers themselves. (Bawden, 2001, p.9).

The limited research that has been conducted in a multi-disciplinary vein (see for example, Owen 1992, Hiltz and Turoff 1985) has been predominantly concerned with establishing a correlation between over-supply of information and individuals' idiosyncratic traits such as attitude, age, experience, and skills, often arriving at tenuous conclusions. It is the intention of this research to explore the causes of information over-supply from a perspective that has not been previously considered in the research in this area, and to generate unique understanding of some of the major causes of information overload. We propose to take up this challenge by developing causal models of information overload building on some of the more important research in Cognitive Psychology, Marketing and Information Systems. These models incorporate specific hypotheses that link attributes of individuals such as their aversion to loss and tendency to hoard information, and information input attributes such as the degree of redundancy as they impact the volume of information processed and how it, in turn, affects decision performance. This research will test whether aversion to loss (defined as a fundamental and evolutionary psychological trait), can be established as causative of information overload. The intent is to initiate a new stream of information overload research characterized by inter-disciplinary theoretical perspectives to be tested using a rigorous experimental regimes supported by the judicious use of information technology tools. The evidence thus obtained is expected to form the basis for recommendations for ameliorating the adverse effects of information overload.

General Research Questions

As noted above, from an academic viewpoint, there is a need to address the gap in literature around the role of individuals in the cause of information over-supply. From a social perspective, the problems related to information over-supply are becoming more acute with vast, poorly quantified economic and social costs. Whilst social and technological progress has a trajectory of its own, an improved understanding of individuals' role and personality traits that contribute to information overload can help prevent or minimise its negative effects and to maximise effective search and retrieval of information. The proposed research program can help us answer the following important questions:

- What are some of human traits and tendencies that can be attributed as the causes of information overload?
- Under what environmental conditions are these human behavioural bases stimulated to act as to cause information overload and how do they affect human decision making?
- What types of individuals are prone to act in ways that contribute to an over-supply of information?

The timeliness, importance, and contemporary relevance of the research stems from the particular historical juncture we find ourselves in – what has come to be referred to as the information age. Some of the distinguishing characteristics of the information age include:

- The transition to service orientation from a manufacturing base. The primary driver of the economy shifts from material goods to information and knowledge,
- The labor force is comprised largely of information workers who process information rather than those who work on land or machinery,
- The pervasiveness of information technology tools and applications which produce information on a continuous basis,
- The scope of the economy is largely global and no longer confined to national boundaries.

The information workers referred to earlier bear the brunt of the ravages of information overload. It is reported that the designs of many of the jobs in the information age involve multi-tasking. This involves many employees having to work on multiple tasks and projects on an ongoing basis. The volume of information flows can rise significantly as a result (Aral et al 2006). As well, the number of interruptions and context switches increase steadily. Anecdotal reports suggest that information workers change activities every three minutes because of a range of interruptions and the time needed to get back to the original task can be as high as 30 minutes. Paradoxically, some of the technological solutions and tools designed to assist workers to manage information better, end up adding to the overload problem. It is estimated that more than a quarter of an information worker's time on the average is taken up by email, instant messaging, blogs, social networking and applications such as Twitter, and other uncontrolled information flows (Crovitz 2008).

Theory, Conceptual Foundations, and Hypotheses

One of the creative aspects of good experimental research is asking interesting questions and the choice, operationalization, and measurement of theoretically robust independent (causal) variables. The choice of appropriate variables to focus on is inherently difficult when researching information overload due the vast and inter-disciplinary research literature referred to in the foregoing. A key innovation in our approach is to carefully sift through the body of previous research and to hone in some of the most relevant and proximate variables which have been directly or indirectly linked to information overload. 'Aversion to loss' has received much attention in the psychology and marketing literatures but not in the context of information overload. This concept was first proposed by Kahneman and Tversky (1979) in their prospect theory framework. Classical expected utility theory assumes that individuals choose between risky or uncertain prospects on a rational basis with the aim of utility maximisation. In contrast, prospect theory posits that people perceive gains and losses in terms of changes using their current position as a reference point. The central proposition of the theory is that losses and disadvantages have greater impact on peoples' preferences than gains and advantages (Tversky and Kahneman 1991). This applies to both risky and riskless choices and the related hypotheses have been validated through carefully designed laboratory experiments (Kahneman and Tversky, 1979, Tversky and Kahneman, 1991).

While prospect theory deals with 'aversion to loss' in the abstract, our approach is to focus on 'aversion to loss' as applied to information. The question we ask is to what extent aversion to loss of information is a contributory factor to overload. There is tantalising evidence emerging from the work of Ariely and his colleagues in Marketing (Ariely 2008) to suggest that its applicability is likely to be high. He has argued that in decision making scenarios where the decision maker is provided with a set of options, eliminating an option is experienced as a loss by the decision maker. The overall effect is that people are susceptible to keeping options open to avoid the sense of loss (Bell 1982; Ariely 2008). Shin and Ariely (2004) employed "door games" to demonstrate the consequences of loss aversion in choices. Their experimental results demonstrated that doors (a surrogate for alternatives/information) that threaten to disappear caused the subjects to invest more effort in keeping these doors open even when the options provided by their choice were of little value (and effectively lose money in the process).

We hypothesize that aversion to loss is an important cause of information overload. Decision making contexts involve the use of information artifacts. Clinging to the artifacts and hoarding in the hope that they will come in handy in the future represent behavioral patterns that we extrapolate from prospect theory and apply to information overload. The hypothesis is stated in the null form as:

> **H1:** People are likely to select similar number of information artifacts for use in decision making when there is a threat of future unavailability of access to information as compared to when there is no such threat.

Decision Satisfaction and Decision Confidence

It has been shown that people generally hold the misconception that the more information they use the better their decision outcome is likely to be. Kruglanski (1989) suggested that this is because information processing is undertaken to remove uncertainty in decision making situations. Confidence, a key outcome in decision making, signifies the extent of certainty achieved. Information processing and confidence are reciprocally linked. That is, information processing is undertaken to reduce the uncertainty that is inherent in a decision making context until a level of clarity is reached, influenced by situational factors such as time constraints and decision criticality (Small

and Venkatesh 2000). Several studies have noted the relationship between information use and decision confidence. Oskamp (1965) found that confidence in clinical diagnosis increased as a function of the amount of available information, but without any corresponding increase in judgmental accuracy. Similarly, Chervany and Dickson (1974) provided two groups with varying amounts of data. The decision makers in the group with less data (descriptive statistics as opposed to access to raw data) produced more accurate results but had less confidence in the decisions than those given access to a higher amount of data. Therefore, it is expected that there is a positive relationship between the number of information artifacts selected (and processed) and the level of decision confidence. The hypothesis is stated in null form as:

> **H2:** There will be no significant relationship between the number of information artifacts selected (and processed) and the level of decision confidence.

Decision satisfaction represents an affective attitude towards the decision (Small and Venkatesh, 2000). It "..is characterized as an attitude and defined as a function of a decision-maker's belief that the alternative chosen has some (valued) attribute(s), and the relative value placed on the attribute(s)" (Small and Venkatesh 2000, p. 10). Scammon (1977) found that experimental subjects in a consumer decision making situation supplied with decreased amount of information in simplified form reported lower levels of satisfaction and desiring more information. Iyengar and Lepper (2000) found that subjects who encountered the extensive-options condition (higher information volume) reported that they enjoyed the choice process more than those encountering the limited-options (lower information volume) condition. Jacoby, Speller, et al. (1974) in another consumer choice scenario, found that subjects who were provided more information felt more satisfied, than did subjects who were given less product information. However, Malhotra (1982) concluded that subjects' reported levels of decision satisfaction with their choice decreased as the number of alternatives in the choice set, or the number of attributes on which information was provided, increased. Based on the above, we hypothesize in the null form that

> **H3:** Decision satisfaction will be unrelated to the amount of information used in the decision making process.

Research Methodology and Design

The hypotheses developed above were tested through a controlled laboratory experiment using a 1X2 design with aversion to loss as the independent variable and two treatment levels – threat of information unavailability (experimental group) and no threat of information unavailability (control group). The experimental task for the experiment was a decision making simulation involving a product choice scenario. Product choice scenarios have been used in several studies to research the effects of information on decision performance (e.g. Jacoby, Speller, et al. 1974; Payne 1976; Olshavsky 1979; Malhotra 1982). These studies require the subjects to choose the best product (e.g. laptop) from a range of alternatives by considering a finite set of attribute values of a set of products.

Aversion to loss was operationalized using a novel web-based system. The system presented a matrix (see Fig. 2) of all the attributes of each product but the actual values of the attributes were hidden behind a URL and the subject had to click on each to expose the value. The control group (no threat of information unavailability) subjects were provided the opportunity to click and select the product attribute values (information units) at their leisure throughout the experimental decision making task prior to committing their decision. In the 'aversion to loss' treatment condition, the threat of unavailability was operationalized by restricting the subjects to having the option to choose the product attribute values only at the start of the experiment. The subjects were instructed that they had only one shot at selecting all the information attribute values they needed at the start and they had no further access to them during the performance of the decision task of selecting the best product alternative. Decision confidence and satisfaction were measured using standard multi-item instruments (Sainfert ad Booske 2000).

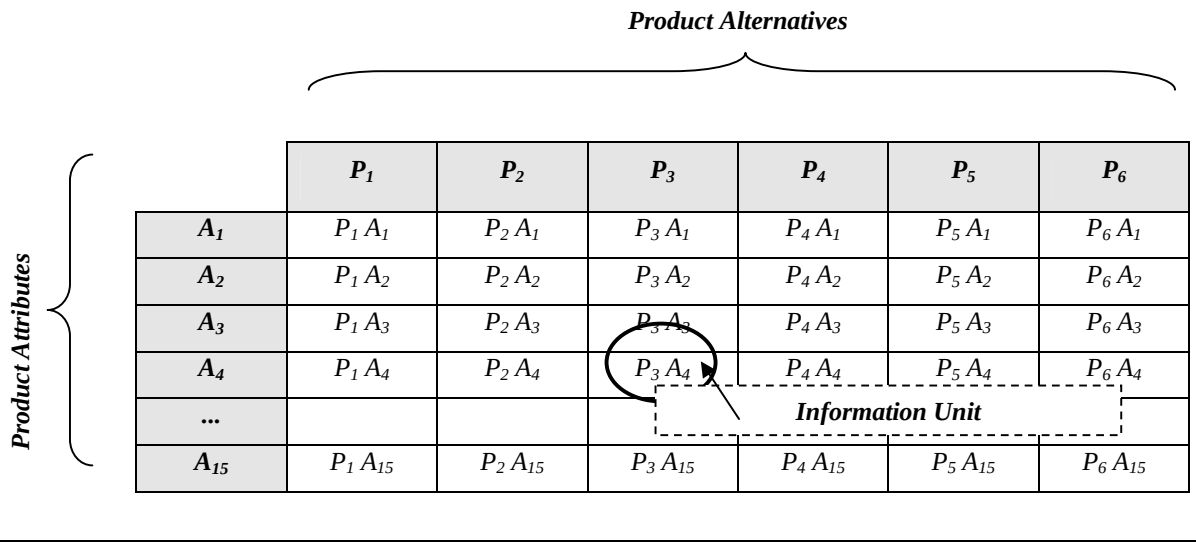


Figure 2. Product Choice Matrix

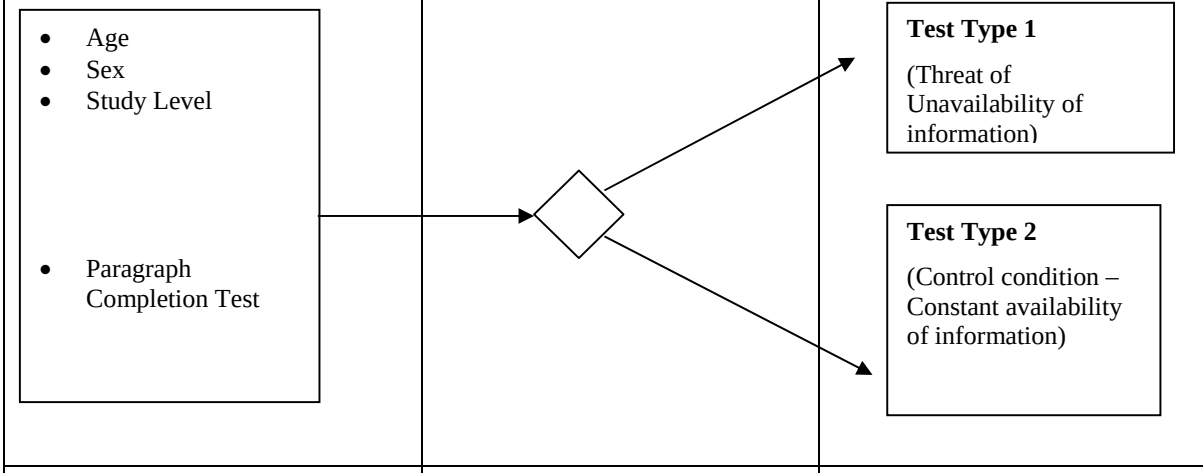
Choosing the product attribute values does not necessarily reveal the information pertaining to that attribute for a product. The subjects were also required click on each individual information units for each product and for each attribute chosen in order to reveal the attribute values. This is an improvement over previous studies (like Malhotra 1982, Jacoby, Speller et al. 1974) that use this type of experiment design. These former studies assume that once a participant is given access to information on products' attributes, the participant considers that attribute for all products. This may not necessarily be the case. A subject might not compare the information values of an attribute across all available product alternatives. Therefore the amount of information used is operationalized as the number of individual information units the subjects chose to click and view.

Subjects were provided with three decision making tasks in successive order. This was done in order to ensure that subjects had the opportunity to become familiar with the experimental procedures, the nature of the task, and the process that was required of them. Data from the first task was not used in our analyses; only data from the second and third tasks were used. Each task took approximately six minutes to complete. Time limits were not imposed on the participants as many studies have noted that time constraints can induce significant stress and other undesirable effects into the decision making process.

The selection of experimental subjects has important implications for the validity and reliability of the research. While experimental research can enhance internal validity of the design, the level of external validity is dependent on the extent to which the subjects are representative of the population to which we intend to generalise the results. In light of this, we used a mixed pool of subjects to be drawn from undergraduate and postgraduate (part-time) student groups. The latter group comprises employees of local organizations and their inclusion is expected to increase the external validity of the proposed research. The subject pool was randomly assigned to the two treatment groups. We ended up with a total of 91 subjects with 46 in the experimental group and 45 in the control group. The subjects provided a token inducement in the form of a small reward valued at $15.00 in order to encourage serious participation in the study. The data generated and gathered during the experiment was directly logged into a database that was developed. A pilot test of the decision making simulation and the measurement schemes was carried out using ten subjects and minor changes were applied to the wording of the decision making tasks but the results were generally in line with expectations. The tests of the hypotheses were carried out using standard statistical procedures.

Application Design Overview

A web-based application was designed and constructed that was capable of accommodating the experimental workflow. The application was built using the Ruby on Rails web application framework (version 2.1.0), supported by a MySQL (version 5.1) database management system back-end for storage and retrieval of data.



1: Participant required to complete a demographic survey. Application supports data collection.	**2:** Researchers randomly assigns participant to test condition. Application simulates the appropriate treatment condition.	**3:** Under the application's treatment condition simulation, the participant completes decision making tasks.

Figure 3. Experiment Application Design and Workflow

The application captured and logged the experimental data including subjects' age, sex, and educational level as well as the scores on decision satisfaction and decision confidence post-decision making based on the questionnaire. Details of the information units selected by the subjects under the two experimental treatments were also recorded.

Data Analysis and Results

The reliability of the scales used to measure decision satisfaction and decision confidence was assessed using Cronbach's Alpha tests and found to be robust. For decision satisfaction, the overall Cronbach's score was 0.856 which is considered highly reliable. Each of the sub-constructs of decision satisfaction, 'satisfaction with choice', 'usability of information', and 'adequacy of information' recorded higher than the acceptable threshold value of 0.70 (0.865, 0.815, and 0.729 respectively). Cronbach's alpha score for decision confidence was 0.770.

One-way Analysis of Variance (ANOVA) test was conducted to determine the differences across the two treatment conditions (threat of information unavailability/aversion to loss, and constant availability of information/no aversion to loss). The results are presented in Table 1. The hypothesis on aversion to loss was strongly supported indicating that there is a statistically significant difference in the average number of information attributes or units processed by the experimental group of 41.33 (aversion to loss) as compared to the control group (no aversion to loss) of 32.26. It is interesting to note that the average score on overall decision satisfaction is significantly different with higher satisfaction recorded for the control group (3.43) as opposed to 3.2 for the treatment group while the difference in means in the decision confidence scores was not statistically significant at 5% significance level (4.09 for the control group and 3.92 for the treatment group).

Table 1. Analysis of Variance (ANOVA) Results						
		Sum of Squares	**df**	**Mean Square**	**F**	**Sig. (p)**
Total Number of Attributes Used	Between Groups	75.572	1	75.572	13.814	.000
	Within Groups	486.889	89	5.471		
	Total	562.462	90			
Decision Confidence	Between Groups	.619	1	.619	1.263	.264
	Within Groups	43.628	89	.490		
	Total	44.247	90			
Overall Decision Satisfaction	Between Groups	1.192	1	1.192	4.077	.046
	Within Groups	26.012	89	.292		
	Total	27.204	90			

Overall Decision Satisfaction and Decision Confidence

Correlation tests were conducted on the various constructs that make up overall decision satisfaction (satisfaction with choice, adequacy of information, and usability of information) and the total number of information used. While there were weak positive relationships, there was no significant correlation between total amount of information used and satisfaction with choice ($r = 0.045$, $p = 0.337$). Thus H2 could not be rejected and we conclude that there is no statistically significant correlation between the number of information attributes used and overall decision satisfaction

Correlation test was also conducted on the measure of decision confidence and the total number of information attributes used. Again, even though there was a weak positive relationship, it was not statistically significant. The correlations between total amount of information used and decision confidence ($r = 0.106$, $p = 0.158$). Thus H3 could not be rejected.

Related Results: Decision Performance

One of the interesting aspects of the experimental setup was that given the way the decision making scenarios were constructed, it was possible to identify the 'most relevant' information attributes and the 'correct decision' for each task in light of the facts supplied. This enabled us to analyze the impacts of the total number of information attributes used and the total number of relevant information attributes used on decision performance. Consistent with the conceptual model of information overload adopted in this study (Schroder, Driver et al's (1967) framework), our results indicate that decision accuracy of participants increased initially, reached a peak when they viewed between thirty five (35) and forty (40) information units, and thereafter, accuracy declined as the number of information attributes used increased (Figure 4).

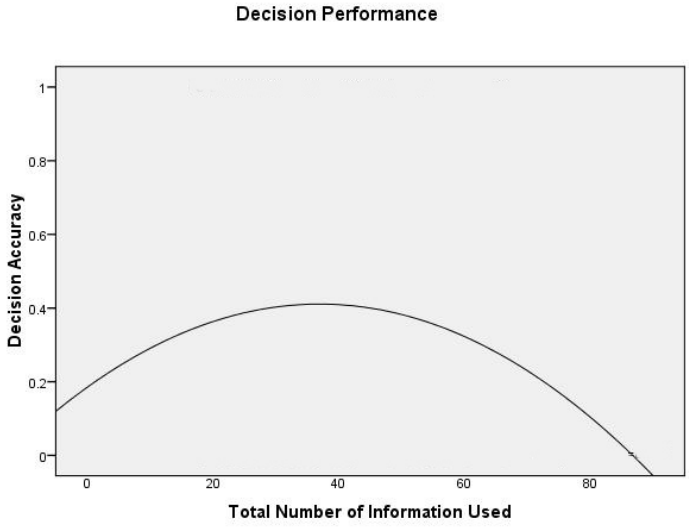


Figure 4. Decision Accuracy versus Amount of Information Used in Decision Making

Furthermore, we found that decision accuracy increased as the amount of relevant information attributes processed, increased (Figure 5). As expected, decision accuracy peaked when they had consulted all the thirty (30) units of the relevant information (there were five dominating alternatives with six relevant attributes each).

Discussion

Aversion to loss is an important psychological concept first proposed by Tversky and Kahneman (1979) in their prospect theory framework. However, *aversion to loss* is not the result of a rational comparison between the gains and losses, but rather a general reluctance to forfeit a possession or opportunity formed from the human tendency to avoid losses (Shin and Ariely, 2004). The primary motive for undertaking this research was to explore whether aversion to loss can explain information overload. The experimental study setup two treatment conditions that were designed to test how individuals' aversion to loss impacts their information selection and use behavior under a non-complex decision making scenario. One treatment condition was the control group in which the subjects were presented with a constant information availability condition, and in the other, the subjects faced the simulated threat of information non-availability. The results conclusively demonstrated that the concern that information will become unavailable in the future leads to individuals holding on to more information than they would without the threat. They do this presumably to keep their options open. What is interesting is that this phenomenon can potentially be an important contributor to information overload with all its deleterious consequences!

The study implies that individuals were holding on to more information than might be necessary out of their desire for future flexibility. This points to a general hoarding type behavior when it comes to information that does not necessarily improve the quality of decisions and very often leads to delayed and poorer quality decisions in the real world. The results further show that people making decisions under the threat to information unavailability are likely to be less satisfied with their decision than people who have a continuous access to information. It is ironic that the subjects under the treat of information unavailability seem to feel that they have had inadequate amount of information even though they were processing significantly more information than the subjects without the threat. Decision confidence does not appear to be linked to the amount of information processed.

The experimental evidence presented suggests that individuals value information differently when it is under the threat of disappearance. This causes people to overvalue information and hence integrate the pieces of information into their decision making process that they otherwise may not. This has consequences in the real world. It was been demonstrated by many scholars that having too much information results in poorer decision making. They used more information not because it was pushed on to them by information technology, or because it was distributed by the social machinery, but rather because the people themselves, out of an aversion to loss, chose to use information with limited concern for its relevance. In real world decision scenarios, there are substantial costs associated with this 'self over-supply' of information.

A 2007 *New York Times* article claimed that "the information overload ... is largely a by product of workers grappling with the growing tide of e-mail, instant messages, cell phone calls, wikis, blogs etc which has resulted in, U.S. dollar terms, "a $650 billion drag on the economy" (Lohr, 2007). *Reuters* conducted a large study of information overload in 1996 that covered 1300 business professionals in the U.K., U.S, Hong Kong, and Singapore. It found that 38% of the surveyed group felt that they wasted "substantial" amounts of time in seeking information. A further 43% felt that their decision making pace was adversely affected by the availability of too much information. A significant portion also attributed information overload to increased stress and interpersonal tension in the workplace (Waddington, 1996). Our results indicate that the technological factors may be complemented by psychological ones in the form of aversion to loss which may exacerbate the situation. The kind of causal understanding developed in this research, albeit tentative, can suggest approaches for counseling and training to ameliorate the deleterious effects of information overload. Our results can provide useful guidelines and counter-measures for enabling information workers and organizations to combat infoglut and overload which can lead to productivity improvements. A deeper understanding of the causes of the problem can assist IT managers and designers to design and deploy IT solutions with the primary goal of conserving people's attention. The outcomes of the research can help improve business organizations to deploy IT solutions more innovatively and thereby extract more value from their IT investments.

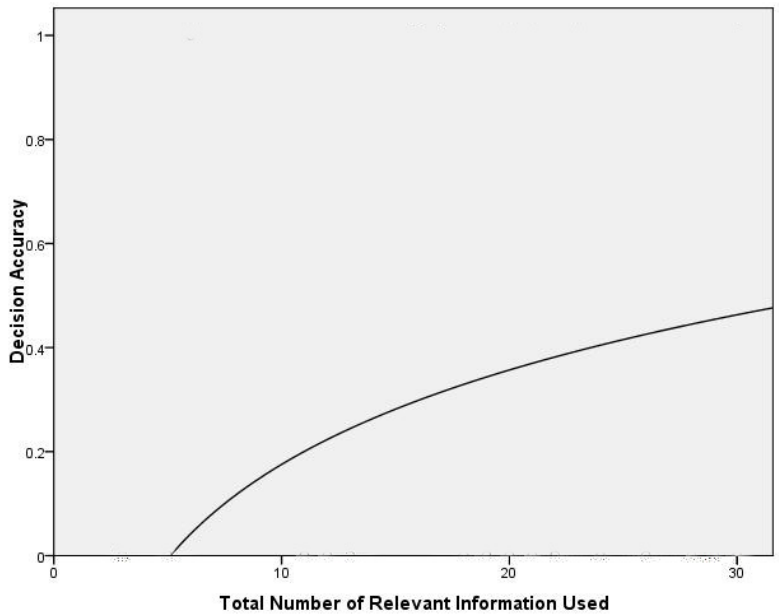


Figure 5. Decision Accuracy versus Amount of Relevant Information Used in Decision Making

Conclusion

We have presented an inter-disciplinary research agenda to address the critical problem of information overload and made a strong case for research into the underlying causal factors that contribute to the problem. Experimental evidence presented suggests that individuals acquire, use, and presumably, value information differently when it is under the threat of disappearance. This causes people to overvalue information and hence integrate the pieces of information into their decision making process that they might otherwise not have acquired. This has important consequences in the real world. It was been demonstrated by many researchers that having too much information results in poorer decision making. They used more information not necessarily because of technological and social pressures, but rather because the people themselves, out of an aversion to loss, chose to acquire and use more information. The costs associated with this approach to information acquisition and use are considerable. The results clearly show that when people feel that their access to information is threatened, they go above and beyond to acquire and use a lot more information than they normally would have - a fruitless exercise that only leads to poorer decision performance. More research is needed to isolate other important contributory factors and to investigate them in conjunction with 'aversion to loss' in order to generate a more holistic understanding of the information overload phenomenon.

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