World Academy of Science, Engineering and Technology
International Journal of Computer and Information Engineering
Vol:12, No:6, 2018

The Importance of Applying Established Web Site Design Principles on an Online Performance Management System

R. W. Brown, P. J. Blignaut

***Abstract*—**An online performance management system was evaluated, and recommendations were made to improve the system. The study shows the effects of not adhering to the established web design principles and conventions. Furthermore, the study indicates that if the online performance management system is not well designed, it may have negative effects on the overall usability of the system and these negative effects will have consequences for both the employer and employees. The evaluation was done in terms of the usability metrics of effectiveness, efficiency and user satisfaction. Effectiveness was measured in terms of the success rate with which users could execute prescribed tasks in a sandbox system. Efficiency was expressed in terms of the time it took participants to understand what is expected of them and to execute the tasks. Post-test questionnaires were used in order to determine the satisfaction of the participants. Recommendations were made to improve the usability of the online performance management system.

***Keywords*—**Eye tracking, human resource management, performance management, usability.

I. Introduction

PERFORMANCE management is an integral part of any modern organization and is described as "a continuous process of identifying, measuring, and developing the performance of individuals and teams, and aligning performance with the strategic goals of the organization" [1]. Performance management is implemented in an organization through a performance management system (PMS). Reference [10] views a PMS as:

> "The evolving formal and informal mechanisms, processes, systems, and networks used by organizations for conveying the key objectives and goals elicited by management, for assisting the strategic process and ongoing management through analysis, planning, measurement, control, rewarding, and broadly managing performance, and for supporting and facilitating organizational learning and change."

If the online PMS is difficult to use, it becomes a frustrating and time-consuming activity for the employee as well as the line manager. If the system is not well designed, it may negatively affect employees' opinion about performance management in general. Therefore, it is vital to determine the usability of the online PMS to improve employees' opinion about the system and increase employee buy-in. This study will focus on the usability of the current online PMS at the University of the Free State to determine its ease of use through eye tracking and a subjective questionnaire. Specifically, the following two research questions were formulated:

- How usable is the online PMS of the UFS?
- How can the online PMS of the UFS be improved?

En route to answering the above-mentioned questions, the study aimed to identify tasks that users of the online PMS of the UFS find easy to perform as well as those that pose a difficulty to users. Although all references are to one specific system, they serve also to illustrate that design flaws still exist in modern systems and that they have a detrimental effect on usage if designers do not adhere to accepted principles and conventions.

The next section focuses on online performance management systems per se with the subsequent section focusing on some general usability principles and the use of eye tracking to evaluate usability. These sections are followed by a discussion of the methodology that was applied to evaluate the usability of the performance management system of the UFS. The results are then discussed, followed by a discussion on the recommendations to improve the system so that it can better serve the community at the University of the Free State.

II. Online Performance Management Systems

A. Advantages and Pitfalls

Online performance management systems (PMSs) have definite benefits for both the organization and the employees. These systems can provide individual feedback and collated organizational data, which can be used for human resource planning and system evaluation purposes. Studying the collated data can also assist with managerial planning, remuneration schemes and human resource development programs. "Individual performance management outputs include opportunities for remedial skills development, retention, career development, training and upskilling programs", according to [14].

A well-designed and effective PMS will influence employees' self-esteem positively and their perceived value for the organization will improve. They will better understand the behaviors and results required in their positions and they

R. W. Brown a Lecturer at the University of the Free State, Bloemfontein, 9301 ZA (corresponding author, phone: +27744037596; fax: +27514012754; e-mail: brownrw@ufs.ac.za).

P. J. Blignaut is a Professor at the University of the Free State, Bloemfontein, 9301 ZA (e-mail: blignautpj@ufs.ac.za).

will be able to maximize their strengths and minimize their weaknesses [2]. Managers will develop a motivated workforce, gain greater insight into their subordinates and will be able to differentiate between good and poor performers [2]. Organizations will enjoy protection from lawsuits and be able to base organizational change on substantiated knowledge. They will enjoy enhanced employee engagement and reduced misconduct [2].

Possibly the biggest pitfall of an online PMS is when it is inefficient and ineffective, or has high user dissatisfaction. If the online PMS is not usable, staff members will have a negative connotation towards the system and performance management in general. This may lead to staff members not buying into the PMS with resultant incomplete data and consequently the employer could make wrong decision based on erroneous information.

Reference [6] used a literature review to identify the main problems that are encountered when a PMS is implemented. Thirty-one experts in the field of performance management had to complete a survey to capture their opinion on the frequency, impact and solvability of problems encountered in practice. The findings of the study were that the most severe problems are:

- Lack of commitment by top management.
- Not having a performance management culture in the organisation.
- Performance management receiving low priority.
- Performance management being abandoned after a change in management.
- Management placing a low priority on the implementation of performance management.
- Employees not realising the benefits of performance management.

B. A Specific Success Story

A large number of organisations worldwide employ online performance management systems. Amongst these is UBS – a financial services group based in Switzerland who deployed a universal performance appraisal system throughout the entire organisation. Their system is linked to PeopleSoft, where the company's employee records are stored. Each employee has a unique login that enables the system to recognise the user and automatically display the appropriate information from PeopleSoft. This information includes details such as the individual's current objectives, his role profile, to whom he reports and who reports to him.

In 2006, John Warner studied the online performance management system of UBS. He resolved that the most important benefit of the online PMS is that the system enables UBS to analyse departmental needs more effectively across all of its businesses because of the system's functionality and its ability to provide a more accurate reflection of performance (individuals, teams, businesses and company overall). In turn, this enables the corporate human resources (HR) department to identify training "blind spots" and highlight these specific training needs to the businesses [20].

John Mahoney-Phillips, the group head of human capital performance at UBS, said the following about their online PMS:

> "One of the advantages of the system is that we can drive down the analysis to a business group and then advise on, for example, how a cadre of managers could be built up, having identified the existing development gaps. A lot of our work in HR starts at group level as we carry out a 'maths' analysis. This helps inform overall talent development, but we can also drill down through the data and give businesses specific information to enable them to target development and manage assets much more effectively that in the past. This is just one of the many areas of added value that the system has brought to the organization." [20].

C. Performance Management at the University of the Free State

The current online performance management system of the University of the Free State (UFS) was implemented in 2007. Like the system at UBS, the online PMS at the UFS is connected to the PeopleSoft database that contains all the employee information. Since the system is online, it can be easily accessed from anywhere on any of the campuses and there is no paperwork involved. Also, because of the typical university structure of faculties, departments and divisions, an online PMS allows the UFS to easily identify struggling departments, divisions or staff members.

The performance management cycle at this university comprises three main phases (Fig. 1), namely creating a performance plan, evaluating the effectiveness of the work environment and evaluating the performance, and has two main role players (line managers and employees). All three phases take place in the online PMS environment.

During phase 1, the employee starts by either creating a new performance plan or reviewing a previous performance plan. This phase commences towards the end of the previous year. Once the employee has signed and submitted the performance plan electronically, his/ her line manager needs to approve and sign the plan. If needed, the employee can be requested to review the performance plan before the half-year discussions, where after the line manager has to approve the plan again.

The improvement and development plan as well as the work environment survey are done in phase 2. The employee starts by completing the work environment survey, followed by the improvement and development plan. These also need to be approved by the line manager at the end of the phase. The final phase, phase 3, is about employee evaluation. The employee needs to attach evidence of tasks performed and assesses his/her own performance. Thereafter, the line manager will also assess the employee's performance.

III. Usability Analysis

When any new system is implemented, problems may arise. The relevant question for this study is: What potential problems may arise when a performance management system is implemented?

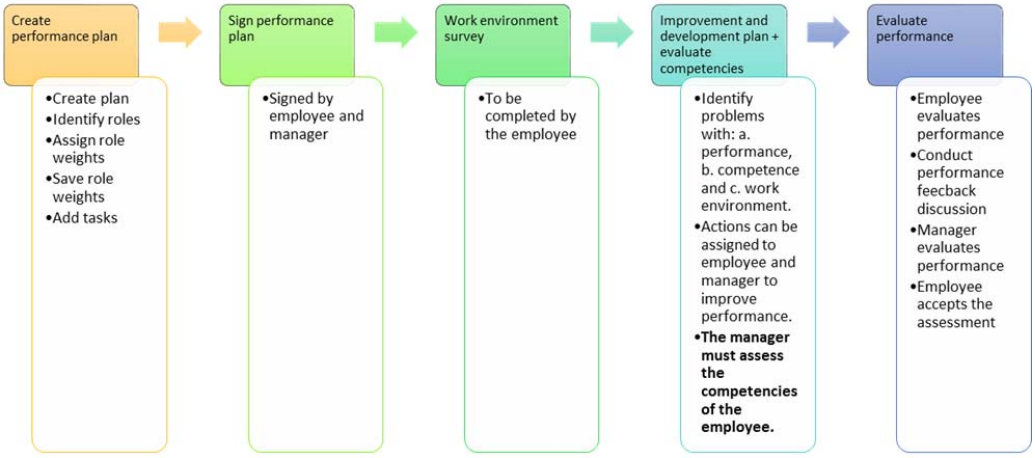

Fig. 1 Steps of the online performance management system of the University of the Free State (Adapted from: [19])

A. Usability in General

Usability testing is the technique of evaluating a product by testing it with actual users of the product. Reference [16] expresses it as follows:

> "Usability testing is a technique in user-centred design used to evaluate a product by testing it with actual users. It enables us to obtain direct feedback on how real users work with a product. We can measure how well they perform with respect to accuracy or efficiency and note if they meet pre-set goals. Users can often surprise us; they do the unexpected. To create a design that works, it is helpful for developers to see what real people do and look at as they interact with a product."

Usability is defined by the International Organization for Standardization (ISO) as:

> "The extent to which a product can be used by specified users to achieve specified goals with effectiveness, efficiency, and satisfaction in a specified context of use" [7].

This definition of usability is based on three important keywords, effectiveness, efficiency and satisfaction, which are defined as follows by ISO 9241-11 [7]:

- Effectiveness: This refers to how accurate and complete, users can achieve specific goals in particular environments. As such, effectiveness determines whether the system meets the demands of the users and whether a user is able to use the individual elements of the system. In this study, effectiveness was expressed in terms of the success that participants could achieve with given tasks on the online PMS.
- Efficiency: This refers to the resources spent on achieving goals in relation to the accuracy and completeness of the goals achieved. Efficiency is reflected by the time and effort users need to perform specific tasks. In this study, efficiency was measured in terms of the time it took participants to understand what is expected of them and to execute the tasks.
- Satisfaction refers to the comfort and acceptability of the work system to its users and other people affected by its use. In this study it was determined through a post-test questionnaire in which participants had to report on their experience.

According to [8], usability tests have five common features:

- The primary goal is to improve the usability of a product/ system.
- All participants should represent actual users of the product/system.
- Participants should perform actual tasks with the product/ on the system.
- What participants do and say should be recorded.
- The data obtained should be analysed and used to improve the usability of the product/ system.

This study will use employees of the UFS to test the usability of the online PMS. This method of testing enables researchers to obtain direct feedback on how real users work with the product.

B. General Design Principles for Development of Online Systems

Heuristics are broad rules of thumb that can be used to evaluate the usability of a system. Jacob Nielsen collaborated with Rolf Molich [15] to develop heuristics for the design of web pages and refined these to a set of 10 general heuristics for web site design. They referred, inter alia, to error prevention and recovery from errors, visibility of system information, agreement between the system and the real world, putting the user in control, following established conventions for navigating and browsing, flexibility and ease of use, and the availability of help and documentation.

In a more recent publication, [11] also refers to heuristics that can be used when designing web pages. Some of these are in addition to those of [15], but he adds that systems must speak the user's language, i.e. use familiar words, phrases and concepts and that information should be presented in a logical and natural order. He also stresses the importance of an aesthetic and minimalistic design along with the principle of chunking, i.e. materials must be written so that documents are short and contain only one topic. Feedback is important and erroneous or misleading links should be eliminated.

Many of these principles seem to be common sense and one

might be tempted to assume that developers will adhere to them without even thinking of them. It is alarming, however, how many systems do exist that do not comply with these basics. Without referring to the mentioned heuristics in [15] and [11] explicitly, this study will endeavour to identify the design flaws in the online performance management system of the University of the Free State and propose recommendations to improve it. Although all references are to one specific system, they serve to illustrate that design flaws still exist in modern systems and that they have a detrimental effect on usage if designers do not adhere to accepted principles and conventions.

C. Eye Tracking as a Complementary Technique for Usability Testing

In recent years, eye tracking has been used with usability testing as an additional method to evaluate user experience. Eye tracking data has emerged as a valuable way to inform the design of user interfaces. Website developers can also use eye tracking to determine which features are looked at and which are overlooked, and this will assist them in adapting the website to make it more usable.

In a typical usability study (not using eye tracking) of an online system/ website, participants will be asked to think aloud (giving running commentary) about their experience while using the online system/ website. This may cause some participants to feel uncomfortable and they may not be completely honest in their feedback. When eye tracking is combined with typical usability study methodologies, this problem can be eliminated and answers can be obtained for a number of questions that could not be answered accurately before. These questions are linked to the placement of links, input fields, images and slogans, for example "Do users notice this link?" and "Do users know the steps they need to follow in order to complete a given task?"

According to [5], eye tracking is also useful from the standpoint of usability for testing hypotheses about design. Reference [5] further states that analysis of eye movements can add an additional dimension to usability testing by providing information about human behaviour that would be difficult to obtain through traditional usability testing alone.

Several usability studies of online systems/ websites have been conducted using eye tracking in the past. Reference [4] conducted a study that examined the effectiveness of the design elements on news websites. They considered different methods of slide show navigation, breaking news formats and design options for supplemental links. They wanted to determine which layout/design is the most informative, had the highest engagement as well as the highest level of participant involvement.

Reference [9] conducted an explorative study to measure effectiveness, efficiency and user satisfaction of a prototype called Infobiotika, which is aimed at supporting antibiotic use in intensive care units. They combined traditional usability methods with eye tracking technology. With the use of eye tracking methods, they were able to identify several unexpected issues in terms of navigation, design problems and user performance.

More recent usability studies include a study on the position of boxes in web surveys [13], a study on the usability of a university registrar's office website [18] and a study that evaluated the visualisation support for antibiotic use in ICU [9]. All these studies aimed at improving the usability of online systems by giving the participants actual tasks to perform on each system. The eye tracking data was then analysed and specific recommendations were made.

In this study, participants were given specific tasks that are representative of a typical session with the online performance management system while their gaze behaviour was recorded on a remote desktop eye tracker. The gaze behaviour was afterward analysed to give the authors an insight into specific issues that participants encountered. The eye tracking software also provided data with regard to the time it took participants to find a specific link or button and click on it for the first time – typical efficiency measures.

IV. Research Methodology

A. Participants

Staff of the UFS who make use of the online PMS, formed the population of the study. The sample was drawn from the population through non-probability, purposive sampling [17]. In total 23 participants, spread over 12 departments or divisions, were tested, consisting of three "power users" (used as a benchmark) and 20 staff members of the UFS (12 line managers and eight employees). Every employee has a line manager and every line manager is also an employee with a line manager. Six of the regular participants used the online management system once per year, 13 participants used the system once every six months and one participant used the system every month. The "power users" were users that are very familiar with the system and use it on a daily basis.

B. Stimuli and Equipment

The eye tracking tests were conducted on the online PMS of the University of the Free State. The data was recorded with a Tobii TX300 desktop eye tracker running Tobii Studio version 3.4.0. The sessions were conducted in the usability laboratory of the Department of Computer Science and Informatics at the UFS. Each session took approximately 30 minutes to complete.

C. Design

With the ISO definition of usability in mind, the research followed a blended design that consisted of survey-based and evaluative research [12]. A pre-test questionnaire was used to determine the demographics, computer usage and frequency of use of the online performance management system (PMS) of the participants. Effectiveness of task execution was measured in terms of the percentage of tasks successfully completed. Efficiency was measured through the quantitative eye tracking measurement of time to first fixation as well as the time to the first mouse click on the relevant button or link. Heat maps were used to visualise the eye tracking results. User satisfaction was determined through a post-test questionnaire,

which was subjective and qualitative of nature. The questionnaire was based on the Questionnaire for User Interaction Satisfaction (QUIS), developed at the University of Maryland [3]. The QUIS makes use of a 9-point scale to rate specific aspects of the human-computer interface.

D. Procedure

All participants followed the same protocol to ensure the results would be comparable. Participants had to do the following tasks:

1. Create a new performance plan.
2. Add tasks to the performance plan.
3. Sign the performance plan.
4. Complete the work environment survey.
5. Create an improvement and development plan.
6. Sign an employee's performance plan.
7. Assess an employee's performance plan.

Employees had to complete task 1 to task 5 and line managers had to complete task 1 to task 7. The power users executed the same tasks in the same order and their results were taken as benchmark to evaluate the performance of the regular employees (employees and line managers).

Participants were asked to log out of the system after the completion of every task to ensure that all participants started each task at the same point, so that recordings were comparable with regard to the time spent on each task.

The facilitator recorded his subjective impressions on the difficulty that participants experienced during task execution and also recorded the success rate of task execution manually during the user testing sessions.

E. Ethical Considerations

A sandbox version of the online PMS was used, meaning that participants' personal information in the actual system was not available to the researcher. Participants used prescribed information to complete each task and each participant was given a generic username and password to ensure anonymity.

F. Other Recommendations

Due to the fact that the online PMS is a web-based system, which is dynamic in nature, each task had to be divided into different static scenes to process the eye tracking data. These scenes are explained in Table I. Areas of interest (AOIs) were drawn on each of the scenes and two eye tracking metrics were used, namely the time to first fixation and the time to first mouse click. Some of the scenes with AOIs are shown in Figs. 2 (a) and (b).

TABLE I
TASKS DIVIDED INTO SCENES

Task	Scene	Start of scene	End of scene
Task 1	1A	Home page of PMS.	Clicked on "Performance Management".
	1B	Home page of Performance Management.	Clicked on "New Plan".
	1C	Home page of Performance Plan.	Clicked on "Roles".
	1D	Once "Roles" page has been loaded.	Submitted the selected role.
	1E	Once "Weights" section has been loaded.	Saved the weight.
Task 2	2A	Home page of PMS.	Clicked on "Performance Management".
	2B	Home page of Performance Management.	Clicked on "View/ Edit" of the performance plan.
	2C	Once the performance plan has loaded.	Clicked on "Add task".
	2D	Once participant has finished entering the task.	Clicked on "Submit".
Task 3	3A	Home page of Performance Management.	Clicked on "View/ Edit".
	3B	Once the performance plan has loaded.	Clicked on "Sign".
	3C	Once the sign dialog box has loaded.	Clicked on the "Sign" button.
Task 4	4A	Home page of PMS.	Clicked on "Work Environment Survey".
	4B	Home page of Work Environment Survey.	Clicked on "View".
	4C	Once the Work Environment Survey has loaded.	Clicked on "Submit".
Task 5	5A	Home page of PMS.	Clicked on "Performance Management".
	5B	Home page of Work Performance Management.	Clicked on "View/ Edit".
	5C	Once improvement and development plan has loaded.	Clicked on "Add employee action".
	5D	Once add employee action screen has loaded.	Clicked on "Submit".
Task 6	6A	Home page of PMS.	Clicked on "Performance Management".
	6B	Home page of Performance Management.	Clicked on "View/ Edit" of the performance plan.
	6C	Once the employee's performance plan has loaded.	Clicked on "Sign".
	6D	Once the sign dialog box has loaded.	Clicked on "Sign".
Task 7	7A	Home page of Performance Management.	Clicked on "View/Edit" of the performance plan.
	7B	Once the employee's performance plan has loaded.	Clicked on "Assess".
	7C	Once the assess dialog box has loaded.	Clicked on "Submit".

Due to the fact that the data is not necessarily normally distributed and the small number of power users, the non-parametric alternative to t-tests, the Mann-Whitney U-test, was used to test the hypothesis that there is no difference in the performance of regular and power users. Two measures were used to measure performance, namely the time it took participants to fixate on a specific area of interest for the first time and the time it took them to click on the required button

or link.

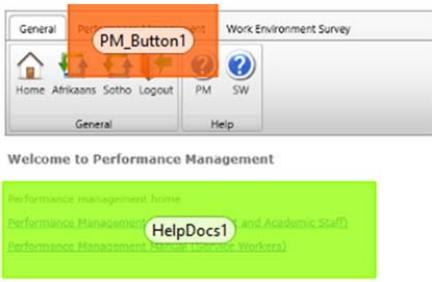

Fig. 2 (a) Areas of interest for Task 1A

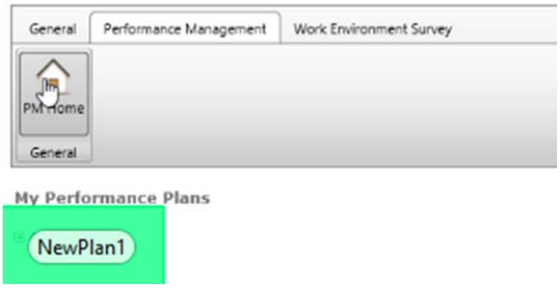

Fig. 2 (b) Areas of interest for Task 1B

V. Findings

The discussion below starts with a per task analysis of effectiveness and efficiency of task execution. Thereafter, a summary of the effectiveness measures and a summary of the efficiency measures are provided. Finally, a discussion of user satisfaction is done.

It is important to note that the findings are very specific with regard to the current online performance management system at the University of the Free State. As mentioned previously, the study aims to underline the importance of adhering to established design principles and conventions and the effect it has on users and organisations if systems deviate from these.

A. Per Task Discussion of Effectiveness and Efficiency

1. Task 1

In Task 1, the participants had to create a new performance plan and set the role and role weights for the performance plan. Participants found this task rather tricky with only nine participants being able complete the task on their own. Eight participants had to be assisted in completing the task and the facilitator had to complete the task for three participants. Furthermore, there were six participants who wrongly clicked on the *Help* links when trying to complete the task.

Scene 1A. In the first scene (Fig. 3), participants had to click on the *Performance Management* button at the top of the screen in order to continue with the task. On average, it took participants only 2.36 s to see the links to the *Help* documents and it took them 8.74 s to see the *Performance Management* button and 16.87 s (an additional 8.13 s) to click on it.

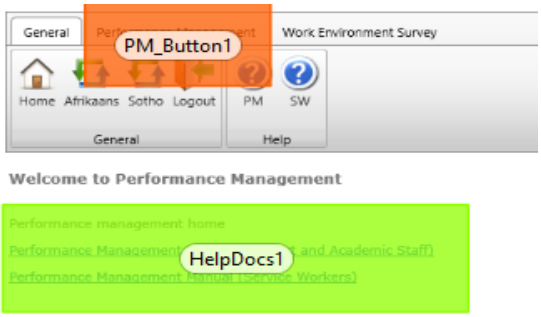

Fig. 3 Scene 1A

The average time it took the power users to see the button was 5.00 s and they clicked on it virtually immediately after seeing it. From this, we can deduce that the regular users saw the button but were not sure that it was the correct action to take to continue with the process.

Scene 1B. This scene required participants to click on the *Add New Plan* link. During testing, it was noticed that the participants found it easy to complete this part of the task, as can also be seen in the eye tracking data (Table III).

Scene 1C. This scene started once the new plan had been created and participants had to click on the *Roles* button in the toolbar. It took participants an average of 8.41 s to see the *Roles* button and 11.90 s to click on it. On the other hand, it took power users only 1.08 s to see the button and 4.61 s to click on it. It seems, therefore, as though the regular users struggled to find the *Roles* button, but once they found it, they needed only a few moments to ensure that it was the correct thing to do.

Scene 1D. Participants had to select *Role 5* from the list and then submit the selected role. Participants did not struggle with the task too much, as it took them on average 2.24 s to see where they had to select the roles and a further 6.07 s to select and submit the role. The power users took 0.34 s to see where they had to select the roles and a further 3.94 s to select and submit the role. Fig. 4 shows the heat map of all participants for this scene. It can be seen that participants did not read the descriptions of the roles but simply selected the role and submitted it.

For the last scene of Task 1, participants had to select the weight that should be associated with the role created in Task 1D. On average, participants took 3.09 s to see where they had to select the weight and a further 7.34 s to select and save. The power users took 0.41 s to see where they had to select the weight and a further 6.22 s to select and save. In other words, the regular users took somewhat more time than the power users to find the link, but once they did so, they completed the task in the same time as the power users.

Fig. 4 Heat map for Scene 1D

Log Out Scene

Participants had to log out after every task and start with the next task from scratch to ensure that the execution times are comparable. It was noted during the user sessions that participants struggled to log out for the first time. Some participants suggested that the *Log Out* button should permanently appear on the toolbar and not only under the *General* tab.

The Log out scene starts when a participant completed Task 1E and ends when he clicks on the *Log Out* button. On average, power users took 6.83 s to click on the button while employees took 10.79 s and line managers took 14.92 s.

2. Task 2

In Task 2, the participants had to add tasks to the newly created performance plan.

Scene 2A. In the first scene (Fig. 5), participants had to click on *Performance Management* at the top of the screen to continue with the task. On average it took them 1.76 s to see the links to the *Help* documents and 2.13 s to see the *Performance Management* button. The significantly shorter time to see the *Performance Management* button can be attributed to the fact that it is the second time participants followed this route.

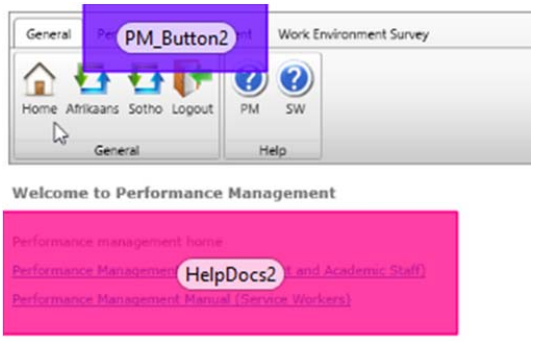

Fig. 5 Scene 2A

Scene 2B. Participants had to click on the *View/Edit* link of the performance plan created in Task 1. On average, the participants took 3.89 s to see the link and 9.74 s to click on it, compared to the 1.68 s and 3.77 s respectively of power users. The fact that participants took about 6 s longer than the power users to click on the *View/ Edit* link, indicates that participants did not know how to complete this scene.

Scene 2C. This scene required participants to click on the *Add Task* link to add the new tasks. On average, it took them 1.53 s to see the *Add Task* link and 4.17 s to click on it – indicating that participants found it relatively easy to complete this scene. Participants knew exactly where to go to add a new task to their performance plan, as can be seen from the heat map for Task 2C in Fig. 6.

Scene 2D. When adding a new task, users must also add indicators for the task. Once the indicator has been entered, users must scroll down to find the *Submit* button (Fig. 7). Scene 2D was set up to determine how long it took participants to notice that they need to scroll down in order to submit the new task. In total, 11 participants were able to complete this task themselves, but nine of the participants had to be assisted to find the *Submit* button. On average the participants took 6.92 s to click on the *Submit* button, where the power users only took 3.19 s.

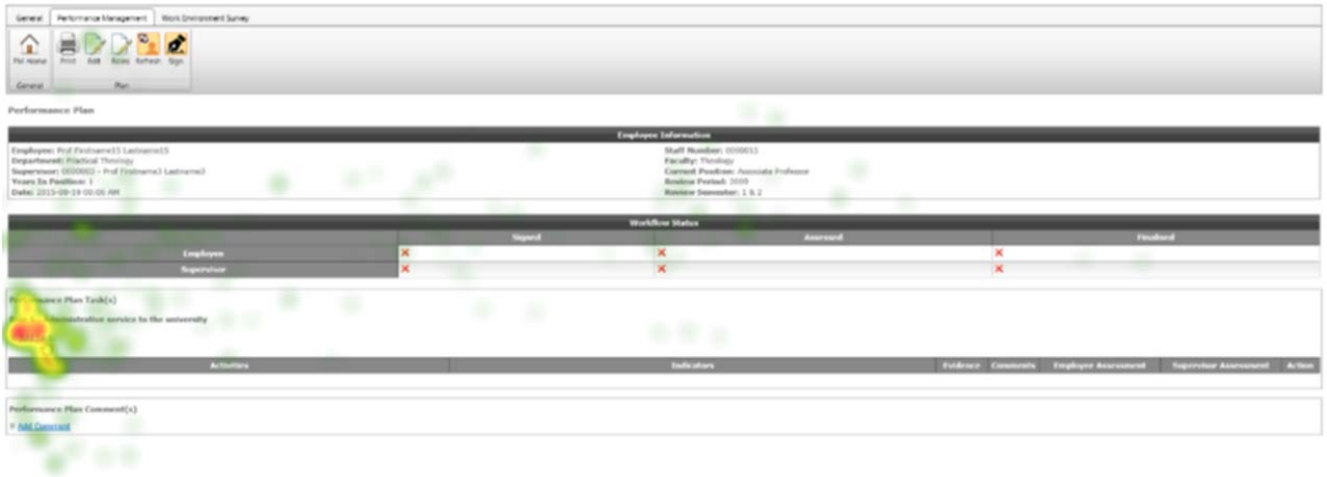

Fig. 6 Heat map for Scene 2C

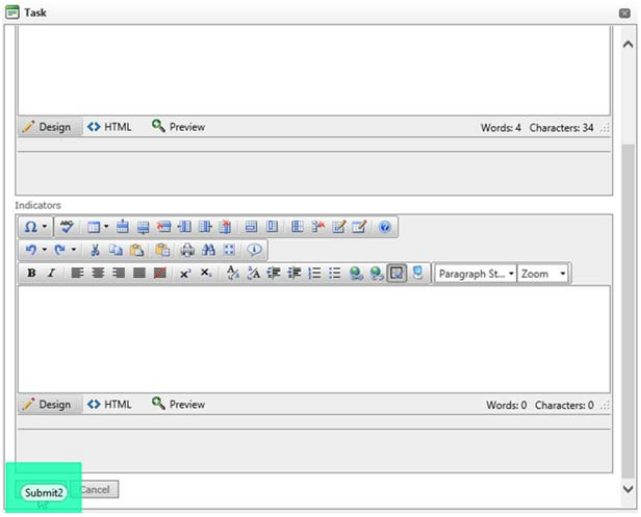

Fig. 7 Scene 2D

3. Task 3

For Task 3, participants had to sign the performance plan that they created in Task 1. In total, 10 participants were able to complete Task 3 on their own and another 10 had to be assisted.

Scene 3A. The first scene (Fig. 8) starts at the performance management home page, where participants had to click on the *View/ Edit* link to continue. On average, participants took 2.28 s to see the link for the first time and 8.09 s to click on it. During testing it was noted that the reason for this long delay in clicking on the link could be attributed to the fact that participants were not sure where they needed to go to sign the plan. In contrast to the regular user, the power users took about the same time (1.79 s) to see the link, but only 2.44 s to click on it.

Fig. 8 Scene 3A

Scene 3B. During this scene, participants had to click on the *Sign* button in the toolbar. The participants took 5.38 s before they first saw the *Sign* button, while the power users took 3.87 s to see it.

Scene 3C. No quantitative efficiency measures are available for this scene as it was added to determine whether participants read the description before they signed their performance plan. Looking at the heat map in Fig. 9, the feint green marks along the description suggest that participants only browsed the description hurriedly before signing their performance plan.

4. Task 4

Participants had to complete the concise version of the Work Environment Survey (WES). Fifteen participants were able to complete it themselves and five had to be assisted to complete the task.

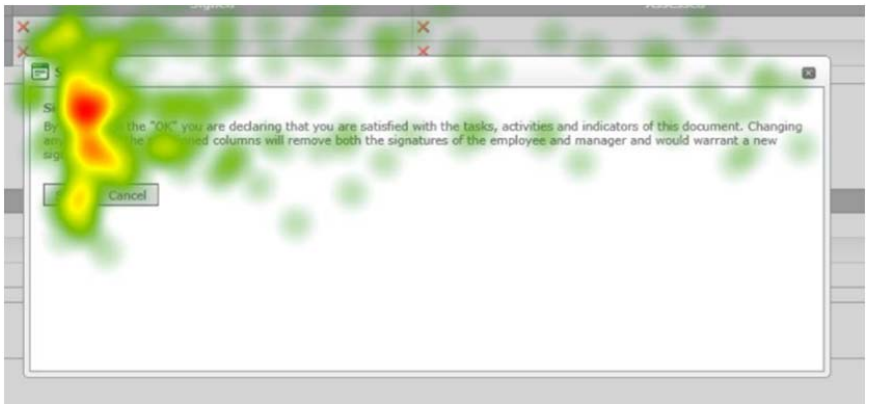

Fig. 9 Heat map for Scene 3C

Scene 4A. The first scene starts at the PMS Homepage where participants had to click on the *WES* button at the top of the screen. On average, participants took 3.27 s to see the *WES* button (compared to the 0.23 s of the power users). The participants took 5.34 s to click (3.32 s for the power users).

Scene 4B. Scene 4B starts on the WES home page where participants had to click on the *View* button to continue to the actual survey. Participants saw the name of the survey (1.25 s) first and then saw the *View* button (3.93 s). The heat map in Fig. 10 shows that there were two main areas on the screen where participants focused – one being the location of the name of the survey and the other the *View* button where they needed to click to complete the survey.

Scene 4C. This scene is about completing the work environment survey. It consists of various sections, including questions, an explanation of the importance and satisfaction ratings and the area where importance and satisfaction had to be selected. When examining the scan paths of participants, two of them were specifically interesting as they represent the diversity with which participants consider the survey. The top scan path in Fig. 11 (a) shows that the participant only read the first question and then answered the rest of the questions without reading the questions. The scan path in Fig. 11 (b) shows a participant who read each of the questions and even read the ratings.

5. Task 5

Participants had to add items to an improvement and development plan under the following headings:

- Area of Performance to be Improved,
- Area of Work Environment to be Improved, and
- Actions and Training Taken by Employee.

During testing it became clear that participants did not know where and how to access the improvement and development plan. Most participants indicated that they had never created such a plan before. The large significant difference between the time it took participants to see the *Performance Management* button and the time it took them to click on it (*cf.* Scene 5A below) confirms that participants did not know where to go to create the improvement and development plan.

Scene 5A. The first scene for this task starts at the home page of the PMS, where participants had to click on the *Performance Management* button in order to continue. Participants took 2.54 s to see the button and a further 4.78 s to click on it. Power users took 0.67 s and a further 1.82 s, respectively.

Fig. 10 Heat map for Scene 4B

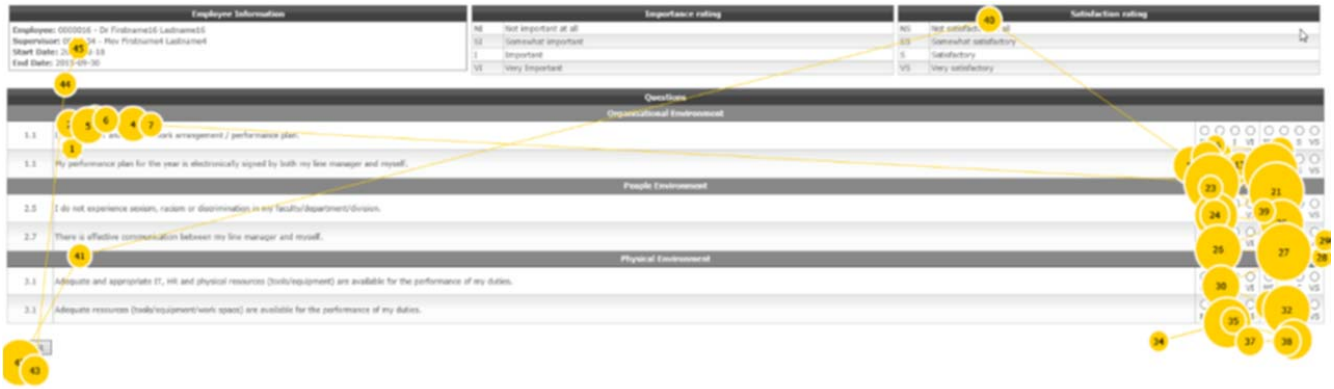

Fig. 11 (a) Scan path of one participant for Scene 4C

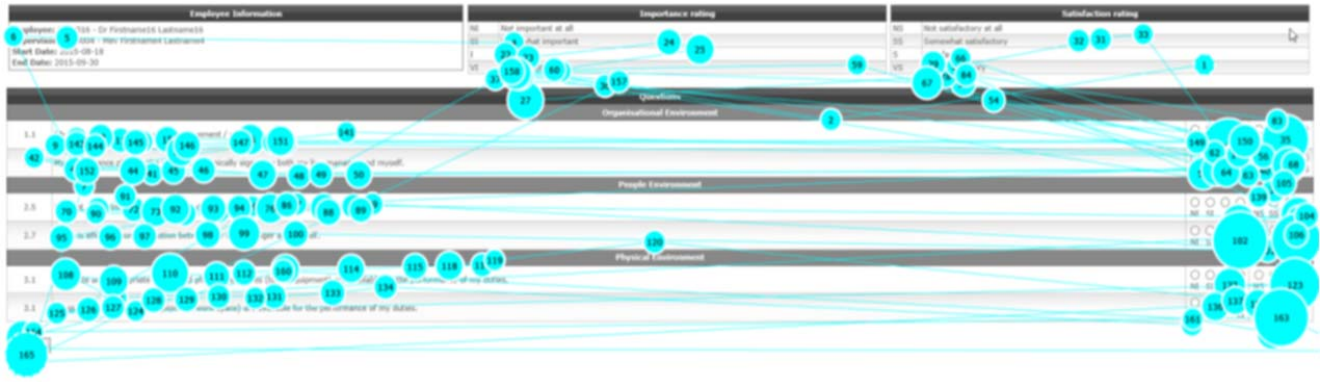

Fig. 11 (b) Scan path of one participant for Scene 4C

Scene 5B. In this scene (Fig. 12), participants had to click on the *View/ Edit* link to access the improvement and development plan. On average it took participants 2 s longer than the power users to see the *View/ Edit* link and a further 4.95 s to actually click on the *View/ Edit* link. It seems as though participants were not sure as to which link to follow. Figs. 13 (a) and (b) compare the scan path of a regular user with the one of the power users. The power user had only six fixations before he clicked on the *View/ Edit* link in contrast with the regular participant who had 67 fixations before he clicked on the link.

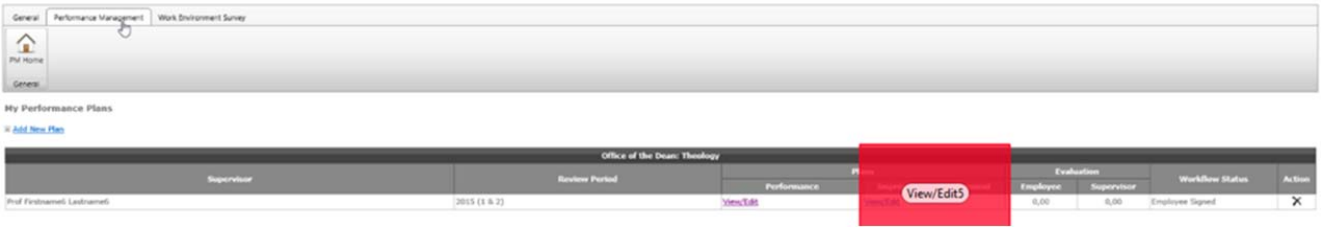

Fig. 12 Scene 5B

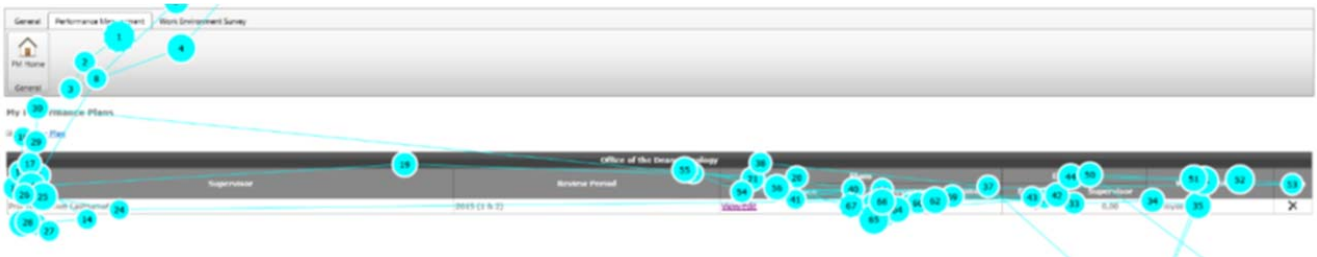

Fig. 13 (a) Scan path of a regular user for Scene 5B

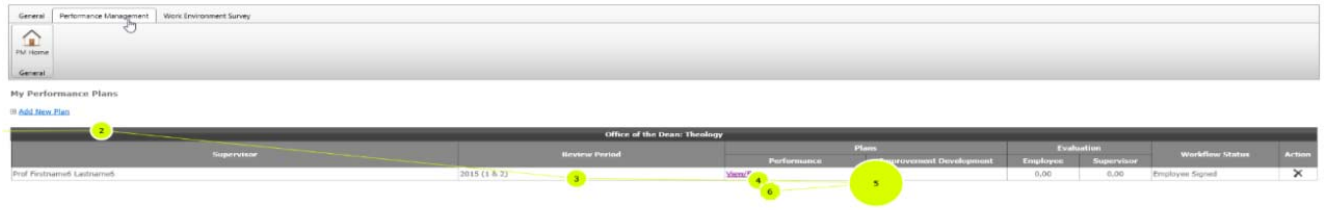

Fig. 13 (b) Scan path of a power user for Scene 5B

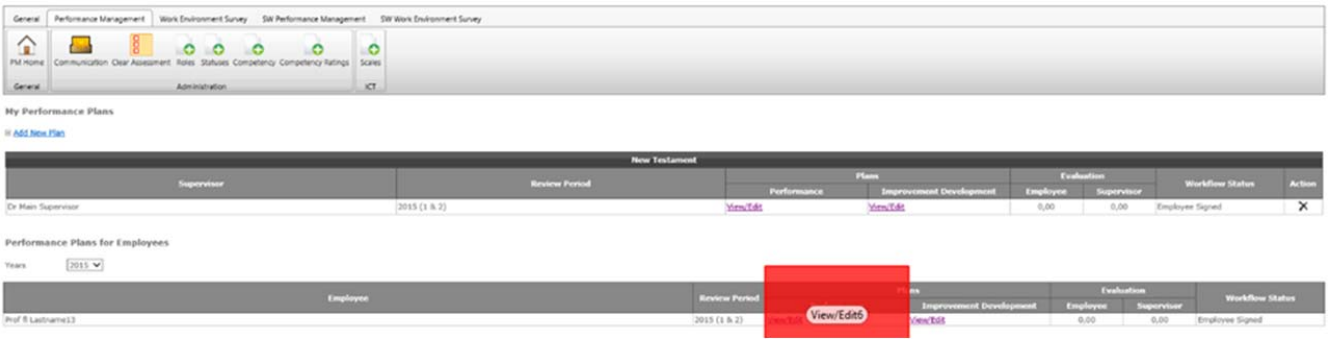

Fig. 14 Scene 6B

Scene 5C. It is evident from the data in Table III that the participants did not struggle with this scene. The time to the mouse click for regular users was very close to that of the power users.

Scene 5D. For the final scene of the task, participants had to add the actions and training to be taken by the employee. This part of the task had to be completed in a specific order: Firstly, participants had to set the status as completed. Thereafter, they had to enter/ select the date of completion and, finally, participants had to enter a description. Fifteen participants had to be assisted to complete this part of the task and only five were able to complete it on their own. It was noted during testing that participants struggled because they assumed all the information had to be entered into the description box (which is very large in size), without carefully scanning the box. It was also noted that even the power users clicked in the description box before clicking on the status box.

6. Task 6

Line managers were instructed to access a fictitious employee's performance plan and sign it. Half of the participants had to be assisted to complete this task.

Scene 6A. The first scene started on the home page of the PMS and participants had to click on the *Performance Management* button in order to continue. There was only a difference of 1.21 s between the time it took participants to click on the button and the time it took the power users to click on it.

Scene 6B. Participants had to click on the *View/ Edit* link on the employee's performance plan in order to continue (Fig. 14). Regular users (6.07 s to find the link + 5.79 s to click on it) took much longer than power users (0.78 s + 1.67 s, respectively) to complete this scene. Power users knew where to look for the link and clicked on it immediately. The data indicates that participants struggled and did not know where they had to go to sign an employee's plan.

Scene 6C. After the employee's performance plan was loaded, the participant had to click on the *Sign* button to sign the plan. Participants spent a long lime locating the *Sign* button, seeing that the time to first fixation on the *Sign* button was 7.09 s, while power users only took 0.26 s to locate it. Once they saw the *Sign* button, both participants and power users took approximately 2 s to click on the button.

Scene 6D. This scene was set up to determine if participants read the message in the sign dialog box. The heat map in Fig. 15 shows that participants surveyed the message in the dialog box only briefly or not at all.

7. Task 7

Line managers had to assess an employee's performance plan. Participants struggled to complete this task, with eight participants who had to be assisted to complete the task and only four participants being able to complete the task on their own.

Scene 7A. The first scene begins on the home page of the performance plan where participants had to click on the *View/ Edit* link to continue. Participants took 8.05 s before they clicked on the link, in contrast with the power users who took only 1.61 s to click on the link. Participants saw the *View/ Edit* link after 2.58 s, but searched further as if they did not know that they had to click on it. More than half of the participants also looked at the evaluation section of the performance plan (fixated on it after 4.62 s), before they clicked on the *View/ Edit* link.

Fig. 15 Heat map for Scene 6D

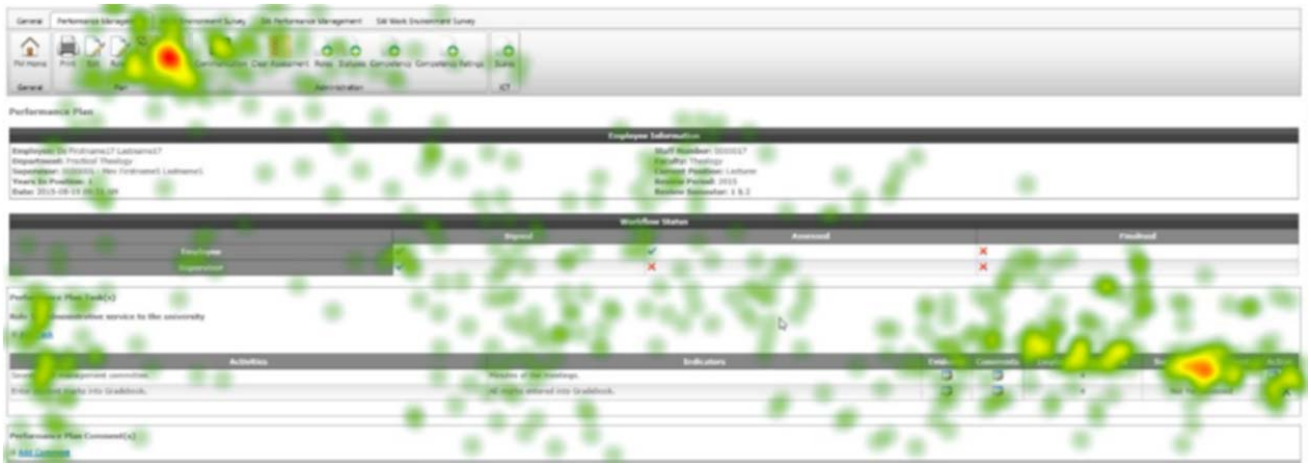

Fig. 16 Heat map for Scene 7B

TABLE II
TASK COMPLETION BY PARTICIPANTS

	Completed	Assisted	Completed on behalf	Total number of participants
		All Participants		
Task 1	9	8	3	20
Task 2	11	9	0	20
Task 3	10	10	0	20
Task 4	15	5	0	20
Task 5	5	15	0	20
First Log Out	7	13	0	20
TOTAL	**57**	**60**	**3**	**120**
		Line Managers		
Task 6	6	6	0	12
Task 7	4	7	1	12
TOTAL	**10**	**13**	**1**	**24**

Scene 7B. Participants had to click on *Assess* to assess the performance of the employee. Participants struggled to find the *Assess* button and took 15.36 s (power users took 5.10 s) to click on it.

Participants first viewed the *Supervisor Assessment* section of the performance plan (1.44 s) before they saw the *Assess* button (9.79 s). This shows that participants expected to be able to assess the performance under the *Supervisor Assessment* section, which is also shown in the heat map in Fig. 16.

Scene 7C. This scene started once the *Assess Plan* dialog box opened and ended as soon as a participant submitted his assessment. Participants took 2.99 s and power users 0.47 s to see where they had to select the assessment. Participants took an additional 3.13 s to click on an assessment for the first time and power users only an additional 1.37 s.

B. Effectiveness of Task Execution

A summary of the success rate of task execution is shown in Table II. From these results, together with the notes taken by the facilitator during the user sessions, it was clear that no participant could do all tasks unassisted. The task where most participants had to be assisted was Task 5. The facilitator also had to point 13 participants towards the *Log Out* button.

The majority of participants (15) struggled to complete Task 5D and had to be assisted. Participants did not examine the dialog box carefully and simply wanted to enter all the information into the *Description* box. Participants struggled with task 7B (Fig. 16) as they took almost 10 s longer than the power users to click on the *Assess* button, although this

difference was not significant.

The only task that most of the participants were able to complete themselves was Task 4 (*cf.* Fig. 10); even though participants commented that the *View* column should have a different name and that the headings/ ratings of the WES are not clear. Most of the other tasks were about 50/ 50 between the participants completing the task themselves and being assisted by the facilitator.

There is a definite indication that participants were not totally comfortable working with the online PMS. These results are quite alarming, as it means that no participant would under normal circumstances be able to complete his/ her plan or do the assessments unassisted. Consequently, this will have a substantial impact on data integrity, confidentiality and reliability of organizational trends that are identified from the aggregated results.

TABLE III
RESULTS OF A SERIES OF MANN-WHITNEY U TESTS FOR THE DIFFERENCE IN PERFORMANCE

Task	Time to first fixation					Time to first click				
	Regular users		Power users		p	Regular users		Power users		p
	N	Mean	N	Mean		N	Mean	N	Mean	
Log out	17	7.4	3	5.2	0.341	18	14.5	3	9.4	0.291
1A PM Button	19	8.7	2	5.0	0.590	19	16.9	3	5.4	0.022
1A Help docs	18	2.4	3	1.4	0.880	6	8.5	0		-
1B New plan	18	2.3	2	0.9	0.413	16	4.6	2	3.2	0.725
1C Roles	17	8.4	2	1.1	0.054	20	11.9	3	4.6	0.075
1D Define roles	19	0.5	2	0.0	-	0		0		-
1D Select roles	18	2.2	3	0.3	0.014	20	3.8	3	1.5	0.016
1D Submit	18	3.2	3	3.1	0.651	19	8.3	3	4.3	0.028
1E Set Weights	19	3.1	3	0.4	0.007	20	4.0	3	1.5	0.025
1E Save Weights	12	5.3	3	1.3	0.386	18	10.4	3	6.6	0.291
Task 1	**158**	**4.0**	**23**	**1.5**	**0.017**	**138**	**8.6**	**20**	**3.9**	**0.000**
2A PM Button	15	2.1	2	0.6	0.264	19	5.5	3	1.4	0.035
2A Help docs	15	1.8	2	0.4	0.941	1	4.0	0		-
2B Performance Plan	17	3.9	2	1.7	0.550	20	9.7	3	3.8	0.218
2C Add task	18	1.5	3	0.9	0.651	19	4.2	3	2.1	0.180
2D Submit	12	6.5	3	2.3	0.036	20	6.9	3	3.2	0.032
Task 2	**77**	**3.0**	**12**	**1.3**	**0.158**	**79**	**6.6**	**12**	**2.6**	**0.001**
3A View/ Edit	18	2.3	2	1.8	0.753	20	8.1	3	2.4	0.050
3B Sign	18	5.4	2	3.9	0.850	20	7.4	3	3.3	0.157
Task 3	**36**	**3.8**	**4**	**2.8**	**0.982**	**40**	**7.8**	**6**	**2.9**	**0.011**
4A WES	15	3.3	1	0.2	-	20	5.3	3	3.3	0.438
4B WES Name	17	1.3	2	0.2	0.207	1	5.0	0		-
4B WES View	19	3.9	2	0.7	0.042	20	6.0	3	2.2	0.025
4C Importance	18	4.4	1		-	0		0		-
4C Satisfaction	18	5.8	0		-	0		0		-
4C Questions	20	1.3	2	0.2	0.332	0		0		-
Task 4	**107**	**3.3**	**8**	**0.3**	**0.003**	**41**	**5.7**	**6**	**2.8**	**0.031**
5A PM Button	17	2.5	2	0.7	0.259	20	7.3	3	2.5	0.061
5B View/ Edit	19	2.5	3	0.5	0.015	20	8.9	3	2.0	0.012
5C Add performance	20	0.6	3	0.3	0.294	20	9.1	3	7.1	0.494
5C Add WE	20	18.0	2	7.9	0.775	20	37.1	3	27.3	0.294
5C Add actions	19	48.8	3	21.5	0.028	19	56.1	3	40.5	0.126
5D Status	15	6.0	2	3.1	0.502	20	9.4	3	4.8	0.132
5D Date	20	10.3	3	4.1	0.254	20	12.5	3	6.5	0.075
5D Description	20	5.1	3	9.4	0.438	20	3.8	3	2.8	10.000
Task 5	**150**	**11.9**	**21**	**6.2**	**0.091**	**159**	**17.8**	**24**	**11.7**	**0.027**
6A PM Button	10	1.1	3	0.8	0.933	12	3.7	3	2.4	0.220
6B View/Edit	11	6.1	3	0.8	0.013	12	11.9	3	1.7	0.012
6C Sign	10	7.1	2	0.3	0.107	12	9.5	3	2.5	0.130
Task 6	**31**	**4.8**	**8**	**0.7**	**0.010**	**36**	**8.3**	**9**	**2.2**	**0.002**
7A Evaluation	8	4.6	0		-	0		0		-
7A View/ Edit	10	2.6	3	0.6	0.108	12	8.1	3	1.6	0.012
7B Assess	12	9.8	3	3.9	0.130	12	15.4	3	5.1	0.071
7B Sub-assess	9	1.4	1	1.7	-	2	7.4	0		-
7C Assessment	12	3.0	3	0.5	0.097	12	6.1	3	1.8	0.025
Task 7	**51**	**4.5**	**10**	**1.7**	**0.005**	**38**	**9.7**	**9**	**2.9**	**0.000**

Recommendations on how the online PMS of the UFS can be improved, together with a discussion on the limitations of this study, will be presented in the next main section.

C. Efficiency

The time to first fixation and time to first mouse click per scene (Table I) are shown in Table III. The overall results per task are also shown. A non-parametric alternative to t-tests

was used to test the hypothesis that there is no difference in the performance of regular and power users. The results of the Mann-Whitney U (MWU) test for each sub-task, with sufficient valid observations, are also shown in Table III.

Although the MWU test is based on rank sums and not on the means of the two samples, the means are shown since they are informative for interpretation of the results. Significant p values ($\alpha = 0.05$) are highlighted. In some instances, the time to first fixation could be misleading because it is possible that a participant's eyes were focused on a specific area on the screen prior to loading the page – resulting in a zero time for the time to first fixation.

It is important to note that the MWU test might have failed to prove that the regular and power users differ significantly on a specific task due to the small number of power users. A larger number of power user observations could have led to a different result. One can only be 95% sure of the outcome for tasks where a significant result ($\alpha = 0.05$) was obtained – not for those where no significant result was obtained.

It seems as though power users in general performed significantly better in each of the tasks, although the results were not significant for all the scenes. Participants struggled to find the button to start Task 1 (Fig. 3). Participants also took about twice the time that power users took to select roles and set and save roles. A similar trend was found for Task 2 (Fig. 5) where participants struggled to find the button to start the task and to finally submit their responses (Fig. 7). Participants struggled to find the *View/ Edit* links in Task 3A (Fig. 8), 5B (Fig. 12) and 6B (Fig. 14), which could indicate that participants did not know that they had to click on *View/ Edit* to continue with the task.

D. User Satisfaction

A summary of the results from the post-test satisfaction questionnaire are shown in Table IV.

TABLE IV
NUMBER OF RESPONSES PER ITEM AND RESPONSE LEVEL ON THE POST-TEST QUESTIONNAIRE

	Strongly agree	Agree	Not sure	Disagree	Strongly disagree
I found the online performance management system easy to use.	1	11	3	4	1
I found the online performance management system enjoyable to use.	2	7	5	6	0
I found the online performance management system frustrating to use.	1	7	4	5	3
I found it easy to create a new performance plan. (Task 2.1 & Task 2.2)	4	9	3	4	0
I found it easy to sign my performance plan. (Task 2.3)	5	14	0	0	1
I found it easy to complete the work environment survey. (Task 2.4)	4	13	1	2	0
I found it easy to create an improvement and development plan. (Task 2.5)	3	10	1	5	1
I found it easy to sign an employee's performance plan. (Task 2.6)	4	7	0	1	0
I found it easy to assess an employee's performance. (Task 2.7)	2	7	1	1	1

Despite struggling with the system in various aspects as proven above and noted by the facilitator during the user sessions, the feedback received from participants was not as negative as one would expect. This misalignment could be due to three reasons:

- Participants completed the questionnaire giving the feedback they thought were expected of them.
- Participants are so used to struggling with online systems that they did not struggle more with the online PMS than with other systems.
- Participants were assisted in completing some tasks and they may have taken the assistance into account when completing the questionnaire.

If participants indicated that they found the online PMS frustrating to use, they were asked in an open-ended question why that is the case. Some of the responses are listed below:

- *"Difficult to always know where to click and sign."*
- *"Change of commands and program only using it once in 6 months – tend to forget procedures."*
- *"To log out I have to click on the General tab."*
- *"It was easy to use; however, I battled to find some tabs."*

The last question of the post-test questionnaire was asking for any comments on the system. Some of the feedback that was received is listed below:

- *"Assess should be next to the name/ task."*
- *"Description for assessment must be available."*
- *"Year of assessment must have current year as default."*
- *"The system is very complicated to complete, because there are separate blocks for everything that needs to be entered."*
- *"The links are not where you would expect them to be, for example you don't expect to have to go back to general in order to log out."*
- *"Abbreviations on the work environment survey are not clear."*
- *"The need for scrolling some windows is unnecessary."*

These comments were taken into account during the redesign of the system as discussed in the next section.

VI. RECOMMENDATIONS FOR THE IMPROVEMENT OF THE ONLINE PMS OF THE UFS

The benefits of a well-designed performance management system are listed in Section II.*A*. The fact that most participants use the system once in six months or once per year and that the online PMS of the UFS is changed every year, stress the need for a usable system. Even if people receive training in the use of the system, the low frequency of usage and frequent changes will cause them to forget the necessary actions and become frustrated. This will mean that a task that should be motivational and rewarding becomes like a mountain to climb, and people will be reluctant to do their duty in this regard. And when they do it, they will make errors or provide incomplete information – to such an extent that the system bears no benefit for them or the organisation.

No framework exists for the design of an online system and specifically for an online performance management system. Therefore, there is no framework to compare the online PMS of the UFS with. The only benchmark is that of generic heuristics or "rules of thumb" for online systems in general. From the list of heuristics given by [11], the following were identified as being problematic in the online PMS of the UFS:

- Speak the user's language. Information is not always presented in a logical and natural order;
- Minimise the user's memory load. A good system is one that is intuitive to use and does not expect the user to remember how to do things from training or previous usage.
- The design must be aesthetic and minimalistic. Information that is irrelevant or distracting must be removed.
- Use chunking. Users should not be forced to access multiple documents to complete a single thought.
- Give navigational feedback. It should be easy to return to the initial state.
- Do not lie to the user. Erroneous or misleading links should be eliminated.

These heuristics were taken into account when the recommendations below were developed. The recommendations fall into three categories, namely the home page of the system as a whole, the home page of performance management and the home page of the work environment survey.

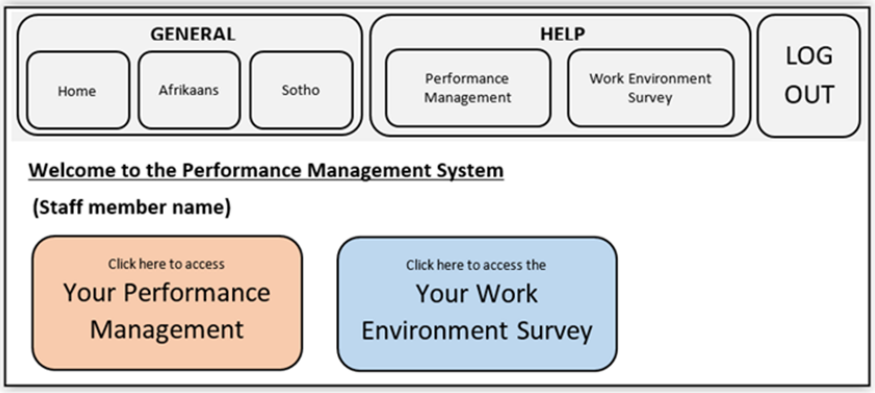

Fig. 17 Redesigned home page of the online PMS for employees

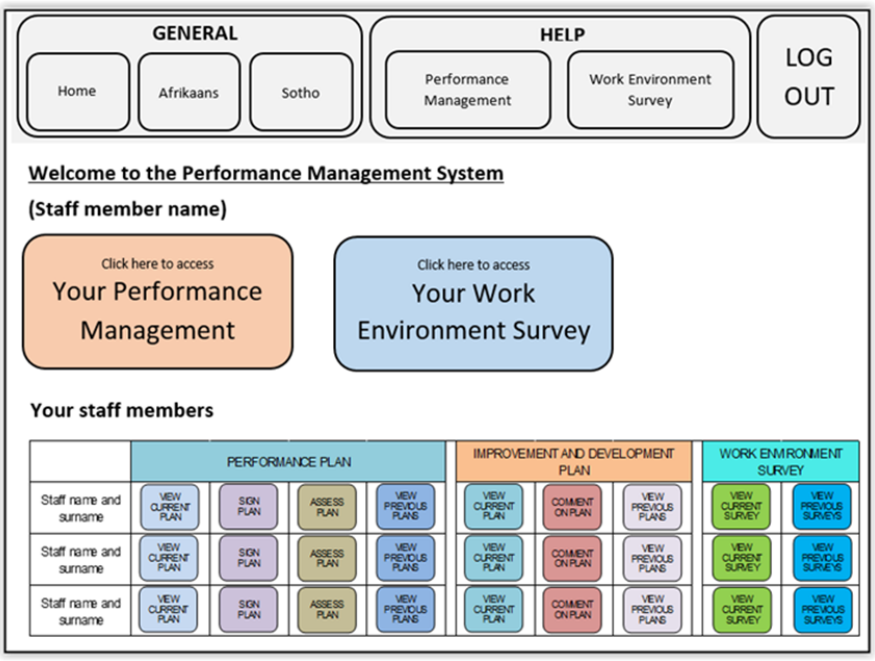

Fig. 18 Redesigned home page of the online PMS for line managers

A. Home Page of the Online PMS

The home page of the online PMS is where users start. It is recommended that the home page (Figs. 3 and 14) be redesigned as shown in Fig. 17 (for employees) and Fig. 18 (for line managers). It is suggested that the links to the *Performance Management* and *Work Environment Survey* be

removed from the toolbar at the top of the screen and moved to a position below the toolbar where the links to the *Help* document are currently. This decision was based on the fact that it took employees 3.33 s and line managers 1.73 s to see the links to the *Help* documents, compared to the 11.04 s and 7.07 s for employees and line managers, respectively, that it took them to see the *Performance Management* button (Task 1A).

B. Home Page of Performance Management

From the information in Table III, it became clear that participants struggled to click on the *View/ Edit* links and they were not sure where to go to complete tasks. Therefore, a redesign is also necessary for the home page of performance management for all employees (Figs. 5, 8, 12, 14 and 16) (Task 1 to Task 5). The recommended design is simplified and presented in Fig. 19.

C. Home Page of the Work Environment Survey

The need for the redesign of the work environment survey home page (Fig. 10) became evident since participants were not sure where to click to complete the various tasks of the work environment survey. The redesigned home screen of the work environment survey is shown in Fig. 20.

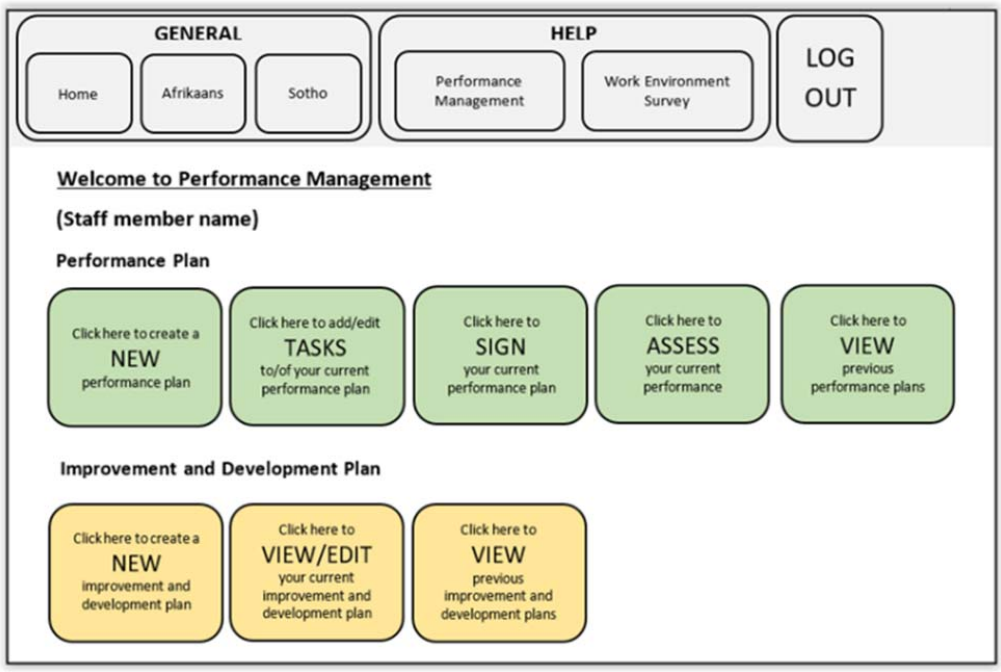

Fig. 19 Redesigned home page of performance management

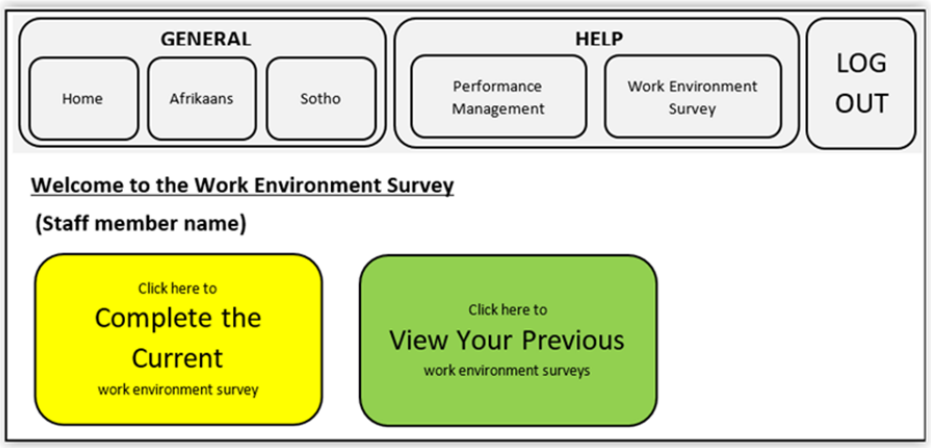

Fig. 20 Redesigned home page of the work environment survey

D. Window for Entering New Tasks

An additional aspect that needs improving is the windows that are used for entering new tasks (Fig. 7). These windows should be resized in order to remove the need for scrolling down when submitting the task.

VII. Summary

The purpose of this study was to evaluate the usability of the online PMS of the UFS in order to make suggestions and recommendations on areas that can be improved. In a broader sense, the study also intended to highlight the effects of ill-adherence to accepted and established design principles and conventions. It was illustrated that design flaws can have negative effects on the usability of a system with consequences for the users as well as their employer – with regard to errors and incomplete/erroneous data as well as perceptions and motivation.

A number of recommendations were made with respect to the design of the online PMS of the UFS. It is hoped that implementation of these recommendations will not only improve the overall user experience but also contribute to an improved perception of the system by staff members. Furthermore, this study contributes to the body of knowledge about the usability of online performance management systems. It should be possible to apply the principles and recommendations of this study to most systems that are developed in the Human Resources field.

References

[1] Aguinis, H. (2009). Performance management. (2nd ed.). Upper Saddle River, NJ: Pearson Prentice Hall.

[2] Aguinis, H., Joo, H. & Gottfredson, R. K. (2011). Why we hate performance management – and why we should love it. Business Horizons. 54, pp. 503-507.

[3] Chin, J.P., Diehl, V.A., & Norman, K.L. (1988). Development of an instrument measuring user satisfaction of the human-computer interface. In CHI `88 Conference Proceedings: Human Factors in Computing Systems (New York, 1988), ACM Press, pp. 213-218.

[4] Chu, S., Paul, N. & Ruel, L. (2009). Using eye tracking technology to examine the effectiveness of design elements on news websites. Information Design Journal. 17(1), pp. 31-43.

[5] Cooke, L. (2005). Eye tracking: How it works and how it relates to usability. Technical communication. 52(4), pp. 456-463.

[6] De Waal, A. A. & Counet, H. (2009). Lessons learned from performance management systems implementations. International Journal of Productivity and Performance Management. 58(4), pp. 367-390.

[7] Dix, A., Finlay, J., Abowd, G. & Beale, R. (1998). Human-computer interaction. Hertfordshire: Prentice Hall Europe.

[8] Dumas, J.S & Redish, J.C. (1993). A practical guide to usability testing. Norwood, NJ: Ablex Publishing Corporation.

[9] Eghdam, A., Forsman, J., Falkenhav, M., Lind, M. & Koch, S. (2011). Combining usability testing with eye-tracking technology: evaluation of a visualization support for antibiotic use in intensive care. User Centred Networked Health Care. 2011, pp. 945-949. DOI = 10.3233/978-1-60750-806-9-945.

[10] Ferreira, A. & Otley, D. (2009). The design and use of performance management systems: An extended framework for analysis. Management Accounting Research. 20, pp. 263-282.

[11] Galitz, W.O. (2002). The Essential Guide to User Interface Design. (2nd ed.). New York: John Wiley & Sons.

[12] Hofstee, E. (2006). Constructing a good dissertation. EPE. Sandton, South Africa.

[13] Lenzner, T., Kaczmirek, L. & Galesic, M. (2014). Left feels right: A usability study on the position of answer boxes in web surveys. Social Science Computer Review. 32(6), pp. 743-764.

[14] Nankervis, A. R. & Compton, R. L. (2006). Performance management: Theory in practice? Asia Pacific Journal of Human Resources. 44(1), pp.83-101.

[15] Nielsen, J. (1995). 10 Usability Heuristics for User Interface Design. Retrieved on 24/11/2015 from: http://www.nngroup.com/articles/ten-usability-heuristics/

[16] Olmsted-Hawala, E., Holland, T. & Quach, V. (2014). Usability testing. In J. R. Bergstrom and A. J. Schall (Eds.), Eye tracking in user experience design, (pp. 49-80). Elsevier - Morgan Kaufmann: Waltham, USA.

[17] Sekaran, U, & Bougie, R. (2013). Research methods for business. (6th ed.). Chichester: John Wile & Sons Ltd.

[18] Tüzün, H., Akinci, A., Kurtoğlu, M., Atal, D and Pala, F.K. (2013). A study on the usability of a university registrar's office website through methods of authentic tasks and eye tracking. The Turkins Online Journal of Educational Technology. 12(2), pp. 26-38.

[19] University of the Free State. (2015). Performance Management Manual. Division: Performance Management and Staff Development.

[20] Warner, J. (2006). UBS's online performance management system contributes to business integration. Competency & Emotional Intelligence. 14(1), pp. 5-8.