A critical analysis of the web printing system @SwanseaUni and evaluation of alternative design

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Introduction

Finally the time of my fist coursework submission came. I was at the library and I had just finished working on my essay so that I had to print it out. After briefly looking for information on the university website I discovered that I could print the essay through website itself: "perfect!". I logged-in into the system, uploaded the file, pressed the 'Mono' option to print in black and white and "horror!": with a mixture of disappointing and fear, with no chance to undo my action, a message appeared in front of my eyes: "Your print job has been sent to the selected printer successfully" with the printing status set to "Printing". I did not want to print it yet, and what "selected machine" was it talking about? I did not choose any. The main reason for my fear was that I had recently attended the university unfair practice lecture, where I learned that my career would have been over if I had been found guilty of plagiarism; now thinking of my essay printed somewhere outside in thrall of any student was driving me crazy. What happened was that I did not expect the printing to be done without any confirmation, or even without choosing the printer machine to use. Not knowing what else to do, I run to the nearest photocopy machines, but my essay was not there. I went back to my laptop, and now on the web-page the printing status was changed to "Printed". I run back to the photocopy machines again, but still nothing. At this point, I panicked: I really could not understand what

was going wrong and "I am a computer scientist!" I kept saying myself. Only after a while, when I succeeded to calm down, I started looking for some instruction on the website to finally realize that "Printed" only meant that the file was sent to the printer, and that a confirmation from the printer itself was still needed to actually print the file.
The printing system of the Swansea University is used by hundreds of students everyday and they should not really find themselves facing this kind of situation. Even if it is true that an explanation of the system was given in the website, students should be able to use a printing system easily or at least only by learning while interacting with the system, without spending valuable time reading a manual for such an easy task.

Related Work

According to Dix et al the "evaluation has three main goals: to assess the extent and accessibility of the system's functionality, to assess users' experience of the interaction, and to identify any specific problems with the system" [3]: the following analysis is mainly focused on the third aspect. There are several techniques of evaluation. Excluding the possibility of involving users, since it would be too expensive [2], the only possible way to evaluate a system is through usability experts performing inspections, meaning "a set of cost-effective ways of evaluating user interfaces to find usability problems" [8]. The predominant form of evaluation is *ruled-based*, in which a system is evaluated as usable if it adhere to a set of rules. However this kind of evaluation is sometimes too focused on the system features rather than on the interaction [5]. The system which will be analysed is a website which allows to remotely print files, so it has a very specific simple goal: because of this reason a *procedural* inspection method, such as the *cognitive walkthrough*, is preferred. In fact, as proven by Lewis et al. [7], the cognitive walkthrough is particularly appropriate to evaluate simple interfaces which do not require complex tasks: this is the case of the printing system which to print a files, in the simplest case, requires not more than 12 steps. The cognitive walkthrough is a "technique for evaluating the design of an interface with a special attention to how well the interface supports *dicovery learning*[1] i.e. first time use without formal training" [11]. The technique appears particularly suitable since, as said, any student or university employee should be able to use the printing system without a specific training.

Analysis

Following Reiman et al.'s directions [11] through the cognitive walkthrough the usability expert should produce: a description of the users of the system including their knowledge and experience, a description of the most representative task/s that can be performed on the system and the list of the correct actions made available by the interface through which each described task can be subdivided.

Users The printing system can be used by students, staff and visitors [1]. However, since internal staff usually has access to its own resources, and visitors are a minority, students have to be considered as the main target. Knowledge and experience of each user can be very different since students are of different nationalities, age and education level[2], however it can

[1] Borthick and Jones explain that "in discovery learning, participants learn to recognize a problem, characterize what a solution would look like, search for relevant information, develop a solution strategy, and execute the chosen strategy" [4].

[2] According to university statistics the 73% of students are under 25, so it can be assumed that they can operate at the best of their performance, not considering specific deficiencies. International students are a big part as they represent the 28% and almost all students, the 80%, have at least a diploma. For further details look at Appendix B

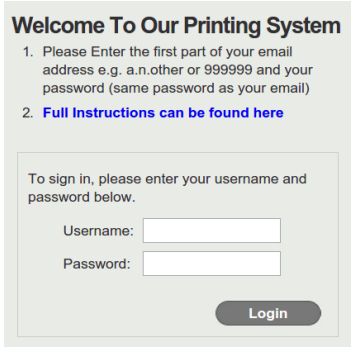

Figure 1: Above the login form are shown instructions about which credential should be used: however the explanation is not clear enough.

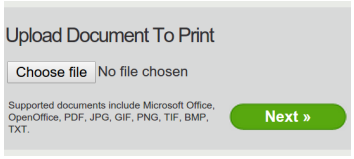

Figure 2: Because of its green colour the 'Next' button is much more visible than the 'Chose file' so that it easily gets the user attention; therefore because its meaning is general it could be chosen as candidate for a wrong action.

be assumed that they all are familiar with the interaction with websites and printing machines and that they can properly understand written English.

Tasks For the analysis only one main task has been considered: printing a document in black and white for the long-side. The starting point is at the log-in page `https://print.swan.ac.uk/login.cfm` and log-in and logout are considered as a part of the task.

List of correct actions The task is divided in the sequence of the 13 actions needed to its achievement.[3]

For each action the usability expert has to answer to four questions [3]:

Q1 Is the effect of the action the same as the user's goal at that point?

Q2 Will users see that the action is available?

Q3 Once users have found the correct action, will they know it is the one they need?

Q4 After the action is taken, will users understand the feedback they get?

Both positive and negative answers are written in a appropriate document, and a comment about possible usability issues has to be given.

Results [4]

Here is reported every usability problem raised by those user actions of the task [UA] which led to a negative answer to any of the four questions [Q].[5]

UA2 Type the username. [Q1] The user is supposed to be familiar with the log-in mechanism. However a username is requested without any previous registration process: this means that a clear explanation of how to retrieve the username should be given. Even though direction are given on the top of the page (Figure 1) "Please Enter the first part of your email address e.g. a.n.other or 999999 and your password (same password as your email)" they are not clear for several reasons. Firstly, the first letter of "Enter" is upper cased without any apparent reason: it could lead the user to think about an explanation, such as the existence of a 'Enter' button, taking him to wrong assumptions. Secondly, the given clues are not helpful: "first part of your email address" does not have a clear and unique meaning in this context, where the multiple names of the e-mail can be separated by dots. Thirdly, the given examples are not meaningful enough: in both cases "a.n.other" and "999999" the chosen words or numbers are slightly out of context; moreover the first example "a.n.other" is too close to the "e.g" abbreviation, making hard to distinguish where one word ends and the other starts. Finally, the user could be tempted to ask for help clicking on the "Full Instructions can be found here" since the ordered list suggests a connection between the two steps of the list: however the help refers to the printing mechanism and not to the log-in one.

UA4 Type the password. [Q1] The only hint given to the user to retrieve her/his password is that it is the same of the e-mail: however since the user could not remember the password a recovery procedure should be given. Perhaps it is not specified that e-mail refers to the Swansea University one.

UA6 Press the 'Choose file' button. [Q3] Two different buttons, 'Choose file' and 'Next', are available in the upload area and it is not clear which one is the correct one for the achievement of the user intention. In fact the 'Next' button is green, so more visible than the 'Choose file' which is gray, and the label text ('Next') is so general

[3] For the complete list of actions see Appendix A.
[4] To see the analysed interface look Appendix D.
[5] For the complete list of answers see Appendix A.

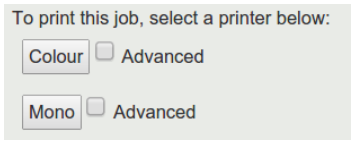

Figure 3: The design does not follow standards: the check boxes are usually adopted to choose between a list of options; however in website they are used to display\hide content.

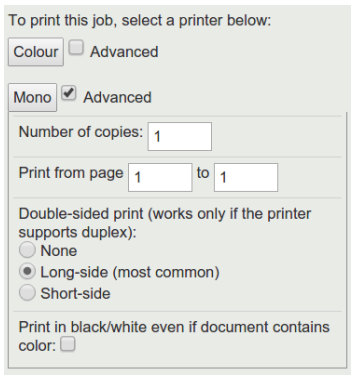

Figure 4: The printing settings panel of the 'Mono' option.

that could be applied to any situation: the combination of these two factors could lead the user to press the wrong button (Figure 2).

UA8 Press the 'Open' button on the dialogue box. [Q4] The text next to the 'Choose file' button changes to the name of the chosen file when the files has been chosen. However since the colour of the message is the same as the ordinary text of the page, it is unlikely to be noticed by the user.

UA9 Press the 'Next' button. [Q3] The 'Next' button is not clearly labelled: 'Next' is too generic given the context. Moreover the green colour is not legitimate: since in the other sections of the website it is always gray, the user could be led to a wrong assumption to justify the colour choice.

UA10 Click on the 'Advanced' check box of the 'Mono' section. [Q1] Once the file has been uploaded, the user will look for the printing settings. However no clear action corresponding to her/his intention is available. [Q3] Therefore the user has to guess which one between all possible links and buttons is the right one for her/his intention. This happens because labels and page objects are not meaningful enough and they do not follow standards as happens for the check box elements (Figure 3).

UA12 Press the 'Mono' button. [Q1] Once the long-side option has been selected, the user will look for the action to confirm the printing: furthermore her/his intention is reinforced by the printing status set to "Awaiting release". However no clear action is available to the user. [Q3] Therefore the user has to guess which one between all possible links or buttons is the right one: this happens because labels and page objects are not meaningful enough. Moreover there is a semantic overlapping between actions: the 'Mono' button and the check box option to "Print in black\white even if document contains color" seem to have the same functionality (Figure 4). [Q4] Once the user has pressed the 'Mono' button a message is shown on the top of the page: "Your print job has been sent to the selected printer successfully". However the printing status changes from "Awaiting release" to "Printing" and it stays still until the page has been refreshed by the user. The user could not be able to infer the actual status of the system, because it is not clear if the file has being printed or if it has only being sent to the printer machine.

UA13 Click to the 'Refresh link' [Q1] To see the printing status updated the user has to update the page: however it is not clear why the user instead of the system should perform this action. [Q4] Once the page has been refreshed the printing status changes from "Printing" to "Printed": one more time the user could not be able to infer the actual status of the system, because it is not clear if the file has been printed or if it has only been sent to the printer machine.

Discussion

The 41.6% of issues are raised by question one, which is related to the unrealistic assumptions about the experience and the knowledge the user should have to perform an action. For example it is took for granted that the user has the knowledge to easily find out the correct e-mail; it is also the case of the 'Refresh' button, since it is not clear why the user should know that the page needs to be refreshed. Issues raised by question one could also depend on the fact that the user does have the experience so that she/he can make previsions but the actual behaviour of the system does not match with her/his previsions. This usually happen when standards are not respected: it is the case of the check box element used to open a panel rather than to choose between multiple options. Another 33.3% of issues are highlighted by question three, which is related to the semantic of the available actions: when they are am-

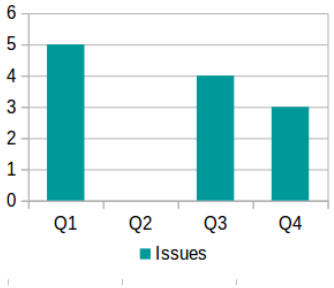

Figure 5: In the bar chart is shown the number of issues raised by each question: the distribution is homogeneous except for question two which did not lead to any usability problem. This happens because controls are always clearly visible.

biguous the user cannot derive which one is the right one; in other words the link between the control and the action is not strong enough. It is the case of the button labels, which sometimes are not salient, as happens for the 'Mono' and the 'Colour' buttons. Also shapes and colours have an intrinsic semantic: it is the case of the 'Next' button which is green, and because the green is usually associate with a positive meaning, plus the fact that the other buttons are always gray, the user could make wrong assumptions. Finally the last 25% of issues are lifted by question four which is strictly connected to the appropriateness of the feedback. More often the feedback is not visible enough, as the case of the status message which have the same colour of the standard text, or it is completely misleading, as for the printing status which are "Printing" and "Printed" but actually mean "Sending to the printer" and "Sent to the printer".

According to Norman the interaction between a user and a system can be summarized in a perpetual cycle of *execution* and *evaluation gulfs* (Figure 6): the higher is the gulf, the more difficult is the system to use. In the analysed interface, the highest gap within the execution gulf is the one between the expression of the user goal in psychological terms and the research for the corresponding actions sequence in 'system' terms, namely the controls made available by the system; this is highlighted by the high number of negative answers given to question one and three: as mentioned before it depends on the unrealistic assumption about the user knowledge and experience. On the other side of the interaction, the highest gap within the evaluation gulf is the one between the interpretation of the output and the evaluation; this is highlighted by the high number of negative answers given to question four: as mentioned before it depends on the poor implementation of the feedback response. Therefore for the user it is very hard to construct and exploit a correct *mental model* [6]: on one side she/he cannot use her/his previous mental model[6] during the execution gulf because the interface does not follow standards; on the other side she/he cannot change her/his existing mental model to make it adhere to the actual system because of the inappropriate management of feedbacks. As result it is very difficult for the user to learn how to use the system in a proper way.

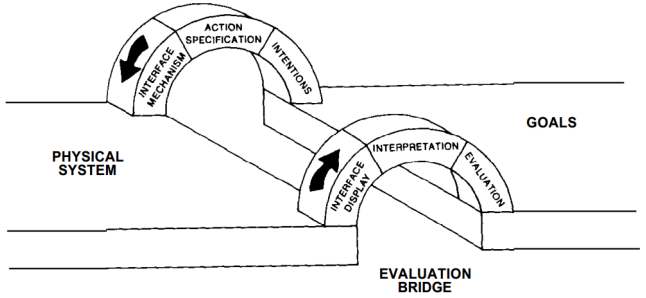

Figure 6: The execution gulf is divided in four segments: "intention formation, specifying the action sequence, executing the action and finally making contact with the input mechanism of the interface". The evaluation gulf is divided in four segments too: "the output displays of the interface, the perceptual processing of those displays, interpretation and finally to the evaluation - the comparison of the interpretation of the system state with the original goals and intention" [9].

Alternative design[7].

The alternative design will try to fix the issues[8] found during the analysis by reducing the gap in both the execution and the evaluation gulf.

[6] As mentioned in the users' paragraph the user has supposed to have a mental model about how the printing system works.

[7] Too see the complete alternative design of the interface look at Appendix D

[8] Each solved issue will be referenced by the user action UA and the question Q which led to find the usability issue: i.e. UA2-Q1 identifies the usability issue/s raised by question one of the second user action.

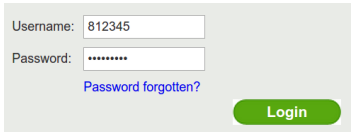

Figure 7: To improve consistency and to make the state of the system visible, the buttons behaviour have been changed: they appears as gray when disabled and green when enabled.

The log-in page As shown in Figure 8 instructions have been changed to be more salient: [UA2-Q1] examples are more meaningful since are now related to the context (`j.doe@swansea.ac.uk` and `812345@swansea.ac.uk` recall respectively a proper name and a realistic student number); the "Full Instructions can be found here" has been moved to the main page of the website where it is more useful since it gives information about how to print and not about how to log-in (Figure 10); a help section, which redirects to a contact form to asking for help, has been added instead; finally the next button behaviour has been modified to achieve consistency: it is gray by default but once the user has typed username and password it becomes green (Figure 7).

The main page The upload area has been changed to improve consistency and to avoid ambiguity (Figure 9). The label of the upload button has been changed from "Next" to "Upload" so that the meaning is made unique while the color has been made consistent with the log-in one [UA9-Q3]: it is gray when inactive and becomes green when active, meaning when the file is chosen; in this way an additional feedback is given to the user for the upload of the file [UA8-Q4]. The "Choose file" button border has been coloured in green as the other active buttons, so that it asks for the user attention [UA6-Q3]; it also changes value, from "Choose file" to "Choose new file" to give more information about the current state of the system as well as an extra feedback [UA8-Q4]. The entire content of the printing area has been changed. Once the user has uploaded the file, the option panel is automatically shown: in fact there is no more difference between "Mono" and "Colour" since the choice of the printer is managed inside the panel itself [UA10-Q1/Q3]; the settings for each printing job can be seen clicking on the "Settings" icon. It is possible to choose between printers through a drop down list where for each element of the list it is shown the name of the printer and if the printer is enabled for the colour mode printing: if the user chooses a printer which does not allow the colour printing, the radio button below will be disabled. In this way the redundancy of the "Print in black/white even if document contains color" has been avoided [UA12-Q3]. Morevoer adding constraint to the interface is a good way to prevent error [10].

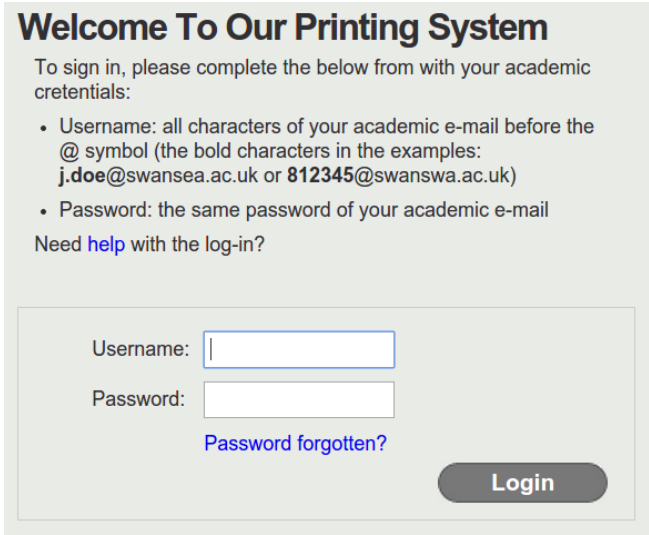

Figure 8: The chosen alternative design overwhelms the user with much information: an alternative solution would be adding a singular link for help instead having all instructions listed in the page. However the log-in page is a hinge[9] for the website so that is crucial for the user to have all information she/he needs made available in a glance in order to easily go through the log-in step.

[9] Hinges are crucial part of a graph, as they include critical information: when deleted the graph is disconnected meaning it is no more possible to reach a specific part of the graph [12].

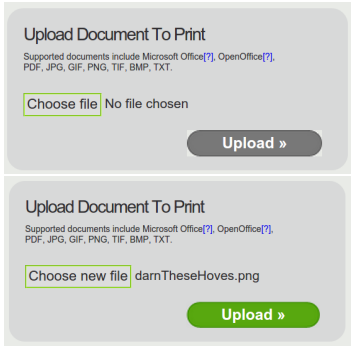

Figure 9: "Microsof Office" and "Open office" to indicate extension is not clear; to avoid making the list too long, two links for explanations have been added instead. Also the indication about extensions has been moved in a upper position since it is important for the user to read it before she/he tries the upload.

Figure 10: Form the log-in page the link for the printing help has been moved to the main page, where it can be really helpful for the user.

Some improvements have been applied also for the password management [UA4-Q1]: instructions have been clarified and a recovery mechanism has been implemented through the link "Password forgotten?". A "Send" button has been added: its design reminds of the other buttons of the website and the label has been made salient, so that the user can easily understand what is it for [UA12-Q1].

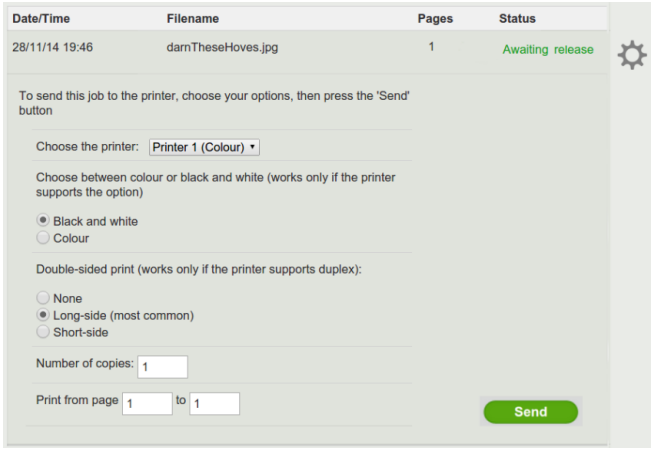

Figure 11: The printing jobs are elements of a list where each element can be expanded through the settings button: in this way it is possible to choose between the printing options and finally to sent the specific job to the printer.

The refresh button has been removed because, ideally, the page should be refreshed automatically.

Printing status	New printing status
Printing	Sending job to the printer
Printed	Job sent to the printer
Delete	Delete job

Table 1: New printing status of the interface: they have been changed toto eliminate ambiguity [UA12-Q3,UA13-Q4]

Conclusion

The analysis of the interface highlighted that all usability issues are attributable to the high gap in both the evaluation and the execution gulf: as seen the three main reasons are related to the unrealistic assumption about the user knowledge, the weak link between the control and the action and finally to the lack of an appropriate feedback. The cognitive walktrought has been proved to be an effective technique, especially to evaluate the interaction. However it does not come without any problems: in fact it is very time consuming, as result it is not possible to evaluate a high number of tasks. Also it does not allow to consider slight changes in the variables used for the task. For example it would not be possible, since too costly, to perform the same task six times only to evaluate the different language version of the website[10]: in fact they would probably have most of their issues in common. As result some usability issues cannot be found or considered. Moreover it does not allow a deep analysis of errors. Since the evaluated task is always accomplished, it is not possible, for example, to investigate the cost of errors, meaning how far a mistake can lead. Finally, all evaluation techniques performed by usability experts can take to positive false results: in fact sometimes experts see usability problems which user will never face in the reality. The proposed alternative design fixes all usability problems found during the analysis: however because the cognitive walktrought does not completely cover every area of usability, an evaluation with user to complete the analysis is suggested where possible.

References

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[10] The website is available in six different language: Welsh, English, Italian, Dutch, Spanish and French

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Appendix A

Here is reported the document used for the analysis.

Task1

1 Task 1 definition and list of action

1.1 Definition

The task consists in: printing a document in black and white for the short-side. The starting point is at the log-in page EveryonePrint - Login and log-in and logout are considered as a part of the task.

1.2 Actions

The identified action for the task are presented in the following list where US stays for User Action while SD for display responces.

UA1 Select the 'Username' textbox

SD1 The cursor in the textbox starts to blink, the border of the textbox border becomes glowing and if the user have logged-in in the past, his username could be suggested

UA2 Type the username

SD2 Characters appears in the text box as the user is typing them

UA3 Select the 'Password' textbox

SD3 The cursor in the textbox starts to blink, the border of the textbox border becomes glowing

UA4 Type the password

SD4 Small black circles appear in the text box as the user is typing them

UA5 Press the 'Login' button

SD5 The navigation is redirected to a new page where the printing functionality can be performed

UA6 Press the 'Choose file' button

SD6 A dialogue box to choose the file from the local file system is opened

UA7 Choose and select the file to print on the dialogue box

SD7 The file appears as hightlighted

UA8 Press the 'Open' button on the dialogue box to confirm

SD8 The dialogue box is closed and the focus goes back to the webpage: now the name of the file appears close to the 'Choose file' button

UA9 Press the 'Next button'

SD9 An "upload" message is beaflily shown under the 'Next button' and a new element appears in the printing jobs list; the name of the file close to the 'Choose file' disappers and the label 'No file chosen' is set back.

UA10 Click on the 'Advanced' check box of the 'Mono' section

SD10 A new panel with options for the 'Mono' section is opened

UA11 Click on the 'Short-side' radio button

SD11 The 'Short side' radio button is selected

UA12 Press the 'Mono' button

SD12 The 'Mono' option panel is closed, a status message appears "Your print job has been sent to the selected printer successfully" and the status of the job is set to "Printing"

UA13 Click to the 'Refresh link'

SD13 The 'Mono' option panel status changes to "Printed"

UA13 Click the 'Logout' link

SD13 The navigation is redirected to EveryonePrint - Login and a message "Successfully logged out" is shown.

2 Task 1 action evaluation

2.1 The questions

For each performed action in the Task 1, four questions needed to be answered by the usability expert:

Q1 Is the effect of the action the same as the user's goal at that point?

Will the customer realistically be trying to do this action?

Q2 Will users see that the action is available?

Is the control for the action visible?

Q3 Once users have found the correct action, will they know it is the one they need?

Is there a strong link between the control and the action?

Q4 After the action is taken, will users understand the feedback they get?

Is feedback appropriate?

2.2 Answers for action

For each action the usability expert needs to answer both in negative and positive case: the last one identifies possible usability issues.

UA1 Select the 'Username' textbox

Q1 *Is the effect of the action the same as the user's goal at that point?*
Yes. It can be assumed that the user is quite familiar with the procedure of filling of a from.

Q2 *Will users see that the action is available?*
Yes. The text box is clearly visible.

Q3 *Once users have found the correct action, will they know it is the one they need?*
Yes. The text box is clearly labelled and it can be assumed that the user is quite familiar with the log-in mechanism.

Q4 *After the action is taken, will users understand the feedback they get?*
Yes. The cursor in the text box start to blink and its border becomes glowing.

UA2 Type the username

Q1 *Is the effect of the action the same as the user's goal at that point?*
The user is supposed to be familiar with the log-in mechanism. However a username is requested without any previous registration process: this means that a clear explanation of how to retrieve the username should be given. An indication is shown on the top of

the page "Please Enter the first part of your email address e.g. a.n.other or 999999 and your password (same password as your email)" which unfortunately it is not clear for the following reasons:

- the first letter of "Enter" is upper cased without any apparent reason: it could push the user to think about an explanation, such as the existence of a 'Enter' button, leading him to wrong assumptions;
- the given clues are not helpful: "first part of your email address" does not have a clear and unique meaning in this context, were multiple names of the e-mail can be separated by dots;
- the given examples are not meaningful enough: in both cases "a.n.other" and "999999" the chosen words or numbers are slightly out of context;
- the first example "a.n.other" is too close to the "e.g" abbreviation, making hard to distinguish where one word ends and the other starts.
- the user could be tempted to ask for help clicking on the "Full Instructions can be found here" since the ordered list suggests a connection between the two steps of the list: however the help is referred to the printing mechanism and not to the log-in one.

Q2 *Will users see that the action is available?*
Yes. The text box is clearly visible when typing in.

Q3 *Once users have found the correct action, will they know it is the one they need?*
Yes. It can be assumed that the user is quite familiar with the log-in mechanism so the meaning of typing the username is quite clear.

Q4 *After the action is taken, will users understand the feedback they get?*
Yes. The typed characters are promptly displayed in the text box.

UA3 Select the 'Password' textbox

Q1 *Is the effect of the action the same as the user's goal at that point?*
Yes. It can be assumed that the user is quite familiar with the procedure of filling of a from.

Q2 *Will users see that the action is available?*
Yes. The text box is clearly visible.

Q3 *Once users have found the correct action, will they know it is the one they need?*
Yes. The text box is clearly labelled and it can be assumed that the user is quite familiar with the log-in mechanism.

Q4 *After the action is taken, will users understand the feedback they get?*
Yes. The cursor in the text box start to blink and its border becomes glowing.

UA4 Type the password

Q1 *Is the effect of the action the same as the user's goal at that point?*
No. The only hint given to the user to retrieve his password is that it is the same of the e-mail: however since the user could not remember the password or he could even does not have an e-mail, at least a procedure for the password recovery should be given. Perhaps it is not specified that e-mail is referred to the Swansea University one.

Q2 *Will users see that the action is available?*
Yes. The text box is clearly visible when typing in.

Q3 *Once users have found the correct action, will they know it is the one they need?*
Yes. It can be assumed that the user is quite familiar with the log-in mechanism so the meaning of typing the username is quite clear.

Q4 *After the action is taken, will users understand the feedback they get?*
Yes. The typed characters are promptly displayed in the text box.

UA5 Press the 'Login' button

Q1 *Is the effect of the action the same as the user's goal at that point?*
Yes. It can be assumed that the user is quite familiar with the procedure of submitting a from. The button has proper characteristics: appears as a button and on the 'mouse-over' event the cursor change shape as suggested by standard.

Q2 *Will users see that the action is available?*
Yes. The button is clearly visible.

Q3 *Once users have found the correct action, will they know it is the one they need?*
Yes. The button is clearly clearly labelled.

Q4 *After the action is taken, will users understand the feedback they get?*
Yes. After clicking on the button the navigation is redirected to another page as expected in a log-in mechanism.

UA6 Press the 'Choose file' button

Q1 *Is the effect of the action the same as the user's goal at that point?*
Yes. It can be assumed that the user is quite familiar with the procedure of uploading a file.

Q2 *Will users see that the action is available?*
Yes. The button is clearly visible.

Q3 *Once users have found the correct action, will they know it is the one they need?*
No. Two different buttons, 'Choose file' and 'Next', are available in the upload area, and it is not clear which one is the correct one. In fact the 'Next' button is green (more visible that the 'Choose file' which is gray) and the label text ('Next') is so general that could be applied to any situation: the combination of these two factors could lead the user to press the wrong button.

Q4 *After the action is taken, will users understand the feedback they get?*
Yes. After pressing the button a browsing dialogue box is opened.

UA7 Choose and select the file to print on the dialogue box

Since this action is related to the computer operating system rather then to the website, no answer is given. Therefore any user should be able to interact with a browsing dialog box to select a file.

UA8 Press the 'Open' button on the dialogue box to confirm

Since this action is related to the computer operating system rather then to the website, no answer is given to the first three question. Therefore any user should be able to interact with a browsing dialog box to select a file. However the last question is considered since its feedback impacts on the website interface.

Q4 *After the action is taken, will users understand the feedback they get?*
No. The text next to the 'Choose file' button changes to the name of the chosen file when the file has been chosen. However since the colour of the message is the same as the ordinary text of the page, it is unlikely to be noticed by the user.

UA9 Press the 'Next button'

Q1 *Is the effect of the action the same as the user's goal at that point?*
Yes. The 'Next' button appears as the first logical action should be perform by the user after having uploaded the file.

Q2 *Will users see that the action is available?*
Yes. The 'Next' button is clearly visible.

Q3 *Once users have found the correct action, will they know it is the one they need?*
Yes. The 'Next' is not clearly labelled since 'Next' is too generic given the context; moreover the green colour is not legitimate: since in the other sections of the website it is always green, the user could be lead to a wrong assumption to justify the colour choice.

Q4 *After the action is taken, will users understand the feedback they get?*
Yes. After pressing the button e message appear on the top "Your print job has been added successfully. It will be processed automatically in a moment." A panel in a list of printing jobs is opened, asking for the user attention to manage the current job.

UA10 Click on the 'Advanced' check box of the 'Mono' section

Q1 *Is the effect of the action the same as the user's goal at that point?*
No. Once the pdf file has been uploaded on the website, the user will look for the available actions which allow to manage the printing settings. However no clear action is available to the user

Q2 *Will users see that the action is available?*
Yes. The check box is clearly visible.

Q3 *Once users have found the correct action, will they know it is the one they need?*
No. The user has to guess which one between all possible links and buttons is the right one for his intention. This happens because labels and page objects are not meaningful enough and they do not follow standards: the check box, which is usually used for choosing multiple option, is used here to show/hide a panel.

Q4 *After the action is taken, will users understand the feedback they get?*
Yes. After clicking on the check box the option panel is shown.

UA11 Click on the 'Short-side' radio button

Q1 *Is the effect of the action the same as the user's goal at that point?*
Yes. The user is supposed to be familiar with the radio button element, which in this case is used in a proper way and context.

Q2 *Will users see that the action is available?*
Yes. The check box is clearly visible.

Q3 *Once users have found the correct action, will they know it is the one they need?*
Yes. The check box is clearly labelled.

Q4 *After the action is taken, will users understand the feedback they get?*
Yes. After clicking on the check box the new element appears as selected.

UA12 Press the 'Mono' button

Q1 *Is the effect of the action the same as the user's goal at that point?*
No. Once the short-side option has been selected, the user will look for the available actions which allow to actually print the pdf file: this intention is reinforced by the printing status message set to "Awaiting release". However no clear action is available to the user.

Q2 *Will users see that the action is available?*
Yes. The 'Mono' button is clearly visible.

Q3 *Once users have found the correct action, will they know it is the one they need?*
No. Therefore the user has to guess which one between all possible links or buttons is the right one: this happens because labels and page objects are not meaningful enough. Moreover there is a semantic overlapping between actions: the 'Mono' button and the check box option to "Print in black/white even if document contains color" seem to have the same functionality.

Q4 *After the action is taken, will users understand the feedback they get?*
No. Once the user has pressed the 'Mono' button a message is shown on the top of the page: "Your print job has been sent to the selected printer successfully". However the printing status changes from "Awaiting release" to "Printing" and it stays still

until the page has been refreshed by the user. The user could be unable to understand the actual status of the system, because it is not clear if the file has being printed of if it has only being sent to the printer machine

UA13 Click to the 'Refresh link'

Q1 *Is the effect of the action the same as the user's goal at that point?*
No. In order to see the printing status updated the user has to update the page: however it is not clear for the user why it is his job to refresh the page, since the same job could be manage by the website. [Q4] Moreover once the page has been refreshed the printing status changes form ting status changes from "Printing"' to "Printed". Onemore time the user could be unable to understand the actual status of the system, because it is not clear if the file has been printed of if it has only been sent to the printer machine.

Q2 *Will users see that the action is available?*
Yes. The 'Refresh link' is clearly visible.

Q3 *Once users have found the correct action, will they know it is the one they need?*
Yes. The 'Refresh link' is properly labelled and the icon is meaningful.

Q4 *After the action is taken, will users understand the feedback they get?*
No. After refreshing the page the printing status changes to "Printed" which could be lead the user to think the file has been printed while it has only been sent to the printer machine.

UA13 Click to the 'Logout' link

Q1 *Is the effect of the action the same as the user's goal at that point?*
Yes. It can be assumed that the user is familiar with the logout mechanism.

Q2 *Will users see that the action is available?*
Yes. The 'Logout' link is clearly visible.

Q3 *Once users have found the correct action, will they know it is the one they need?*
Yes. The 'Logout' link is properly labelled.

Q4 *After the action is taken, will users understand the feedback they get?*
Yes. After clicking on the link the navigation is redirected to the log-in page and a message is shown of inform the user the logout mechanism has been done successfully.

Appendix B

Here are reported the details about users characteristics. Basic data have been retrieved thanks to the university statistics office. For any further details refer to statistics@swansea.ac.uk

Age

All Students	19 to 21	22 to 24	25+	<19	Unknown
Full-Time Research Postgraduate	45	238	294	0	0
Full-Time Taught Postgraduate	154	541	395	0	0
Full-Time Undergraduate	5015	1165	1323	4993	0
Part-Time Research Postgraduate	0	10	126	0	0
Part-Time Taught Postgraduate	17	62	700	1	0
Part-Time Undergraduate	52	110	1675	18	17

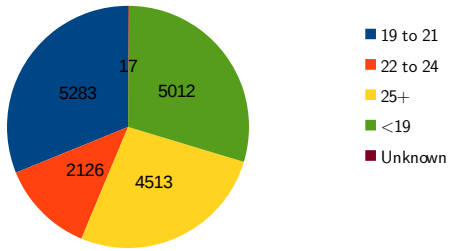
Age

All Students	19 to 21	22 to 24	25+	<19	Unknown
Total Postgraduate	216	851	1515	1	0
Total Undergraduate	5067	1275	2998	5011	17

Age

All Students	19 to 21	22 to 24	25+	<19	Unknown
Total without distinction	5283	2126	4513	5012	17

Number of students for Age



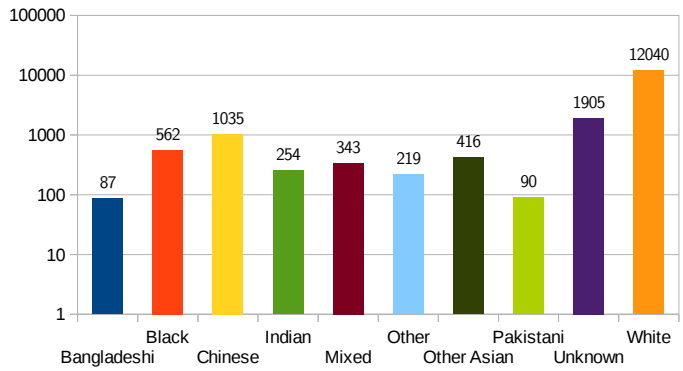
Ethnicity

All Students	Bangladeshi	Black	Chinese	Indian	Mixed	Other	Other Asian	Pakistani	Unknown	White
Full-Time Research Postgraduate	2	21	34	7	19	21	28	10	44	391
Full-Time Taught Postgraduate	6	86	300	25	13	23	56	2	143	436
Full-Time Undergraduate	70	429	691	201	288	150	314	71	1303	8979
Part-Time Research Postgraduate	0	4	1	3	2	1	0	1	11	113
Part-Time Taught Postgraduate	2	11	5	10	11	12	10	2	92	625
Part-Time Undergraduate	7	11	4	8	10	12	8	4	312	1496

Ethnicity

All Students	Bangladeshi	Black	Chinese	Indian	Mixed	Other	Other Asian	Pakistani	Unknown	White
Total without distinction	87	562	1035	254	343	219	416	90	1905	12040

Number of students for Nationality



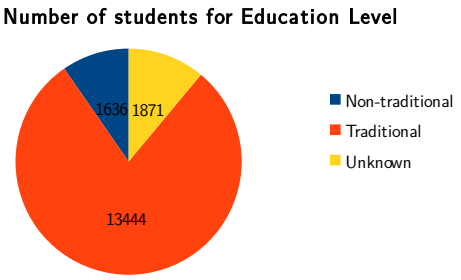
Note: the scale is logarithmic

	Quali cations on entry		
All Students	**Non-traditional**	**Traditional**	**Unknown**
Full-Time Research Postgraduate	0	562	15
Full-Time Taught Postgraduate	9	1058	23
Full-Time Undergraduate	1565	10084	847
Part-Time Research Postgraduate	0	130	6
Part-Time Taught Postgraduate	34	614	132
Part-Time Undergraduate	28	996	848

Traditional quali cations on entry include A Levels, BTEC etc

Non traditional will include students coming in via Access courses, work experience etc

	Quali cations on entry		
All Students	**Non-traditional**	**Traditional**	**Unknown**
Total without distinction	1636	13444	1871



Appendix C

Here is reported the old design of the interface.

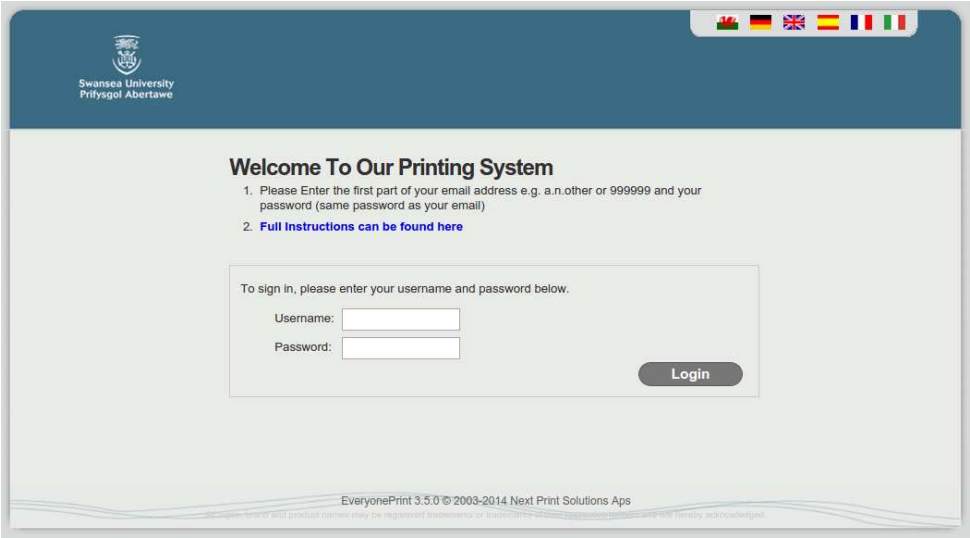


Figure 1: Login page

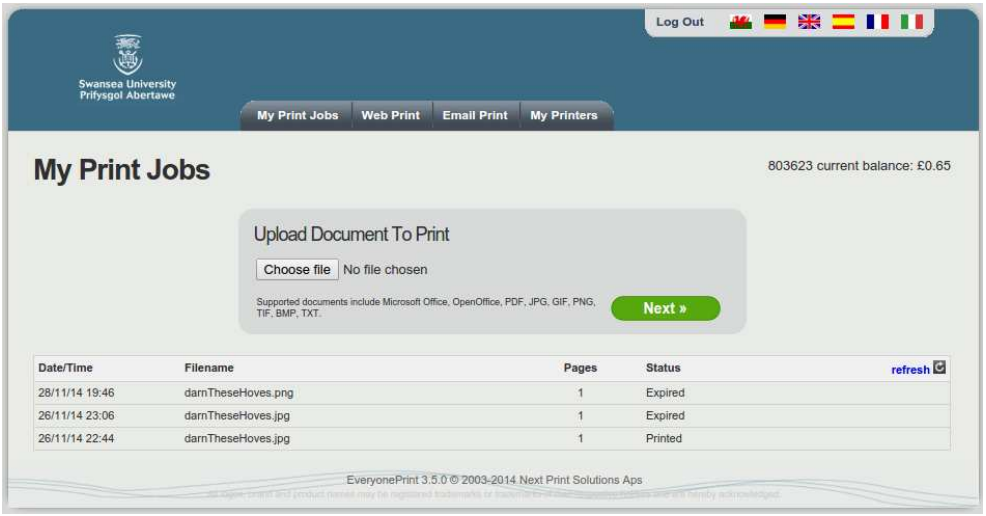


Figure 2: Main page after login

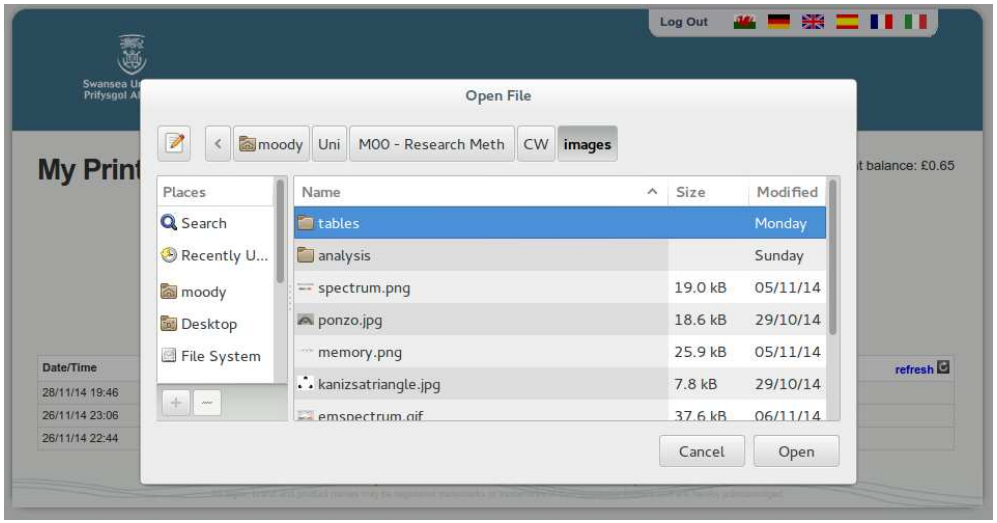


Figure 3: Main page after pressing the 'Choose file' button

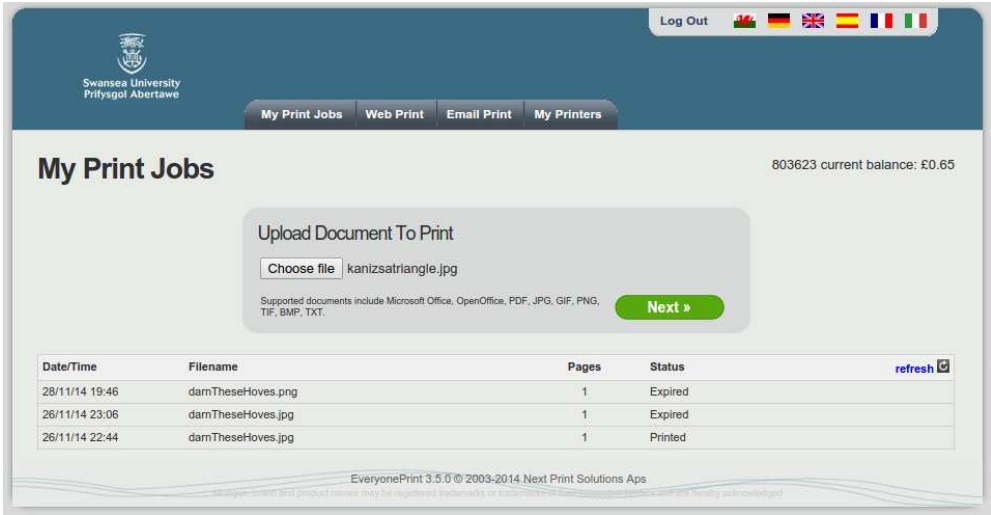


Figure 4: Main page after the file has been chosen

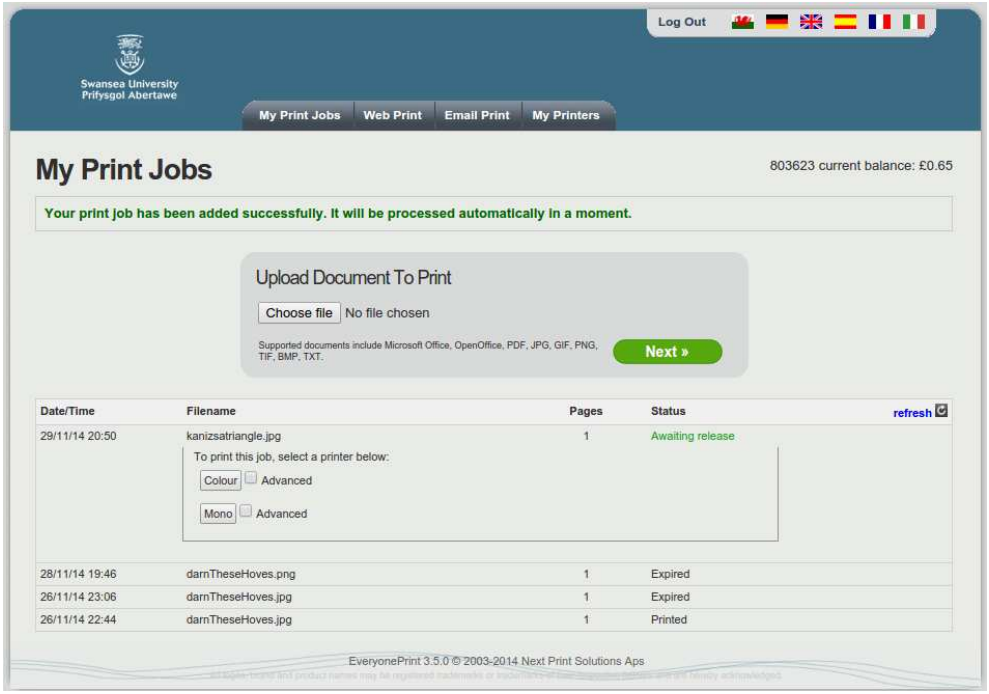


Figure 5: Main page after the file has been uploaded

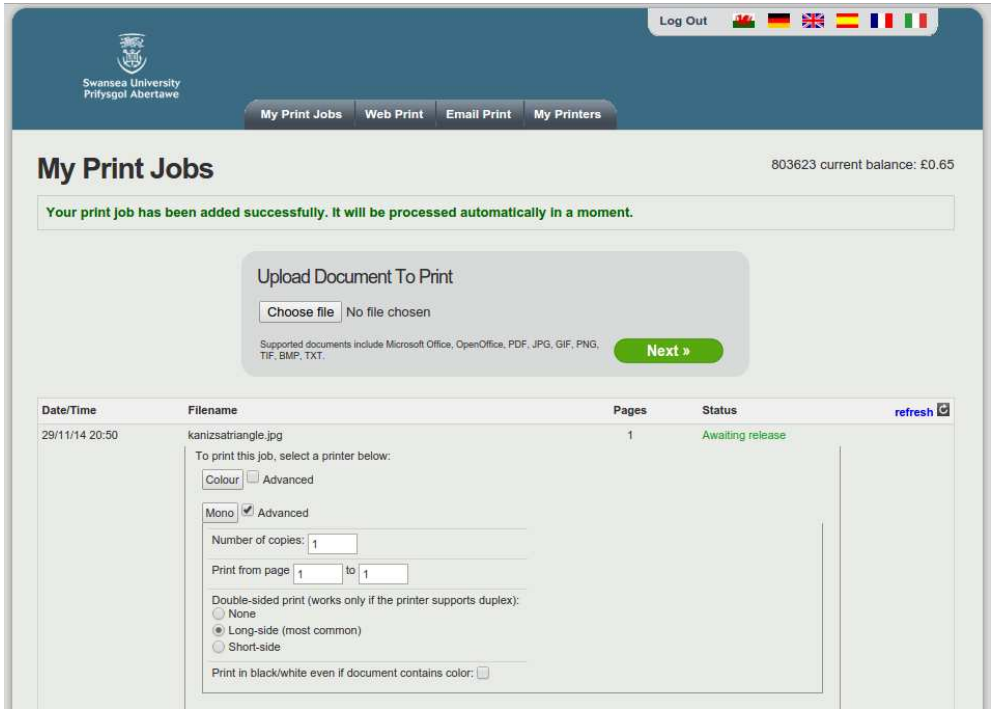


Figure 6: Main page after selecting on the 'Advanced' option of the 'Mono' section

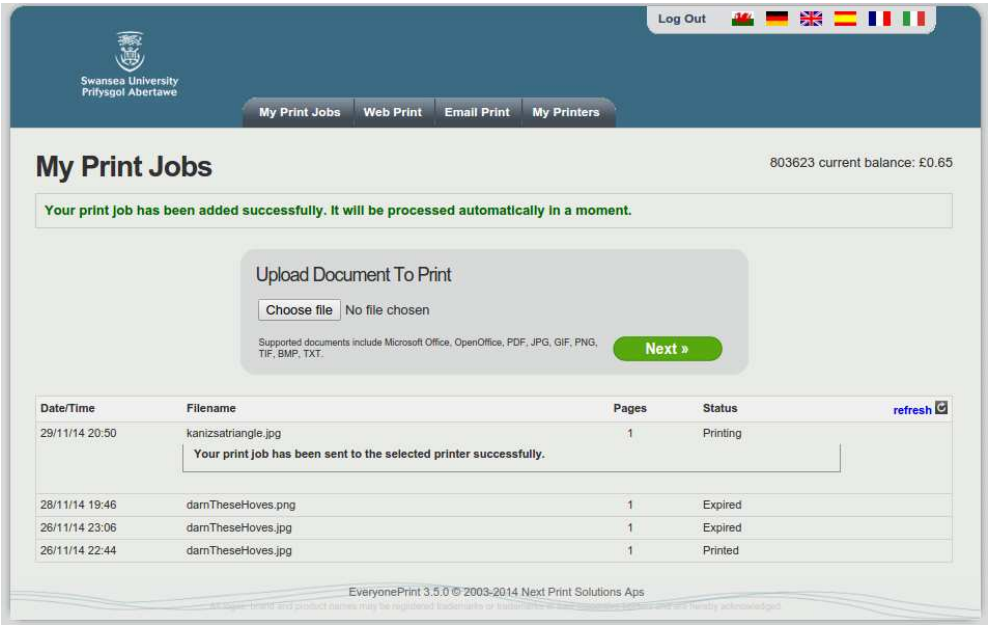


Figure 7: Main page after pressing on the 'Mono' button

Appendix D

Here is reported the alternative design of the interface.

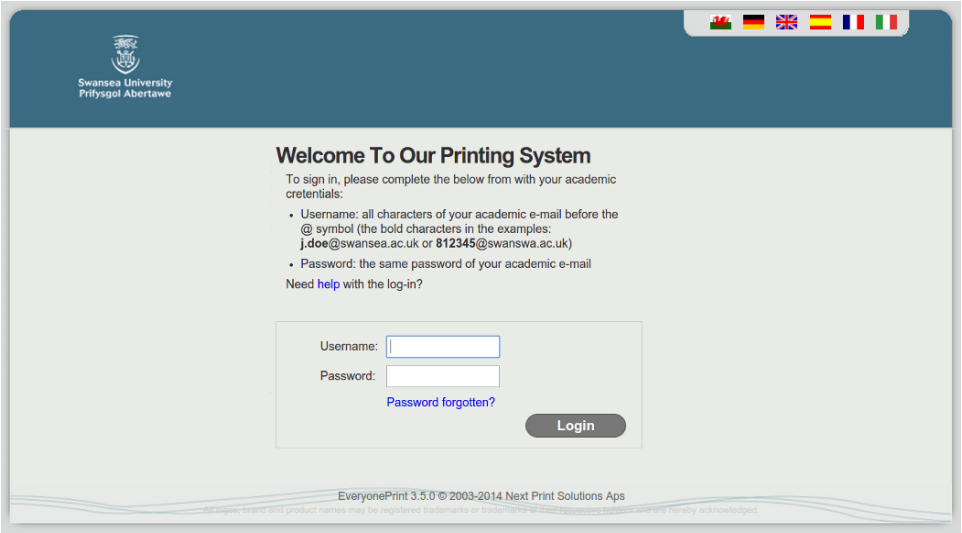


Figure 1: Login page

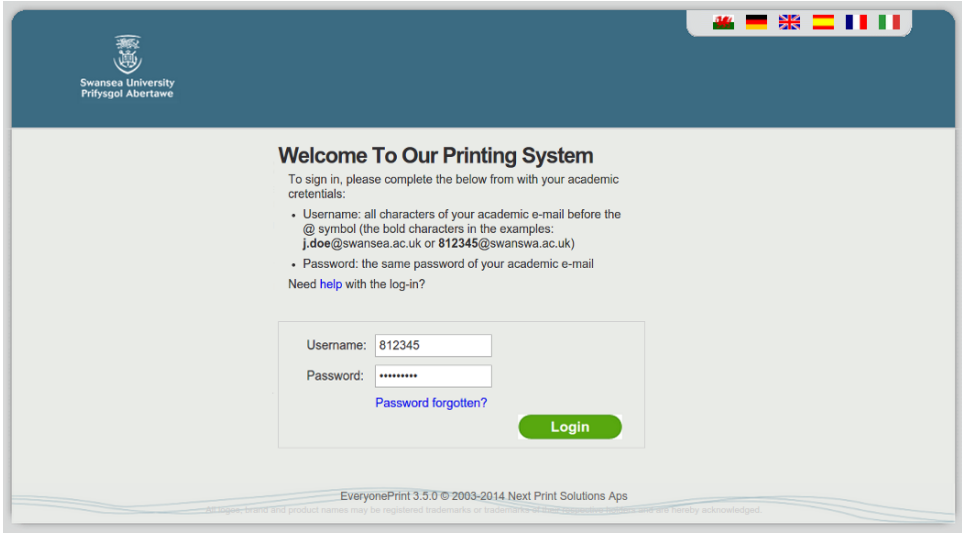


Figure 2: Login page after filling fields

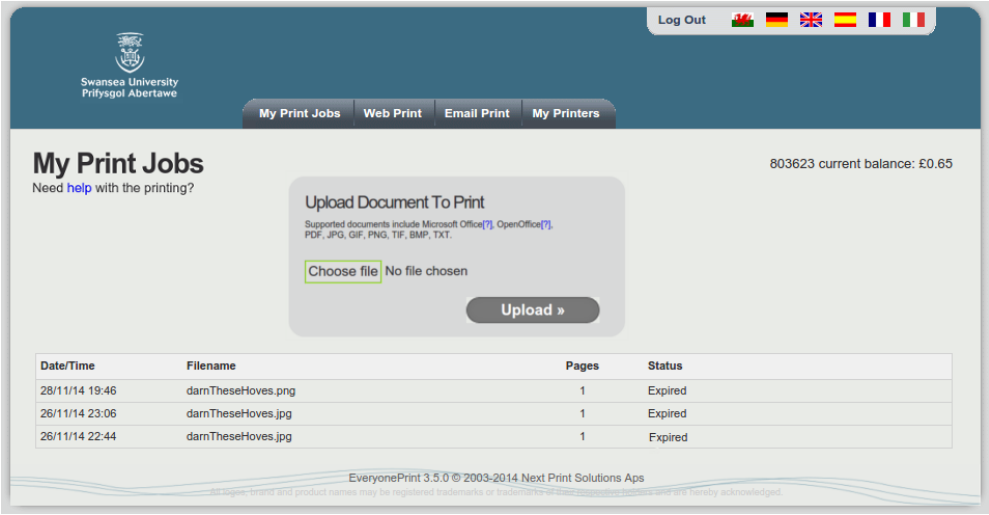


Figure 3: Main page after login

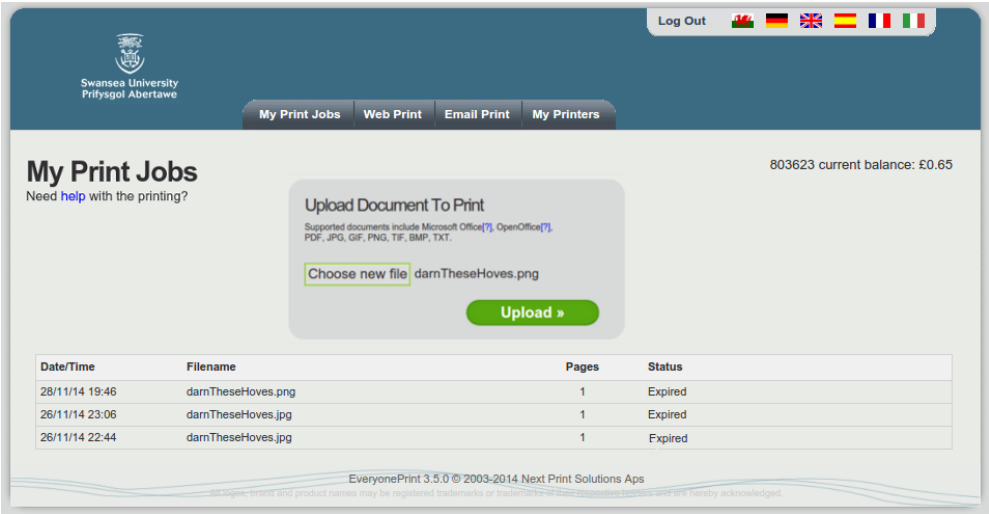


Figure 4: Main page after the file has been chosen

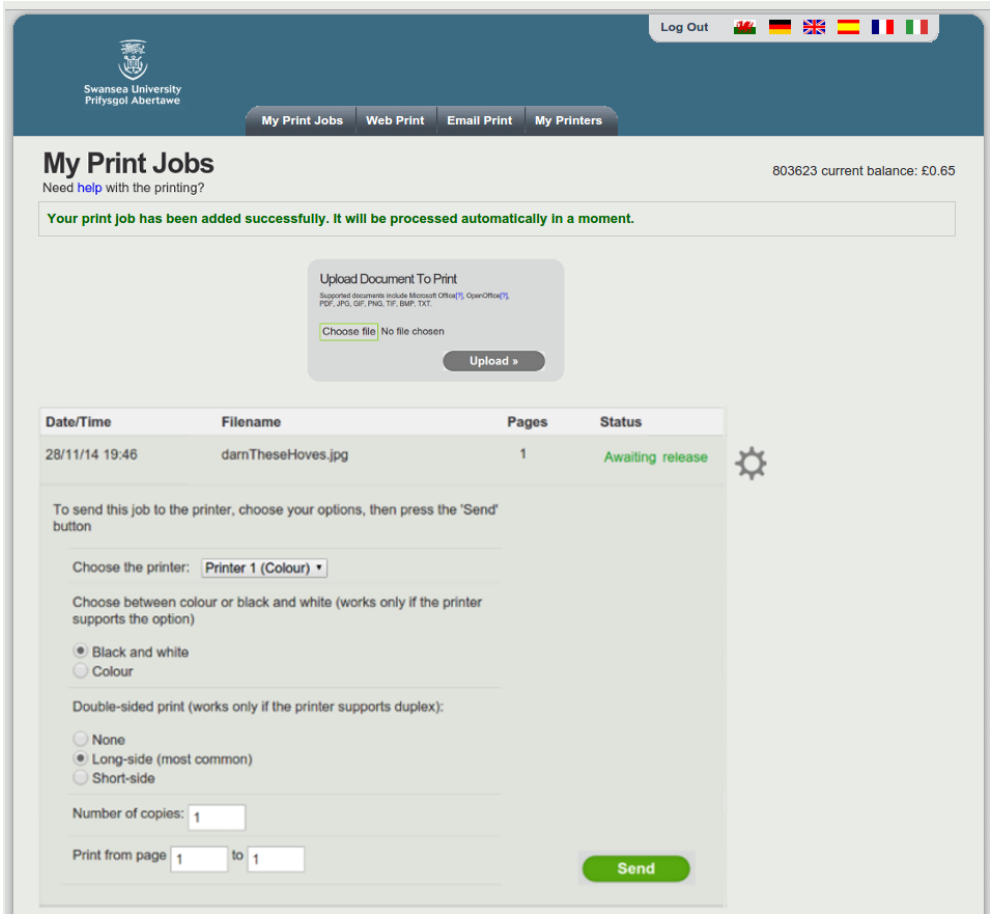


Figure 5: Main page after the file has been uploaded

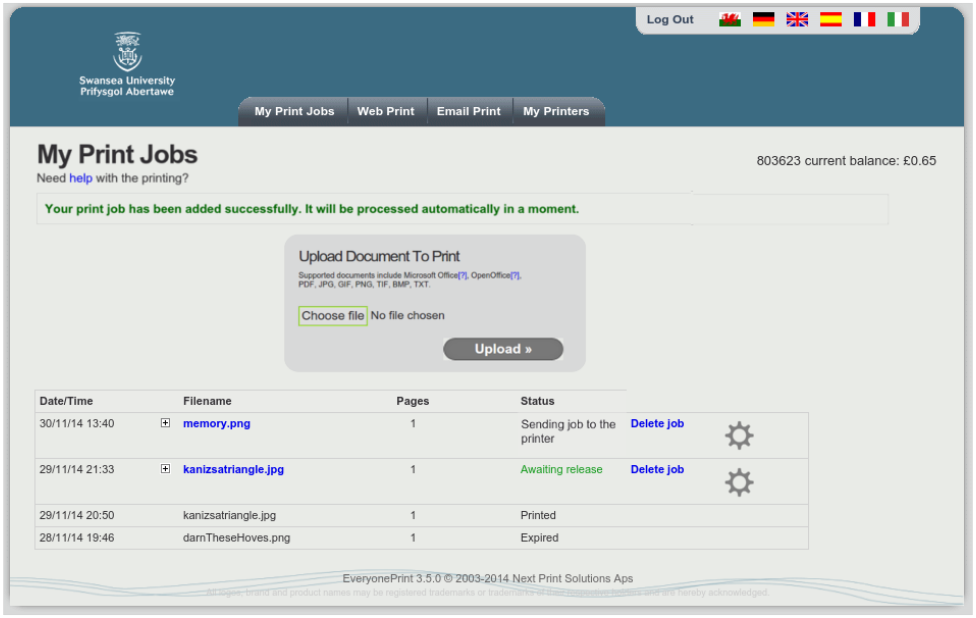


Figure 6: Main page the job has been sent to the printer