Information Overload and Worker Performance: A Decision Making Perspective

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Abstract

Today, the issue of information overload is now commonly addressed in the popular press with such phrases as "Information Fatigue Syndrome". It is increasingly perceived as having an adverse affect on worker performance and decision making. However, the decision making literature typically assumes that individuals start from a position of a lack of information or simply have enough information. This paper examines the perceived existence of information overload and its effect on decision making. A sample of MBA students from New Zealand and the USA responded to a questionnaire on this topic. Nearly all respondents held professional appointments in organizations.

1. Introduction

Much of the literature in decision making assumes you have enough information. The emphasis in this literature, then, is one of generating the necessary information (starting from the position of a lack of information), rather than continually having to "prune" the information database and/or identify mis-information [1]. That is, as Phillips [18] has argued, decision making is a requisite process, where one aims for the minimum specification of a model for decision making. This minimalist approach is especially true in the so-called technical models of Operations Research and Decision Making where, if anything, there is not enough information – resulting in uncertainty and probabilistic modelling. However, the minimalist approach is opposite to some of the early work in decision making (e.g., [20]) where, using a descriptive approach, a theory of bounded rationality and satisficing for human decision making was developed. The satisficing

heuristic, where a decision maker stops searching for once a satisfactory solution has been found, is one approach for dealing with too much information and recognizes the often pragmatic constraints of time and resources available. Further, as Miller [13] has also noted, the satisficing approach recognizes the cognitive limitations of human decision makers. Few formal, prescriptive models of decision making take explicit account of cognitive factors. One notable exception in the multiple criteria decision making literature is the ZAPROS method of Larichev and Moshkovich [9] which recognizes the cognitive limitations of the human decision maker and structures the solution process so that only modest cognitive demands are made. Even so, most of the decision making literature presumes that less, rather than more information is available. This, then, motivates our study of decision making in the situation where there is "information overload."

Given the growth in information technology and the Internet, it is not surprising that information overload is increasingly addressed in the popular press [3, 10, 19]. The research by David Lewis, as reported by Nellis [15] confirms what is generally known in the wider business community; that is, "Information Fatigue Syndrome" is here. So while there is little doubt as to the existence of this phenomenon, our research relates to its perceived existence and effect on decision making, while taking consideration of the personality or cognitive style of the decision maker.

Considerable research has been undertaken regarding the effects of information load on decision quality; both for individuals and groups, principally under laboratory conditions. The typical approach is to consider independent variables such as information load (quantity and type), time pressure and decision maker experience, and examine their effect on decision quality. Other issues considered in this experimental research include problem structure (structured or unstructured problems), the nature of the solution (selecting alternatives or actually solving a problem) and the decision maker (group or individual).

Early work by Jacoby *et al.* [8] in marketing suggested a U-shaped relationship between information load and decision quality; as information load increases, decision quality first increases then subsequently decreases. Malhotra [11], and others have challenged these findings. More recently, Hahn *et al.* [4] showed that in the absence of time pressure, increasing information load resulted in increasing decision quality. However, under conditions of time pressure, decision quality first increased with information load and then decreased – providing additional support for the U-curve hypothesis, but only under conditions of time pressure.

In another laboratory experiment Iselin [7] examined unstructured decision making. Independent variables were information diversity, decision experience and task learning, with each categorized in two levels. The dependent variable of decision performance was operationalized by using two variables; profit and decision time. It was found that profit was not affected by information diversity although, not surprisingly, decision time was. Decision experience and task learning affected both profit and time as expected. In the light of more recent work it is likely that profit, a key measure of decision performance, would also have been affected if decision makers had been time constrained as the information diversity increased. This result was noted much earlier by Wright [23]. These findings suggest that if decision time is unlimited, then there is no effect of information overload. Meyer *et al.* [12] provide further contradictory results with a

laboratory study in a group setting where they found that information load did affect decision quality but time pressure did not affect the quality of decisions.

Little research has attempted to link decision maker experience and background to information overload. Moreover, even though early findings suggest that information overload is likely to have an impact on worker productivity, the vast majority of research on this topic have been controlled laboratory experiments where the subjects were not actually dealing with real decision problems. One exception is O'Reilly [16], who conducted a questionnaire-based study of information overload in the workplace. He found that subjects who report to be underloaded perform better than those who are overloaded with information. But those who are (relatively) underloaded, are less satisfied.

As findings regarding information overload became increasingly available, some methods for dealing with it were also proposed. For example, Moutinho [14] suggests that information overload can be successfully managed by organizing complex problems into meaningful structures; in this case, by structuring problems using the Analytic Hierarchy Process (AHP) methodology. It is generally accepted that some formal problem structuring does facilitate quality decision making [6] and mitigates against the use of informal decision heuristics – such as satisficing. However the issue here is more likely to be the value of problem structuring generally, rather than any method in particular. Furthermore, as noted earlier, most proposed decision making methods do not specifically address the cognitive aspects of decision making and information overload.

This research endeavours to contribute towards such understanding by attempting to provide answers to two research questions: (i) *Are individual factors comparatively more or less important than task factors in influencing information overload?* and (ii) *Does information overload significantly affect task productivity and outcome quality?*

2. Data collection and analysis

This research has been based on a sample of 108 MBA students from two countries: 59 students were from three sections, conducted in different academic semesters, of a one-semester MIS course in the Fox School of Business Management, Temple University, USA. 49 students were from four sections, also conducted in different academic semesters, of a Quality and Systems Thinking module in the Waikato Management School, University of Waikato, New Zealand. Nearly all respondents held professional appointments in organizations. The Temple University students were asked to answer a questionnaire and were given partial course credit for their participation. Their answers were then complemented through interviews conducted face-to-face, over the phone and by e-mail. An identical questionnaire was administered to the University of Waikato students. In order to reduce question misinterpretation bias, the researchers were available to answer any queries related to the questions. To reduce question-order bias, the order of the questions was changed at random before each new questionnaire was given to a section of students [5].

The data collection instrument was designed to incorporate measures for each of the constructs discussed in Figure 1, as well as open-ended questions in which the respondents have been either asked to explain their answers or to provide additional qualitative information regarding their perceptions. Two types of construct measurement

scales were used in the instrument, continuous ordinal scales (e.g., for measuring the average number of work-related decisions per day) and five-point interval scales (e.g., for measuring decision focus). A set of twenty-two informal interviews with respondents informed the selection of semantic differential terms used in the development of the interval scales [21].

Construct type	Construct	Measurement items	Description
Individual factors	Knowledge base	Work knowledge acquisition in months	Number of months of formal education and hands-on practice needed to perform work-related activities well
		Skill acquisition in months	Number of months of hands-on practice needed to acquire skills to perform work-related activities well
	Decision style	Decisional scope	Five-point scale: 0 (focus on details) -- 4 (focus on the big picture)
		Decision rationality	Five-point scale: 0 (very intuitive) -- 4 (very rational)
Task factors	Amount of information processed	Pages read	Average number of equivalent written pages read per working day
		Pages written	Average number of equivalent written pages written per working day
	Task complexity	No. of work related decisions	Average number of relevant work-related decisions made on a working day
		No. of different work related activities	Average number of different work activities performed per working day
	Number of information exchange interactions	No. of information giving interactions	Average number of information giving interactions per working day
		No. of information receiving interactions	Average number of information receiving interactions per working day
Information overload	Information overload intensity	Information overload intensity	Perceived information overload intensity experienced at work (five-point scale)
Task outcomes	Task productivity	Information overload impact on productivity	Perceived information overload impact intensity on work productivity (five-point scale)
	Task outcome quality	Information overload impact on quality	Perceived information overload impact intensity on work quality (five-point scale)

Figure 1. Construct measurement items

In order to provide answers to the two research questions, data were analyzed with the aim of establishing the existence and comparative strength of links between individual and task factors and perceived information overload, as well as between perceived information overload and its impact on task productivity and outcome quality. This was attained by the calculation of both simple descriptive statistics for each of the measurement items, and Spearman product-moment correlation coefficients for each pair of construct measurements. The use of a non-parametric technique (i.e., Spearman's) required that the continuous ordinal scales be first converted into ranked ordinal scales, before the Spearman correlation coefficients were calculated [17, 22].

3. Results

The data analysis has been summarized into a set of descriptive statistics for each of the construct measurement items. We first report on the extent to which our respondents experience information overload, as shown in Table 1.

YES	NO
66.4%	33.6%

Table 1. "Do you usually experience information overload?"

This result is significant ($p<0.001$) using a Chi-square test. Certainly the perception of 2/3rds of respondents was that they experienced information overload. However, the strength of perceived information overload is also important. Figure 2 provides a breakdown of strength of perceived information overload intensity.

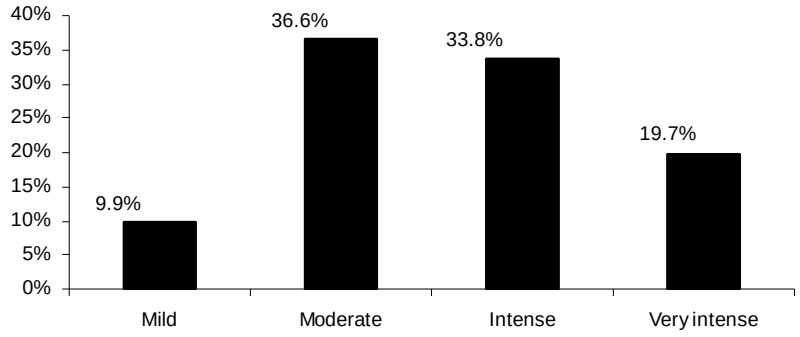

Figure 2. Distribution of perceptions regarding information overload intensity

About 50% of respondents who experienced information overload perceived that overload to be intense or very intense. Again this result is significant ($p<0.01$) using a Chi-square test.

We now consider Table 2 below. The last five rows at the bottom of the table show descriptive statistics that have been calculated before continuous ordinal scale measurements were ranked. The Spearman coefficients of correlation were calculated after this ranking took place.

	1	2	3	4	5	6	7	8	9	10	11	12	13
1 No. of work related decisions	1												
2 Decisional scope	**.28**	1											
3 Decision rationality	**-.37**	-.17	1										
4 Pages read	**.21**	**.22**	-.15	1									
5 Pages written	.09	.10	**-.20**	**.53**	1								
6 No. of information giving interactions	**.42**	**.25**	**-.22**	**.36**	**.31**	1							
7 No. of information receiving interactions	**.44**	.15	-.17	**.31**	**.37**	**.74**	1						
8 Work knowledge acquisition in months	.14	.12	-.05	.14	.18	**.37**	**.32**	1					
9 Skill acquisition in months	**.26**	.05	-.13	.10	.12	**.42**	**.35**	**.82**	1				
10 No. of different work related activities	**.44**	.09	**-.21**	**.20**	.14	**.44**	**.50**	.19	**.21**	1			
11 Info. overload intensity	.05	**.22**	.00	.11	.02	.07	.04	-.02	.01	.01	1		
12 Info. overload impact on productivity	.10	**.34**	-.06	**.23**	.12	**.21**	**.30**	.03	.04	-.02	**.37**	1	
13 Info. overload impact on quality	.07	**.28**	-.12	.19	.10	**.25**	**.26**	-.03	.00	.01	**.41**	**.74**	1
Standard deviation	12.8	1.0	1.0	27.8	10.7	22.1	23.9	44.0	32.7	6.3	1.5	1.2	1.3
Median	3.0	3.0	3.0	20.0	5.0	11.0	13.5	60.0	26.9	7.0	2.0	3.0	2.5
Mean	7.2	2.6	2.9	29.9	9.6	19.6	21.4	66.5	36.2	8.5	1.7	2.4	2.3
Minimum	0.0	0.0	0.0	2.0	0.0	1.0	2.0	0.2	0.0	0.0	0.0	0.0	0.0
Maximum	105.0	4.0	4.0	100.0	75.0	150.0	175.0	180.0	180.0	30.0	4.0	4.0	4.0

Coefficients of correlation *

** Spearman coefficients; N = 108; P < .05 (two-tailed test) for coefficients in bold; P < .01 for coefficients in bold and underscored*

Table 2. Descriptive statistics for construct measurement items

A number of observations can be made from the data. Data subsets will be referred to from Table 2 using the format (row numbers, column numbers). Firstly, (11-13,11-13) confirm the strong correlation among the different construct measurements for information overload. Similarly, (4-7, 4-7) are all correlated suggesting, for example,

that respondents who read and write more pages are also involved in more information interactions.

Two construct measures were used to assess the cognitive style of the decision maker; decisional scope and decision rationality. An analysis of (11-13, 2-3) suggests a marked difference between these two constructs in terms of correlation with information overload. Decisional scope is significantly correlated with perceived overload; that is; respondents who tend to focus more on the big picture appear more likely to perceive and experience information overload. Or conversely, those who are more detailed are less likely to experience overload. Perhaps more surprising is that decision rationality is not correlated with perceived information overload. This would suggest that neither more rational nor more intuitive people perceive or experience information overload differently. Finally, it should be noted that decisional scope and decision rationality have no significant correlation.

The other significant observation is the impact of context on perceived information overload. From Table 2, (12-13, 6-7) exhibit significant positive correlation suggesting that the number of "information interactions" – both giving and receiving – are important factors in affecting perceived overload. However, pages read and pages written (12-13, 4-5) are not significantly correlated, although some modest correlation does exist. This is not surprising; as the number of interactions increase, so does perceived overload. But it is actual interactions, not "pages" read or written that appear to affect overload. It could be surmised that there is less pressure associated with reading and writing "pages" than there is with interactions which are often synchronous, as opposed to asynchronous, communications. As a side issue, it can be seen from (5-6, 3) that respondents who see themselves as more rational than intuitive tend to be involved in more information giving (pages written and information giving interactions).

The constructs which measured work related decisions and activities (and which were significantly correlated) appear to have a negligible effect on perceived information overload. This may suggest that variety of activities and decisions made on a daily basis are not significant contributors to information overload.

4. Discussion

Recall our two research questions: (i) *Are individual factors comparatively more or less important than task factors in influencing information overload?* and (ii) *Does information overload significantly affect task productivity and outcome quality?* It is quite clear, and not surprising, that the perceived intensity of information overload has a significant, positive correlation with its perceived impact on productivity and quality. In other words, individuals who perceive themselves as information overloaded also perceive a negative impact of information overload on the productivity and quality of their work. Conversely, individuals who perceive information overload as low, do not see its effect on work quality and productivity as significant. Although perceptions cannot be directly equated to outcomes, this suggests that information overload affects task quality and productivity, and thus a positive answer to question (ii).

As to the first research question, again the answer appears from the data to be relatively straightforward. Perceived information overload is affected by both individual and task factors. More specifically, the two principal factors are decisional scope (focus

on details or the big picture) and the number of information interactions (both giving and receiving). Moreover, the data suggest that these two factors are not independent. Context or task is clearly important and suggests that, because it is only determined by information interactions and not "pages," time pressure may be an implicit cause of overload. What is more important and certainly far more difficult to influence is the cognitive style factor we entitled decisional scope. Respondents who tend to take a more detailed approach appear less disposed to being overloaded.

While this study has provided some further results on the phenomenon we refer to as information overload, it has also raised a number of questions. What is the role or effect of cognitive style? Can it be changed? Driver *et al.* [2], for example, suggest that managers can change their decision style over time, in response to changing contexts. Further, our study does not, at this stage, offer any practical or prescriptive way of dealing with information overload. Further research is needed.

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