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Usability as a Panacea

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Abstract

After implementation of a web-based application in a tertiary education environment, an expert review of this application was conducted. An analysis of the processes and results of the expert review of the web-based application is presented. The owners of the system implemented the recommendations of this expert review to resolve system issues. Through two rounds of expert evaluations, system modifications were made based on recommendations from the initial expert review. The concern that usability evaluations are used as a 'cure-all solution' to demonstrate to users that system owners are trying to resolve issues with the system is discussed. It should be understood by all those involved in the development and implementation of applications that usability evaluations are unlikely to provide the claimed benefits when issues are beyond the scope of the web-based application. Rather, in these cases a review of the overall business process in order to have a genuine positive impact is required.

1. Introduction

A web-based application was implemented within a university to maintain the records of academic and research staff outputs, thereby allowing for increasing flexibility of the process and better government reporting. This system was created with the vision of moving from a manual offline process that traditionally occurred only once a year with limited staff input, to an online process completed by university staff involved in creating the research output. With the system moving online, information that had previously been inaccessible would become available to all from anywhere with Internet access.

After the implementation of this online system, its usability was evaluated. Usability evaluations are all too often conducted without reference to the entire organisational process within which they exist. This organisational process must consider many things beyond the system interaction alone [1,2]. Typically, system owners consider that if the usability of the system is improved then organisational issues that are related to, but beyond the scope of, the system will also be resolved. This study presents a case where Usability Evaluation Methods (UEMs) were applied to increase the usability of the web-based application, however the overarching processes (which establish the organisational context of the system) were not altered. Thus, while better system design increased user interaction with the system, limited benefit to the organisation was gained.

This study initially provides an analytic evaluation of the web-based application designed to increase the overall ease of use of an entire process within a university environment. However, when all staff (end-users) had the opportunity to attend training sessions at the time of system launch, the system owners stated that initial concerns were raised by the end-users about the lack of intuitive design in the system. Since the implementation of the system across the university, concerns have been brought to the attention of the system owners through the in-built help facility and help-desk email and telephone line. A number of concerns regarding the method of publication entry were identified by end users.

The analytic method involved a usability evaluation and used a combination of expert reviews, heuristic evaluations of the system and an evaluation of the typical user tasks. The user task evaluation focused on the method of publication entry used by academic and research staff, and the usability of the system at each stage. Publication entry is the part of the system where most interaction occurs, and effective usage of this part of the system is essential for end-users to ensure the system's overall success. Based on the results of the initial expert review, the system designers modified the user interface. This paper will explain issues identified with the system interface that were subsequently modified, and user workflows through a basic task model. The paper will then reflect upon the success of these modifications, and consider the value of usability evaluations on a system that exists in a flawed environment.

2. Literature Review

As previously stated, the traditional process was manual and offline and occurred over a finite period. As depicted in Figure 1, data was duplicated and passed between numerous people before being entered into the system. Manual confirmation was also required.

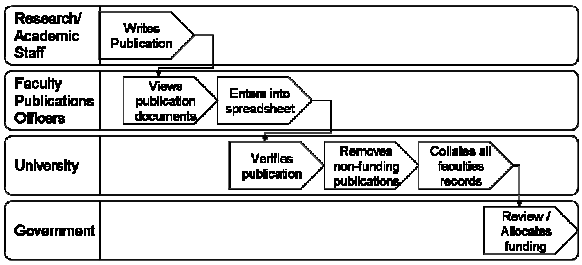

Figure 1. Traditional Process

Key issues identified with this traditional process were:

- Faculties were never told what information was reported to the government
- The collection occurred over a finite period in the year, and
- The process was labour intensive.

The web-based application that was designed for the university was primarily designed for the capture of research outputs from academic and research staff and to reduce the issues identified in the previous section.

The system was developed within the university, and was designed under the assumption that researchers and academics would be the primary users. The aims of the system are to capture research outputs to meet the needs of the university for government reporting, and to allow staff to capture **all** of their research outputs (beyond the generally recognised four output categories of: books; book chapters; journal articles and conference publications). The system was used initially for the collection of the 2006 research output data. Over the past three years, the system has been incrementally developed to provide greater functionality and better usability.

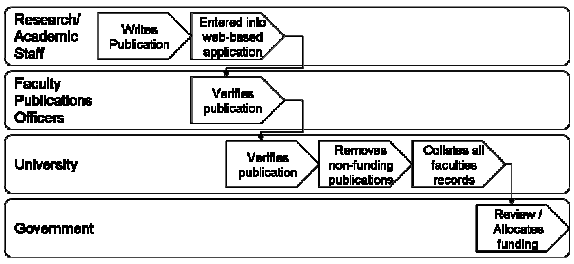

Figure 2. Web-based Application Process

As can be seen from Figure 2, the major change in the process has been the shifting of the data entry from the faculty PO to the research and academic staff members.

The system's secondary focus was to make the university's research output publication information available to all. This was completed by creating public profiles for all staff at the university involved in research. Each staff member's profile displayed their details, a CV and the publications that they have written. This information was stored in a central location instead on individual staff pages. Thus, the new web-based application creates a more open process with organisational consistency of information which has been verified.

2.1. Usability Evaluation Methods (UEMs)

The concept of evaluation can be traced back to the beginning of systems analysis. Specifically, Usability Evaluation Methods (UEMs) are over 20 years old. A number of different methods have been developed to evaluate the usability of computer systems [3,4]. Such UEMs have been developed as the result of much work by both designers and researchers, as they attempt to improve the usability of systems to further meet users' needs [4]. UEMs can involve experts modelling or evaluating, and users evaluating, a system in different ways [4].

In contrast to the common perception that usability evaluation should only be conducted in the early stages of system development, it is necessary to conduct usability evaluations throughout the entire product life cycle [5]. However, Krug claims that when usability testing is implemented to evaluate a system's design, it is usually "too little, too late, and for all the wrong reasons" [6].

Expert based UEMs involve using experts or teams of experts to carry out an evaluation of the user interface of a system. The underlying concept of these types of evaluations is that the expert provides feedback on their evaluation of the system to further develop the system [7]. Nielsen has argued that expert based UEMs are cheap, fast and can be carried out at any stage of the development. Heuristic evaluations commonly locate usability problems prior to user testing or in situations where there is a limited budget. One major issue with heuristic evaluations is that, in situations where the system under evaluation is highly domain-dependent and the evaluator has limited domain expertise, usability problems may often be overlooked by evaluators. This is also the case when the evaluator has little knowledge of the overall system that is being used.

Nielsen [7] generated ten general principles for user interface design. These principles are referred to as "heuristics" due to their general nature. Nielsen's ten heuristics are:

- Visibility of system status

- Match between system and the real world
- User control and freedom
- Consistency and standards
- Error prevention
- Recognition rather than recall
- Flexibility and efficiency of use
- Aesthetic and minimalist design
- Help users recognize, diagnose, and recover from errors
- Help and documentation

Nielsen states that these heuristics are more 'rules of thumb' than specific guidelines and should be used to make informed decisions about a system, as opposed to conducting quantitative analysis of the system. Heuristic evaluations were first formally described in presentations in the Human–Computer Interaction conference through papers published by Nielson and Molich [8]. Since then, they have refined the heuristics based on a factor analysis of 249 usability problems [7] to derive a revised set of heuristics with maximum explanatory power.

The advantages of heuristic evaluation are reflected by its commercial and industrial applications. Referred to as a 'discount usability engineering method', it is certainly cheap but also fast, easy to learn, flexible, and most importantly effective [9]. Although heuristic evaluation falls into the category of 'expert review', it can be used effectively by both novices and experts. Ideally, an evaluator should have a broad background in usability evaluation and interface design as well as specific knowledge of the subject domain. An independent study by Jeffries et al. [3] that compared four different UEMs concluded that heuristic evaluation produced the best results compared to the other UEMs because it found the highest number of problems, including most of the serious problems, at the lowest cost.

The design of websites that are both easy to use and useful requires a great amount of skill. For this reason a large amount of effort, time and money is invested by companies in an attempt to produce websites that meet the needs of users. Once such a website is built, it is necessary to evaluate the site to ensure it is usable for users. Many different methods can be used to conduct such evaluations, and are typically classified as either user-based methods or non-user-based methods [3,10]. Non-user-based methods may be conducted by experts or by less skilled evaluators using models to assist them. Evaluators of websites need to decide the purpose of the evaluation to ensure selection of the most appropriate evaluation method for that situation.

Wickens and Hollands [11] identified three states of action when discussing errors caused by human behaviour. The desired state involves a user performing actions that are normal behaviour. The second state, inefficient behaviour, involves a user performing a behaviour that is not the most desirable action, but results in a correct action being performed. Erroneous behaviour is the third state, where the user does not achieve their goal. These states will be discussed in conjunction with the relevant issues.

3. Methodology

After discussions with the system owners, an analytic method [12] using a combination of expert reviews, heuristic evaluations of the system and an evaluation of the user tasks was employed. This process was conducted with three evaluators who initially conducted their reviews of the system independently then met to discuss their results. The evaluators all had domain knowledge and had previously conducted usability evaluations. It is recommended that between three and five usability experts conduct an evaluation [7], so that a variety of different perspectives of the system under evaluation can be gained. In heuristic evaluations, experts study the interface and look for properties of the system that may lead to usability issues and problems for end-users.

The expert review initially consisted of a free-flow inspection of the system, so that the reviewers could learn the features of the system, understand how they worked, and consider the web-based application workflow compared with the traditional process. The reviewers' initial pass of the system helped them to gain general perceptions about the features, with subsequent passes providing more detail on specific elements whilst understanding the overall design of the system. This gave the reviewers an opportunity to develop a very basic task model of how users interact when completing the main tasks of the system, with relation to the entry of a research output.

Following the independent evaluations of the system, the reviewers met to discuss their findings. During this meeting the reviewers discussed the tasks that a user needs to complete to enter a publication into the system, so that it can be recorded for government requirements. At this stage the reviewers created a simple task analysis diagram. Task analysis, from a practical perspective, is concerned with identifying tasks that a user should perform and the main properties needed to perform those tasks [13]. Once tasks are analysed and understood, they can be simply modelled. The reviewers also reviewed the log file transcripts which identified issues and the development system history to the help-desk.

When the system was examined with Nielsen's heuristics in mind, consideration was given to whether a heuristic was adhered to or was violated in the system design. Any problems that were outside the specific heuristics were noted by the reviewers

for further evaluation and discussion, as were any successful features of the system that worked well. These heuristics were evaluated as 'rules of thumb' as stated by Nielsen.

Based on Wickens and Hollands [11] stages of action for human behaviour, severity of the issues was recorded. It should be noted that some of the issues identified in this paper will not directly cause errors which are visible to a user. It is also possible for users to make errors that are not the fault of the web-based application but lack of understating of the overall process.

The results from the initial expert evaluation were presented to the owners of the system for their consideration and to inform further development of the web-based application. The system owners identified the modifications to the system that they deemed to be appropriate, these were made by the developers, and then another round of expert evaluations were conducted to review the changes to the web-based application.

4. Results

During an internal meeting with relevant stakeholders, it was stated that *the system was used successfully for the capture of the university's publications for government reporting*. Despite this '*success*', the owners of the system noted that the web-based application was not efficient or usable from the perspective of the end-users, based on feedback that the owners received.

The following sections of this paper identify and discuss a range of issues that existed in the system. Some of these issues were simple for the developers to resolve, while others concerns will need to be considered in future versions of the system. These issues may require a rethink of the way that the system is designed. Following this discussion a review of the help-desk transcripts is presented and discussed.

It should be noted that the system owners assumed that all users should have an understanding of the types of information that was entered into the system, as they had published the research output. While this is true for most fields, *for example authors, year, title, publisher etc.*, several fields were unknown to users when the system was first introduced.

Publication entry is the major feature of the web-based application. This feature is used by the majority of end-users. Therefore, the process of capturing all necessary information in the system should be as simple as possible. It was stated by the system owners that *this was the section of the system that received the largest number of comments from the end-users*.

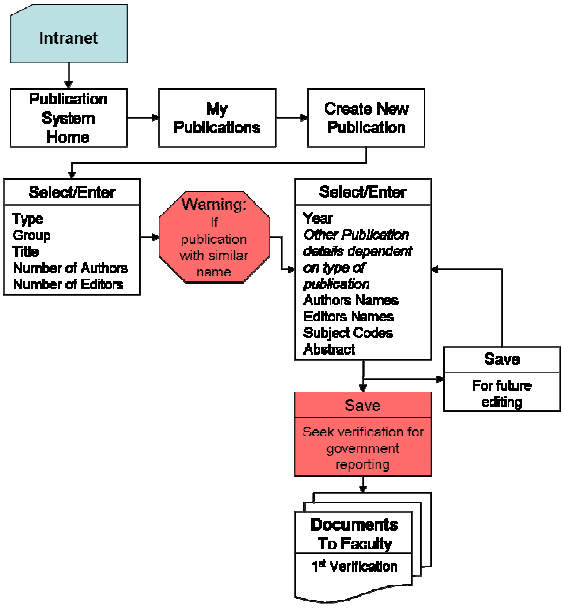

Figure 3. Web-based application – basic task model

Figure 3 above is a diagram presenting the basic task model outlining how a user completes the process to enter a publication into the web-based application. Initially the user must log on to the university's intranet and then they are able to access the research publication system to record their research outputs. A user then clicks on the 'my publication' button then 'add new publication'. The process of entering a publication then has two major steps. In the first step, the user must give details about the overall publication type, the group to which the publication is assigned, and the number of authors/editors that the publication has. The system then checks to confirm that the publication has not previously been entered into the system. Once this is confirmed, the user supplies the specific citation details of the publication and optionally provides the paper abstract. If there are publications with a similar name, then a list of those publications is displayed, and the user can say whether the publication has been previously entered or if this is actually a new publication. Once all relevant information is entered into the system the user then chooses the option 'request faculty verification'. This is where the traditional manual process resumes in the eyes of a researcher or academic. However, the web-based application is used throughout the overall process from a university perspective for their verification and to create the reports for Government funding.

5. Discussion

After the initial expert review of the web-based application, the designers edited a number of aspects to improve usability.

Previously, when tabbing through the fields in 'Publication details', the cursor could become 'lost' if it disappeared into a section which had not been expanded. This type of issue is an inefficient behaviour between the system and user. The disappearing cursor is an issue for users that use the keyboard to tab throughout the system, rather than relying on the mouse. The solution that the designers chose was that when tabbed to the next section the bar would be come highlighted and a user could press the space-bar to expand that section to continue adding information without using the mouse. This solution resolved this initial problem.

Initially, no warning message is given before a publication is deleted. This issue could result in possible erroneous behaviour. This problem has since been rectified with users receiving a pop-up message asking for confirmation for deleting a publication.

No descriptions were given for fields that were not normally associated with the bibliographic data associated with publications. This information was previously only understood by the Publications Offices and the central department for Australian Government reporting. An example of this information was 'Research Fields, Courses and Disciplines Classification' codes (RFCD Codes) *for example 280104 Computer-Human Interaction*. These have since been replaced with 'Field of Research Codes' (FOR Codes) *for example 080602 Computer-Human Interaction*. To resolve this issue the developers have added a '(?)' symbol next to each of the fields where a user may not understand what is required. Training has also since been provided to staff about these coding requirements (which is outside the scope of the web-based application). This is one example of an acknowledgement that the broader context of the system impacts on users' ability to use the system, even when such issues are beyond the scope and responsibility of system owners and developers.

5.1. Help-desk review

From the help-desk transcripts it was found that most of the issues that were identified by end-users were not concerned with the usability of the system. Rather, these issues were concerned with the broader environment in which the system operates, or the data contained within the system. Typical identified issues included:

- Login Access issues
- Requests to change a user's details (both personal and previous publications)
- Asking for access to training
- Asking for additional features (e.g. the ability to use non-Latin characters, like Cyrillic (Greek))
- Initial performance issues
- The overall process

From the review of the help-desk files after the initial expert review of the system, it was found that the system problems were actually beyond the web-based application. The initial expert review was conducted independently of the help-desk's transcripts, with the owners of the system stating that users found that the system was not usable. However, after reviewing the transcripts it has been discovered that the owners were hoping that improving minor issues could improve overall system satisfaction.

It should be noted that staff received extensive training during the initial rollout of the system. Hands on training sessions were conducted throughout all faculties, however it was up to each faculty to ensure that staff attended. Some faculties made attendance at these sessions voluntary, and in such cases many staff who required training did not attend. This situation was outside the control of the developers, but had a significant negative impact on the perceived usability of the system. The system developers provided an extensive online help guide available within the system at the time of launch in an attempt to combat this situation, however it was unable to resolve the problems created by allowing staff to only attend training sessions voluntarily.

6. Research Findings

This research used a number of expert based approaches for identifying issues in the system, as a result of user feedback indicating inadequacies in the system. Several issues have been identified within the system. Some of these issues have been rectified. Where issues have not been rectified, potential solutions have been presented in the results. It is expected that if the system designers modify the system in light of the further recommendations presented, then the system could become more usable for end users. It is recommended that user involvement in the system design be facilitated through user evaluations of the system, allowing designers to learn how users interact with the system, and assisting in the identification of further system issues.

However, it must be observed that usability testing is not a "silver bullet" in trying to identify and resolve a system's failures. This paper has identified that, while usability testing can identify faults within the system, there are external factors that are far beyond its capabilities. This paper also highlights the importance of expert evaluations. With the expert review, specific issues with the usability were identified. These same issues were not found with the feedback from end users. The expert reviewers were also able to identify and understand the difference between problems with system

usability and problems with the actual business process.

To achieve maximum efficiency and usability, an application must be based on sound and complete business processes. Reflection on the usefulness of the usability testing applied in this study supports Krug's claim that usability testing is often implemented "too little, too late, and for all the wrong reasons" [6]. While usability testing was able to identify and rectify problems experience when using the system itself, the underlying business processes on which the application was based can be considered to be flawed. As a result, the researchers conclude that usability testing was conducted for the wrong reasons, trying to find a quick application fix to a business process issue.

7. Future Work

As it can be seen from the discussion, it is evident that further work by the system developers is necessary to continue to improve some of the discussed usability issues. However, these changes may only provide limited benefit. In the transcripts from the email and telephone help-desk, most of the issues that were identified were actually about the overall process rather than specific usability concerns within the system. For this reason no amount of usability testing, be it expert or user based, can solve the problems with the overall process. While the expert reviewers had the ability to identify that some problems were caused by system usability issues, many were the fault of the actual business process that surrounds the system. This identification occurred after the expert reviewers were aware of the user feedback. Further research could enhance our understanding of *system* versus *context* issues, with this understanding used to benefit the development of new metrics to aid in the development and testing of systems.

8. Conclusion

The system can be argued to be a success as it does what it was set out to accomplish. That is, academic and research staff can record their research outputs and these research outputs are available for all to see through their staff profile page. These profiles are available 24/7 on the Internet, allowing open access to information previously not available in any format. The system has also been used effectively for the capture of research outputs for Government reporting for 2006 through to 2008, and staff can currently enter their 2009 research outputs. Many other areas for improvement have been identified but not addressed. While concerns could be addressed, they require a review of the overall business process. Usability evaluations are useful for identifying these issues but system developers require high-level business support if optimal outcomes are to be achieved.

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