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Debiasing problem identification for e-commerce initiatives

John R. Drake

East Carolina University

Email: drakejo@ecu.edu

Ravi Paul

East Carolina University

Email: paulr@ecu.edu

ABSTRACT

Cognitive biases are recurring problems in judgment and decision making. Existing e-commerce websites evolve through many iterations, involving thousands of decisions about technology, design, marketing, and business priorities. Over time, biased decisions made years ago become embedded within the website's socio-technical framework, resulting in unsatisfactory conditions. To overcome these limitations, a methodology is needed to identify the problems. In order to develop a method for analyzing e-commerce websites for possible improvements, we need to understand and overcome common thinking biases. To accomplish this goal, we employ design science research to construct and evaluate a methodology for analyzing and identifying opportunities for improvements, while avoid common biases in thinking. This methodology is field tested with over twenty organizations. These organizations found the outcomes of the analysis to be instrumental to improving their websites.

KEYWORDS: Cognitive biases, e-commerce, debiasing, design science research

INTRODUCTION

Cognitive bias has long been a known issue in decision making (Kahneman & Tversky, 1979b; Tversky & Kahneman, 1974). For example, humans are particularly susceptible to over and under estimating numeric probabilities. This is particularly problematic in e-commerce because small mistakes on probability estimates when dealing with millions of customers can have huge impacts on revenue and customer retention. These biases are also insidious because most people are not aware that they even have a bias, otherwise they would correct for it and thereby mitigate its effects. Even managers cognizant of potential biases still revert to heuristics and rules of thumb to make decisions in fast paced environments. Once decisions have been made, they often become embedded in the organization or the information system, making changes difficult.

Current research in information systems has addressed bias in several ways, including user resistance to IS implementation (Kim & Kankanhalli, 2009), requirements determination (Browne & Ramesh, 2002), and development of an decision support system (Arnott, 2006). However, little attention has been spent on problem identification of existing systems. While there is a rich research stream in information systems planning, that research focuses on new initiatives and strategic alignment. Often that judgment is left to a manager to identify. However, managers can become blind to on-going business problems. Consultants are sometimes brought into an organization to help identify those problems with a fresh set of objective eyes. However, consultants may bring their own biases.

Fortunately, there are techniques to overcome those biases, helping managers to reason more objectively. Building off of debiasing techniques used in diagnostic medicine (Croskerry, Singhal, & Mamede, 2013), we designed a project structure employing two sets of debiasing strategies – task-based and person-based strategies. Some tasked-based strategies include structured data acquisition, personal accountability, and specific educational interventions. Some person-based strategies include iteratively focusing attention on type 1 processing (fast intuitive thinking) and type 2 processing (slow rational thinking) such that each are optimally used (Kahneman, 2011), establishing metacognitive feedback, and introducing stakeholder perspectives.

While this study will focus on e-commerce problem identification, the set of techniques designed in this study may find broader application across information systems and managerial decision making generally. Future research could build on this foundation.

LITERATURE REVIEW

Biases play varied roles and result in incorrect or bad judgements and decisions depending on the field and importance of the decisions being made. There are various types of biases that impact judgements and decision making and therefore the types of debiasing interventions that may be needed to mitigate the biases are also different. Debiasing strategies and techniques to improve judgement and decision making have been the subject of research for several decades. Unfortunately, most of the research undertaken to study debiasing have shown that simply teaching people about biases is not effective. In fact, there is very little in these findings to support that simply knowing what biases are and trying to mitigate them through self-effort works in any significant way (Beaulac & Kenyon, 2014). To address the multiple types of biases, multiple techniques of debiasing need to be integrated together to achieve the most optimal results.

Several frameworks and models for categorizing debiasing strategies have been proposed and studied. Fischhoff (1982) referenced the strategies used to mitigate the negative effects of biases as debiasing and proposed a categorization model that places debiasing strategies into two categories - ones that could be applied to people or to tasks. Building on Fischoff's categorization, Soll, Milkman and Payne (2015), evaluate various strategies under the two primary categories – people and tasks – and provide a guide for effective debiasing.

Person-based debiasing strategies

Debiasing strategies that fall under the first category, i.e interventions applied to people, would mitigate the biases by addressing the individuals directly (Fischhoff, 1982; Kahneman & Tversky, 1979a; Larrick, 2004). These interventions can take the form of providing better knowledge and relevant training to improve the skills and techniques needed to effectively debias the individual (Lilienfeld, Ammirati, & Landfield, 2009; Soll et al., 2015). Thus, domain knowledge mastery is a very effective, albeit not complete, antidote to biases in decision making in individuals. For this strategy to be most effective, targeted teaching and training should be provided as close to the decision-making task as possible. Relevant and timely feedback on iterative tasks provide rich metacognitive input that allows the subjects to self-assess and correct their biases. In addition, appropriate incentives can also provide the impetus to reflect and take the time to arrive at a non-biased solution to domain-based problems. In a recent article, Morewedge et. al. (2015) report on a couple of longitudinal studies that resulted in beneficial effects of debiasing in decision making with a single training session. They further "suggest its use alongside improved incentives, information presentation, and nudges to reduce costly errors associated with biased judgments and decisions." (Morewedge et. al. 2015, p. 129)

Biases can also arise from making quick evaluations without careful deliberation or calculation, especially in uncertain events (Tversky & Kahneman, 1992). However, delineation of intuitive, unconscious, quick thinking process and rational, conscious, slow thinking processes takes advantage of the strengths of each and avoids the negatives (Kahneman, 2011). These two thinking process, sometimes referred to as system 1 (the intuitive, fast process) and system 2 (the rational, slow process) thinking, have found practical application in theories of reasoning, judgment, decision-making, and social cognition (Evans, 2008). These domains have found that biases can emerge when systems 1 and 2 thinking are not differentiated. By carefully differentiating which thinking system is used for which steps, some biases can be mitigated. Not without good reason do we find best practices in writing iterate between each system - first brainstorm topics (system 1), next arrange the topics in a logical order (system 2), then quickly write a rough draft (system 1), and lastly edit the draft (system 2) (Berkun, 2009; Rand, 2001). Decision support systems have also focused on one or both systems to improve the decision quality users (Sage, 1981). Thus, developing a process that switches between each thinking system should help reduce bias.

Task-based debiasing strategies

On the other hand, debiasing interventions in situations that are attributed to tasks primarily propose changing the environment in such a way it provides automatically filtered knowledge to promote better, and less biased, decisions (Johnson, Payne, & Bettman, 1988; Russo, 1977). A couple of task-based debiasing strategies have been shown to be quite powerful in mitigating biases in a controlled environment, especially in situations where person-based debiasing strategies are not intuitive or feasible (Klayman & Brown, 1993). A simple but powerful strategy is to encourage decision makers to look at the problem from multiple perspectives and thus

avoid the pitfalls associated with narrow thinking that can reveal itself when a person makes a quick and reactionary decision simply based on incomplete or erroneous information (Hogarth, 2001). But, a far more insidious kind of narrow thinking occurs when a person makes a judgement call only based on one, obvious perspective without consideration of multiple perspectives that could significantly enrich the decision-making process. Thus, framing the task to force consideration of multiple perspectives should result in a more broadly considered solution and has been shown to be quite effective (Larrick, 2004; Pronin, Puccio, & Ross, 2002).

Another equally powerful strategy is to structure the environment to "nudge" the subject in a positive direction (Beaulac, G., & Kenyon, T., 2014). Thaler and Sunstein (2008) posit that a "nudge" is a strategy that frames the options in a way that encourages the subject to make better choices. These nudges can take varying forms including structuring the information provided to the subjects in a debiasing-friendly format such as structured worksheets.

Some empirical research exists in studying the efficacy of specific strategies for debiasing (Beaulac & Kenyon, 2014; Morewedge et al., 2015). Unfortunately, very few studies propose a unified, robust model to test and create a repeatable method consisting of a proven combination of debiasing strategies to consistently improve decision making. Given the environment we are working in (e-commerce problem identification), we chose to create and test a debiasing model that included several proven strategies from both categories (person and tasks) to reduce biases. The proven strategies included in the model are: targeted teaching and training, providing rich and timely feedback, "nudging" techniques such as providing structured worksheets to encourage the use of multiple perspectives, and Incentives. An appropriate research methodology for this type of a study is design science research.

METHODS

We applied the Decision Science Research methodology in this research study. According to best practices for design science research (Peffers, Tuunanen, Rotherberger, & Chatterjee, 2007), the methodology should consist of six steps – 1) identify the problem, 2) specify the objectives for the solution, 3) develop the artifact, 4) implement the artifact, 5) evaluate the solution, and 6) communicate the results.

The first step in the methodology is to "identify the problem". In our study, the problem under study is the misidentification of problems with ecommerce initiatives due to the biases of the decision makers.

The objective of the solution is to debias the decision makers by introducing a process that: 1) focuses on learning techniques for improving the thinking process, 2) mitigates common biases in identifying problems, and 3) produces positive results.

Because the objectives included a focus on learning, a classroom environment provided an appropriate location to develop and implement a solution. However, for the solution to be practical, the classroom needed to work on real business problems. To that end, an assignment was created that required students to work with real businesses, directly interacting with the project sponsors and their websites. The students also wrote reports for the sponsor at the end of the semester. The classroom environment also facilitated some control in testing the

debiasing techniques. Furthermore, it is essential to ensure that domain knowledge is sufficiently understood, since it is impossible to teach thinking skills without the requisite knowledge (Carson, 2007). In this case, the domain knowledge of e-commerce concepts was provided in the class prior to the parts of the project requiring that knowledge.

When developing the e-commerce problem identification techniques (hereafter referred to as the artifact), design science research recommends using an iterative development of a new concept, technique, or tool to solve a business problem (March & Storey, 2008). The project in question has first created 2 years ago, with several iterations for improvement since then. It started with a collaborative effort between several e-commerce and business domain experts to identify important areas of e-commerce that needed attention. It also involved a review of literature to identify potential biases. The artifact was modified over the next two years, adding elements such as structured worksheets and modifying the peer reviews.

In the fall of 2016 and spring of 2017, the final iteration was implemented. The designed artifact is described below. According to design science best practices, the artifact description should constitute the largest part of the research manuscript (Gregor & Hevner, 2013).

To evaluate the artifact, feedback from students and project sponsors was collected on the effectiveness of the artifact in identifying problems and suggesting solutions. We present those findings after the artifact description.

DESCRIPTION OF ARTIFACT

The artifact consists of a semester long project involving four analyses from different stakeholder perspectives structured by worksheets identifying specific data to collect. Peer reviews of the analyses provide education interventions and introduce metacognitive feedback. The completed report is presented to the project sponsor to encourage personal accountability. Throughout the project, assignments iterate between fast and slow thinking.

Preliminary setup

Approximately 2 months prior to the beginning of the class, the instructor solicited businesses and organizations willing to participate in the project. Interested organizations fill out a short survey about their business and website. The instructor then reviewed the applicants and selected the top few companies that offered the best potential for debiasing. This often entailed websites with some minor problems, that aren't overly large or complex. Furthermore, organizations from different industries and using different technologies are selected to enhance the variety of learning opportunities. The instructor interviewed each of the sponsors from the selected organization with the same set of priming questions.

After the interview, the instructor requested additional documentation as applicable. Normally this included access to the websites' log files, which documents visitor behavior on the site, along with the length of visit, the pages viewed, and the country of origin. Some projects also included intranet logins, business-to-business coverage, and sales figures. The interviews and data are recorded on a secure server that only class members have access to view.

At the beginning of the class, students self-select into groups of 3-4 members each. After groups are formed, each individual picked one website in which to analyze. Members of the same group were required to pick a different website.

Analyses

The project began with a coverage of concepts and theory from a textbook and online resources. After reading the relevant topics and discussing their implications in class, students are given worksheets to complete. The worksheets focused the students' analysis by framing discussions in terms of one of four different stakeholder perspectives and deductively applying the e-commerce theory to the particular website they are analyzing. Those four perspectives were the manager, the marketing professional, the user, and the information technology (IT) professional.

In the manager analysis, students started by describing the business and its industry. This includes reviewing competitive websites to gain perspective on the industry. Then, referring to the recorded interview, students identified relevant business goals and how the website facilitates those goals. With those goals in mind, the students are challenged to define specific key performance indicators. Many organizations do not have key performance indicators defined, so students must suggest appropriate indicators for them. Students then search if current metrics do exist and what the current performance is.

In the marketing analysis, students were tasked to analyze the website as a marketing professional. Most students have already taken a class in marketing prior to this course. They are re-introduced to those marketing concepts in the course readings and discussion. In the worksheet for this analysis, they defined the user profile of their target customers and described the sales funnel for those customers. Next, students compared the sales funnel to the business goals in the previous analysis to look for gaps in the goals or key performance indicators. Students analyzed the tools and techniques currently used to support the marketing function. Special emphasis is given to search engine optimization and social media engagement because of its integral role in web site marketing.

In the user experience analysis, students are introduced to concepts related to user interface design. The worksheet tasked the student with describing the typical user, specifically the primary characteristics and goals. Students applied this findings to the user experience. The user experience was broken down into five planes – strategy, scope, structure, skeleton, and surface (Garrett, 2006). Strategy consists of the overall approach to the design, focusing on how major elements interact to achieve the website's objectives. Scope identifies functional specification and content requirements that users want. Structure refers to the information architecture and interface design, including organizational schemes, labeling systems, navigation systems, folder structure, and the relationship between pages and sections. The skeleton denotes individual page plan, such as the size and shape of the header, the location and number of feature items, and the contents of the footer. Lastly, the surface plane consists of decisions on colors, fonts, images, and other styling elements. This includes cross platform checks, link analyses, and social media analyses that determine the extent that users can accomplish their goals.

The last analysis changes the perspective to that of an IT professional. Student are challenged to identify and describe the IT in use and study the pros and cons of that platform versus alternatives. Students analyze the website based on ease of development, hosting, maintenance, security, and privacy or ethical concerns.

Groups

Each of the analyses were completed on an individual basis. Students are placed into groups for peer reviews. After the analyses were completed, students turned in a copy of the analysis to the instructor and brought several copies to class. In their groups, students exchanged their analyses and completed a review of each group member's analysis. The purpose of the peer review is three-fold. First, it provided reviewees with multiple outside assessments as to the quality of their work. Second, it gave the reviewers a chance to observe other e-commerce examples in order to better induce and integrate the concepts. Third, it challenged reviewers to reflect on their own work through observation of effective and ineffective analyses by their group members.

On peer review days, the instructor started with a short introduction with instructions for how to effectively review the analyses. These instructions were included on a separate worksheet with guiding questions to help the reviewer. It included questions about the effectiveness of the review and lessons learned from this analysis that the reviewer could apply to their own work. Students were given examples of excellent, good, and poor peer reviews. The instructor let the students work for an hour on completing the reviews of their group members. At the end of the hour, students returned a copy of the peer reviews to the reviewee and to the instructor.

To encourage quality peer reviews, the instructor gave credit for completion. The instructor also promised that final reports that are voted "best" by the project sponsor would earn the entire group a bonus toward their final grade. This friendly competition between groups was designed to focus students' attention writing for an appropriate audience. It encourages personal accountability.

Final Report

After the four analyses and peer reviews were completed, students were tasked with updating their analyses based on the peer reviews. The analysis part of the course is largely deductive, applying existing theory to specific instance. The peer reviews inductive. The updating of the analyses deductive. The final report is designed to synthesize everything they have observed in order to create new knowledge, by recommending the top few things that the website can do to improve.

The instructor conducted a workshop on how to synthesis the findings and recommend changes. The workshop started with a review of the four analyses and a discussion on how to identify opportunities for improvement. Given the emphasis on goals throughout the analyses, the students start prioritizing opportunities for improvement based on the success or failure of the website in achieving those goals. Whenever key performance metrics fall significantly short of key performance indicators, there are opportunities for improvement. The instructor also highlighted how to justify recommendations with logic, expert opinion, and quantitative evidence.

After a list of recommendations were identified, the workshop then showed students how to identify the improvements with the biggest impact through use of a weighted average score card. The top few improvements become the recommendations included in the final report. They are instructed to only include the top 3-5 recommendations.

Instructions for the final report stated that they should start with a one paragraph executive summary at the beginning, specifying the 3-5 recommendations. The following 4-8 pages

provide the reasons for these recommendations. Finally, the report ends with a plan for revision. The four analyses form appendixes that they can refer to in the report.

EVALUATION OF THE ARTIFACT

The difficulty in evaluating debiasing stems from the fact that few people recognize their own biases, so they find it difficult to identify when they have avoided them. Furthermore, unlike diagnostic medicine, there often is no clear singular problem. Instead, there may be many problems. In such a case, evaluation of the techniques and processes for debiasing should focus on perceptions of effectiveness and usefulness of the techniques or processes.

Feedback from the students were encouraging. In an anonymous survey of students, 95% said the project was slightly effective, effective, or very effective in helping them to understand e-commerce concepts. 95% of the students found the worksheets to be somewhat useful, useful or very useful in completing the project. 70% of the students found the peer reviews to be somewhat useful, useful or very useful. See table 1 for more details.

Table 1: Student feedback on project	
QUESTION	MEAN
Average effectiveness in understanding concepts (scale of 1-7, 1 not effective, 7 very effective)	5.8
Average usefulness of worksheets (scale 1-7, 1 not at all useful, 7 very useful)	6.2
Average usefulness of peer reviews (scale 1-7, 1 not at all useful, 7 very useful)	5.1
Average level of difficulty (scale 1-6, 1 very difficult, 6 very easy)	2.7

A sampling of student comments include:
> "PLEASE continue to use the worksheets as a guide in the future. They were extremely helpful in determining what information would be useful to the organizations that were evaluated."

> "The worksheets you provided for the analysis and peer reviews were a great help. By reviewing others work also helped me compare and improve my own work. Good technique!"

> "I think the online recordings in conjunction with the peer reviews and worksheets came in handy."

> "Overall the project is a great hands on learning experience."

While the project sponsors were intimately familiar with their businesses and websites, they found the reports helpful in part because the reports uncovered blind spots in their thinking. The sponsors were not ignorant of e-commerce, but often underemphasized various components, leading to failures in how the website was implemented. Feedback from the sponsors provided

evidence that the reports were effective and surpassed expectations. In a survey of project sponsors, 100% said the project exceeded or far exceeded their expectations. 100% said the project was either effective or very effective in helping their organization.

The sponsors were able to see that different perspectives were used, enabling the student to see the big picture. For example, one sponsor commented on a report that:

> "He took a holistic approach in analyzing information about our company, our goals, how we market the site, the user experience, etc. He compiled all the information into a very useful and easily executable tactical plan."

Sponsors found numerous improvements in the reports that they themselves had not yet identified. One sponsor stated:

> "We were impressed with all of them. Each had some really great suggestions. We actually identified 29 separate items to implement by looking at all of the reports. Some of the suggestions have already been implemented. We will be meeting with our website people on Friday to see how we can implement the rest."

DISCUSSION AND CONCLUSIONS

Through the use of task-based and person-based debiasing strategies, this project provides a solution for mitigating biases in problem identification. The outcomes from the process suggests that students and businesspeople found the completed report effective and useful. In particular, e-commerce analysis benefited from viewing the systems from multiple viewpoints, using both deductive and inductive thinking at specific steps to successively refine conceptual understanding, and using worksheets to "nudge" them in a positive direction. Furthermore, the peer reviews provided additional opportunities for debiasing by helping students see additional examples of e-commerce solutions and analyses of those solutions. The combination of these elements helped frame concepts into a meaningful, objective framework based on real word observations. The project we outlined above helps accomplish these objectives.

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