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Informing Science: The International Journal of an Emerging Transdiscipline

What is the transdiscipline of Informing Science?

What is Informing Science: here is an hour long video introduction by Prof. T. Grandon Gill, presented at InSITE 2011 in Novi Saad, Serbia, and two books that are available online for free viewing and downloading of their PDFs:

- Informing Science Volume One: Concepts and Systems, and
- Informing Science Volume Two: Design and Research Issues

.

Lastly, in 2009 I wrote the paper A Philosophy of Informing Science.

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The journal Informing Science: the international journal of an emerging transdiscipline especially welcomes papers that bring together and cross the research heritage and epistemologies on finding better ways to inform from diverse fields including technology, psychology, brain science, information science, and other diverse disciplines and the application of these ways to finding better ways to inform to client disciplines such as health care, government, and education. The journal welcomes conceptual, theoretical and empirical contributions. The ideal paper builds on existing research not only in the author's own discipline but also from the transdiscipline of Informing Science.

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The academically peer refereed journal Informing Science endeavors to provide an understanding of the complexities in informing clientele. Fields from information systems, library science, journalism in all its forms to education all contribute to this science. These fields, which developed independently and have been researched in separate disciplines, are evolving to form a new transdiscipline, Informing Science.

Informing Science publishes articles that provide insights into the nature, function and design of systems that inform clients. Authors may use epistemologies from engineering, computer science, education, psychology, business, anthropology, and such. The ideal paper will serve to inform fellow researchers, perhaps from other fields, of contributions to this area.

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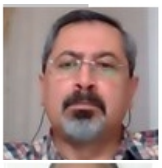

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Reclassification of Electronic Product Catalogs: The "Apricot" Approach and Its Evaluation Results

A B S T R A C T

Electronic Product Catalogs (EPCs) are becoming more and more important as businesses interact electronically with one another and with customers. EPCs are the databases in which businesses store information about their products. EPCs allow customers to locate items they wish to purchase and business partners to access a business's offerings. Typically each business's EPC is organized to meet the requirements of one of many competing standards. Problems arise when various business partners use different standards to organize their EPC. Translating a product catalog from one standard to another manually is no easy task, even for a single item, and the typical EPC contains thousands of items. This situation is known as the reclassification problem. The paper describes the problem in greater details and also proposes a solution, which we dub "the Apricot approach".

The article starts with a brief overview about EPCs and classification systems. It then provides a description of the reclassification problem and describes existing solutions. Next, the Apricotapproach and its implementation are described. This article provides evidence that the Apricot Approach is useful and fruitful.

Keywords: Classification, Reclassification, Electronic Product Catalogs, Apricot, eCl@ss, UNSPSC, e-Business, Product Ontologies.

Introduction

In recent years, e-Business has gained attention, and buying and sellings products online in an important component of e-Business. Today for many companies its e-Business value is much higher than the traditional way of conducting business. E-Business enables shop owners to offer a huge number of different products from various suppliers. Electronic Product Catalogs (EPC) enable customers to locate and order products. EPCs started enhancing or, in many cases, even replacing the traditional area of paperbased catalogs. They provide a shop owner a cost effective way of presenting products to the customer without being bound by constraints of paper-based catalogs, such as a maximum number of pages. EPCs can inform clients when product data are updated or added. The larger number of potential products is, of course, beneficial for (I) customers, who have more choices of products, (ii)

shop owners, who can keep product data updated, and (iii) manufacturers, who are able to reach better product placing in online shops. In some scenarios, a shop owner is sent a catalog from each manufacturer containing all available products. In many cases, these catalogs contain thousands of products. A study conducted by Abels and Hahn (2006) found the number of products per catalog averaged about 34,000.

Although having that many products in catalogs has many advantages, the large amount of product data raises new problems. One major problem is providing an overview about the products and their attributes. This is where so-called classification systems come. Classification systems in e-Business have been developed, "to assign each product to a product group corresponding to common attributes or application areas" (Leukel, Schmitz & Dorloff, 2002). Classification systems will be introduced in details in the following subsections together with product catalogs.Basically they aim in providing a common structure for grouping similar products.

After giving a brief introduction about classification systems and electronic product catalogs, the next section describes today's problems with classification systems. This article focuses on the reclassification of product data. It gives an overview about existing approaches and introduces our Apricot framework for reclassifying products. This approach helps product suppliers inform their clients about new or updated product data by sending a product catalog in the specific classification system of the client. We demonstrate the functionality of Apricot and present evaluation results that have recently been finished. The novelty of Apricot is the aproach itself (unlike other solutions, it interprets existing classification information) as well as its application to e-business catalogs in terms of using and evaluating the tool.

The purpose of this article is to:

• give an overview about the meaning of classification systems as a key factor in informing clients,
• explore the problems of classification systems in practice,
• focus on the reclassification problem and provide an overview about possible solutions,
• introduce the Apricot framework for reclassification and
• describe the success of this approach in real-world scenarios, providing an overview about the evaluation results of the prototype.

Electronic Product Catalogs

Electronic product catalogs are used to store various product data in a homogenous catalog, which is often divided into different category groups. Baron, Shaw & Bailey (2000) define an electronic product catalog as "electronic representations of information about the products and/or services of an organization." Muldoon (2000) divides those catalogs into catalogs targeting the end consumer, called the B2C-catalog, and catalogs targeting other business-partners (B2B). He emphasizes that both are important for modern e-Business.

Since several years ago, various different formats are available for storing product catalogs. Some of them are based on XML and provide a high flexibility for different product types and different requirements. Examples for common product catalogs are BMEcat, cXML, OAGIS or XCBL. A comparison of those formats and their functionality and purposes is described in Quantz and Wichmann (2003). The choice of a catalog format depends on the application area as well as on the functionalities needed. Moreover, it depends on requirements of business partners and existing software solutions. It is important to consider the version number of a standard used. For example, the catalog formats BMEcat and OAGIS provide many important enhancements in their current version that were not contained in earlier versions. Though both formats are downwards compatible, which in this case means that they allow the usage of files based on a new version in systems that expect files based on the old version and vice versa, the full potential can only be revealed if both partners are using the same version of a standard.

For this purpose it necessary that both the supplier of product data and their consumer; for example, an operator of a web shop or the user of an e-procurement application, agree on using a common format to exchange product data. The usage of a standard format enables an exchange of different product data with multiple business partners. This makes it easy to integrate the data of new business partners. Dorloff, Schmitz and Leukel (2002) describe advantages that standardization in this area can have and they reference Olson (2000), who described differences of catalog exchanges in B2B domains, compared to B2C environments. He states that (i) the interaction between information systems is essential, that (ii) the business content is diverse and complex, and that (iii) the control mechanism ranges from one-sided to peer-to-peer relationships. Dorloff, Schmitz and Leukel therefore suggest fostering the usage of standard formats in this area.

Whenever different e-Commerce partners are using different catalog formats, a transformation from one format into another one is needed. Marron, Lausen & Weber (2003) demonstrate this by using XPath (see also Clark & DeRose (1999) for a similar application). Other transformation approaches can be found in Omelayenko and Fensel (2001) or in Poulovassilis and McBrien (1998).

Classification Systems

As mentioned at the beginning of this section, classification systems are used to assign each product to a specific category. In classification systems, those categories are called classes (see DIN 32705, 1987).

Classification systems can either be defined within the product catalog itself or they can be defined externally. Those classification systems that are defined within the catalog itself are catalog specific, and they tend to change from catalog to catalog. They are often called product groups. Most of the catalog formats available today provide the possibility to define product groups and to arrange products into them. In cases where the classification system is defined externally, the products are assigned to a class by using a class-code. For example, the string 49-23-15-13 in product descriptions based on theUNSPSC-System (http://www.unspsc.com), defines that this product is a toy train. Classification information can easily be integrated in many modern catalog

```
...
<Article>
   <Supplier AID>57663</SupplierID>
   <Article_Details>
      <Description_Short>XtraTrain 2005</Description_Short>
      <Description_Long>
           A battery driven toy train with blue lights for every age
      </Description_Long>
...
   <Article_Price>
       <Price_Amount>45,50</Price_Amount>
       <Price_Curency>USD</Price_Currency>
    </Article_Price>
...
<Article_Features>
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 <Reference_Feature_Group_ID> 49231513</Reference_Feature_Group_ID>
</Article_Features>
...
```

Figure 1: Product catalog fragment with a product assigned to 49231513

formats, such as BMEcat, without any problems (see Hentrich, 2001). Figure 1 shows a small fragment of a BMEcat catalog showing a product that is assigned to the class 49-23-15-13. A classification system consists of an unchangeable list of classes (see Grabowski, Lossack & Weißkopf, 2002). Almost all classification systems currently used to classify products are based on a hierarchy. In order to complement this, classification systems sometimes provide a set of keywords, descriptors, and attributes for each class. Well-known product classification systems are, for example, UNSPSC, ETIM or eCl@ss (see http://www.etim.de and http://www.eclassonline.com). Furthermore, the Technical Dictionary of RosettaNet (RNTD), a subsidiary of the Uniform Code Council (UCC), is often referred to in this domain (see RosettaNet, 2004). In the literature, other ordered structures are often called a classification system too, such as the order structure of eBay. A comparison between those three classification systems can be found in Beneventano, Guerra, Magnani, and Vincini, (2004). At the top of Figure 2(a) an example for a structure of a classification system is shown. As seen in the figure, classification systems may define a set of attributes for each class. Those attributes are used to specify the properties of products located in a class. For example, they can specify the shape or the color of a product. Usually, those

attributes are inherited along the classification hierarchy. Products assigned to a class can, therefore, define values of all attributes of the class.

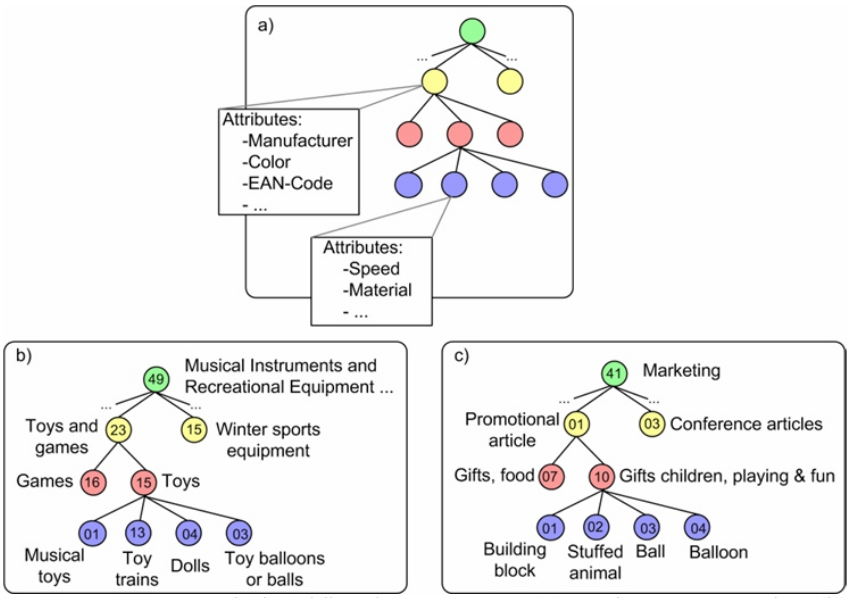

Figure 2: Structure of classification systems (a) and two examples (b), ©

At the bottom of Figure 2, fragments of two classification systems can be seen in (b) and ©. (Their attributes are not displayed because of space limitations.) The first one (b) shows a fragment of UNSPSC 5.0, while the second one shows eCl@ss 5.0. As seen in the figures, the actual code of a specific class is evolved from the codes of its upper classes. For example, the class "toy trains" is 49-23-15-13, which is the concatenation of all upper classes (49-23-15) plus its own code (13). This makes it easier to quickly sort products or to group them based on different levels.

Advantages for clients when using classification systems

Classification systems offer many advantages to customers dealing with product catalogs. The most important advantages are the possibility of grouping similar products. This enables customers to easily find similar products even though they have different product descriptions. Another advantage is that classification codes are independent from the natural language of the product description. This enables clients to search for products in all languages. Compared to simple keyword searches, a client does not have to know the exact keyword to find a product. For example, searching for "notebook" will normally not list products that are described with the word "laptop" when relying on a keyword search. There has been a lot of discussion about using classification systems and their advantages in literature within the last years. For further discussions, the following publications can be recommended: Dorloff, Schmitz, and Leukel (2002), Ding et al. (2002) and Abels and Hahn (2006).

Main Tasks and Problems

There are many different classification systems that can be used commercially without cost. In many cases, they are maintained and updated by a consortium that adds classes, and changes or removes them during the years. When applying classification systems to real-world product catalogs, then two main tasks can be identified: classification and reclassification (see Fensel et al., 2001).

Classification

The first task is the initial classification of product data. When using a classification system, it is

necessary to assign each product of a catalog to a specific class of the classification system. It is therefore necessary to analyze the product and to find a corresponding class for this product. This task can be performed manually or in an automatic or semi-automatic approach.

Classification systems in current use tend to have many different classes. For example, eCl@ss 5.1 contains more than 25.000 different classes completed by more than 21.000 keywords. UNSPSC 7.0 defines more than 18.000 different classes arranged in a hierarchy with 55 classes on the first hierarchy level. Hence, companies that use classification systems usually have to deal with a large number of classes, which sometimes makes it hard to clearly identify the correct class for a product and which leads to a relatively high amount of time needed for classifying products. In Grabowski et al. (2002) the authors identify about 5-10 minutes of work for each product when using a manual classification. The reason is the high number of similar classes in most classification systems. Using an automatic or semi-automatic process can help to speed up this process. For example, a semi-automatic classification of product data is provided by Storeserver Classifier (see Storeserver, 2005) or e-proCAT (see e-proCAT, 2005).

Reclassification

The second important task that appears when using classification systems is the reclassification of product data. According to Beneventano and Magnani (2004) this is the process of classifying a product that has already been classified before. This becomes necessary whenever a product catalog has been classified using a classification system that is not identical to the classification system needed for further processing. For example, one might have used UNSPSC to classify a product catalog but the business partner might use eCl@ss. In those cases, it is necessary to switch from one classification system to another one. Hence, all products of the catalog have to be assigned to the new class structure. As stated by Tanenbaum (1996), "the nice thing about standards is that there are so many of them to choose from".
The client (e.g. a small company) of a product supplier often uses an e-procurement system to exchange product data. Clients can use product catalogs of suppliers to integrate products into their e-procurement system, allowing them to order products electronically. If client and supplier are using different classification systems, then an integration of the product catalog into their own classification structure within the e-procurement system requires manual work. Providing an automatic or semi-automatic reclassification will help to better inform clients of new product data. The reason is that the catalog of the supplier can automatically be reclassified before it is integrated into the e-procurement system. This allows the client to easily access the new catalog data in a faster and much more cost effective way.

Existing Solutions for Reclassifying Products

When looking at existing approaches and their implementations for performing an automatic reclassification of product data, two different types can be identified:

1.Approaches based on a mapping between the two classification systems.
2.Approaches based on analyzing product data (mainly descriptions)

The first type is based on the idea of creating a mapping between the two classification systems.
For example, a mapping might be defined that says "49231513" in UNSPSC is the same as "41011006" in eCl@ss. Using a table of those mapping definitions enables us to simply searchand-replace the existing classification information with the new class coded. Table 1 shows an example fragment of such a table:

Table 1: Fragment of a mapping between UNSPSC and eCl@ss

Source		Destination
Unspsc:industrialpaper	→	eCl@ss:writingpaper
Unspsc:businesspaper	→	eCl@ss:writingmaterialdrawingmaterial
Unspsc:toiletpaper	→	eCl@ss:hourseofficesantcleaner
...	...	...

There are several approaches that describe how to create such a mapping. For example, Beneventano and Magnani (2004) and Benetti (2001) describe those approaches.

For a reclassification of product data in e-Business, the use of mappings allows a very fast reclassification with low efforts, once the mappings are produced. An exclusive usage of mappings is, however, normally not possible because, in most cases, there is no isomorphism between the systems. Ding, Fensel, Klein, Omelayenko, and Schulten (2003) mention the following problems, "Mapping the content standards by specifying pairs of equivalent categories is not always possible due to different principles used to aggregate the products into categories of the same abstraction level. For this reason, for example, mapping UNSPSC to eCl@ss includes creation of manyto-many bridges regrouping the products to categories." In Schulten et al. (2001) similar problems have been identified. It is most likely that the first classification has a different hierarchical structure and depth than the second one. Because of this, there is a lack of information for classifying a product correctly when limiting to a pure mapping approach. For example a classification B system might have a category called Paper in the main category Office Materials. B might now need an additional break down into White Paper, Recycled Paper, etc. (see Figure 3). Hence, additional information is needed to re-classify all data correctly. To perform the re-classification it is in this case not enough to map the categories of both classification systems, but to analyze each product data independently and it is, of course, desirable to automate this classification and reclassification processes as much as possible to save both time and costs.

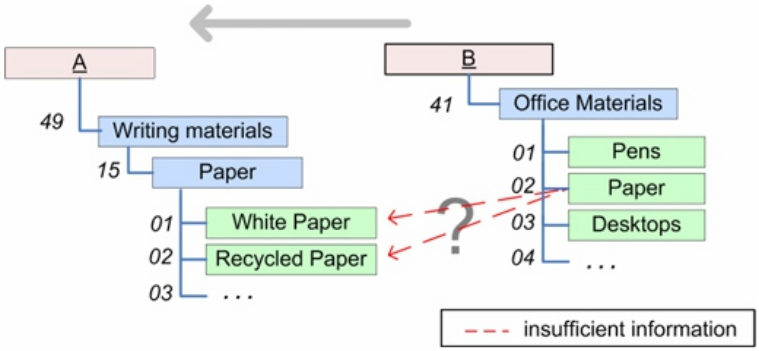

Figure 3: Problems of an application of mapping information for re-classification

Since the classes of the two classification systems are in most cases very different, the described problem appears in many mappings. In Häusler (2005) an example for 50 classes is given for a mapping between UNSPSC and eCl@ss. The result was that in the average, each eCl@ss class could be mapped to about 6 classes in UNSPSC. This means that this approach is not suitable for performing a complete reclassification of product catalogs.

The second type consists of approaches based on analyzing the data of each product in order to assign the product to an appropriate class. Those are basically classification approaches that neglect the existing classification information and that try to perform a complete new classification of the product into the new taxonomy.

Examples of existing implementations are Goldenbullet (see Ding et al, 2002), PAK (see Grabowski et al., 2002), ePro-CAT and Storeserver Classifier. Their main information source for performing the classification is the interpretation of product descriptions and keywords. The success of a classification based on such an analysis of the descriptive product data varies strongly and is dependent on the concrete approach. Ding et al. (2002) indicate that to achieve a precision of 78% with their Approach called GoldenBullet, they use a Naïve-Bayes classification in GoldenBullet to classify 40% of the products, while they used the other 60% as training data for the algorithm. They testified that this rate is already higher or at least equal to the error rate of a manual classification. In Wolin (2002), the AutoCat system is introduced, which is able to classify between 77.3% and 79.5% correctly. Agrawal and Srikant (2001) use an approach that considers the similarity between products when classifying them. They use the taxonomy of Google and Yahoo for evaluating their approach and reach between 58.9% and 64.4%. In summary, existing reclassification schemes have severe problems.

The Apricot Approach

The main task of the classification process is to find the correct class for a product. In the case of a reclassification process, we have the same task but this time we have additional information that can be interpreted: this is the information of existing class assignments of the product. This information is neglected in most existing solutions since they were not developed for the reclassification but for the classification of products. In our Apricot approach, we use this information to perform a higher success rate than most other approaches. Apricot is an integrated approach that is, on the one hand, able to interpret product data such as the product description and, on the other hand, considers existing classification information as well. In this section, we describe the Apricot approach to provide an overview about how Apricot works.

Our approach can be divided into several interconnected phases that are arranged as a circle in order to reclassify all product data. In our approach all products are reclassified sequentially. The phases of Apricot can be summarized as:

1.Preparation of language based and catalog based information,
2.Cleaning & Enhancement,
3.Analysis,
4.Combination,
5.Class selection & attribute generation, and
6.Enrichment.

Figure 4 shows these phases and their succession. As soon as the reclassification process has been finished, the product data are stored in an output catalog and the Apricot approach is finished.

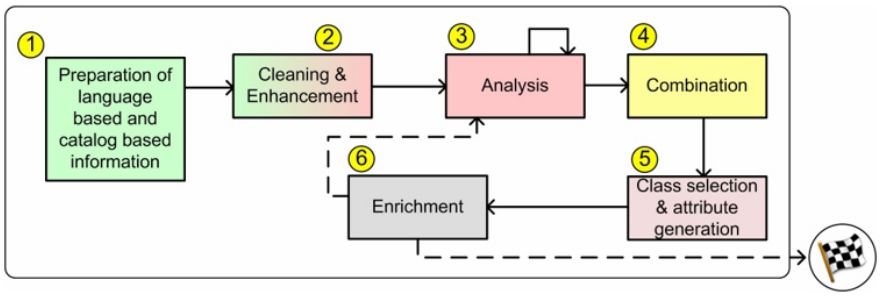

Figure 4: Different phases of the Apricot approach and their succession

Phase 1: Preparation of Language Based and Catalog Based Information

The preparation phase is used to import all necessary information needed for performing the reclassification process. This includes three different kinds of information:

1.Information from the product catalog.

The product catalog itself is parsed and imported into a data structure that represents the product catalog, including all of its information. For the implementation of Apricot, we realized the support of BMEcat product catalogs. Hence, an XML-parser for BMEcat is used in this phase to parse the catalog and to retrieve all product information, such as product descriptions, price information and product groups.

2.Information from the specifications of the classification systems.

Apart from the catalog information, the class hierarchy of all involved classification systems is needed. Hence, their class structure is imported and represented in a data structure within Apricot. It is important to not only import the class names but to also consider class attributes, keywords and synonyms if available.

3.Language information used in the later phases.

Among other data, class names, product names and attribute names have to be interpreted in a later phase of Apricot. Because of this, it is necessary to import some language dependent information such as a dictionary or a thesaurus. In order to assure that the approach is completely language independent, that information is imported based on the language of the catalog that has to be reclassified.

Phase 2: Data Cleaning & Enhancement

To detect similar classes and to interpret product related data, it is necessary to adjust all data to each other. For example, a price in USD for a product could be written as “12,34 $” or as “USD 12.34” or it might even be available in a completely different currency. Apricot tries to recognize this and to adjust all data to a common format with identical units in phase 2.

Moreover, text information is cleaned, too. This is done by using a language based stemming algorithm, such as the Porter Stemmer (see Porter, 1980). This makes it possible to replace all words with their basic form. For example, the word “houses” is replaced with its singular (“house”). Furthermore, so-called stopwords are removed. Stopwords are words that do not have any influence for the further processing. Examples in the English language are “he”, “the”, “for”, etc. Further information can be found in Heyer, Quasthoff & Wolff (2002).

Apart from adjusting information, this phase performs an enhancement of the existing information. This is done by (a) performing a word splitting of compounds (“football” Æ “foot” + “ball”) and by (b) adding synonyms wherever possible (“laptop” Æ “notebook”).

Phase 3: Analysis of Data

The third phase is the main phase of the approach that integrates several different approaches, called "analyzers," for interpreting the data from the product catalog and from the existing classification information. An analyzer might, for example, be based on an approach that uses the product keywords as a base for assigning a product to a class by comparing the class name with the product keywords. It might also be a machine learning approach using the product descriptions as a base for finding possible class assignments.

A controller forwards the product data to all analyzers. They can be divided into three different types:

1.Classifiers: Classifiers are based on the product catalog data. They analyze product properties in order to find potential classes for a product. For example, they might analyze the product description or its keywords and compare it with the class names of the classification system.

2.Reclassifiers: Reclassifiers are based on the existing classification information. They try to look at the current position of the product in the classification systems. For example, a product might already be classified based on UNSPSC and it might furthermore be located in a product group. A Reclassifier uses this information to find possible classes in the structure of the new classification system.

3.CategoryFilters: While Classifiers and Reclassifiers both result in a list of potential classes for the product, CategoryFilters use another approach. They analyze all classes in order to remove those filter classes that are very unlikely for the product. For example, if we know that a product costs about 5,- $ then it is very unlikely that this product belongs to a class that consists of 1000 other products each costing more than 500,- $. Our evaluation of Apricot has shown that the analysis of product prices is, for example, able to filter about 7.73% of all classes.

Figure 5 shows the analysis phase. Each analyzer contains a priority that can be changed by the user. This makes it possible to change the influence of an analyzer if necessary. For example, one might want to define that an interpretation of product descriptions is more significant than the interpretation of existing classification information.

After applying all analyzers, their results are collected and forwarded to the next phase of Apricot that deals with the combination of the results.

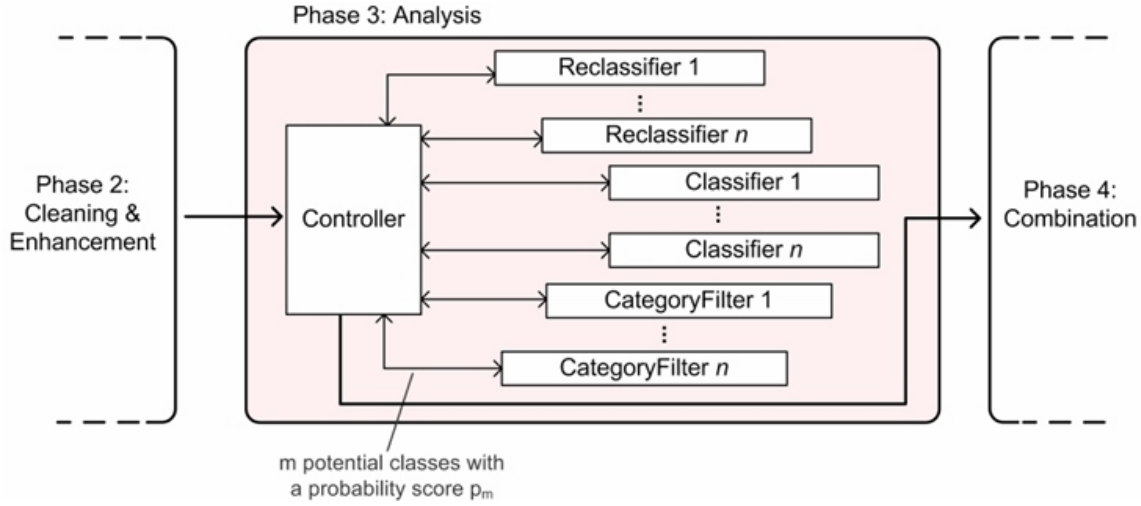

Figure 5: The third phase consisting of a controller and a set of analyzers

Phase 4: Combination

Within the combination phase, Apricot combines the results of all analyzers based on their priority. This phase aims at creating an aggregated list of potential classes for the product. This list is ordered by a score value that represents the probability of the class belonging to the product. For example, Table 2 shows on the left part the input of the combination phase. This input consists of a list of potential classes and its probability for each analyzer as well as a priority value. The right part of the table shows the output of this phase. In Table 2, we have shown a simple aggregation that uses the priority as a weight factor. In this case, the priority was chosen manually. Within the Apricot framework, it is possible to change the way, figures are combined. There is also an approach for automatically determining the priority of all analyzers. For more information, please look at Abels and Hahn (2005).

Table 2: Input and output of the combination phase

Results of analyzers					**Aggregated results**	
Analyzer-No	Priority	Class	p		Class	Score
1	3	Class_1	0,50		Class_1	6,00
1	3	Class_2	0,25		Class_2	0,75
2	6	Class_1	0,75		Class_3	1,50
2	6	Class_3	0,25		…	…
…	…	…	…			

Phase 5: Class Selection and Attribute Generation

The fifth phase of Apricot, class selection and attribute generation, consists of two sub phases. The first one is the selection of a class for the product. This can either be an automatic or a manual step. In an automatic approach, the class with the highest score in the table that has been produced in the last step is chosen. In case of using a manual selection, the user is involved. For each product, the product data and the first entries of the table created in phase four are displayed to the user. The user is then free to select the correct class for each product based on the suggestions of Apricot.

Once the class has been selected, Apricot generates attributes for the product based on the attribute list of the class. As stated in the last section of this article, some classification systems, such as eCl@ss, provide a list of attributes for each class. Those attributes are, for example, the manufacturer or the color of the product. Apricot tries to generate these attributes automatically. This is done by using three information sources:

1. Existing attributes from other class assignments.

When reclassifying products, we assume that the product has been assigned to at least one other class structure before we classify it to the classification system that we need. For example, we might need the product data to be classified based on eCl@ss and it might have been classified based on UNSPSC and ETIM before. It is also possible that the product was classified before based on the same classification system in a different version than the one that we need. For example, we might need eCl@ss 5.0 and the product might already have been classified based on eCl@ss 4.1. -- Hence, there are a lot of cases where the class attributes were already defined in the existing classification information. Apricot, therefore, looks at this information and tries to find identical or very similar attributes. If Apricot finds such an attribute, its value can be reused to generate the new attribute.

2. Product properties from the catalog data.
Several class attributes such as the product manufacturer or the EAN number of a product, might also be specified as product properties within the electronic product catalog data itself. For example, BMEcat catalogs contain an extra field for specifying the manufacturer of each product. In those cases, Apricot uses the product data to generate the attributes, as needed by the class.

3. Extraction of information from the text description of the product.
In cases where Apricot was not able to find the attribute data in existing classification information or in the product catalog data, it is possible to scan test-based product information, such as the product description, for finding out the attribute values. (This method is not yet included in the current implementation of the approach) This is, of course, a very vague way of detecting product attributes but it can be useful for some specific attributes. For example, if we find a string 10" x 12" x 80" in the product description then it is very likely that these values represent the dimensions of the product.

At the end of the attribute generation, the suggested values are displayed to the user so that he or she can change or complete the data if necessary.

Phase 6: Enrichment
At the end of the last phase, the product is classified completely. In the sixth phase, the class assignment is used to enrich the analyzers. Since some analyzers might depend on a machine learning approach, the assignment is forwarded to a special interface of the analyzers allowing them to use the decisions as a base for future assignments.

Once, the enrichment is finished, Apricot either continues with the next product or it ends the process by storing the reclassified catalog with all necessary information.

Realization and Evaluation Results
Apricot was conceptualized and implemented in a two years project. Its first prototype and the evaluation of this prototype have just been finished allowing us to present the evaluation results in this section.

Realization
Apricot was realized as a framework for automatic or semi-automatic reclassification and therefore it does not have a specific user interface. Instead, it provides methods for other software applications to start and manage the reclassification process. To evaluate the framework and to gain an impression of its capability, we created a demo application in Java. This application can be used to completely reclassify BMEcat based product catalogs into several classification systems. In our first prototype, we integrated eCl@ss 3.0, 4.0, 4.1 and 5.0 as well as ETIM 2.0 and UNSPSC 5.0 and 7.0. Figure 6 shows a screenshot of Apricot that displays the classification window allowing the user to select a class for a product during phase 5 (class selection).

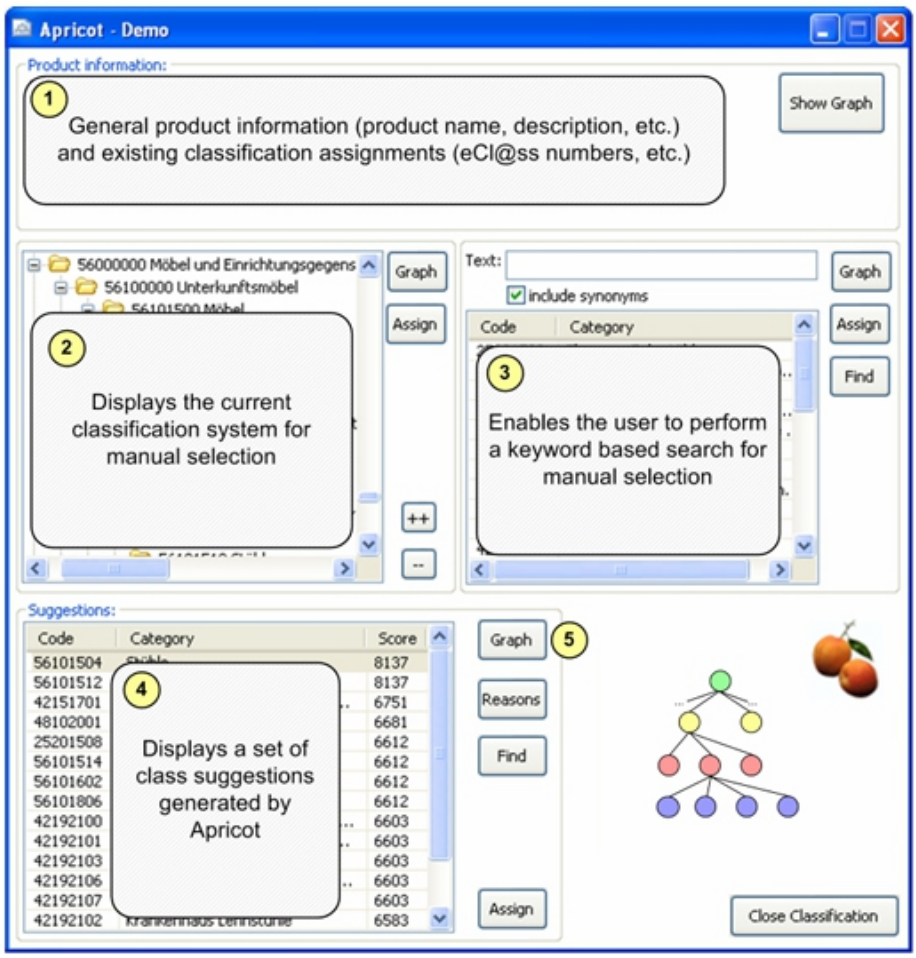

Figure 6: Screenshot of the Apricot demo application

As seen in Figure 6, the window displays some product information (1) and it offers the user to either manually select a class of the classification system or to select a class from the suggestions of Apricot (4). In case of manually selecting a class, the user can either use the class tree of the classification system (2) or can search classes by keywords and their synonyms (3).

The Apricot demo software monitors the user's behavior in order to collect statistical data. We collect the following information:

- Percent number in which the user used the first suggestion of Apricot (Top-1)
- Percent number in which the user used one of the first 3 suggestions of Apricot (Top-3)
- Percent number in which the user used any suggestion of Apricot (Top-100) (We limited the number of suggestions from Apricot to a maximum of 100 classes)

Clicking on the "Graph" button of the window (5) displays an interconnected graph of information used by Apricot to reclassify the product. It opens another window with graphical nodes that can be clicked and enhanced to view, for example, the product catalog and its classification information graphically. Figure 7 shows a screen shot of this information for a product "GrandStar 2005".

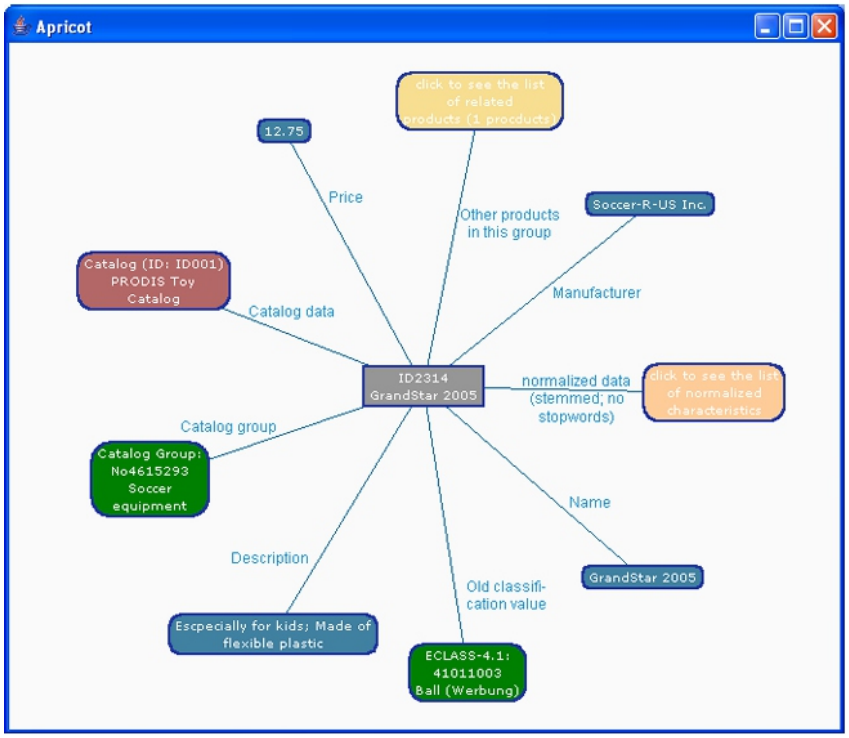

Figure 7: Interpretable data when reclassifying products

Evaluation Data and Evaluation Results

To perform an evaluation of Apricot, the demo application of the Apricot prototype was used to monitor the user's behavior as stated above. For evaluation purposes we used a test catalog based on real-world product data from the "office material" domain. We created a test set of 100 products and classified them manually based on UNSPSC 5.0. Furthermore, we arranged the products into 29 different product groups. For our evaluation, we chose eCl@ss 4.0 as our destination classification system for the reclassification process. All products in our test catalog got price information, a product name and a short product description (one sentence per product). Some of the products contained a manufacturer name and some keywords.

Duration of the reclassification process and memory needed

In our test scenario, Apricot needed between 3 and 15 seconds depending on the hardware and depending on the product details. Afterwards, Apricot displayed the suggestions to the user. Including the time each user needed for choosing a class, the whole process took about 1.25 minutes on average. Compared to a manual classification, this is between 4 and 8 times faster since manual classification usually takes between 5-10 minutes (Grabowski et al., 2002). For our test scenario, about 256MB of RAM was used by Apricot to manage the classification systems and the catalog data.

Quality of the reclassification process

As explained above, the demo application monitored the Top-1, Top-3 and Top-100 values when performing the evaluation. We distinguish between the first 50% of the product catalog and the second 50% because some of our analyzers used a machine learning approach allowing them to continuously increase their quality during the reclassification process.

We included a special analyzer that received a set of keywords defined by the user. Those keywords were

used to modify the suggestions of Apricot to re-score them. The idea is that product catalogs normally belong to a specific domain. For example, they deal with office material or sports equipment, etc. Therefore, classes that deal with this domain are more likely than classes from other domains. In our approach, this set of keywords is called a "context". We evaluated the Apricot approach using three different scenarios with (i) no definition of a context, (ii) a very short set of 3 words (short context) and (iii) a detailed context with 29 words. For example, the short context consisted of { "office", "material", "desktop" }. The results of our evaluation can be found in Table 3.

Table 3: Evaluation results of the Apricot approach

Type	No context	Short context	Detailed context
1st 50% of the product catalog: (with no or only a few machine learning effects)			
Top-1	64%	38%	68%
Top-3	82%	70%	84%
Top-100	94%	92%	96%
2nd 50% of the product catalog: (with machine learning effects produced by the 1st 50%)			
Top-1	76%	46%	76%
Top-3	86%	76%	88%
Top-100	98%	94%	98%

In the first set of rows representing the first 50% of our product catalog, all machine learning analyzers are untrained. Hence, there is no machine learning effect that could be used by any analyzer at the beginning of the process. Hence, the results of the first rows can be viewed as the accuracy rates that are produced when using the Apricot approach without training. As the reclassification process goes on, the analyzers start learning from products that have already been classified correctly. Hence, the accuracy increases because of those machine learning effects. In Table 3, this can be seen by looking at the numbers of the second 50% of the catalog. Those numbers can therefore be interpreted as the accuracy of Apricot approach with training.

As seen in Table 3, in about 76% of all cases, the first suggestion of Apricot is accepted by the user and is, therefore, considered to be a correct suggestion. In about 88% of all cases, the correct class was included in the first 3 recommendations and in up to 98% of all cases the correct class was at least within the set of suggested classes of Apricot.

Surprisingly, the definition of a context, in terms of defining keywords for the catalog, is not always beneficial. The evaluation has shown that a small set of words actually decreases the quality, while a detailed set can slightly increase the overall results.

We repeated our evaluation for two external product catalogs provided by two companies that deal with office material, and we got very similar percent numbers with those catalogs. (There was only a small deviance of between 5%-10%.)

Comparing the evaluation results with existing solutions that have been introduced in an earlier section of this article, we can see that the overall results outperform many products in quality. One of the major advantages of the Apricot approach is, however, the possibility to use the approach with good results from the beginning of the product catalog. It is not necessary to provide a large amount of training data or to pre-process a certain percentage of the catalog. Apricot starts with a good success rate right from the first product and increases the quality during the reclassification process.

Since UNSPSC does not support attributes, we repeated the evaluation again by reclassifying products that were based on eCl@ss 4.0 to eCl@ss 5.0. Looking at the generation of product attributes, Apricot was able to generate about 85.7% of all attributes automatically by looking at existing classification attributes and by interpreting catalog data.

Conclusion and Further Research

The evaluation of the prototype has shown that Apricot provides a highly flexible and fast approach that is able to provide a high quality for a semi-automatic reclassification. Compared to other solutions, Apricot reuses existing classification information and it is based on the integration of several different analysis approaches. It can be used as a way for performing a semiautomatic reclassification by interacting with the user or it can be used as a way to identify a list of potential classes for a product that is used as a basis by other applications. This can speed-up the integration of new products from a supplier into the systems of his client. Hence, the exchange of information between the supplier and the client is improved. The realization and the evaluation have shown that the reuse of existing classification information can be an important information source for performing semi-automatic reclassifications.

Since Apricot is still a prototype, it would be interesting to perform some additional testing in real-world scenarios by integrating Apricot into existing product catalog systems any by using it in a long-term in order to identify weak points and additional requirements. The test catalog is currently based on two real world catalogs that have been combined. In the next phase, we want to perform a long-term evaluation by integrating our system into a real-world e-procurement system. This will give us detailed information on how the system develops within a large time scope.

This will also allow verifying the long-term development of the machine-learning analyzers. However, since it is necessary to perform this evaluation in a real-world environment with multiple users, this experiment is scheduled to last at least six months. We hope that it will help to identify parts of the system that might be improved.

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Good Intuition or Fear and Uncertainty: The Effects of Bias on Information Systems Selection Decisions

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ABSTRACT

IS selection decisions are traditionally viewed through a techno-rationalist lens; however, it is clear that numerous biases affect the decision makers. In this paper, we have categorised common types of biases into four groups. Firstly, information biases distort information and how it is weighted. Secondly, cognitive biases are "games" decision makers play to simplify information processing. Thirdly, risk biases distort the way information is used in order to minimise risk. Finally, uncertainty biases act to reduce the uncertainty surrounding decisions. In this paper, we have developed a framework for conceptualising how these biases interact and affect decisions. After introducing the framework, we use it to examine specific Information Systems acquisition decisions in two organisations. The first organisation is a not-for-profit Australian health and aged care group that purchased a Patient Management System. The second organisation is an Australian higher education institution that purchased an Enterprise Resource Planning system. The paper concludes that the framework is useful; however context has an important role in determining the effects of bias on decision outcomes.

Keywords: Bias, Uncertainty; ERP, Decision Making

Introduction

Decisions relating to the selection of Information Systems (IS) are becoming increasingly complex and at the same time critical to many organisations. Decisions are the outcomes from the process of assessing and evaluating factors and decision making is the act of choosing among alternatives (O'Reilly, 1990). The informing systems that affect decision making are influenced by a number of contextual organisational factors including cost, time and resource availability (Simons & Thompson, 1998). Though a wide body of literature exists on decision making processes and models (see for example March & Simon, 1958; Mintzberg, Waters, Pettigrew & Butler, 1990; Simon, 1997), little research has been conducted about the informing systems and influences affecting senior managers mak-ing decisions relating to IS: one such group of influences is bias. Biases distort and filter the information available to decision makers and though there is considerable literature from the management and psychology disciplines describing the effects of bias on decision making, the nexus between such biases and IS decision making outcomes is poorly documented and understood.

The limited amount of research into IS decision making has revealed that IS decision making is rarely logical or rational (Bannister & Remenyi, 1999). This is contrary to conventional thinking that the decision to purchase or implement an Information System follows standard large capital acquisition practices and is the result of a formal evaluation with logical and rational justifications (Ballantine & Stray, 1999; Doherty & King, 2001; Irani & Love, 2001; Lin & Pervan, 2001; Verville & Halingten, 2002).

The lack of rationality in many IS decision making processes can often be traced back to contextual influences, many of which are intangible biases (Jamieson & Hyland, 2004). This study seeks to

highlight and describe the effects of these biases on IS decisions outcomes by examining their role in two large IS projects. This research aims to establish ways of mitigating negative effects of bias, while modelling its role in complex IS evaluations.

The paper begins with an overview of this study where a model of the interaction between information, bias and decision making is described. The theoretical background to the research is detailed by describing four groups of biases that affect informing systems. The case study methodology and analysis techniques are then outlined. The paper then presents findings of empirical research with a focus on the bias groupings identified from the literature. The paper concludes with a discussion and analysis of the findings and presents a revised version of the theoretical model.

Theoretical Background

As Simon (1987) noted, intuition does not operate independently of logical analysis as the two elements are complementary in a decision making processes. While Simon understood that elements such as stress play a part in the rationality of decision making processes, he also noted that there are a number of cognitive and environmental biases that also affect decisions. These biases, in combination with other contextual factors, can radically affect the way information is gathered and processed within the informing system.

Four groupings of biases that affect decision making are prevalent in the literature. These are information biases, cognitive biases, risk biases and uncertainty biases. For the purposes of this study, their effects on informing systems, information and the way information is processed has been developed into a model as depicted in Figure 1.

In this model, bias affects decision making in two ways. Firstly, information flows into a decision making process and in doing so may pass through one or more bias lenses of filters. A bias lens is a conceptual view through which decision-makers process information. The lens has the potential to screen, alter or intensify the information that enters it. An example of this is an information bias that distorts the perceived benefits of a decision option. Secondly, biases can influence how the decision occurs by shaping the process. An example of this is an uncertainty bias that restricts or stops the search for informing factors.

Not every bias group will be present in all organisations and decisions. However, from the literature, it is clear they have a role in decision making. In this section, each of the bias groups and their effects are described in order to provide the theoretical background to the research and for later justification of the findings and development of the model.

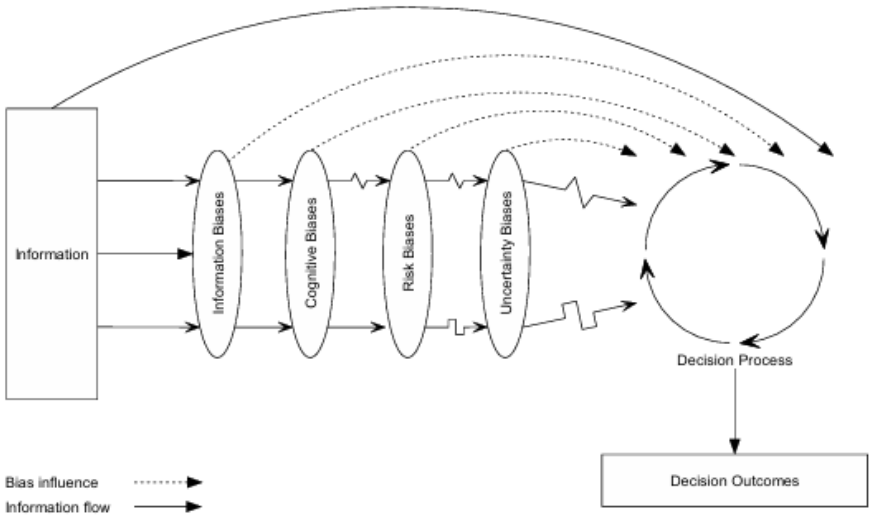

Figure 1 - Bias in an informing system

Information Biases

Information biases are the first group filters and influences that affect decisions. This is because, when choosing amongst alternatives, decision makers often unconsciously distort information. This is known as desirability bias, optimism, outcome bias, value bias and wishful thinking (Russo, Meloy, & Medvec, 1998). In their study of pre-decisional information distortion, Russo et al. found that the formation of preferences occur without instruction and this can lead subsequent pre-decisional distortion of product information. They also found that pre-decisional distortion is proportional to prior confidence in the leading alternative. This means that even when decision makers are not asked to choose an alternative based on information presented to them, they still intuitively form a preference. This preference then biases or distorts their decision making process. Russo et al. also found that even when presented with clear, factual, non-subjective decisionrelevant diagnostic information that presented contrasting information between alternatives, people still exercised individual pre-decisional distortion. They note that pre-decisional distortion presents a genuine risk to choice accuracy and provided a reason for this bias:

The desire to reduce effort might lead to pre-decisional information distortion, as follows: Distortion builds confidence in the leading brand, which enables a sufficient level of confidence to justify stopping the search for product information sooner than it would have been without distortion. Earlier stopping saves the effort of additional information search (Russo et al., 1998, p. 448)

This behaviour reinforces the satisficing decision making in Simon's (1967) rational model and his view of administrative behaviour and the administrative man (Simon, 1997). This means that while information biases can distort information, they can also alter the way in which the search for information occurs.

Cognitive Biases

In order to simplify decision making, a second group of biases, Cognitive biases, are applied to decision making. Duhaime and Schwenk (1985) argued that the amount of information available to decision makers often exceeds the decision makers' processing limits. Since decision makers are often unable to cope with all the information relevant to a decision, they simplify the decision making process by

applying cognitive filters or biases. Brindle (1999) refers to these biases as cognitive games. The four main biases that Duhaime and Schwenk (1985) have identified are reasoning by analogy, illusion of control, escalating commitment and single outcome calculation.

Analogy

Reasoning by analogy is the application of analogies from simple situations to complex strategic problems. Duhaime and Schwenk note that this scaling of analogies from simple to complex problems can lead to an over simplification of the information to be considered in making the decision. Brindle (1999) calls this bias the misuse of analogy game and described it as the process of comparing and referencing other past decisions to the current decision under consideration. This analogy provokes a subtle emotional bias that causes the decision maker to either focus on or ignore certain information, depending if the information was relevant to the decision that it is being compared to. It will also lead to elimination of decision alternatives if they were similar to failed selected alternatives in previous decisions. Finally, misuse of analogy can be used to build support for a decision alternative. This occurs when an alternative is the same or similar to the alternative in the previous decisions.

Illusion of control

The illusion of control is where decision makers overestimate the extent to which the outcomes of a decision are under their personal control and their ability to correct or fix problems should they arise as a result of a decision. There is also an overestimation of the personal ability of the decision maker to actually make the decision. This form of bias tends to occur in individuals who have experienced prior success in complex decision making. Decision makers affected by this bias tend to focus on the parts of the decision they can control and not think about the factors that exhibit uncertainty. They also overestimate their own capabilities in order to reassure themselves in the face of uncertainty.

Escalating commitment

Escalating commitment is the tendency for a decision maker to maintain and increase support for a decision, even if the decision appears to be having negative consequences. An example of this occurs when a decision is made to acquire a product. Following the decision, there is a significant feeling of personal responsibility by the decision maker to remain with the product even if it is not performing, thus the bias in this example would deter divestment. This is a potentially harmful bias as there is evidence of its negative effects, particularly on Information Systems projects, in the literature (Mahaney & Lederer, 1999; Smith & Keil, 2003).

Single outcome calculation

Single outcome calculation is the restriction of decision alternatives to the most promising ones as determined by shared beliefs within the organisation at the time of the decision. This provides a rapid convergence of options but restricts creative alternatives. This restriction of alternatives can be as severe as a single option without any search for alternatives. This is common in the case of divestment where the organisation reaches the collective belief that a failing capital investment decision must be reversed. This type of bias reduces stress in the decision making process.

Other cognitive biases or games include the framing game, the criteria selection game and the rationality game (Brindle, 1999). The framing game is concerned with the way a problem is defined and constrained. If a problem's dimensions are reshaped, this will affect the information

sought and decision alternatives. Once framing occurs, there is a commitment to the way in which the decision is being made. This can be thought of as a combination of Bainbridge's (2002) overconfidence bias and Duhaime and Schwenk's (1985) escalating commitment. Decision makers become attached to their understanding of the problem and the decision alternatives. They become increasingly less predisposed to admit new information and alternatives into the decision making process. Sometimes framing is simply a case of not looking at the real problem (Brindle, 1999). Brindle (1999, p. 609) notes "sometimes, decision makers are not aware of their real agendas, but present the problem, often with perfect integrity, as the way they 'see' it".

The criteria selection game is described as the bias decision makers have towards measurable, quantitative data as opposed to less measurable qualitative data (Brindle, 1999). Decision makers like simplified, easy to understand data, even though this may omit details that are necessary in the decision process. Maritan (2001) supports this view with her findings that quantitative data is more heavily relied on for justifying capital investment projects. Visual data, such as graphs and charts, will be more important to decision makers than qualitative arguments (Brindle, 1999). As discussed later, this "game" is the result of uncertainty and the need to reduce information load.

Brindle (1999, p. 611) calls the rationality game as "the most insidious game". This bias occurs when decision makers produce rational arguments to constrain the information search or list of alternatives. The underlying reasons for these rational constraints are not examined and are not transparent. These restrictions constrain the decision maker and the ultimate quality of the decision. The key point is that the underlying reasons are not challenged. There is a degree of crossover between this game and Duhaime and Schwenk's (1985) concept of single outcome calculation in that organisational beliefs quickly constrain the alternative list.

It is important to understand that these cognitive games are not deliberate attempts by decision makers to distort information or the decision making process. The application of these biases is a reaction to the complexity of decisions and the need to simplify the management of information. It should also be evident that bias groups do not act in isolation of one another.

Risk Biases

Risk biases form the third group of filters and influences that act on the decision process. These biases mainly act on decision alternatives and minimising risk during the decision process. The perception of risk can bias decision outcomes because many of the information and cognitive biases that are used by decision makers are also used to mitigate risk. Conventional decision making theory suggests that choice is a combination of risk and expected gain. Decision makers who are risk averse choose alternatives that may have lower potential gains, with smaller variations of outcomes and with relatively low risk. Decision makers who are risk seeking choose alternatives that potentially provide higher gains, though with greater variation in outcomes with higher risks (March & Shapira, 1987). However, based on an unpublished work of Shapira's (Shapira, 1986, as cited in March & Shapira, 1987), March and Shapira provide a number of insights into managerial perceptions of risk that showed variations from conventional decision theory.

The first area concerned the definition of risk and concerning this, they had three findings. Firstly, they have found that in weighing up decision alternatives, managers do not treat uncertainty about positive outcomes as risk. Risk is only associated with potential negative decision outcomes. Secondly, managers

view risk in terms of magnitude, not probability. Managers view risk in terms of how much negative impact a decision alternative could cause, not the combination of probability and the impact of the decision. Managers look for worst outcomes or maximum losses which in themselves do not indicate risk. Thirdly, while managers discuss and seek precision in measuring risk in quantifiable terms, most managers are not interested in reducing risk to a single quantifiable figure or formula. This is perhaps not so surprising given the difficulty in establishing such metrics in the first place.

The second area concerns attitudes towards risk. March and Shapira (1987) have found that the perception of risk and risk taking varies depending on the position in the organisation. For example, senior managers see risk taking as important and were more likely to take risks. However, March and Shapira have found that practically, managers were individually risk adverse within organisational structures, encouraged group decision making and did not encourage risk taking. This contrasted with their findings relating to managers' beliefs about their individual risk taking. Managers believed that they were more judicious and less risk averse than their colleagues, while also believing that they were greater risk takers than they actually were. Managers believed that risk taking was essential to their roles and acknowledged the emotional pleasures that risk taking provided. However, taking risks also depends on the context of the decision. If a decision maker is operating above the expected performance target, they are less likely to take risks. If the decision maker is operating below target, they are more likely to take risks.

The third area concerned dealing with risk. Managers were reported by March and Shapira (1987) as believing that risk was a manageable issue and made the clear distinction between risk and gambling. While gambling involved inherently uncontrollable risk, risk taking involved the reduction of uncertainty and risk modification. Managers would seek to reduce the probability of negative alternative consequences before making the decision. However, managers often do this by reassessing or modify the risk associated with a given alternative, either by recalculating the risk or including controlling strategies. This behaviour is an application of information and cognitive bias. It is clear from these findings that risk has some influence on decision outcomes and processes. However, in order to mitigate risk, decision makers seek to reduce uncertainty. This relationship with uncertainty biases is explored in the next section.

Uncertainty Biases

The final grouping of biases is Uncertainty biases. These filter and influences act on information and process in order to reduce uncertainty in the decision maker. The level of uncertainty surrounding a decision creates a bias that alters the way in which information is gathered and the decision is made. In order to reduce uncertainty, decision maker often use cognitive games, or biases. Uncertainty is the perceived gap between the information available and the information a decision maker wants to have (Buchanan & Kock, 2000). It is the difference between the knowledge required to make a decision and the knowledge a decision maker has at that time and it is often inversely proportional to the decision-maker's level of understanding of the problem (Falzon, Zhang, & Davies, 2000).

Uncertainty influences both the decision maker and the outcome of the decision and occurs when the decision maker is unable to assign definite probabilities to the consequences of a decision (March & Simon, 1958). In order to reduce uncertainty, decision makers often attempt to acquire more information. Daft and Lengel (1990) indicate that as part of this behaviour, decision makers often gather and rely on more information from external sources, especially if there are limited internal sources

available. However, as discussed later, some research suggests that the acquisition of additional information is not necessarily informing better decisions or reducing uncertainty (Buchanan & Kock, 2000; Chan, 2002; Grise & Gallupe, 2000; Iselin, 1993) and there is considerable evidence to suggest that providing additional information can increase uncertainty levels (Bartlet & Green 1966, Dudycha & Naylor 1966, Khon 1974, and Woodruff 1972, as cited in Jacoby, 1977).

Information

The measurement of the information used in decision making is described as Information load. Information load is "the variety of stimuli (it consists of all data and information available to the decision maker) to which the receiver must attend" (McCormick, 1970 p. 114). It consists of external stimuli, dimensions of information, diversity of information and alternatives (Grise & Gallupe, 2000). Iselin (1993) separates the concepts of information and data load by defining data load as the number of cues or pieces of data that were not relevant to the decision and information load as the number that were relevant to the decision. This meant that, of the data relevant to the decision, only a given proportion of it could be used as information directly informing the decisions, while the remainder, the data load, was simply discarded. It was found that increasing the data load resulted in poorer decision quality (Iselin, 1993).

Part of the problem associated with the way decision makers process information is the way in which data is presented. Decision makers may be more effective when they are presented with data in a form that has a greater cognitive fit with their decision making processes (Mintzberg, 1972; Umanath & Vessey, 1994). If data can be manipulated and presented in a more effective way, this may reduce information load, for example, presenting data graphically rather than in tabulated form (Umanath & Vessey, 1994). There is evidence to suggest that data manipulation leads to more accurate and quicker decisions (Vessey, 1994) although more recent studies have suggested that simply converting data into graphs does not necessarily reduce information load (Chan, 2002). Even so, a cognitive game is played to reduce uncertainty by selecting information that aligns with the decision making process.

Information overload

Although uncertainty provokes decision makers to seek more information, increasing information may not decrease uncertainty. As Schroder, Driver and Streufert (1967) argue, there is a limit to the amount of information that can be integrated into the decision making process. They maintain that the information absorption peaked, and then declined, as environmental complexity, or the amount of information available to the decision maker, increased. This behaviour is described as Information overload and results from "the finite limits of the ability of human beings to assimilate and process information during any given unit of time" (Jacoby, 1977, p. 569). It is a direct result of too much information for the available information processing capacity (Schick, Gordon & Harka, 1990, as cited in Chan, 2002). Information overload has been identified as a problem in the management of information systems as it impedes the organisation and analysis of ideas and alternatives (Grise & Gallupe, 2000). As information load increases, so does the instance of information overload (Grise & Gallupe, 2000). This problem has been referred to as "Information Fatigue Syndrome" (Buchanan & Kock, 2000). If the increase in information creates an information overload, then decision makers have greater uncertainty as they are not only unsure of the decision outcomes but they are also unsure of which information is most relevant to the decision making process.

The result of this uncertainty is a vicious circle because as information load increases, the proportion of

information sought decreases while the number of alternative decision outcomes sought increases (Swain & Haka, 2000; Umanath & Vessey, 1994). This means that as a decision maker is faced with an increasing amount of information relating to a decision, they choose to seek less of it while also searching for more possible decision outcomes or options. This means that the more complex a decision is, the less informed, systematic and thorough the decision making process will be. This has an adverse effect on decision quality (Chan, 2002) and as Chan (2002, p. 3) notes, "providing more information than they [decision makers] can accommodate will reduce their problem solving effectiveness and lead to poor decisions".

The overall effect of the uncertainty biases is one of recursive cognitive games until the decision makers perceive that their levels of uncertainty are lowered to acceptable limits. These games often rely on either selecting data that aligns with their decision making style, or by applying complex uncertainty reduction thought processes similar to the heuristic-systematic decision making style (Eagly & Chaiken, 1993). The net effect is that the perception of uncertainty can lead to sub-optimal decision outcomes.

Methodology

Qualitative data for the study was gathered from ten interviews with key stakeholders in two organisations that had recently implemented large information systems. One organisation was from the private sector (Organisation A) and one was a government funded education institution (Organisation B).

Organisation A is a not-for-profit Australian health and aged care group based on the religious philosophy of care and charity. The group operates over a number of facilities across regional centres, consists of three acute care, one aged care and various support facilities such as food preparation, laundry and central administration. The organisation was originally established in the early part of the 20th century by a religious order and now has more than 1100 employees. Organisation B is an Australian higher education institution spread over multiple sites throughout Australia. In addition, it maintains commercial operations in a number of Australian states in capital cities as well as commercial agreements with offshore delivery partners.

The two organisations examined in the case studies were selected because of a number or core commonalities in their needs and drivers for the implementation of the IS. Both projects had similar complexity and similar organisational risk associated with a failed selection and implementation process. However, the organisations differed in many other contextual ways which provided an insight into varied culture, organisational history, decision making style and politics. Interviewees were selected based on their involvement with the selection and implementation processes. Senior managers, members of decision making bodies and people who informed the decision process were interviewed from multiple levels and functional areas. This selection of interviewees gave a broad range of views and a richness and depth to the data gathering.

Additional data was obtained from organisational documentation and media reports. Interviews and documentation were synthesised into case narratives and a text based analysis was performed to obtain key themes and outcomes. Detailed information on the methodology is beyond the scope of this paper, however, the interested reader should note that the approach taken follows Yin's (1994) case study methodology. The methodology was selected because of the depth and richness of data that can be gathered from qualitative case studies. The analysis was guided by Klein & Myers' (1999) seven

principles of interpretive research and is based on the hermeneutic technique used successfully by Myers (1994a, 1994b) in his examination of IS project failures in New Zealand. As such, findings are presented as a part of an overall case narrative with contextual information provided to explain or describe the effects of the behaviours and biases. It should be noted that a statistical treatment of the data is inappropriate because of the small sample size and the aim of the research in describing the effects of bias in IS projects.

Findings

The study found considerable empirical evidence of bias in decision making in both organisations with both positive and negative impacts on decision outcomes. This section details the findings of the research by contrasting the data from the two cases. Each project is described and then evidence of the effects of each of the four bias groups is detailed. A summary of the effects of the bias on each organisation completes the analysis for each case.

Organisation A

Organisation A required a replacement for its electronic patient management system. The legacy software, a Patient Management System (PMS) was introduced in 1984 and used terminal based technology. This system was maintained and upgraded in response to changes in the health care industry and government regulations. As well as patient management functionality, the product contained an integrated financials module used for billing, accounts payable, accounts receivable, general ledger and assets. During the life of the legacy software, it went through four software vendors. The second last vendor signalled their intent to "de-support" the product and gave users four months notice to move to another product, however, they withdrew the deadline due to pressure from large users and continued to support the product. Finally, Vendor A1, the final owner of the legacy software, announced the date at which it would no longer be supported and offered a replacement system, Product A1. As interviewees noted, the "old system worked fine" and it "was a very stable system", just that it was no longer supported. Therefore, a decision was made to explore alternative systems and make an implementation decision. Ultimately, the vendor of the existing legacy system was selected to provide the new patient management solution. The organisation implemented the system and there was a high level of satisfaction in the outcomes.

Evidence of information bias

Evidence of pre-decisional bias was provided by the Group Executive Officer (Business). He justified the selection of the successful vendor's product by stating it was strategically aligned with the needs of the organisation and that there were good support relationships in place. However, he then went on to make the comment that the "incumbent was first cab off the rank". This theme was prevalent throughout the interviewees in the organisation who viewed the existing vendor's product as the one that was always going to be the likely choice. Interviewees trusted the information from the vendor, and with this view in mind, benchmarked other vendor's products against the incumbent's. The Chief Financial Officer (CFO) remarked on the bias towards the incumbent vendor stating that there was always a "lean towards them" and "at the end of the day if you have two products that stack up fairly well and you know that their old support has been good, then you are going to go with the one that you know".

Evidence of cognitive bias

There was an indication that single outcome calculation was occurred during the decision making, however, the effects were mainly positive. The organisation has a cohesive culture and strong shared

belief system. Much of the decision making and evaluation was about guiding the organisation through the process to an inevitable single conclusion. The indication from the interviews was that the evaluation process was not so much about evaluating products as effecting organisational change and user acceptance. The Group EO (Business) stated that "the culture of our organisation is consultative so this process was consistent with this". As the Information Officer stated, "It wasn't a hard decision to make in the end as there were not a lot of choices. It was quite obvious at the end".

Another example of this bias, in combination with the rationality game, came about when it became clear that the preferred vendor was not able to provide an integrated financials package. However, the preferred vendor did offer a separate financial system that integrated closely with their product, although it was based on UK market requirements. This product was not regarded as entirely suitable: "when we did the evaluation, we would say that the financial system didn't have the same robustness of the Patient Management System but we went for integration over that", noted the Group EO. The vendor later withdrew the product, offering an alternative from another vendor with customised interfaces to the Patient Management System and this was accepted by the organisation. When the CFO was asked if other finance system options were considered, she replied:

No…I guess we were a bit pre-locked into the financials we went to, as we'd started on the patient management system, they had made a decision on the system we were going for, and that group had a particular financials package … it wasn't until we'd gotten part of the way down the track that they pulled out and offered an alternative financials package … so we really just took that and went through an implementation study with them.

However, the CFO had some reservations:

I'd like to have had the time to investigate more systems because we didn't know if there was anyone else out there that could have supported or interfaced with us as effectively as we believed [the selected financials product] would. We now know of at least one other player out there who could have done.

The CFO also stated that, "if you were doing it again, you'd obviously evaluate more than one system". This evidence indicates a form of escalating commitment on the part of Organisation A. They were locked into one vendor and had already decided to go with whatever finance solution the vendor provided. This created a form of single-outcome mindset, leading to the null evaluation and choice of the default product.

Evidence of risk bias

Organisation A's management could easily be classified as risk averse, having a conservative approach to organisational management and strategic direction. However, at the time of the PMS selection decision, there were additional pressures. The hardware running the legacy system was out of warranty and the Information Systems Officer noted that "It was time to make a change anyway". The risk adverse nature of the organisation and its decision makers made them give more weight to such factors as the long term relationship with the vendor and how well they would be supported. The Project Manager noted that:

A big part of it initially was the relationship … one of the biggest things … you need to get a feel whether you're going to be there in ten years time with these guys … certainly cost is a major factor but its not the highest factor … the fact that they were going to be a good partner for ten years was probably one of the highest thing …you get a gut-feeling of how they behave and their history at other sites.

The Group CEO stated that "You get a sense… a gut instinct … about how supportive these people are going to be". To minimise the risk to the organisation, the project manager also negotiated a contract that included penalty clauses for failure to deliver support.

Evidence of uncertainty bias

Organisation A approached the decision surrounding the PMS selection with a low degree of uncertainty. This meant that the effects of uncertainty biases were minimised, leading to more focused information gathering. While it could be argued that this artificially narrowed the search options, the decision makers were already familiar with many of the vendors and products on the market. As an example, the Group EO stated that:

We were not unfamiliar with competitor because part of the evaluation was the representative from the opposition sites come to the software evaluations of both products … their scores counted to the ultimate outcome and we had and we did a review in the early 90s of [on alternative product] and the product we saw in 2000 was no different than the one we saw several years ago except that it had a web browser over it. We were not convinced that a legacy product with a web browser on it would give us the advantages and the information together as going with [the selected product].

Perhaps this low level of uncertainty was because of a perceived lack of alternatives. The Group EO noted that:

Look, there might have been three or four systems we started with and each time we narrowed it down, we dropped one off the list because we thought it would not deliver what we wanted. We didn't want to go from one system to another and not gain anything … not have spent all that time and money and not come out the other side not being able to access the information we needed. The low level of uncertainty meant that the decision was rational and transparent, reducing the effects of other biases.

Effects of bias in Organisation A

Organisation A engaged in a structured, formal, decision making process. However, the actual motivation for this process was just as much about effecting organisational change and acceptance as it was about choosing between products. From the outset, evidence suggests that there was bias towards the incumbent vendor's product offering. This was explained using words like "confidence" and "comfort" in relation to how the organisation felt towards the vendor. This lowered the level of perceived risk and uncertainty. Although there was some evidence of single outcome bias, the decision making generally appeared rational and was both technically an organisationally justified.

One negative effect came from the single outcome/rationality bias on the selection of the financials system. This decision seems to have come from a null search without considering other viable options. This may account for the mild level of dissatisfaction with the decision and decision making displayed by the CFO.

Overall, the pre-decisional bias exhibited was justified by the relationship the organisation had with the vendor. The positive outcomes from the transparent and rigorous evaluation process provided the organisation with confidence in the decision and the outcomes. It was the transparency and rigour of the evaluation process that limited the effects of other bias groups.

Organisation B

In 1993, the Organisation B's IS division became involved in an Australia-wide project for developing a core specification for a higher education administrative systems. The Core Australian Specification for the Management of Administrative Computing (CASMAC) was initiated in 1991 with Australian higher education institutions following one of three different software implementation paths. These consortiums were advantageous in terms of software purchasing power and knowledge leverage.

The purpose for joining a consortium and following the CASMAC path was that the organisation had been aware since 1989 that it needed to replace its Student Records System (SRS). The organisation and the SRS were suffering from the constant need for reactive patching and fixes brought about by changing government policies and rapid organisational growth and change. However, the CASMAC consortium dissolved and the initiative was abandoned by the organisation in 1997. While work began on an upgrade to the SRS to meet Y2K requirements, this was regarded as an interim solution. As IS Professional A noted:

[The SRS] was on its last legs literally …It couldn't keep up with the changing requirements of government easily … It couldn't keep up with the requirements of Student Admin or the faculties … the backlog of work was huge. The [organisation] needed to go more for [a] self-service model … and they just couldn't do that.

The issue of replacing the SRS was raised at a meeting of senior executives in the organisation and a working party was formed. There was strong support from the Senior VP for integration of the organisation's administrative systems and the reengineering and development of better administrative procedures and practices. A decision was made to replace the SRS. Furthermore, as the IS Executive noted:

They wanted a student system and they wanted a finance system that was easy to integrate with the student system and while we're at it, we also need a HR system … The top priority was still the student system.

In late 1998, the organisation issued a Request For Proposal (RFP) for the delivery of an administrative information system. Three vendors responded and performed software demonstrations onsite. An evaluation committee was formed to perform a high level functional analysis of the alternatives. In March 1999, the organisation approved the purchase of the ERP B1 Finance, Payroll and Student systems from Vendor B1 at a cost of approximately one and a half million dollars. The organisation also commissioned a detailed five week consultancy with the implementation partner, Consulting B1, to prepare an Implementation Planning Study (IPS). The purpose of this study was to identify project priorities, develop the business case in respect to benefits and costs and to scope all deliverables. As a result of this study, the eventual budget for the implementation of ERP B1 was established: this was approximately fourteen and a half million dollars. However, the implementation was subject to budget and time slippages and final costs to the organisation are estimated as high as twenty million dollars. Functionally, only the Student and most of the Finance systems were ever delivered, with extensive work required after the implementation (in excess of $1M) to address issues with the Finance System.

Evidence of information bias

Two aspects of pre-decisional bias were evident. The first related to a strong bias against the option of

building a new administrative system in-house. This was supported by comments from Academics A & B, with Academic A stating that:

[The IS Executive] certainly presented the view forcefully that we shouldn't be building systems in-house, we should be buying them off the shelf because that was going to be a lot cheaper. My memory of the sorts of figures that were being talked about at this point in time were maybe a million bucks, maybe not even that much …

I think what we had in our heads was that there were about three people in [the IS division] working on a student records system and maybe the calculations went like this: We've got three people over there working on this, that's 150 grand a year. We can buy one more cheaply because that's what we've been told therefore we would be spending about one hundred thousand dollars to get a new student records system.

This is consistent with the views of Academic B, who as chair of the evaluation committee, felt that his options were restricted. He stated that "I felt my hands were tied behind my back when for a start when I don't think I had the choice of looking at the fourth option". The "fourth option" he refers to was the option to build a new SRS in-house. He believes that by not examining this option, the decision process was restricted. He went on to add that "I felt that at that meeting it was almost cut-and-dry that it wouldn't be the idea of upgrading 'in-house'… I think [upgrading] the existing system wasn't considered".

The second aspect of pre-decisional bias was the strong bias towards ERP B1. The system had been demonstrated to at least one member of the senior executive who had then gone on to lobby other decision makers by distributing demonstration disks. IS Professional A, as a member of the evaluation committee, felt she had little impact on the decision she felt the decision had been made very early in the process and that everything that came after it was justification. She stated that "they had a team of more senior people that made the decisions … you got the impression that they already had the decision they wanted … and what we were doing was to justify that decision".

This is consistent with Academic A's statement that the IS Executive had handed him a disk with a demonstration of ERP A even before the RFP was called. There is another indication of this pre-decisional bias in IS Professional B's belief that he had little impact on the decision and the comment that "I think [the IS executive] was pretty keen to go with [ERP A] before we started the whole exercise". When asked how this was indicated, IS Professional B responded that "he was mentioning it a lot and that we need to go with ERPs because they are state-of-the-art and we need to introduce workflow procedures". He went on to add that "there must have been something operating on the decision process [and that the] decision to go with [ERP A] was made outside the group [of senior executives]". His belief was that the IS Executive had decided long before the evaluation process that ERP A would be selected and implemented.

Cognitive bias at work

Decision making surrounding the selection of the ERP was affected by a number of cognitive biases including reasoning by analogy, single outcome calculation and the criteria selection game. The interaction between these biases was related to issues surrounding risk mitigation and the reduction of uncertainty.

The decision making process had evidence of reasoning by analogy bias. Many of the decision makers had a poor understanding of the complexity and scale of the decision, least of all the potential organisation impacts and costs. The decision makers treated the decision like similar smaller decisions that they had made before. Academic B explained that:

I think they thought it was just like buying 'Word' and it works and this was a very different kettle of fish. I think that very few of those who made the decision had had exposure to the idea of buying a package before, let alone an ERP.

This form of reasoning by analogy also led to aspects of the illusion of control bias. In the face of uncertainty with decision makers having little experience in they type of decision they were making, they reduced uncertainty by reassuring themselves that they had made successful similar decisions in the past, in the same style. When asked how this had come about, IS Professional A stated that:

We had had pretty good success with the finance and [HR] systems and the users were happy with the functionality that we got from those systems … Everyone was quite happy to go out and look for a product and evaluate what was out in the marketplace.

In effect, the decision makers believed that their previous successes in evaluating and implementing much smaller systems empowered them to make a good decision surrounding a much more complex product.

However, it is important to bear in mind that this bias was only reaffirming the pre-decisional biases and the preferred outcome. In order to justify the preferred outcome, single outcome calculation occurred. First of all, options were restricted, as IS Professional A explained:

Our philosophy was that we need to go and get something off the shelf because everybody needs the same things in a student system and we as an organisation would find it difficult to keep up with … the government regulations.

Secondly, there was a need to eliminate or restrict the choices so that there was really only one viable option. Apart from the preferred vendor, two other competing vendors were approached to provide a RFP whose products were, at face value, immature. However, a third vendor with a well known international product, although with limited local presence, was not invited to submit an RFP. Given the preferred vendor had only recently started to localise their SRS product, this seemed to be unusual.

Thirdly, information gathering was limited. This appears to have simplified the process that reduced the level of uncertainty. However, this had negative impacts on the evaluation and decision making process. IS Professional B maintained that the decision process was illogical and based on little substance, remarking that “I was a bit amazed that we went from the … glossy brochure to putting in an order basically”.

The final bias at work was the criteria selection game. In order to reduce uncertainty and to justify the preferred option, quantitative potential cost savings were used. It was reported that up to three hundred positions would be saved by implementing the ERP, primarily in casual and seasonal staff. This was quantified by the finance manager at approximately three million dollars per annum. However, the

validity of this data is disputed and has not been substantiated postimplementation. IS Professional B was scathing about the estimates stating that "the decision to implement the ERP was based on cost savings which were invented … I know the savings were absolutely fudged".

Risk bias at work

Much of the decision making process was concerned with avoiding or minimising risk to both the decision makers and the organisation. One problem evident with the decision process was that the people who evaluated the RFPs and products felt little ownership of the decision. The role of the evaluation team was to make a recommendation, however, as discussed previously, many already knew what the preferred option was be and felt it was their job to justify it. Moreover, information concerning some of the risks associated with the preferred product was either not communicated or was ignored by the senior executive making the final decision.

Part of this lack of risk awareness came about by the three layered decision making process. Academic B described the following steps in the decision process:

It went from [the evaluation committee] back up to the [Senior VP] who by that stage had formed another committee to keep looking at it. We knew that [Higher Education Organisation B1] was the first cab off the rank so we actually had an ISL (video link-up) with a number of key people at [Higher Education Organisation B1]

As the purchase price of the ERP was above the level the Senior VP could approve, there was a special presentation to University Council. They saw part of the [Higher Education Organisation B1] video plus presentations from various members of the executive review committee. They were also given an "executive summary of the [evaluation committee] report". The IS Executive confirms this version of events:

We then got the senior executive and some council members. We had them in a video conference link to [Higher Education Organisation B1] who had chosen [ERP B1]… We had the senior sponsor of the [Higher Education Organisation B1] project, maybe the vice-chancellor of [Higher Education Organisation B1] on the video conference link assuring the senior executives at this [organisation] that it was the right decision to make and why they'd made their decision, so, the [Senior Organisational Executive], then signed off because it was millions of dollars and exceeded the signing authority of the Senior VP so that's how we got ERP B1.

Risk was mitigated by the executive decision makers talking to, and being reassured by, other executives at an organisation which was implementing the preferred product. However, information concerning implementation difficulties and increasing budget and project timelines from the same site were not communicated to the University Council.

A second risk bias that occurred could be best described as "follow the leader". Members of the evaluation committee were aware of the vendors who had a presence in Australia. Furthermore, they were aware that as a relatively small institution they needed to choose a vendor that would have a continued presence and one that, as part of a larger syndicate, they could lobby for product changes. Academic B explained by saying that:

We also looked at who within Australian [higher education institutions] has what packages and who is proposing to move to what packages. It was clear that [Vendor A] had the vast majority of the sites, for example they had [numerous institutions listed].

Vendor B1 had a significant presence in Australian higher education institutions at the time of the selection decision. The perceived risk in a "small" institution going with one of the smaller ERP vendors was explained by IS Professional:

We are too little to make a decision of a software vendor that no one else has picked. Part of the reason to buy [ERP B1] was that it was a financially viable organisation, it had an existing customer base in America and Australia with [a] Student [records module]. … We had to go with what the other major [higher education organisations] were doing because that … added to the decision making process but it also adds to the clout when we need changes to the software … we've got a bigger user group … We couldn't gamble on going on a smaller provider.

Uncertainty bias at work

Given the complexity of the ERP selection decision, it would be easy to assume that there would be a high degree of uncertainty thus visible effects of information overload. However, in this instance, quite the contrary occurred. It appears that this organisation self-censored the level of information available to decisions maker in order to decrease uncertainty. This had negative consequences on the evaluation process. IS Professional B believed that the cursory review completed by the evaluation committee had limitations, stating that "as far as I was concerned the advisory committee was only advising on what they thought was the best solution … they didn't look into it in terms of suitability in detail".

He went on to add that "we didn't actually talk to anybody who was using the product on the sites or anything like … it was really the glossy brochure without even the test drive". Academic B also admitted that the evaluation was not necessarily as rigorous as it could have been. Much of the bias at work in the ERP selection decision can be traced to the high degree of underlying uncertainty and the efforts to, at face value, minimise this uncertainty.

Effects of bias in Organisation B

This case challenges some conventional understandings about how a complex IS decision such as the selection of an ERP would be performed. A boundedly rational approach to the decision making process would see decision makers gather as much information as they thought they needed to inform the decision. However, in this instance, little information was gathered. Interviewees admit that they operated on sales information and demonstrations. On this basis, they selected a product. Inexplicably, this almost appears to be an instance of "information underload" although conforms with what theoretically happens in the face of uncertainty (Daft & Lengel, 1990). Interviewees gave examples of where information was excluded or options were restricted from the decision process, for example, not considering either the other "large" ERP in the market or the build in-house option. These are examples of pre-decisional bias and single outcome calculation.

Consistent with the literature was the need to make the decision processes appear rational. The appearance of rationality can often be achieved by using hard, tangible justifications for a decision. One such "hard" justification given in this case was cost savings: this is consistent with the criteria selection game. However, it is evident form the statements of interviewees there were a number of soft factors in

the form of the biases already described. Perhaps more telling is that it is doubtful if any of the cost savings quoted were ever achieved.

From the evidence of strong pre-decisional bias, in combination with other cognitive biases and the effects of risk and uncertainty, there appears to have never been a question of which product would have been selected. Many in the organisation regard the decision outcomes as poor, and the projected efficiencies are yet to be realised. It is clear that bias in this decision making process restricted the options and created negative information filters.

Discussion

The two cases differ in many ways; however, the basic decision was the same. Both organisations were faced with the selection of a major piece of IS infrastructure that would have considerable organisation impacts. Both organisations had the personnel and resources to effectively evaluate systems. Both organisations faced similar time constraints. This raises the question: why would bias help a decision making process in one organisation and hinder it in another?

The research findings indicate that the way in which bias affects decisions outcomes is related to a number of contextual influences. These influences include organisational culture, organisational history, organisational relationships, internal organisational structures, politics, composition of the decision making body and organisational size. In keeping with the model depicted in Figure 1, contextual factors play a role in the way bias affects information and the way bias affects the way decisions occur. The research findings indicate that the same bias elicits different results, depending on the context in which it is applied. An over-arching theme to the findings is that uncertainty biases have a considerable role in determining how other bias groups are applied.

Information Bias

In Organisation A, the organisational history and level of trust developed between the organisation and the existing vendor were strong contextual influences in the decision making and led to pre-decisional bias. This formation of a preference before a formal evaluation occurs is not unusual (Russo et al., 1998). In this instance, while the existing vendor relationship contextually influenced the decision, it also biased information. Information from the vendor was regarded as reliable and exhibited lower levels of uncertainty than that from other vendors. A pre-decisional bias in the form of "bench-marking" occurred whereby an implicit comparison of information from other vendors was performed against the existing vendors, even before it was formally evaluated. From this, it could be argued that this bias was justified and produce positive effects by reducing uncertainty and simplifying the decision process.

However, in Organisation B, the pre-decisional bias was based on a product awareness that resulted from political lobbying within the organisation. A general perception had been developed in the minds of senior decision makers that other organisations were using the product successfully and that they had not encountered difficulties or cost over-runs during implementation. Another element of Organisation B's pre-decisional bias was the automatic exclusion of the in-house build option. This was based on the contextual elements of organisational history and culture whereby the internal IS department was viewed by some senior managers as incompetent. This bias not only eliminated the option of building in-house with existing staff, but it also removed several options associated with sub-contracting out the requirement of the organisation. It also limited the amount of input that internal stakeholders may have had on the assessment and evaluation.

The overall complexity of the decision caused a great degree of uncertainty in Organisation B and this distorted the information that fed the informing system. The extensive use of cognitive games to simply information and make the decision comparable with previous decisions created an artificial decision environment. The use of a poorly informed decision making body, a contextual factor, and the reliance of selective, high-level information demonstrates the presence of cognitive and risk biases. It is particularly interesting that in order to achieve cognitive fit and reduce uncertainty (Mintzberg, 1972; Umanath & Vessey, 1994) senior decision makers justified their decisions by nominating the views of their peers at other organisations and estimates of financial savings.

Process Bias

Another consideration when evaluating the effects of bias is to determine if there was scope for them to impact on the decision process in any meaningful way. As previously discussed, the findings indicated that bias affected the decision processes. The extent to which bias affected the process was dependent on organisational structures and culture and these structures dictated how rigid and transparent the decision process was.

Although staff in both organisations stated that they had formal evaluation processes, documentation and supporting interviews indicated that Organisation A had a more rigid and transparent process than Organisation B. This included formally recorded score cards and a weighting system. However, while organisation B had a report from the evaluation committee, the actual process of evaluation and the data used to justify the recommendation was not formally recorded. This was compounded by the loose transition from a recommendation from the evaluation committee to the senior executive to the verbal presentation to University Council. At every phase in this process, human bias could be, and was, introduced. The extent to which this process was flawed was highlighted by criticism in the organisation's annual external audit.

Organisation A had an existing culture of thorough evaluation practices with the organisational structures in place to undertake them. Organisation B had a more informal culture and had disjointed organisational structures in place that permitted a looser evaluation. However, why were structures not put in place in Organisation B to facilitate a more rigid and transparent process? Data indicates that this was not necessarily in the best interest of some of the key decision makers, especially those with strong pre-decisional bias. To reduce the levels of uncertainty surrounding the decision, the evaluation process was devolved and information was selectively filtered up to final key decision makers. The overall complexity of the decision, the uncertainty surrounding it in and the combination with the lack of structure and ownership culture allowed this to happen.

Development of the model

In order to capture the interaction between contextual factors and bias, a refinement of the decision making model depicted in Figure 1 is suggested. The revised model, depicted in Figure 2, takes into account contextual factors such as organisational history that can mitigate or alter the effects of the bias groups.

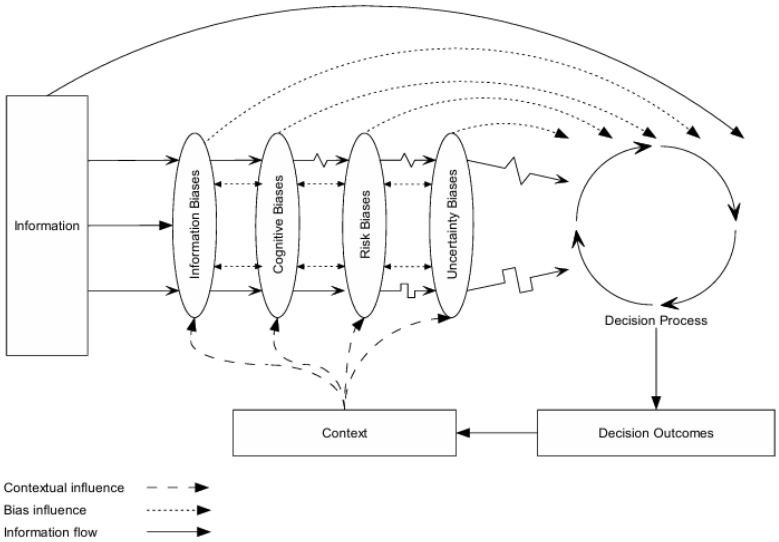

Figure 2 - Bias in an informing system (contextual model)

In the model, decision outcomes also feed into context as they become part of the organisational history and affect other contextual factors such as politics and organisational structures. The revised model also proposes an interaction between bias groups. Although in this study only uncertainty biases were observed to perpetuate other biases, it seems likely that other bias groups interact with one another. It should be noted that the direct interaction between contextual factors and decision processes has not been captured in this model as it is beyond the scope of this study.

Conclusions

The results of this study clearly indicate that bias is a function of the contextual influences such as organisational culture, organisational history, organisational relationships, internal organisational structures, politics, composition of the decision making body and organisational size. The extent to which this bias will affect a decision will depend on how rigid and transparent the decision making process is or needs to be. It is also clear that biases can be linked to the level of uncertainty surrounding a decision. That is, when there is a degree of uncertainty, individuals will resort to using biases to deal with the uncertainty: at times this may increase organisational uncertainty but it reduces the apparent risk to the individuals. From these two studies, it is apparent that lower levels of uncertainty, as in the case of Organisation A, lead to a lower susceptibility to entertain bias. However, in organisations where there is a high degree of uncertainty surrounding the decision, bias has more potential to influence decision making. This potential influence may be tempered with more rigor and transparency in the evaluation and decision making process.

In summary, this paper has described the effects of bias in two organisations making similar IS selection decisions. It is clear from this study that reality and the data captured by decision makers can often be two very different things. We have determined that bias within an informing system may have a positive effect on a decision if the bias is based on reliable experiences or information. However, bias can also distort information gathering within an informing system and lead to sub-optimal outcomes. In order to temper the effects of bias on the way information is gathered and evaluated, rigorous and transparent IS evaluation practices must be used. However, for these practices to occur, contextual factors such as a supportive organisational culture and structure must be in place.

Limitations

The research from this paper is drawn from a larger study however for the purposes of reporting, much of the detail has been condensed. The sample of organisations and interviewees are indicative of the results obtained from other projects and since no attempt has been made to perform statistical analysis, the small sample size has no effect on a qualitative study of this type . The methodology relies on the honesty and openness of the participants of the study however the analysis technique has been designed to triangulate facts through multiple verifications. However, it is recognised that in this type of qualitative study, the authors' own biases become part of the interpretive process. In doing so, every attempt has been made to present the findings as part of an explanative narrative, and as Klein & Myers (1999) note, prejudices and biases may in themselves lead to a better understanding of research findings.

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The Academic Open Access E-Journal: Platform and Portal

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ABSTRACT

This paper demonstrates that advanced technologies and the increasing acceptance of academic open access e-journals offer an opportunity to reconsider their form and function as a medium to enhance scholarly communication. The academic open access e-journal is envisioned as a platform and a portal within the context of an open source community including a format and functions that enable it to achieve that objective. A working model for academic open access ejournals is presented. This model is intended for open source communities involved in designing, developing, and/or improving open access academic e-journals.

Keywords: Academic open access e-journals, scholarly communication, open access platforms, open access portals, open source communities

INTRODUCTION

The first purpose of this paper is to explore how technologies and the growing acceptance of academic open access e-journals offer an opportunity to rethink their form and function. The second purpose of this paper is to describe a model that contains essentials elements inherent to the success of academic open access e-journals.

The paper's introductory remarks confirm two key points or working assumptions that underlie the purposes of the paper. Firstly, it is shown that academic open access e-journals are gaining widespread acceptance in most if not all disciplines and fields of study. Secondly, it is shown that conceptualizing academic open access e-journals as "platforms" and "portals" represents a paradigm shift with many potential benefits for theory and praxis in most, if not all, disciplines and fields of study.

The discussion then shifts to describing a working model aimed toward the open source communities involved in designing, developing, and/or improving open access academic e-journals.

The advance of scholarly communication has generally coincided with advances in communications technologyand infrastructure (Schaefer, 1994). But Kronick (1976) cautions avoidance of a simplistic causeand-effect perspective because the rise of scientific journals in Europe was the result of a complex set of forces beyond advances in communications technology (e.g. the printing press) and distribution systems (e.g. regular mail service). The scientific journal arose in the midst of the scientific revolution as scientific inquiry became more structured and the presentation and discussion of its results became increasingly public (Bazeman, 1988; Kronick, 1976, Sarton, 1957). The process of editorial peer-review and regularly published journals ("periodicals") represent the culmination of a historical process involving scholars, publishers, institutions of higher education, government, philanthropic organizations, and professional associations and learned societies (Burnham, 1990; Eamon, 1990; Hagstrom, 1965). The academic open access e-journal represents yet another step in that historical process.

It is important to define the term "academic open access e-journal" because it is often used

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It is important to define the term "academic open access e-journal" because it is often used interchangeably with terms like "online journal" "academic e-journal" and "electronic journal." An academic open access e-journal is a peer-reviewed, edited, scholarly journal that is published online. It uses the Internet and web-based technologies to collect manuscripts for review, disseminate them to reviewers, collect manuscripts that have been reviewed, and notify authors of the results of peer review (c.f. Ashling, 2005; Baudoin, 2003; Hovav & Gray, 2004). In addition, an academic open access e-journal has a specific Web presence that contains digital peerreviewed, edited, scholarly manuscripts that are made available online free of charge and often free of most copyright and licensing restrictions.
The academic open access e-journal as defined herein differs significantly from an "electronic journal" created by the conversion of a "paper journal" to digital form and the subsequent archival of its contents in an electronic database, in a portable storage device such as a CD, on the Internet, or some combination of those three.

For the purpose of this paper, the definition of academic open access e-journals is based upon Budapest Open Access Initiative, International Federation Library Associations, Bethesda Statement on Open Access, and Berlin Declaration on Open Access. These merit a brief overview.
The Budapest Open Access Initiative states that

The literature that should be freely accessible online is that which scholars give to the world without expectation of payment… open access to this literature, [means] its free availability on the public internet, permitting any users to read, download, copy, distribute, print, search, or link to the full texts of these articles, crawl them for indexing, pass them as data to software, or use them for any other lawful purpose, without financial, legal, or technical barriers other than those inseparable from gaining access to the internet itself. The only constraint on reproduction and distribution, and the only role for copyright in this domain, should be to give authors control over the integrity of their work and the right to be properly acknowledged and cited. (paragraph 3)

This initiative is possible through self-archiving and open access journals.

Bethesda Statement on Open Access (http://www.earlham.edu/~peters/fos/bethesda.htm), International Federation Library Associations (http://www.ifla.org/V/cdoc/open-access04.html and Berlin Declaration on Open Access (http://www.zim.mpg.de/openaccess-berlin/berlindeclaration.html),) collectively state that "open access is a property of individual works, not necessarily journals or publishers" and that open access must abide by two conditions. They are as follows:

1.The author(s) and copyright holder(s) grant(s) to all users a free, irrevocable, worldwide, perpetual right of access to, and a license to copy, use, distribute, transmit and display the work publicly and to make and distribute derivative works, in any digital medium for any responsible purpose, subject to proper attribution of authorship (Community standards, rather than copyright law, will continue to provide the mechanism for enforcement of proper attribution and responsible use of the published work, as they do now), as well as the right to make small numbers of printed copies for their personal use.

2.A complete version of the work and all supplemental materials, including a copy of the permission as stated above, in a suitable standard electronic format is deposited immediately upon initial publication in at least one online repository that is supported by an academic institution, scholarly society, government agency, or other well-established organization that seeks to enable open access, unrestricted distribution, interoperability, and long-term archiving.

The production of open access e-journals is not free. Those publishing open access e-journals bear the expenses that mostly include time of editors and reviewers, server space to publish the manuscripts, and any costs borne in producing and distributing the publication in "hard copy" "bound" format.

Obviously, academic open access e-journals would not exist without the technology that enables them to exist. However as is the case with scientific and technical journals in general, academic open access e-journals have been created as a result of the changing nature of scientific inquiry and scholarly communication. For example, three key forces or factors that promote or encourage the rise of academic open access e-journals include: 1) scholars' impatience with the long timelag between submission of a manuscript and its eventual publication, 2) scholars' desire to address perceived shortcomings of the process of peer-review, and 3) the rise of "team science" and multidisciplinary and transdisciplinary research "genres."

The time-lag between submission of articles and their publication is critical for researchers in fields in which knowledge is rapidly changing and credit for "discovery" may rest on the relative timeliness with which a research study is published (c.f. Brown, 2001; Hanes, 2001; Harnad, 1990, 1995, 1997, 2000 as cited in Mizzaro, 2003). It is also critical for faculty who are seeking tenure and promotion and who thus have a limited period of time to identify a "research agenda" and subsequently create a track record of publications (c.f. Denning, 1997; Swanson, 2004). In contrast to traditional journals in which acceptance of a paper and its actual publication may range from several months to one to three years, academic open access e-journals offer better options. They follow a "rolling" publication sequence in which publication occurs online once a paper is accepted. "Hard copy" or "print copy" of the publication is also available: 1) for a fee on demand or 2) for a fee on a periodic or predetermined basis (e.g. quarterly or annually).

Scholars' dissatisfaction with the peer-review process in scholarly publications is welldocumented (c.f. Hayes, 2002; "Methodical progress," 1997; Monastersky, 2005; Starbuck, 2005). Scholars' dissatisfaction is well-founded, given results of studies on the peer-review process. Weller (2001) reports low reliability of peer reviews. Similar findings are reported by Fenn (1997). Weller (2001) has conducted an extensive analysis of studies on peer-review and reports great divergence in the reliability of peer-reviews. Frey (2003) reports similar findings as regards the discipline of economics. These later studies confirm findings reported in an earlier study (Stuart, 1988) that reviewers rely upon heuristics as opposed to any formal evaluation process or procedure.

Beyond their dissatisfaction with the peer-review process, scholars are increasingly calling for peer-review to be more than a method to screen research worthy of publication. Scholars want peer-review to move from an exercise in summative evaluation to a process that involves open (public) development of a research study within the purview of a community of peers (c.f. Ashling, 2005; Dagani, 1995; Faxon Institute, 1991, as cited in Schaeffer, 1994; La Manna & Young, 2002; Mizzaro, 2003; Oliver, 1995 as cited in Peters, 1995; Stodosky, 1995). One scholar (Bachrach, 2005, paragraph 32) argues:

It is clear that electronic publication can serve the scientific community in new ways. The key to publication is information distribution. Electronic publication facilitates this in many ways, some quite novel. Electronic distribution is likely to be less expensive than print. Access by scientists around the world is likely to be much greater and easier. Documents can be made available in less time. Information content is boosted via the electronic medium, allowing for publication of audio, video, large data sets, and interactive tools. The tyranny of page limits becomes obsolete, and while conciseness will remain next to godliness, the advantage of allowing all quality work to be accepted surely outweighs the disadvantage of some verbose contributions. Peer review can be made more inclusive and can empower the community as a whole.

The future of electronic publication holds out hope for a true information revolution. Consider this statement from the UCLA Office of Scholarly Communication (2005, paragraph 3):

Internet technologies are creating new opportunities: While technology has not substantially decreased the cost of producing and reviewing scholarship, it has created efficiencies in those processes. Further, technology allows much greater dissemination at nearly zero marginal cost for additional readers. Technology also enables quicker publication, access to supplementary or source materials, new forms of commentary and dialogue, and new ways to discover and aggregate scholarly resources.

Alternatives to traditional publishing are being thoroughly tested: Several models for disseminating scholarship have emerged and are being deployed. The primary advantage of alternative forms of publishing is that they provide unrestricted (free) access to all potential readers, as compared to traditional subscription or purchase-based publications.

Most alternative forms of publishing also:
- Include peer-review or other quality control.
- Are available quickly or immediately after creation.
- Are managed for long-term availability.
- Are discoverable through traditional indexes or new, community-built services" (UCLA, 2005, paragraphs 3-4).

The rise of academic open access e-journals is one aspect of a growing movement to rethink academic journals and the process of scholarly communication. For example, the Directory of Open Access Journals (DOAJ, 2005) contains over 1,680 journals and 76,416 articles. Lamp (2004) provides links to an additional set of academic open access e-journals. Also, open access peer-reviewed journals have impact factors and citation rates equal to traditional peer-reviewed journals (ISI Thomson 2004, as cited in UCLA, 2005). Vaughn (2003) notes that online "equivalent-print" journals are significantly impacting use patterns in chemistry journals. Brooks (1999) has deemed these trends as part of "postmodern information science." Brooks states:

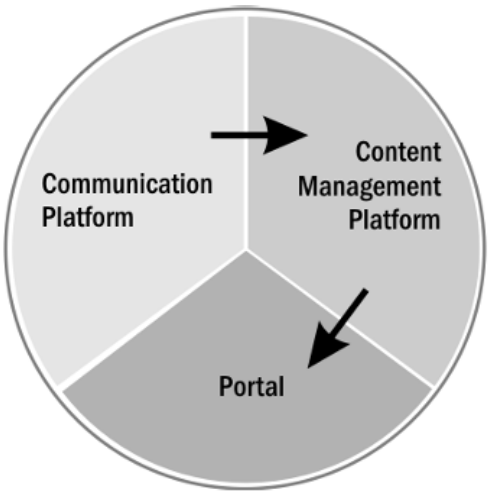

Figure 1: A Model for Open Access EJournals

It synergizes elements of technologies for maximum benefit from academic open access ejournals. The system contains three essential parts critical to success of open access e-journals. They are communication platform, content management platform, and open access portal. Each essential part in the model has several major components. All components in the three parts work together and complement one another. Once these parts are put together, the process of communication, content/manuscript management, and open access to the academic peer-reviewed manuscripts can be substantially improved. In the next section, the critical components of each part are discussed.

Communication Platform

The communication platform is the primary system that links the author to the editor. The main tasks/components in this system must include:

- Author Submission Task – Author electronically submits his/her manuscript for possible review and possible publication in the journal
- Initial Editorial Task – The editor screens the manuscript to determine its suitability for possible publication in the journal. If the manuscript is determined suitable for possible publication, the editor assigns it to 2 or more appropriate reviewers who are comfortable reviewing the paper. The system must allow reviewers to choose topics that match their expertise and knowledge so the editor can choose the appropriate reviewers or so it can be done automatically.
- Reviewers Task – The reviewers are asked to review the manuscript and make recommendation regarding acceptance or rejection of the manuscript. If the paper is accepted, the reviewer is asked to provide constructive feedback on how to improve the paper. If the paper is rejected, the reviewer is also asked to provide constructive feedback on how the paper can be improved.
- Second Editorial Task – Once the reviews are completed, the editor communicates with the author and provides a detailed feedback regarding the decision for publication. The editor will do the same for papers that are rejected and in most cases another outlet is suggested to the author.
- Revising Task – The author revises the manuscript and re-uploads the manuscript into the system.
- Third Editorial Task – The editor edits the paper, communicates with the author and prepares the paper for the Content Management Platform.

Content Management Platform

The Content Management Platform is responsible for content formatting and publication. During this process the ideal platform must have the following components:

- Web Authoring tool – User-friendly web authoring tool that allows template creation and requires no knowledge of XML, HTML, etc. coding.
- Automatic posting of links to articles by extracting required information (i.e., title, author, abstract, keywords)
- XML formatted metadata repository - The open and platform-independent XML formatted repository allows true interoperability among many platforms.
- Built-in application-independent interoperability framework for marking up manuscripts for harvesting. Normally this will be supported by a protocol. The most common protocol for this purpose is Open Archives Protocol Initiative for Metadata Harvesting (OAI-PMH - http://www.openarchives.org/OAI/openarchivesprotocol.html). The OAI-PMI supports interoperability standards intended for efficient dissemination of manuscripts. The harvester acts as a metadata indexing system for creating searchable index of metadata from the repository.
- Converting/integrating raw form of the manuscript (XML) into HTML and/or PDF.

Open Access Portal

The true value of the academic open access e-journals becomes apparent in the portal part of the system. The manuscripts are made available in open access portal where they can be accessed free of charge. The furthering of research within the community of scholars depends on the sound presentation of content/manuscripts and the value-added tools present in the portal. This portal is in direct link with the XML formatted metadata repository and must completely be browserbased. The portal must be accessed in all major browsers. It must also allow the use of PDA technologies to access the portal. The major components of this part are as follows:

- Built-in index – The portal provides a powerful search engine that indexes the manuscripts for searching and finding. It must support advanced querying.
- Data modeling and/or replication of raw data used in manuscripts – The portal makes available the raw data of manuscripts to scholars for data modeling and future replication of the study.
- Text mining – The portal must allow for text mining of the manuscripts. Text mining allows authors to discover hidden facts that may be useful for expanding the knowledge. According to Hearst (2002, paragraph 1), text mining is "the discovery by computer of new, previously unknown information, by automatically extracting information from different written resources. A key element is the linking of the extracted information together to form new facts or new hypotheses to be explored further by more conventional means of experimentation."
- Discussion board – Readers should be able to use the discussion forum to post their opinions about the articles they read. The discussion forum becomes a learning community that promotes further research among scholars. The authors of published manuscripts are automatically a part of this learning community. In the learning community scholars may find mutual interest in topics and collaborate on future research.
- Collaboration tool – The collaboration tool, also known as groupware, allows authors to collaborate on research that interests them mutually. It can organize content in context and give meaning to information (which then becomes knowledge) among the research communities of common interest to further enhance and improve research.
- The Rich Site Summary (RSS) – The Rich Site Summary (RSS) is an XML format used to syndicate

manuscripts. This acts as an intelligent agent that allows other portals to publish certain information about the manuscripts, i.e., author's name, title, source with date and volume number, and in some cases the manuscript's abstract.

User Interface and Scalability

Usability is fundamental to the proposed conceptual system for academic open access e-journals.

Usability attributes are the result of a usable system. These attributes are objective: effectiveness, learnability, flexibility, understandability, memorability, and reliability; and subjective: positive attitude, user satisfaction, and product/system attractiveness (International Organization for Standardization [ISO] 9241-11, 1998; ISO/International Electrotechnical Commission [IEC] 9126, 1991; Nielsen, 1993; Shackle, 1991).

Usability properties are elements that accomplish the usability attributes. They are essential to user interface design and achieve usability of a system (Dumas & Redish, 1993; ISO 9241-11; ISO/IEC 9126; Nielsen 1993; Rosenbaum, 1989; Rubin, 1994; Shackel 1991).

Based on the review of literature, Koohang (2004) identified a number of usability properties inherent to the successful use of a system. They are simplicity, comfort, user-friendliness, control, navigability, load/access time, readability, adequacy/task match, link visibility, high/readable color contrast, appropriate font type/size, well organized, visual presentation, recognition, information relevancy, right to the point information, consistency, feedback, and direction. These usability properties are fundamental to user interface design and must be built in the open access academic e-journals.

The academic open access e-journal must achieve high scalability. Scalability is the ability of the system to easily adapt to the existing needs. The adaptability could be scaling the hardware and/or software to safeguard larger volumes of manuscripts or being able to accept/allow increased users to the portal without any problems. Scalability of the proposed system is about being able to modify the system to meet the current and future needs of the academic open access e-journals.

Conclusion

Ironically, what we suggest is the use of existing and/or improved technologies to “turn back the clock” to a time when scholarly communication was as fluid, personal, interactive, and immediate as possible (c.f. Ruegg, 1996, pp. 16-17, 27). History indicates that scholars will seek alternative methods of communication and alternative organizational structures when they perceive that existing media and existing structures no longer provide the support scholars need to most effectively engage in scientific inquiry and to communicate their findings. Pedersen (1996, pp. 470474) for example recounts that during the 16th and 17th centuries many of Europe's most gifted scientists made an exodus from the universities to the first institutes for scientific research. Similarly, Ruegg (1992, pp. 465-467) argues that book-publishing and foundations became the “ally” of humanism and augmented its initial wide-scale diffusion throughout Europe during the late 15th Century.

The academic open access e-journal is yet another manifestation of that historic process. The academic open access e-journal is a response to scholars' needs; needs that at their core have not changed in nearly a millennium. But there is a qualitative difference. When the open source communities choose to synergize existing and/or new technologies with sound design and functionalities in a system, the

academic open access e-journal is capable of enhancing scholarly communication on a global scale at a speed and "richness" never anticipated.

Naturally, the academic open access e-journal is merely a tool. It is no substitute for the brilliant mind driven by a passion for scientific inquiry and it will never eliminate the biases and foibles of the "real" people who also happen to be scholars. But the academic open access e-journal does provide us the means to do something perhaps as important as conducting inquiry and disseminating the results. The academic open access e-journal provides a historic opportunity to observe the scientific process as it unfolds on a scale and timing never achieved before.

This may be its most important potential. In turn, this prospect raises important questions: "If science is a craft or an art, how can we use the academic open access e-journal as fertile ground to study the process of scientific inquiry itself?" "Will studying how we perform this art or craft enable us to improve our performance?" "Will it enable us to reconsider fundamental tenets of scholarship and identify those tenets that retain value and those that may no longer be relevant?" "Will the academic open access e-journal become the primary fulcrum around which 'post modern science' can be explored?" "Is scientific inquiry and scholarly communication a fully conscious process and if not what elements of its unconscious aspects merit scrutiny?"

Those are interesting questions and by no means even a fledgling start towards an exhaustive list of critical questions raised by the promise of the academic open access e-journal. Yet two things are certain. Firstly, the academic open access e-journal promises to allow scholars to enhance the speed and diffusion of their work. Secondly, the academic open access e-journal as we envision it offers a transparency that permits scholars to obtain a fuller glimpse of the scientific process in "real time" on an unprecedented scale. These benefits alone should motivate the open source communities to identify and exploit the technological synergies that can enhance scientific inquiry, scholarly communication, and the life of the mind.

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On the Difference or Equality of Information, Misinformation, and Disinformation: A Critical Research Perspective

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ABSTRACT

More and better information is often seen as a prerequisite for better management practices. It is the task of information systems to collect or create such information. These simple premises are problematic, however. One of the reasons for this is that the very concept of information is not clear. This paper discusses the notion of information as well as the apparently opposing notions of misinformation and disinformation from a critical research perspective. Starting with a discussion of the question of truth, the paper argues that there is no agreement on what truth is and, therefore, what information is. The critical approach provides a different way of understanding these issues. Critical research aims to change the status quo and lead to emancipation. Drawing on two of the most prominent theoreticians of critical research, Jürgen Habermas and Michel Foucault, the paper explores what truth and information can mean for critical research. The contribution of the paper is to extend the debate on information and truth beyond its typical confines and show to the researcher that these issues are not value-neutral; every commitment to a research approach is a value choice that the researcher makes and needs to reflect on.

Keywords: critical research in information systems, information, truth, Habermas, Foucault, emancipation

Introduction

The concept of information is clearly of central relevance for information systems (IS) research and practice. Many assume that information is central to managerial decision making and that more and higher quality information will lead to better outcomes. This assumption persists even though Ackoff (1967) has argued almost 40 years ago that it is misleading. One of the reasons for the longevity of this arguably naïve reliance on IS to produce more and better information is a lack of conceptual clarity regarding the nature of "information".

There is no universally accepted theory or definition of truth. Yet, we have to use our everyday understanding of the term if we are to work with information. This leads to misunderstandings and problems. In this paper I address this conceptual problem from the point of view of critical research in information

systems (CRIS). The paper starts with a review of the concept of information, emphasising the practical, involved and ethical nature of information. Another important characteristic of information is that it is held to be true. In order to demonstrate the problem of this belief, I briefly discuss the most prominent current theories of truth. The criterion of truth allows for the distinction between the concepts of information, misinformation, and disinformation. Having thus outlined the concept of information and some of its problems, the paper will give an overview of critical research in information systems. After defining CRIS, the paper introduces Jürgen Habermas and Michel Foucault, two of the main theorist of critical thought.,. For these two, truth and information have a different meaning from the one we

traditionally associate with them. This means that, while one can still usefully distinguish between information and mis/dis-information, this can no longer be done from the objective perspective of the detached observer.

Based on the two competing theoretical foundations, the paper proceeds to analyse the meaning of information, misinformation, and disinformation in CRIS. Because of the different theories of truth, it is no longer possible to understand information as a correct description of a state of affairs. From the critical standpoint, one needs to consider question of consensus of those who are affected, but also questions of power and domination. Correspondingly, misinformation and disinformation change their character as well.

By the end of the paper the reader should have an appreciation of the fundamental problems of defining and determining information. The reader will furthermore develop a basic understanding of the value and approach of CRIS. While this approach does not offer any simple solutions, it is still immensely valuable because it allows us to frame questions differently and challenge the assumptions we usually take for granted. The paper demonstrates that what we often see as good and valid information may indeed be seen as disinformation and that the objectivist and positive perspective we usually associate with research can be misleading.

The paper leads to fundamental questions regarding the way we understand information, truth and research. It may therefore be uncomfortable reading for those who follow the established positivist paradigm without reflecting on these issues. It is not truly revolutionary, however, since the discourse on truth and disinformation has been ongoing for over 20 years (Hirschheim, 1985). It should be understood as one contribution to the difficult but necessary process of clarifying the philosophical issues upon which IS research and practice are built (Hirschheim, Klein & Lyytinen, 1995). A lack of understanding and clarity of such issues is not only academically and intellectually unsatisfying but arguably part of the reason for the continually high failure rate in IS.

Information

This section deals with the conceptual basis of the paper by discussing the meaning of the concept of "information". After a brief review of the literature on information, some of the theories of truth are discussed, since information is usually deemed to be true. The last part of the section explores the meaning of misinformation, disinformation, and bias.

Definitions of Information

We allegedly live in an information society and possibly even in the information age. Information surrounds us, powers our economy, and makes us information workers. Given this ubiquity, one should hope that we actually know what information is. Like most ubiquitous terms, however, information is rather opaque. Brock & Dhillon (2001), having done an in-depth review of the term, come to the conclusion that it is almost everything and anything and they liken it to the "ether" of the middle ages, which pervades everything but cannot be captured. In a classic definition, Wiener (1954, p. 17) states that "information is a name for the content of what is exchanged with the outer world as we adjust to it, and make our adjustment felt upon it", thus emphasising the processes involved in information sharing rather than the entity itself.

A typical approach to information in the field of IS is to compare it with the concept of data. Where data

are the raw facts of the world, information is then data "with meaning". "When “data” acquires context-dependent meaning and relevance, it becomes information. Furthermore, we obviously expect information to represent valid knowledge on which users can rely for rational action" (Ulrich, 2001 p. 56). This relationship between data, information and meaning is frequently adopted (cf. Davenport & Prusak, 1998; Walsham, 2001). It is also problematic. First, there is the problem that data are not simply brute facts of the world but that all data is already processed and gathered. Information thus cannot simply be the injection of meaning into data because data already has meaning, otherwise it would not be possible to perceive it (cf. Introna, 1997). The difference between data and meaning is thus a difference in the level and appreciation of meaning (cf. Floridi, 1999). Another problem of this definition is that it renders information completely idiosyncratic. Data that may hold meaning for you may be utterly meaningless to me. This would contradict the implicit assumption that information is more generally accessible, which is required for it to be processed it by machines.

This raises another problem, namely the relationship between information and technology. The reason why we are currently interested in information is that technology allows us to collect information (or data?) in previously unimaginable amounts. It can be processed automatically and checked for higher level patterns that would not be discernible without technology. This requires a new information infrastructure which, in turn, requires huge investments and therefore novel processes and procedures (Kahin, 1997). The transformation of information in a machinereadable format at the same time produces new problems, for example mobility and reproducibility (Straub & Collins, 1990). The technical use of information also suggests that information must be machine-readable and thus quantifiable (Bloomfield & Coombs, 1992). This returns us to the problem of meaning, because information, seen from a technical point of view, does not seem to offer a link to the concept of meaning as introduced earlier as central to information (Grim, Denis & Kokalis, 2004).

Another approach to understanding information would be to look at its function. Information as meaningful data needs to have meaning to (human) agents. Such meaning is only relevant if information can affect actions or perceptions (cf. Mingers, 2001). Information without any consequences is arguably not information. If information has a direct influence on humans, then it will also have an ethical impact. Indeed, the ethical importance of information has been recognised for a long time (cf. Mason, 1986; Stichler, 1998; Wiener, 1954).

This discussion of information could be continued in a variety of directions. One could look at the disadvantages of information (e.g. information overload (cf. Postman, 1992)) or other related concepts such as facts, jargon, numbers, opinions (Brooke, 2002) or resulting developments, such as the informating nature of modern work (Zuboff, 1988). Extending the distinction of data and information, one could discuss further concepts such as knowledge, wisdom, or judgement (cf. French, 1990). The one aspect I will briefly elaborate on in the next section is that of truth.

Information and Truth

One strong assumption about information is that it is true. If it were not true, then the meaning associated with it would be wrong or misleading. Untrue information can also not inform perception or action. De George (2003) distinguishes between data and information precisely because data contains no claim to truth whereas information does.

This raises the difficult question what it means for a statement to be true. I will not dwell on these

questions too long. However, it is important to briefly think about the criteria we accept for something to be held true or false because the critical approaches to be introduced later will differ greatly in this respect from the common sense understanding we typically use.

Truth is a property of a statement. A sentence or proposition can be true or false. When do we say a statement is true? A typical answer would be: "A statement is true if it describes a state of the world as it is." Or, we could rephrase, a statement is true if it corresponds with the way the world is. We therefore call this the correspondence theory of truth (Feyerabend, 1980; McCarthy, 1992).

The correspondence theory would appear to be what has been called the "natural attitude". Humans are socialised into believing that one can objectively perceive and make true statements about an external reality. The theory is problematic, however. The most serious problem it has to contend with, and which even strong supporters cannot overcome, is its inability to explain how an external reality can be equal to a mental representation (Khlentzos, 2004).

Alternative accounts of truth include the pragmatic, consensus, and coherence approaches. For adherents of the pragmatic view, a statement is true if it contributes to a desired outcome (Rorty, 1982). A consensus view of truth is based on the conviction that the criterion for the truth of a statement is the consensus of all (or all relevant or all informed) individuals or parties (Rorty, 1996; Apel, 1994). Finally, a statement can be seen as true if it conforms to a variety of other statements and does not contradict other known true statements. Such an approach is typical for formal languages or mathematics.

All theories of truth have consequences for the way we create true statements, for what counts as evidence and how we collect it (Gergen, 1999). They are closely linked to our understanding of the nature of being (ontology) but also to our view of right and wrong (ethics) or the nature of humankind (anthropology). These implications, which are often discussed under the heading of "paradigm" go far beyond what we can discuss in this brief paper (Orlikowski & Baroudi, 1991; Varey, Wood-Harper & Wood, 2002). The question of truth is important in this essay because it has to do with the difference between information and mis-/dis-information. At the same time, the critical approach does not subscribe to a traditional correspondence view of truth, thus necessitating different criteria for determining the difference between information and mis-/disinformation.

Mis- / and Dis-Information

The most important distinction between information and mis-information and dis-information is the question of truth. Where information is true, misinformation or disinformation are untrue. I follow the definition of the Oxford English Dictionary accessed 27.10.05) and use misinformation to denote "wrong or misleading information". Disinformation is also wrong information but unlike misinformation, it is a known falsehood. The OED defines disinformation as "the dissemination of deliberately false information" and refers specifically to wrong information supplied by governments. In this paper I will continue to distinguish between misinformation as accidental falsehood and disinformation as deliberate falsehood. Bias, as unacknowledged personal conviction, can probably be seen as a reason for misinformation. I will therefore disregard the concept in this paper.

The Critical Approach

Since the unique contribution of the paper is to discuss the concepts of mis-/ dis-information from a critical perspective, I now briefly introduce the idea of critical research in information systems. In the

first section I give a general overview of the debate on critical research and subsequently I introduce the two scholars who are most widely cited in critical research in IS, Habermas and Foucault.

The Concept of Critical Research in IS

Critical research is a concept that is not clearly defined but that is probably best understood as an umbrella that covers a range of different ideas (cf. Brooke, 2002). These ideas have some characteristics in common. Discussing the commonalities allows us to come to a sort of definition of critical research, even though it should be noted that this definition cannot be comprehensive because the range of different approaches is to diverse.

In the field of information systems, critical research is often seen as a "paradigm" (Chua, 1986; Orlikowski & Baroudi, 1991; Trauth, 2001). Loosely based on Kuhn's (1996) notion of a paradigm, this means that critical research is a composition of a variety of aspects, including ontology, epistemology, an assumption about the nature of humans and society and others. The notion of a paradigm is in many respects misleading, which is why I suggest concentrating on the following characteristics of critical research: intention, topics, theory, and methodology. Critical research has its roots in the Marxist critique of capitalism and it is based on the perception that the current status quo is unjust. It can therefore be characterised by its intention to change social realities (Alvesson & Deetz, 2000; Ngwenyama & Lee, 1997) and favour the disadvantaged (Mingers, 1992). Critical research can thus never be purely descriptive but is intrinsically normative and based on values (Walsham, 1993). Another way of saying this is that "a critical stance is focused on what is wrong with the world rather than what is right" (Walsham, 2005).

The concept most frequently used to represent the critical intention to change social realities is "emancipation" (Alvesson & Willmott, 1992; Howcroft & Trauth, 2004; McAulay, Doherty & Keval, 2002; McGrath, 2005). Critical research aims to emancipate those who are alienated because of the current structure of society and production, those who are excluded from the discourses that shape our society. Emancipation stands for the attempt to help people to achieve their potential (Klein & Huynh, 2004). It has an organisational / societal as well as a psychological dimension (Hirschheim & Klein, 1994). This intention to emancipate individuals is sometimes also expressed in terms of empowerment (Lyytinen &Hirschheim, 1988; CecezKecmanovic, 2001).

The critical intention to change reality and emancipate people leads critical researchers toward the choice of certain topics. These are topics which promise the researcher to identify issues of suppression and alienation and allow them to make a difference. They are typically interested in social structures or organisational configurations that express ideologies and reify discourses. The purpose of research is then to expose ideologies and open up discourses by introducing new arguments. The range of topics that allow critical researchers to do this is wide. They range from theoretical and abstract, such as the questions of identity (Forester, 1992) or rationality in business / capitalism (Cecez-Kecmanovic, Janson & Brown, 2002; Levy, Alvesson & Willmott, 2003), to social and legal, such as the problem of commodification of information and humans (Brooke, 2002; Knights & Willmott, 1999) or gender in IS (Kvasny, Greenhill & Trauth), to concrete organisational research. One topic that most critical research is concerned with because it is deeply linked to suppression and emancipation is the issue of power (Brooke, 2002).

In order to realise the emancipatory intention, critical research tends to follow certain methodologies.

However, there is no clear and unambiguous link between the critical intention and a specific research approach (Avgerou, 2005; McGrath, 2005). Current critical research in IS does seem to be close interpretive research in the choice of research methods typically used. This may be explained by the fact that critical researchers usually believe that reality is socially and linguistically structured and that, therefore, methods that emphasise the importance of language are important. Much critical research is also of a purely conceptual nature. There is nevertheless no principal reason why critical research could not use positivist and quantitative ways of doing research.

This very brief introduction to critical research in IS cannot be comprehensive. It cannot address most of the fundamental problems of critical research. How do we know whether someone is emancipated? Can we force emancipation on individuals who are not interested? Can critical research actually achieve the critical intention or is it just abstract talk in the ivory tower (Oates, 2004)? And, maybe most importantly, is critical research just another partial ideology which competes with a range of others and has no claim to universal validity (Wilson, 1997)? I have to leave those question open and now briefly introduce the important theoretical side of critical research by discussing the work of the two most widely cited scholars in CRIS: Michel Foucault and Jürgen Habermas.

Michel Foucault

A good starting point for an introduction to Foucault's work is probably his "order of discourse" (1971), where he describes the overarching themes of his prior publications and outlines future research. The concept of discourse is central to his work. Discourses shape social reality and individual perceptions. His main interest is in how discourses are formed, controlled, distributed, and which mechanisms regulate participation. He is particularly interested in how certain individuals or topics are excluded from discourses. His different works concentrate on different aspects of exclusion from discourse. Mechanisms and procedures of exclusion include insanity, certain views of sexuality, and bodily discipline. Another means of controlling discourses are conditions and perceptions of discourses, such as the Western myth of free and open discourses. And while Western democracies pretend to honour open discourses, Foucault contends that, in reality, they fear it. These critical observations regarding discourses render the allegedly peaceful mechanisms of discourse an expression of (tacit) violence.

Foucault does not try to promote a better form of discourse. His aim is to give an open description of how discourses are shaped (Knights & Morgan, 1991). The way he does this is to describe how configurations of discourses have developed. He uses an archaeological approach, which he also describes in terms of genealogy, which means that he analyses the history of discourses. A concept closely linked to Foucault's work is power. Discourses are the means by which power is exerted but they are also subject to power constellations (Foucault, 1976). The concept of power in Foucault's work is very wide. Power is not just the ability to enforce one's will against others but it is a wide range of influences (Wong, 2002). Power is created and perpetuated through discipline. Foucault's possibly most widely-read book, "Discipline and Punish" (1975) discusses how discipline of the docile body is used to create discourses and social institutions.

Power and discourse are linked by the idea of regimes of truth (McGrath, 2003). These regimes of truth refer to the collection of statements that are considered true and acceptable within a particular discourse. Foucault's research concentrates on how such regimes of truth are constituted. Regimes of truth are a result of power constellations because power allows the establishment of truths. Again, however, this is not a one-way relationship. Regimes of truth can also undermine power relationships.

This idea of regimes of truth is highly relevant to the current paper. It shows that for Foucault truth is not a matter of correspondence between statement and external reality but has to do with negotiations in discourses, which, in turn, are shaped by power relationships and physical and mental discipline. Truth is not given and stable but fluid. Foucault does not want to educate us what truth really is or should be. His interest is in describing how regimes of truth come into being.

Jürgen Habermas

Habermas, probably the most widely cited scholar in CRIS, follows a very different approach to criticality. (For a more complete introduction to Habermas's ideas and their application in IS cf Klein & Huynh, 2004 or Janson & Cecez-Kecmanovic, 2005). For Habermas, too, the concept of discourse is central to critical thinking. It has, however, a vastly different meaning. Habermas is a successor of the idea of enlightenment but he sees that a Kantian reliance on individual reason is doomed to failure. Being inspired by the continental European philosophical tradition but also by Anglo-American philosophy of language, Habermas realises what he sometimes calls the "linguistic turn". This means that reason is no longer seen as an individual property but is moved to a collective realm. The individual human being lives within a "life-world", which means that we all have our individual perceptions of reality and truth. However, these life-worlds are not completely idiosyncratic because they are constituted through socialisation and upheld through communication.

The idea of communication is thus central to Habermas' work and his theory of communicative action (TCA) (Habermas, 1981a, 1981b) is arguably his main publication. Communicative action is one possible mode of action; it is the mode that takes the other serious and therefore aims to understand and communicate with the other. According to the TCA, when we communicate with others, all speech acts carry three validity claims: truth, normative rightness, and authenticity. This means that all utterances imply that the speaker speaks the truth, that the statement is normatively justified, and that the speaker is sincere in what she says. These are not empirical descriptions but transcendental to communication, which means that without the assumptions of truth, rightness, and authenticity, we would not need to be able to communicate.

In many cases, participants in communication will not agree on validity claims and will doubt whether statements are indeed valid. This is where the concept of discourse plays a role in Habermas's writing. Discourses stand for the type of communication where contentious validity claims can be discussed. They imply that the speakers recognise that they interact under the conditions of the ideal speech situation, a counterfactual collection of conditions, which include the ability of everyone affected to participate in the discourse, the absence of overt power differences, the practical and linguistic competencies of participants (Habermas, 1996). The idea of the ideal speech situation is that the best argument will convince the community of discourse and lead to a consensus on the validity claim in question.

With regards to the question of truth, one can state that truth is of central importance for Habermas. However, it is not a correspondence idea of truth that Habermas uses but a consensus theory. A statement can be seen as true, if it is accepted by all competent members of the community of discourse (Habermas, 1998). Truth claims that are contentious are addressed by opening a discourse, not by establishing a reference to the external world. Of course, it is conceivable that the discourse will take up questions of correspondence, but these are not the criterion for truth.

The Relationship between Habermas and Foucault

The brief introduction above cannot do justice to either Habermas or Foucault. It should suffice, however, to convince the reader their approaches offer a different understanding of truth and thus of information. There is a complex debate to be had what the relationship between Habermas and Foucault is (cf. Ashenen & Owen, 1999; Kelly, 1994; Stahl, 2004). Fortunately, we do not have to make a decision here whether they are compatible. It can safely be said that they are both recognised as important reference scholars in the debate on critical research in IS. Both share the critical intention to change social reality, which is perceived as not being just and desirable. While emancipation is an express goal of Habermas's, Foucault would arguably be more sceptical about the possibility of achieving emancipation. His genealogical work can nevertheless be understood as an expression of the desire to help people understand the situation they find themselves in and thus to facilitate an improvement in their status quo.

Having established what critical research in IS means and which theoretical bases there are, I now return to the central question of the paper: what is information / disinformation / misinformation from the point of view of critical theory?

Mis- / Dis- Information in Critical Research

This section combines the above discussions of information and critical research. It concentrates on the nature of misinformation and disinformation as seen from a critical viewpoint and explore the difference with regards to information from a Habermasian and Foucauldian angle.

Truth in Critical Research

For a critical researcher, truth can never be an objective description of an external reality. All perception is always value-laden and based on individual and collective prejudices. Following the hermeneutic tradition, critical researchers in IS tend to agree that prejudices cannot be overcome (Gadamer, 1990). Instead, the purpose of research is to expose them and render them open to discursive analysis. This raises serious problem for a critical epistemology. How can we know what is true if all truth claims can always be contested? And how can critical theory claim to be true, if it fundamentally doubts the existence of eternal truths? The short answer to this is that critical research has to emphasise reflexivity. That means that critical research must question its own assumptions and foundations. Only by remaining open to constant questioning can it be possible to overcome the dilemma of scepticism. (The dilemma of scepticism is that it doubts the existence of truth and thus cannot be true.) And, indeed, an emphasis on reflexivity is central to critical research (Cecez-Kecmanovic, 2001; Steffy & Grimes, 1992; Waring, 2004).

Another important aspect of the understanding of truth in CRIS is that truth cannot be value neutral. It is impossible to divide truth claims from normative claims. Following Habermas, one can say that every speech act simultaneously promotes different validity claims, which can be separated for the purpose of analysis but in practical discourses always exist side by side. A presumably value-neutral statement such as "the Technology Acceptance Model (TAM) offers a good description of ICT user behaviour" is not really value-neutral. It implies that the speaker has a right to say this, and that saying it does not limit anyone's rights. It assumes that objective descriptions are possible and good, which is a value statement. Alternative descriptions of reality are curtailed because the assumed truth of the statement puts the onus on the listener to believe it and use TAM as a description of reality. All of this is not meant to show that this is an immoral statement but rather that it is not value-free.

Truth can also be used as an ideology. The worst form of ideology is that which has been recognised as truth and is therefore no longer open to debate. If we accept as true, for example, that women are inferior to men, then there is no need to debate the statement. Truths, which are generally accepted, are therefore the strongest form of ideology. And they are also closely linked to power. If it is true that managers are rational humans who can recognise the needs of the organization and maximise the utility, then there is no need to question the status of managers in the organisation or the role of commercial entities in society. Truth thus cements power and, at the same time, power helps establish truth. A look at popular discourse about companies and their role in society or the role of ICT in organisations shows that there are numerous "truths", which stabilise the status quo without there being strong evidence to support them. Among them there is the assumption that economic growth is the panacea to most of society's problems, that economic rationality is the best way to approach questions of distribution, or that the use of ICT will improve organisational processes from commerce and government to education.

Such objectification and reification of ideologies is what critical research aims to explore and overcome. With regards to ICT, this means that it is important to discuss its role and uses. ICT does not determine its use but a look at current technology shows that its uses for liberating purposes are rare, whereas the large systems used by government and businesses tend to be about exerting control and power. Ackoff (1967, p. 150), in his paper which inspired the discussion of information and mis/dis-information, said this quite clearly: "Information systems are subsystems of control systems."

Misinformation and Disinformation in CRIS

If we go back to the definition of information, then a relevant aspect is that it makes a difference, that it "in-forms" people and helps them orientate themselves. Given that critical research is interested in emancipation, one can say that from the perspective of CRIS information is what helps emancipate humans, whereas misinformation and disinformation alienates and disempowers. To address this, CRIS can try to point out where information as well as technology hide and propagate ideology. A nice example of this is provided by Introna (1997) who points out that the information provided by MIS is best described as a status symbol. It allows the user (manager) to lay a claim to rationality, which in our society is a legitimization for the exertion of power. This would not be so bad if it did not mean that it legitimizes the manager to make decisions that can alienate others. And it would also be acceptable if the relative nature of such truth claims were clearer. However, the current truth discourse that tries to find universal truths easily turns in to (cultural) imperialism (Gergen 1999).

To return to the difference between misinformation and disinformation, one can say that for a critical researcher misinformation are such claims that inadvertently lead to alienation whereas disinformation are claims which the originator knows to be alienating but nevertheless proposes.

From a Habermasian perspective misinformation is not problematic. It is simply information that is contentious and that therefore will be analysed in a discourse. The person claiming truth will have to explain the reasons for the claim and will have to answer critique. All of this can be done within the framework of communicative action where people recognise each other as dignified beings and are willing to take each other seriously. Disinformation is more problematic. Since it is information that deliberately alienates or disempowers people, the speaker shows a disregard for the other who is disempowered. This means that she is not interacting in communicative mode but in what Habermas calls "strategic" mode, where others are used as means to the speaker's ends. From a Habermasian perspective, this would still be subject to discourse because one could point out to the speaker that she is

self-contradictory. The problem is, however, that she may simply not care. This is where critical research becomes problematic. The hope of current critical research is that by exposing ideology and false claims, these will be rectified. It does not offer any guarantee, however, that this will happen. When disinformation is exposed as such and still not changed, then critical research will have reached its limits and need to interact with other social institutions such as politics or the law to stimulate change.

The distinction between misinformation and disinformation would look different from a
Foucauldian viewpoint. Foucault is much more sceptical about any truth claims than Habermas. A Foucauldian could argue that the distinction between misinformation and disinformation is artificial because it seems to presuppose the existence of a universal truth and the selfreflectiveness of the speaker to know her own intentions when speaking. Both may be doubtful. A further problem would be that the idea of emancipation is much less clear and that it is not obvious whether emancipation is not a particular ideology itself.

The Foucauldian approach would therefore be to undertake a genealogy of information and try to understand why some statements are believed to be true or false and why individuals would form propositions that can be construed as false. The emphasis in such a genealogy would be on questions of power and bodily discipline. How are we socialised in order for us to accept certain truths and falsehoods? This Foucauldian approach does not offer any hope to come to a clear distinction between truth and untruth, between information and misinformation. However, it seems to be carried by an implicit hope that there are better (more empowering) accounts of the world and worse ones. Otherwise there would be little point in undertaking a genealogy.

Conclusion

This paper should have clarified that, from the point of view of critical research, the distinction of information, misinformation, and disinformation is problematic. It is closely linked to the question of truth and we should admit that there is no universally accepted theory of truth. The critical approach will help scholars to widen their understanding of issues and question their own work. Choosing to do critical research is not a value-neutral stance but requires the researcher to actively reflect on their assumption. It is based on a desire to promote emancipation rather than work in systemic imperatives.

The paper will also have shown that critical research does not offer any easy answers. By discussing the two competing theoretical approaches of Habermas and Foucault, it has shown that even within critical research there is no unanimous answer to what information is and whether we can detect and address misinformation or disinformation. However, it should also have shown that critical research provides us with ways of thinking about truth and what we hold to be true or false. It stresses the fact that truth is not a natural occurrence and that it is worthwhile to think about where it comes from and who promotes it or benefits from it.

One argument that the paper certainly does not promote is that critical researchers become the gatekeepers of truth and information. This would only substitute one type of ideology for another. Neither does the paper suggest that there is no truth, which would leave it open to the charges of being relativistic and self-contradictory. Instead, the practical lesson to be learned from the above discussions is that we need to be very careful with regards to truth claims and realize that truth is always open to debate. This means that there is no clear and unambiguous dividing line between information and misinformation. A statement that can serve as useful and clear information when uttered by A in context

B can become an outright lie with political intentions when uttered by person C in context D. The only thing that can be done in the light of this uncertainty of truth and information is to keep an open mind and remain open to discourses and new arguments.

Finally, I hope that this paper will stimulate debate and individual reflection about the critical approach. Researchers should realise that there is no choice between value-laden critical research and objective non-critical (positivist, interpretivist,…) research. Instead, the choice not to engage in critical research is as much a value choice as the choice to do it. Choosing not to engage in a critical way is fundamentally a conservative stance. Researchers are of course free to make such a choice but they should be aware of it and they should ask themselves whether their time is better spent thinking about emancipation or stabilising the current system.

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Would Regulation of Web Site Privacy Policy Statements Increase Consumer Trust?

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A B S T R A C T

Proponents of e-commerce have known for some time that limited participation by consumers partially reflects their concern over the privacy of personal information. To address consumer concerns, web site operators have employed security mechanisms, including privacy policy statements to increase their perceived trustworthiness. While empirical evidence is limited, there is some question regarding the ability of privacy policy statements to engender significantly greater levels of trust. The limited effectiveness of such statements may reflect their voluntary implementation, self-enforcement, and\or significant variance (protection and enforcement) from one web site to another. One possible remedy would be the imposition of legally mandated statements. This study examined the efficacy of legally mandated privacy policies vis-à-vis both voluntary statements of varying degrees of protection and the absence of any such statement. The results were mixed, as legally mandated privacy policy statements were found to be comparable to strong voluntary statements, but superior to none, weak or moderate policies. Perhaps more important, the nature of the privacy policy statement interacted with type of information requested.

Keywords: e-commerce privacy: electronic commerce trust; Internet privacy; Internet trust; online privacy; privacy policy statements

Introduction

The past decade has witnessed rapid growth in e-commerce, particularly with respect to businessto-consumer (B2C) transactions. Both established and new vendors have sought to leverage the diffusion of the Internet to expand their markets. The Internet has allowed established firms to expand their marketplace, but at the same time it has eliminated many of the traditional barriers of entry for new entrants to compete for these same consumers. Consumers once accustomed to limited and known vendors are now af forded more choices, but are often concerned about privacy and trust as many of the vendors are “unknowns” (Pennington, Wilcox & Grover, 2003). Given that consumers are now presented with vendors with whom they have little or no familiarity it comes as no surprise that recent research on e-commerce has found that privacy and trust issues are a key determinant in whether consumers' engage in on-line transactions (Hoffman, Novak, & Peralta 1999).

Recognizing that privacy and trust of the vendor is a critical antecedent to increased participation in B2C e-commerce, researchers have examined several “trust mechanisms” employed by vendors to enhance consumer trust and concomitantly their predisposition to purchase on-line. One mechanism that has garnered considerable interest are privacy policy statements, voluntary, selfreported statements displayed on web sites that convey established policies for the use and distribution of personal information.

Use of privacy policy statements to increase perceived trustworthiness is a relatively new phenomenon, and examination of their use and implications is just beginning to be explored (Criswell & Meinert, 2003; Culnan, 1999; Grewal, Munger, Iyer, & Levy, 2003; Liu & Arnett, 2002; Luo & Najdawi, 2004; Meinert, Peterson, Criswell & Crossland, 2006; Miyazaki & Fernandez, 2000; Pennington et al., 2003; Ranganathan & Ganapathy, 2002). While much of the research to date on this topic has focused on chronicling rates of utilization and variability in content, a few studies have examined the efficacy of privacy statements. Pennington, Wilcox and Grover (2003) found evidence via an experimental design that self-reported guarantees can influence system trust and indirectly influence consumer purchase intentions. In an exploratory study, Criswell and Meinert (2003) found that self-reported privacy policy statements increased consumer willingness to provide personal information on-line. That study and a more comprehensive study by Meinert, Peterson, Criswell and Crossland (2006) also affirmed that not only the presence, but the strength, or level of protection guaranteed by the privacy policy statement influences consumer trust as measured by willingness to provide personal information on-line. These results, while preliminary, seem to suggest that voluntary privacy policy statements have a positive, but relatively limited impact on consumer trust. Only a strong privacy policy statement was found to induce a willingness to provide contact, biographical and financial information and in each case respondents were only "slightly likely". It should be further noted that respondents in these studies were required to read the description of the privacy policy statements. In many instances, potential customers may not read any policies regarding the web site's stated privacy standards.

Given the widespread use of privacy policy statements it's somewhat surprising to find that they have minimal impact on consumer trust. Determining whether the effectiveness of privacy policy statements can be improved would contribute to the knowledge and understanding of what, if any, role they can play in influencing consumer trust of on-line vendors. While the literature offers no insight into why such statements are ineffective, one plausible explanation is that consumers place little faith in privacy policies that lack regulatory oversight. The aim of this exploratory study was to examine whether legally mandated web site privacy policies would be more effective than either no policy or voluntary policies affording varying degrees of protection. This study was intended to provide a preliminary understanding of the extent to which regulation of privacy standards might increase the efficacy of web site privacy policy statements in order to increase consumer trust. As an exploratory study, four specific research questions were examined:

• How willing are consumers to provide various types of information via the Internet when a legally mandated privacy policy is in place?
• Are legally mandated privacy policy statements more effective in engendering trust than either no policy or voluntary policies affording varying degrees of protection?
• Are consumers generally aware of privacy policy statements?
Are consumers reading privacy policy statements?

By addressing these questions, this study aims to contribute to the body of knowledge related to web site privacy policy statements. The findings should be of interest to practitioners, public policy makers and academicians. The findings provide additional insight into the influence of alternative forms of privacy policy statements and the extent to which regulatory oversight might influence consumer behavior.

To address these research questions, this article reports the results of a survey designed to measure the impact of both voluntary\self-regulated and legally mandated privacy policy statements. First, the article

examines related research to develop a basis for this investigation. This literature review necessarily examines findings related to consumer trust and its role in e-commerce and methods employed to increase consumer trust. Likewise the review explores both the protection provided by privacy policy statements and the types of information typically requested by web sites. The literature review concludes with a brief description of existing federal privacy standards that may influence consumer perceptions and/or expectations regarding the government's role in privacy protection. Next, the purpose of the study is outlined in the context of the literature review. This is followed by a methods section that describes the data collection, sample, and results. Following a discussion of the results, limitations of the study and opportunities for future research are addressed. The article concludes with a brief summary of the implications of the study.

Literature Review

An antecedent to virtually all business transactions is consumer trust. When consumers feel vulnerable or at risk they are generally hesitant or unwilling to place orders or provide personal information. Recognizing the importance of consumer trust, individual organizations, industries and public policy makers have sought to identify and implement mechanisms to reduce perceived risks. While concern about consumer trust in e-commerce is a relatively new phenomenon, there are four categories of literature that provide a foundation for this study. The first explores the general basis for trust and its role in e-commerce models. The second chronicles methods for increasing consumer trust. The third examines the strength of privacy policy statements (i.e., level of protection afforded) and the nature of information collected via the web site. The fourth and final category pertains to existing federal privacy standards that demonstrate the viability of legally mandated privacy policies for web sites.

Consumer Trust and its Role in E-Commerce

Numerous studies have demonstrated that many potential customers are reluctant to engage in ecommerce transactions because of concerns about providing personal information through the Internet (Kolsaker & Payne, 2002; Miyazaki & Fernandez, 2001; Suh & Han, 2003). It has been estimated that $15 billion in e-commerce revenues for 2001 were unrealized due to a lack of consumer trust in either the ability or the intent of web merchants to ensure that personal information would only be used in an acceptable manner (Sipior, Ward, & Rongione, 2004).

Definition of trust

A number of definitions of trust have been suggested specifically with regards to e-commerce (e.g., Gefen, 2002; Lee & Turban, 2001; McKnight & Chervany, 2001). Most of the definitions of trust proposed within the realm of e-commerce share a number of common elements. For example, trust has been defined as a consumer's willingness to rely on the seller and take action in circumstances where such action makes the consumer vulnerable to the seller (Jarvenpaa, Tractinsky, Saarinen & Vitale, 1999). As in most definitions of trust there is an element of risk associated with the information submitted through the Internet. Consumers are vulnerable because they are dependent on web merchants to use information in an acceptable manner. The definition also implies that consumers make their own subjective assessment of the risks involved in a particular e-commerce transaction. Finally, a consumer's actions are assumed to be the result of a rational decision making process.

Models of consumer trust in e-commerce

A variety of models on consumer trust in e-commerce have recently been proposed (Jarvenpaa, et al., 1999; Lee & Turban, 2001; Limayem, Khalifa, & Frini, 2000; Liu, Marchewka, & Ku, 2004; McKnight

& Chervany, 2001; Suh & Han, 2003; Tan & Thoen, 2001). For the most part, these models share a number of common elements. For example, most models recognize that individual differences among consumers play a vital role in e-commerce trust. In general, consumers are assumed to differ in terms of their propensity to trust or their disposition to trust (Lee & Turban, 2001; McKnight & Chervany, 2001). The disposition or propensity to trust is likely influenced by consumers' awareness of Internet fraud and their past experiences regarding both the Internet and other situations involving risk. In addition to past experiences, individual differences in the willingness to engage in e-commerce transactions could also be the result of inherit differences in the inclination of individuals to take risks, such as a tendency to be risk averse or a risk seeker (Tan, 1999; Tan & Thoen, 2001).

The assumption that individuals differ in terms of their trust in e-commerce is supported by studies demonstrating individual differences with respect to gender (Kolsaker & Payne, 2002), amount of experience with the Internet (Corbitt, Thanasankit, & Han, 2003; Miyazaki & Fernandez, 2001), and cultural background (Jarvenpaa et al. 1999; Liu et al., 2004). In an attempt to examine the extent of individual differences, Sheehan (2002) developed a four category typology based on concerns about submitting personal information to web sites. This study, based on 889 responses to an e-mail survey, indicated that only a small percentage of individuals could be classified in the extreme groups, "unconcerned" (16%) and "alarmed" (3%). The majority of individuals were classified in the middle two categories, "circumspect" (38%) and "wary" (43%). These results seem to imply that most individuals do not already have strong preconceived notions about the level of risk involved in providing personal information to web sites. Rather the results suggest that the specific attributes of a given web site or web merchant is likely to influence the decisions of most potential customers.

Another component that is common to most models on e-commerce trust is trust in the Internet system (Lee & Turban, 2001; McKnight & Chervany, 2001). It has been proposed that consumer trust in the Internet system is influenced by the perceived technical competence of the system, perceived performance level of the system, and the degree to which the consumer understands the Internet system (Lee & Turban, 2001). These perceptions of the trustworthiness of the Internet system are likely to be highly influenced by media reports. For instance, one frequently reported study conducted jointly by the Computer Security Institute and the FBI estimated the cost of system penetration by outsiders at over seven billion dollars annually (cited in Tribunella, 2002).

The third and most investigated component of most models on e-commerce trust is trust in the web merchant. Studies have shown that the size and reputation of a web merchant greatly influences consumer trust (Jarvenpaa, et al. 1999). It has also been demonstrated that the perceived ability, integrity, and benevolence of a web merchant influences consumer trust (Lee & Turban, 2001). This finding emphasizes that web merchants must not only have good intentions, but also the perceived ability to protect personal information. Strength of authentication, nonrepudiation, confidentiality, privacy protection, and data integrity all have an impact consumer trust in Internet Banking (Suh & Han, 2003).

Methods for Increasing Consumer Trust

To gain consumer trust, web merchants must convince potential consumers that personal information obtained through e-commerce transactions will remain secure. To this end, web merchants have employed a variety of security mechanisms to increase their perceived trustworthiness. These methods include seals of approval or third party certifications, quality and normalcy of web site design, ratings or customer testimonials, endorsements by reference groups, and money-back guarantees (Ba & Pavlou,

, 2002; Corbitt et al. 2003; Grewal et al. 2003; Lee & Turban, 2001; Liu et al. 2004; Pennington et al. 2003; Ranganathan & Ganapathy, 2002; Suh & Han, 2003; Tan, 1999).

Since the effectiveness of these procedures has been reviewed in previous articles, a detailed review will not be presented in this paper (Liu & Arnett, 2000; Ngai & Wat, 2002). Briefly, the results of these studies have provided positive support for the inclusion of many security mechanism, including money back guarantees, warranties, partnerships with established organizations (Corbitt et al. 2003; Grewal et al. 2003), non-online methods of payment (Ranganathan & Ganapathy, 2002) privacy protection guarantees, nonrepudiation (Suh & Han, 2003), approval from reference groups and warranties (Tan, 1999). However, seals, ratings (Pennington et al. 2003) and third party endorsements (Lee & Turban, 2001) have not been found to significantly increase consumer trust.

One of the most widely used security mechanisms by web merchants is a self-reported guarantee or a privacy policy statement. A privacy policy statement is a contractual commitment to consumers outlining how their personal information will be treated. Privacy policy statements represent one of the simpler and less expensive methods of increasing consumer confidence, which may account for their widespread use. The evidence suggests that posting a self-reported guarantee of compliance with e-commerce standards is an effective means of increasing consumer trust (Pennington et al., 2003; Ranganathan & Ganapathy, 2002). Privacy policy statements appear to be most beneficial to the web merchants that have the greatest need to increase consumer trust (Grewal et al., 2003). That is, privacy policy statements were found to be much more useful for web merchants that lacked name recognition than those with an established reputation.

Privacy Policy Statements

Previous research has examined various aspects of privacy policy statements including: levels of protection, enforcement, and interaction with information types.

Levels of protection

Studies examining the content of web sites have found a remarkable amount of variability in the nature and types of privacy policy statements (Liu & Arnett, 2002; Luo & Najdawi, 2004; Miyazaki & Fernandez, 2000). These studies have reported that privacy policy statements vary in terms of their placement, length, and ease of reading. Most importantly, the statements vary in terms of the level of protection guaranteed (Liu & Arnett, 2002). Some privacy policy statements are highly restrictive while others offer no real assurance of privacy. An example of a highly restrictive privacy policy statement might include a statement such as: “Under no circumstances will any information you provide to us over the Internet be released to any third party for any reason whatsoever” (4321net, 2002).

A less restrictive privacy policy statement might include language similar to the following excerpt from the Sun Microsystems privacy policy statement, “If you choose to provide us with your Personal Information on the web, we may transfer that information, within Sun or to Sun's third party service providers, across borders and from your country or jurisdiction to other countries or jurisdictions around the world” (Sun Microsystems, 2001).

A third and least restrictive level of privacy statement does not provide any protection of personal information. In this scenario, the term privacy policy statement is a misnomer as the statement simply indicates that it is the intention of the web merchant to share information collected on individuals with

other organizations. Thus, these types of statements serve primarily as a means of protecting the web site with respect to liability issues, as it is the intent of the web site to share information on customers with other sources.

Enforcement. Differences in web site privacy policy statements are not limited to the level of protection afforded as enforcement also varies. Enforcement generally falls into three categories: self-regulation, third-party validation/audits and regulatory oversight. Although the Federal Trade Commission has been concerned about on-line privacy for some time they have "actively supported self-regulation" (Federal Trade Commission, 2000, p. 20). Hence, the absence of any reference to third party or regulatory oversight in a privacy policy implies self-enforcement. To address consumer concerns related to self-regulation, third-party seal programs have been developed (Liu and Arnett, 2002). Seal programs such as TRUSTe, BBBOnLine (Better Business Bureaus Online Seal), MutiCheck and WebTrust (offered by American Institute of CPAs) allow licensees who abide by posted privacy policies and/or allow compliance monitoring to display the granting organizations seal of approval on their web site. Privacy seals are intended to provide a simple means for addressing consumer privacy concerns. The standards for achieving certification vary and at present there are no fewer than nine services offering seal programs (Higgens, 1998). The least common form of enforcement is regulatory, which reflects in large part the federal government's attempts to rely on self-regulation rather than legal standards. Laws and regulations at both the state and federal level in the United States have been enacted to establish privacy standards for web sites operated by the government. For example, policy set forth by the White House Office of Management and Budget requires federal government web sites to post privacy statements and eliminate the use of covert methods of collecting information, such as cookies (Swire et al., 1999). On a broader scale, laws have been enacted that apply to all web sites, private or public such as the Children's Online Privacy Protection Act (COPPA) of 1998 (SEC. 1301-1308). COPPA requires commercial web sites to obtain parental consent before collecting, using, or disclosing personal information of children under the age of 13.

Types of Information Requested

Much of the research on e-commerce trust has focused on measures of consumers' beliefs, attitudes, and purchase intentions, without consideration for the types of information requested by the web sites. As noted earlier, the inherent risk is associated with the type of information required. Thus, it seems likely that the type of information requested could affect beliefs concerning risk and thus the willingness or intentions of consumers to engage in e-commerce transactions. That is, consumers are apt to engage in e-commerce transactions when a certain threshold of trust is achieved or the level of perceived risk is acceptable. Most theories on risk take into account not only the perceived level of risk involved in a transaction or gamble, but also the stakes involved in the gamble (Tversky, 1995). Thus, it might be reasonable to assume that the trust threshold for engaging in e-commerce transactions varies depending on the potential loss or harm that could result from engaging in a specific transaction. Individuals may be likely to engage in e-commerce transactions when there is little to lose even if the level of trust is low.

Conversely, if (1) the perceived level of risk is high or (2) the potential loss or harm is substantial, there may be a reluctance to engage in e-commerce. It is likely that the perceived potential for loss or harm in ecommerce is dependent upon the type of personal information requested. Thus, whether a consumer engages in an e-commerce transaction is apt to depend not only on the level of trust, but also the potential loss associated with the type of personal information required.

There is enormous variability in the types of information requested by web sites. Some web sites require contact information before consumers are even allowed to access a web site and extensive personal information must be provided in order to complete a transaction (Sipior et al. 2004). At the other extreme, some web sites make it possible for consumers to conduct transactions based on a limited amount of personal information submitted to the web site using such techniques as buyer's authentication, confirmation and payment assurance, or non-repudiation (Hoffman, Novak, & Peralta, 1999). Other web sites may permit consumers to browse potential products and services and then printout order forms that can be submitted using other modes of communication (e.g., telephone, conventional mail, or fax) (Miyazaki & Fernandez, 2000).

A preliminary review of web sites suggests that most of the information requested by web merchants can be broadly classified as contact, biographical, or financial. Contact information includes such items as e-mail address, name, mailing address, and telephone numbers. Contact information is of value to web merchants for several reasons including creating mailing lists to publicize special promotions, products, or services offered by the web merchant. However, contact information may also be sold by web merchants to third parties. Consequently, many individuals are often reluctant to provide contact information to web sites (Greiner, 2003).

Biographical information includes demographic data such as income, personal preferences, interests, and hobbies. Web merchants may use biographical information to profile customers, target future communications for marketing purposes, and customize web pages for individual customers. Web sites may also use biographical information to market their site to advertisers by providing detailed information on visitors to their web site (Liu et al., 2004). Because consumers are concerned that personal information may be sold to third parties, most individuals (over 90 %) have refused to provide biographical information to a web site on at least one occasion and many (approximately 40%) admitted in some instances to providing false information (Hoffman et al. 1999). A recent review of the literature suggests that privacy concerns regarding how web sites use biographical information remains “a most formidable barrier to people engaging in ecommerce” (Wang & Emurian, 2005).

Financial information includes such items as credit card numbers and bank account numbers. Although consumers are obviously reluctant to provide financial information, this information is often viewed as necessary to complete an e-commerce transaction. However, numerous techniques such as buyer's authentication, confirmation and payment assurance, cryptography, digital signatures, non-repudiation, and alternative payment methods can reduce the perceived risks associated with financial transactions (Hoffman, et al. 1999; Kolsker & Payne, 2002; Miyzazki & Fernandez, 2000). While such techniques may complicate the processing of orders for web merchants, these procedures may reduce the perceived risk and increase consumer willingness to engage in e-commerce transactions.

Existing Federal Privacy Standards

Government involvement in the regulation of information privacy on the Internet varies greatly among nations with the degree of government involvement highly associated with the level of privacy concerns among citizens of a particular country (Smith, 1994). Many countries like the U.S., and until recently, Canada and Australia, have not been highly involved in the regulation of privacy standards, leaving it to the internet industry to regulate itself (Bellman, Johnson, Korbin, & Loshe, 2004). These countries have primarily targeted government regulation in certain areas, such as the public sector. This voluntary or sectoral approach contrasts with the omnibus approach, to both public and private sectors, used by the

European Union (Bellman et al. 2004). Since the present study was conducted within the U.S. and for the most part examined the views of U.S. citizens, the focus of the present study is on the federal privacy standards existing in the U.S.

In recent years within the U.S., consumers have been inundated with notifications of federal privacy requirements when dealing with health care and financial institutions (e.g., loans, financial/investment advice, or insurance). In health care settings, patient privacy protection is mandated by the federal Health Insurance Portability and Accountability Act of 1996 (HIPAA), while privacy of consumer information held by financial institutions is governed by the Gramm-LeachBliley Financial Modernization Act of 1999. Periodic (annual) and episodic notification of these acts and the respective institution's privacy policies have certainly contributed to an increased consumer awareness regarding not only privacy issues, but the existence of federal standards and enforcement in select industries. In these settings consumers have grown accustom to uniformity in both format and content of privacy policies. This is in severe contrast to the Internet where consumers are confronted by a myriad of differences including placement, length, level of protection, and enforcement. Internet users must determine to what extent, if any, personal data will be utilized internally and/or shared for external or secondary purposes. Further, consumers must for the most part rely on self-policing and/or 3rd parties (seal programs) to insure compliance with stated policies.

Purpose of the Study

The fundamental purpose of this study is to determine whether the imposition of legally mandated privacy policy statements would significantly increase consumer trust and thus willingness to engage in e-commerce. Attempts to estimate the efficacy of regulation would seem prudent given calls for such regulation and the limited impact of voluntary privacy policy statements and selfregulation. Therefore, this study examined the effects of legally mandated versus voluntary privacy policy statements on consumer willingness to provide personal information.

Recognizing that consumer privacy concerns are determined to some extent by what information is requested (Cespedes & Smith, 1993) and level of protection promised (Meinert et. al, 2006), it is necessary to examine the efficacy of privacy policy statements in the context of both the information at risk and strength of protection afforded by the privacy policy. While information sensitivity varies from individual to individual, some information items or categories generate more privacy concerns than others. Therefore, a second objective of this study was to examine the main and interaction effects of types of information requested. To address this objective, when presenting the alternative privacy policy scenarios the effects of three information categories, contact, biographical, and financial, were examined.

Although privacy policy statements have become common, there is evidence suggesting that consumers may not be familiar with these statements (Westin & Maurici, 1998). It might be expected that with the increased popularity of e-commerce and the growing prevalence of privacy policy statements that more consumers at the present time would be aware of such statements. However, even though consumers may be aware of privacy policy statements, there is no guarantee that they read such statements. Research in the area of consumer behavior has demonstrated that customers frequently fail to read important and relevant information regarding transactions such as product warranties (Adler, 1994) or guarantees (Gore, 1995). Thus, although privacy policy statements are intended to increase consumer trust, if consumers are unaware or do not read the privacy policy statements, then the statements provide

dubious benefits. Therefore, this study also examined whether consumers were generally aware of privacy policy statements and whether they had read a privacy policy statement prior to participation in this study.

Method

Data Collection

Given the exploratory nature of this research and the need to present respondents with multiple scenarios (5 scenarios of privacy policy statements x 3 types of information) a survey was selected over interviews, mall intercepts, quasi-experimental or experimental design. A survey approach also allows for detailed and consistent presentation of the descriptions for both privacy policy statements and information types. With this research procedure, respondents could compare and contrast descriptions, if necessary, to differentiate between the scenarios presented. Subjects were asked on the survey to indicate a willingness to provide various types of information to hypothetical web sites possessing dissimilar privacy policy statements. Concise descriptions of the alternative privacy policies were used to clearly differentiate between the types. Concise descriptions were selected over actual privacy policy statements, as the later are often very lengthy, difficult to read and contain information regarding other aspects of privacy and security. The questions from the survey relevant to the present study are presented in A. As can be seen in the appendix, subjects were not provided with any specific information concerning the nature of the hypothetical web site.

The survey provided the following definition of privacy policy statements. “A privacy policy statement explains a web site's policy regarding the information that is provided online by users.” Following the definition of a privacy policy statement, respondents were given examples of three levels of privacy (strong, moderate, and weak) that seem to typify many of the statements presented on web sites. These examples were based on an examination of policy statements on over 75 web sites. Table 1 contains the descriptions presented to respondents to differentiate between strong, moderate, and weak privacy policy statements. Abbreviated descriptions for the three types of privacy policy statements were utilized to minimize the risk of respondents misinterpreting lengthy or technically written statements. Although the hypothetical privacy statements used in this study were considerably more concise than those usually found on the Internet, they captured the essence (i.e., level of protection) of what was found in the review of 75 such privacy statements.

Table 1: Descriptions of Privacy Policy Statements Examined

Type of Statement	Description Presented to Respondents
STRONG	A strong privacy policy statement explains a web vendor’s policy concerning information that is provided by web users and makes an explicit guarantee that they will not under any circumstances share the user’s information with any other organization, company, or individual
MODERATE	A moderate privacy policy statement explains a web vendor’s policy concerning information that is provided by the web users and also ensures that the information that is provided will remain confidential. It also provides limited sharing of information when the web vendor believes that it is in the best interest of the customer, the web vendor, or both.
WEAK	A weak privacy policy statement explains a web vendor’s policy concerning information that is provided by the web users, but does not offer any guarantee with respect to protecting personal information.
LEGALLY MANDATED	A legal privacy policy statement indicates that federal, state or local laws mandate the presentation and content of the privacy policy statement and use of information collected online.

The survey then provided respondents with a description of legally mandated privacy policy statements noting that "Some web sites indicate that federal, state or local laws legally mandate their privacy policy statement and use of information collected online." Thus, respondents were also asked their willingness to provide personal information IF a web site displayed a legally mandated privacy policy statement.
Following the definition of each example of a privacy policy statement, respondents were asked to indicate their willingness to provide various types of information on a six point Likert scale, ranging from (1) "extremely unlikely" to (6) "extremely likely". The types of information requested were defined in the following manner for the respondents on the survey.

- Contact Information: Request for e-mail address, name, mailing address and telephone number
- Biographical Information: Request for demographic data, such as annual income, personal preferences, hobbies, and interests.
- Financial Information: Request for credit card numbers, expiration date, bank account numbers, etc.

The decision to utilize broad information types reflected the breadth of information that can, and often is collected via the Internet and the desire to avoid a lengthy survey instrument that could easily compromise the quality of responses and/or response rate.

Sample

The sample consisted of 374 students enrolled in graduate courses or non-credit professional courses offered through the Colleges of Business at one of two Midwestern state universities. To achieve a high response rate, the survey was administered during regularly scheduled class periods. Although participation was voluntary, nearly 100% of the enrolled students participated. While the validity of using students in behavioral research has been questioned (Alpert, 1967; Gordon, Slade & Schmitt, 1986; Levitt, 1965), there are instances where they (students) are either good substitutes or surrogates for another population (Khera & Benson, 1970; LaTour, Champagne & Behling, 1990; Remus, 1986) or by virtue of demographic profile are representative of the target population under investigation. The latter instance was the primary justification for the use of graduate business students, specifically working professionals, in the present study. From its inception the Internet and to a large extent e-commerce has attracted substantially larger numbers of well-educated and affluent consumers (Guglielmo, 1999). Consumers with more education and above average incomes continue to be more likely to use the web and shop online (Enos, 2000; Kolettis, 2001). More recent research, has suggested that e-commerce has attracted a more diverse consumer group, however, the younger, more affluent and highly educated individuals still represent the vast majority of internet users (Savage & Waldman, 2005).

The present study relied on graduate students associated with business programs that have historically attracted working professionals. The profile of these students was consistent with the profile described above as on average they are more educated and earn more than the general population. The average age of the graduate students was also very close to the median age (36 years old) of Internet users (Kolettis, 2001). While this convenience sample is not representative of all Internet users it does represent a large segment of Internet users, one that is generally perceived to be more inclined to participate in e-commerce.

Findings

Table 2 summarizes the characteristics of the respondents. As illustrated in Table 2 most respondents connected to the Internet on a daily basis (86.4%). This compares favorably to national norms for Internet users as Kolettis (2001) reported that 72 percent of women use the Internet every day, while 87

percent of men are daily users. Almost the same percent had provided an email address to a web site (88.2%). Overall, the sample were somewhat younger and more educated than the general population, uses the Internet frequently and most have previously provided personal information to a web site. Consequently, the results must be generalized with caution. However, the sample would seem appropriate for a study aimed at determining the impact of privacy policy statements on the willingness of consumers to provide personal information to web merchants.

As shown in Table 2, 79.4 percent of the 374 respondents had reported seeing a privacy policy statement. However, only 170 or 45.5 percent indicated that they were familiar, or more specifically, had read a web site's privacy policy statement prior to the study.

Table 2: Respondent profile: Demographics (n = 374)

Demographic Characteristic		
Age (years)		
Mean	32.9	
S	14.3	
Gender		
Male	216	(57.6%)
Female	157	(41.9%)
No Response	1	
Connect to Internet		
Daily	324	(86.4%)
Twice a Week	19	(5.1%)
Weekly	9	(2.4%)
Monthly	2	(0.5%)
Never	15	(4.0%)
No Response	4	(1.4%)
Provided An Email Address		
Yes	330	(88.2%)
No	27	(7.2%)
No Response	17	(4.6%)
Awareness (Seen a Privacy Policy Statement)		
Yes	297	(79.4%)
No	73	(19.5%)
Familiarity (Read a Privacy Policy Statement)		
Yes	170	(45.5%)
No	154	(41.2%)

The mean willingness to provide the various types of information for each type of privacy statement is presented in Table 3 along with grand means. A 3 (Types of Information) X 5 (Type of Privacy Policy Statement) within subject ANOVA was conducted on the data. The last row of Table 3 illustrates the differences in willingness to provide each of the three types of information requested. The overall mean willingness to provide personal information ranged from 3.74 for contact information to 2.70 for financial information. It is noteworthy that only the grand mean for contact (3.74) exceeded the scale midpoint, thus reflecting a "likeliness" to provide data. The ANOVA results indicated the difference between types of information was significant ($F=188.67$, $p = 0.000$). The results further revealed that all three possible pairwise comparisons were significant ($p < .05$). Respondents are least likely to provide

financial, and most likely to provide contact.

Table 3: Mean Willingness to Provide Information to Web Sites Type of Information Requested

	Type of Information Requested			
Policy Statement	**Contact**	**Biographical**	**Financial**	**Grand Means**
Legally Mandated Policy	4.73	4.31	4.02	4.36
Strong Policy	4.84	4.33	4.01	4.42
Moderate Policy	3.50	2.89	2.22	2.88
Weak Policy	2.71	2.23	1.61	2.20
No Policy	2.88	2.28	1.51	2.26
Grand Means	3.74	3.22	2.70	

Mean based on 6-Point Likert Scale (1-Extremely Unlikely to 6-Extremely Likely)

The main effect for level of privacy offered by the policy statements is summarized in the last column of Table 3. The overall mean willingness to provide information by type of policy statement ranged from a high of 4.42 for strong policies to 2.20 for weak policies. The ANOVA results indicated the difference between the types of privacy policy statements was significant ($F= 576.70$, $p = 0.000$). All possible pairwise comparisons between the conditions were significant except for the difference between a Weak Policy and No Policy. Respondents are significantly more likely to provide information for strong and legally mandated privacy policy statements. The mean response for the remaining privacy policy scenarios (no policy, weak and moderate) fell below the scale midpoint implying reluctance or unwillingness to provide information.

Perhaps the most interesting result was a significant interaction between type of privacy policy statement and type of information ($F = 24.87$, $p = 0.000$). This interaction is illustrated in the main body of Table 3. The type of privacy policy statement had the greatest impact on financial data and the least impact on contact. That is, willingness to provide financial information increased the most as the level of stated privacy increased. The results further indicated that only three of the possible 30 pairwise comparisons were not significant. These included the difference between mandated and strong policy for biographical data, mandated and strong policy for financial data, and weak and no policy for biographical data.

Discussion

Not surprisingly, this study revealed that the willingness of individuals to provide information to web merchants depends on the type of information requested. Respondents were more willing to provide contact than biographical information and likewise biographical rather than financial information. Given the inherent risk associated with these types of information one would expect differences of this nature. These results suggest that alternative payment methods that do not require the submission of personal financial information may be extremely beneficial in overcoming one of the major obstacles

faced by web merchants.

The relative sensitivity of biographical information has implications for organizations that have, or plan to collect such information for purposes of market segmentation or target marketing. The results suggest that consumers concerned about disclosing biographical information may opt to forgo providing any information, including contact, if the former information is a requirement. Future research is needed to demonstrate the necessity and potential value of differentiating between required and optional information either by category (e.g., biographical) or discrete element (e.g., home phone number).

The willingness to provide personal information varied depending on the level of privacy offered by the policy statements. As expected, respondents were more willing to provide information given a strong or legally mandated privacy statement. It was noteworthy that legally mandated policies are unlikely to foster greater trust than strong voluntary policies. Moderate statements proved to be more effective than a weak or no policy statement. On the other hand, a weak privacy statement was no more effective than not providing any policy statement. In summary, it appears that many Internet users, particularly younger and well educated, would be unwilling to provide personal information online, except when offered a strong or legally mandated privacy policy statement (i.e. comparing response means were below the responses with the midpoint of the Likert scale).

The interaction between type of privacy policy statement and type of information has several implications. First, in cases where financial and biographical information are requested strong or legally mandated privacy statements are a necessity. Respondents clearly perceive a difference in sensitivity across information types and are subsequently reluctant to provide more sensitive information in the absence of a strong or legally mandated privacy guarantee. Conversely, the strength of the privacy policy statement is of less importance when soliciting contact information.

A secondary goal of this study was to investigate the degree of prior awareness and familiarity with privacy policy statements. The findings indicate that while respondents were generally aware of privacy policy statements, most do not take the time to read them. This finding is noteworthy given the impact that such statements would purportedly have on consumer trust. If potential consumers do not read privacy policy statements, then even a strong guarantee of privacy will not be effective in terms of increasing confidence. Legally mandated privacy policies would offer the advantage of uniformity and thus a reduced need for consumers to peruse each web sites policy to ascertain the level of protection and enforcement.

However, it should be noted that evidence that consumers frequently do not take the time to read privacy policy statements does not imply that they have no impact on consumer trust. The mere indication that a web site contains a privacy policy statement my increase consumer trust. This

would be consistent with studies demonstrating that warranties and guarantees may influence consumer purchasing decisions, even though the consumer never actually read the warranties or guarantees (Adler, 1994; Gore 1995).

The success and growth of e-commerce is inextricably linked to consumer willingness to provide information to web sites. The findings of this study, while preliminary, suggest that legally mandated privacy policy statements are unlikely to significantly increase consumer trust and concomitantly

participation levels in e-commerce. However, the findings suggest that privacy policy statements should have a strong guarantee of privacy in order to be effective. This is especially true in transactions requiring the submission of more sensitive personal information such as biographical and financial

Limitations and Future Research

First, the sample size and target population were limited which brings into question the degree to which the findings can be generalized. As noted above, while the sample is representative of a significant percentage of Internet users, the findings may not be generalized to other distinct segments such as less educated and older consumers that are increasingly utilizing the Internet. Second, the hypothetical nature of the privacy policy statements used in this study may have seemed somewhat artificial to the respondents. Experimental or quasi-experimental research involving actual web sites and privacy policy statements could be useful for replicating the results of this study. Third, the decision to reduce the granularity of the information types into three general categories rather than discrete data elements (e.g., credit card #, year of birth, blood type, social security number) may have impacted the results. Although some significant differences were noted using broad categories, it would be beneficial to extend these findings in a similar study using discrete data elements of varying sensitivity. Such research could potentially identify within category differences as well as validate the across group differences noted herein (e.g., contact vs. financial). Fourth, since the study was based on current U.S. privacy policy practices and was limited to U.S. respondents the findings may not be transferable to other countries with more restrictive data protection laws (e.g., EU countries). Fifth, other variables may play a critical role in creating trust in addition to, or in combination with the privacy policy statement (Grewal et al. 2003). Similarly, further research is clearly needed to ascertain which individual variables might explain why consumers differ with respect to reading privacy policy statements. Also an understanding of the contextual factors relating to the likelihood that a privacy policy statement will be read could have an impact on the placement, text, etc. of privacy policy statements.

Summary

This study validates earlier findings that type of information and type of privacy policy statement play a role in determining consumer willingness to submit personal information via the Internet. In addition, the findings indicate that legally mandated or imposed privacy policy statements resulting from regulation are unlikely to significantly reduce consumer reluctance to provide personal information on-line. On the contrary, findings from this study suggest that legally mandated privacy statements would be no more effective than strongly worded voluntary policies. This finding clearly contradicts calls for federal legislation to protect consumers and stimulate greater rates of participation in e-commerce. Clearly, more extensive research is needed to fully understand both the limitations and potential of privacy policy to increase consumer trust related to ecommerce.

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Appendix A

Section 3:

While the type of information collected via web sites varies from site-to-site, there are three basic categories of information collected online:

Contact Information: Request for a web users e-mail address, name, mailing address or telephone number.

Financial Information: Request for data sufficient for conducting financial transactions (credit card number, expiration date, bank account number, etc…).

Biographical Information: Request for information for the purposes of marketing. Includes demographic data, annual income, personal preferences, hobbies, interests, and others.

To what extent would you be willing to provide the following types of information IF a web site did not provide a privacy policy statement?	Extremely Likely	Quite Likely	Slightly Likely	Slightly unlikely	Quite unlikely	Extremely unlikely
12. **Contact Information**						
13. **Financial Information**						
14. **Biographical Information**						

Section 4:

Types of Privacy Policy Statements

As stated, a web site privacy policy statement is intended to let users know what level of privacy they can expect if they submit information to that site. Unfortunately, not all privacy policy statements promise the same level of protection when it comes to user privacy. For this survey web site privacy policy statements have been categorized in three basic levels:

Weak: A weak privacy policy statement explains a web vendor's policy concerning information that is provided by the web users, but does not offer much if any guarantee when it comes to protecting the information.

Moderate: A moderate privacy policy statement explains a web vendor's policy concerning information that is provided by the web users and also insures that the information that is provided will remain confidential. It also provides limited sharing of information when the web vendor believes that it is in the best interest of the customer, the web vendor, or both.

Strong: A strong privacy policy statement explains a web vendors policy concerning information that is provided by web users and makes an iron clad guarantee that that they will not under any circumstances share the user's information with any other organization, company, or individual.

To what extent would you be willing to provide the following types of information IF a web site displayed a weak privacy policy statement?	Extremely Likely	Quite Likely	Slightly Likely	Slightly unlikely	Quite unlikely	Extremely unlikely
15. **Contact Information**						
16. **Financial Information**						
17. **Biographical Information**						
To what extent would you be willing to provide the following types of information IF a web site displayed a moderate privacy policy statement?						
18. **Contact Information**						
19. **Financial Information**						
20. **Biographical Information**						
To what extent would you be willing to provide the following types of information IF a web site displayed a strong privacy policy statement?						
21. **Contact Information**						
22. **Financial Information**						
23. **Biographical Information**						

Section 6:

Legally Mandated Privacy Policy Statements

Some web sites indicate that federal, state, or local laws legally mandate their privacy policy statement and use of information collected online.

To what extent would you be willing to provide the following types of information IF a web site displayed a legally mandated privacy policy statement?	Extremely Likely	Quite Likely	Slightly Likely	Slightly unlikely	Quite unlikely	Extremely unlikely
27. **Contact Information**						
28. **Financial Information**						
29. **Biographical Information**						

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