"The development of suitable web usability guidelines for making websites with the Sony PlayStation Portable"

Final Report

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Except where explicitly stated all work in this document is my own

Signed: _____

Abstract

The Sony PlayStation Portable (Sony PSP) games console is a new mobile device that allows for games to be played, music and media files to be enjoyed as well as allowing the user to access the internet through its inbuilt WiFi connection. The aim of this project was to determine whether existing mobile device usability guidelines could be adapted for use on the Sony PSP. Through the research of existing mobile web usability guidelines and the characteristics of mobile devices which influenced their creation, a list of suitable guidelines was drawn up for the Sony PSP based on characteristics it shares with other devices. These guidelines then influenced the creation of a test website that would be tested via a user evaluation to establish whether or not the existing mobile device characteristics were suitably converted for usage on the Sony PSP. It was discovered through the user evaluation that the website was successful thus proving that the existing mobile device characteristics had been converted for use with websites on the Sony PSP.

Acknowledgements

I would like to thank my supervisor, Dr. Richard Foley.

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1. Introduction

1.1 Project Background

Since being released in 2004, the Sony PlayStation Portable (Sony PSP) has proved itself to be a successful portable computer. Even though it is primarily built for playing video games it also possesses media playback functionality as well as possessing a web browser.

Web sites on the Sony PSP look just as good as they would on a conventional browser due to the 16.77 million colour screen (SCEI 2004) and its web browser's compatibilities with web technologies (PSPVault 2005). However, due to the nature of the Sony PSP as a mobile device problems with websites may arise: the 333 Mhz CPU and 32MB memory (SCEI 2004) may prevent some hardware-intensive websites from being displayed, the lack of conventional input may hinder usability, and as with most devices that possess a small screen there may be trouble such as users making mistakes when selecting links and wasting time scrolling (Jones *et al*, 2001). All of these downsides can build-up to poor usability that can lead to wasted time, unnecessary traffic and the discouragement of the user to explore the site (Borges *et al* 1996).

This is not a new story though. Whether it is the limited display space, limited system resources or lack of conventional input, mobile devices share these common characteristics which have led to the creation of mobile web usability guidelines that govern how web pages should look, act and what they should contain.

As these mobile devices share common characteristics, then the Sony PSP should be no different. Mobile web usability guidelines could be created for the Sony PSP based on the characteristics that it shares with other devices.

1.2 Project Aims

The aim of this project is to determine whether or not existing mobile web usability guidelines can be adapted for use on the Sony PSP. These guidelines would then be used in the creation of a test website that would be subjected to a user evaluation to determine if the website is usable or not. The outcome of this project will be beneficial to developers seeking to create web sites and applications for use with the Sony PSP and also to those developing guidelines for other, similar, mobile devices.

1.3 Research Question and Hypothesis

Can existing mobile web guidelines be successfully adapted for use on the Sony PSP? These guidelines can be successfully adapted for use on the Sony PSP when the correct characteristics that govern these guidelines are identified and matched to fit the characteristics of the Sony PSP.

2. Literature Review

The purpose of this section was to discover existing mobile characteristics and how they influenced the mobile web guidelines. From those two areas, a suitable set of guidelines for the Sony PSP could be generated.

2.1 Characteristics of the Sony PSP and other Mobile Devices

The first step of this report was to study the actual hardware of the Sony PSP in comparison to other mobile devices that share the same characteristics. Common characteristics of mobile devices, according to the W3C HTML 4.0 Guidelines for Mobile Access (1999) are that mobile devices all have:

- “Small memory capacity
- Small display space
- Less powerful CPU
- Limited input method”

These factors can be logically split up into three categories:

- System Resources and Capabilities (Small memory capacity, Less powerful CPU)
- Display (Small display space)
- Input (Limited input method)

2.1.1 System Resources and Capabilities

Due to the size of mobile devices, it is impossible for them to possess powerful processors and memory size on par with modern desktop computers due to issues with having to use a low power source (W3C HTML 4.0 Guidelines for Mobile Access 1999). Instead, mobile devices feature processors and memory roughly on par with what was available one decade ago.

One of the major issues with mobile devices is that they vary greatly in their processing abilities. Modern mobile devices, such as the PSP, have relatively fast processors (the PSP itself runs at speeds up to 333 Mhz (SCEI 2004)) but there are still mobile devices available that run at lesser speeds. For example, Buyukkokten *et al* (2000) performed an experiment on a PDA that had processing power with the equivalent of a computer from the 1980s.

The lack of processing abilities can lead to lowered quality or less graphics used. As Kärkkäinen et al (2002) noted in their research that with mobile devices, large files should be avoided and "animations and images should be used with caution."

In the past, system resources of PDAs could greatly constrict what technologies were available for use on them as Gaedke, *et al* (1998) states that "content requiring a lot of computing power, for example compressed video, is usually not suited for display on PDAs" (Gaedke et al, 1998). This article however is quite old, and as aforementioned, modern mobile devices have a lot more power. For example, the fairly recent Palm TX is fully capable of providing support for formats such as “HTML, xHTML, GIF, JPEG, [and] JavaScript” (Palm - Products - Palm TX Handheld, ND).

With the Sony PSP being a recent device, it’s system resources allow for a wide range of technologies to be used, such as: “HTML 4.01, XHTML 1.1, CSS1 and 2 and JavaScript 1.5” (PSPVault 2005). And quite recently it has been upgraded with functionality with Macromedia Flash (Williams 2006). This compatibility allows it to use the majority of features that are used on conventional websites.

Mobile devices may not have access to many fonts due to their limited memory and processing abilities. For example the Sony PSP is limited to using two fonts with the possibility of displaying them in five different sizes. The fonts available are "serif and sans-serif, and the latter is *always* [emphasis theirs] used unless a serif is specified" and the font is set to a default size of “13px - 16px” (Web design for the Sony PSP, 2006).

2.1.3 Display

When it comes to the resolution on mobile devices, they can "vary from 48×48 pixels in a feature phone to full VGA in certain communicators" (Kaasinen *et al*, 2000). This means that, unlike with conventional websites that are normally designed with a pre-determined “minimum resolution” in mind (such as 800*600) mobile websites must be created with a set of both lower quality and wider range of resolutions in mind. This can have the effect of not being able to show full lines of text or large pictures, as seen below:

Figure 1: Mobile web site viewed through a resolution of 176x208

(Source: Perception of Narrow Web Pages on a Mobile Phone, 2003)

Whereas when devices use larger resolutions like 320*240 (such as with the Tapwave Zodiac) there is relatively no problem in displaying a lot of information, as seen below:

Figure 2: The Tapwave Zodiac portable media player

(Source: Brighthand Reviews the Tapwave Zodiac, 2004)

The effect that a low screen resolution may have with mobile websites is that whatever information appears "first" on the screen would get the highest attention from the user. This is backed up by Roto et al (2003) whom carried out experiments based on how users perceive web sites on mobile devices. They concluded that when a user uses a "big screen" then they tend to focus on the centre of the page, whereas on smaller displays "the topmost information on the page got the highest priority." The experiment they carried out was with a mobile device that possessed a screen resolution of 176*208.

The Sony PSP has a high quality display that consists of a 480*272 resolution (16:9 aspect ratio) (Web design for the Sony PSP, 2006). The 16:9 aspect ratio (widescreen) is quite unusual for a mobile device, and was included for the media player and game console functionality of the console. The resolution of the Sony PSP allow for more space than a 320*240 display (as seen above) so websites made to fit with that resolution could be extended to fit more on the screen.

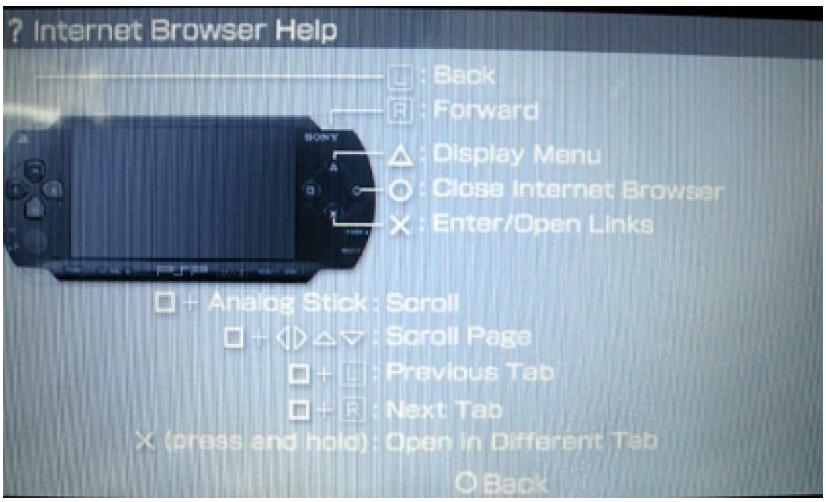
When it comes to colour depth, original devices used to only possess monochrome displays. Modern mobile devices like the Sony PSP have full colour displays (Web design for the Sony PSP, 2006) so there should be no trouble with utilising different colours on the screen. The Sony PSP's web browser is also automatically in "full screen" (e.g. with no toolbars present) (Sony PSP Web Design Primer, 2006) so every pixel of the 480*272 screen is available for use.

2.1.4 Input

One of the most prominent features of mobile devices is that due to their small form factor they do not have traditional input devices such as a large sized keyboard or mouse. This can be seen as being detrimental to usability on a mobile device. Kaikkonen *et al* (2003) state that inputting text is slow on mobile devices compared with a keyboard and Buchanan *et al* (2001) note that on certain devices, input can require a "significant effort from the user."

The lack of a pointing device such as a mouse has led to mobile devices using input methods like joysticks to control pointing. Wobbrock *et al* (2002) did research with a mobile device that uses a joypad and implemented a "target" cursor that the user can move about and interact with. They found that they could mimic the way in which real tasks are done by allocating tasks to each hand. The Sony PSP itself uses two methods in replacing the mouse. These methods are the directional pad (D-pad) and an analog stick. The D-pad is used to quickly move between hyperlinks on the currently displayed page, whilst the analog stick moves a pointer around the screen like a mouse. It should also be noted that unless an extra button is used, no scrolling will occur when using the D-pad or analog stick. As with the mobile device used by Wobbrock *et al* (2002) in their research, the Sony PSP also allocates tasks to each hand, with the left hand being used for pointing (using either the D-pad or the analog stick) and the right hand being used for interacting, as seen in the image below:

Figure 3: The controls for the Sony PSP's web browser

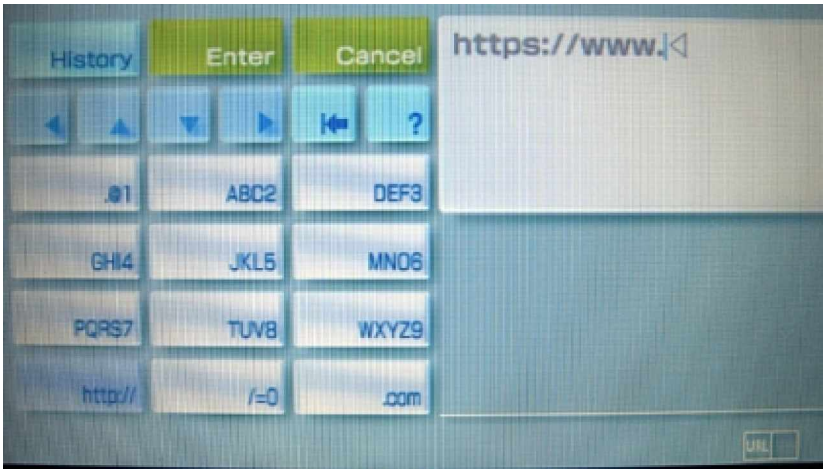


(Source: IGN - Hands-On: PSP Web Browser 2005)

The lack of a full sized keyboard has led to manufacturers having different takes on how best to how to enter text. The most widely used keyboard substitute is arguably the key pad that is utilised on mobile phones as there are "nearly 2.7 billion mobile phone subscribers globally" (Fildes, 2006).

It should also be noted that the Sony PSP utilises a keypad-type interface to allow the input of text as seen below:

Figure 4: Text entry using the Sony PSP



(Source: IGN - Hands-On: PSP Web Browser 2005)

When it comes to inputting text with a keypad, inputting text can be quite a slow task. In an experiment based on evaluating mobile phone text input, Butts et al (2002) discovered that the number of words per minute achieved by users was between 7.2 and 5.5. They also discovered that all of the users found inputting text on a mobile phone to be "frustrating and cumbersome to use."

2.1.5 Conclusions

It is evident that the Sony PSP is fully capable of providing the same technologies used on conventional websites. The display functionality on the Sony PSP is of high quality, with a 480*272 24-bit colour screen that will allow for full colours as well as more screen space than another modern mobile device. The method of input, using a D-pad and analog stick as pointing devices may be

2.2 Mobile Web Guidelines

2.2.1 Use of style sheets

Style sheets are files used to aid separating presentation from content on websites. They can define many aspects of a web site's presentation such as the size/colour of text, placement of articles on a web site amongst other factors.

Style sheets can be seen as vital to mobile web sites. Jones *et al* (1999) notes their potential to aid navigation by reducing the scrolling involved and by minimising the size of page components to "fit the available space"

With that said, the W3C HTML 4.0 Guidelines for Mobile Access (1999) state that the content of the website should be "readable without style sheets" in the event that the mobile device accessing it cannot process style sheets.

2.2.2 Text size

When it comes to the size of text on a small screen, the findings of Kamba *et al* (1996) recommend that "that a practical threshold of legibility for most users lies somewhere between 9 and 12 points." This however may be out of date since it is over a decade old and technology has improved significantly since then. A more recent study by Kärkkäinen *et al* (2002) suggest that mobile web sites should "use at least 14 pts font" because of issues with screen resolutions and "variable lightning conditions" that may arise when using the mobile device.

2.2.3 Length of the web page

Kaikkonen *et al* (2003) suggests that there can be two types of mobile web sites when it comes to the page length: "long page and flat hierarchy or short pages and deep hierarchy." Their findings do report though that the best page length for a site depends on the purpose of the site itself.

From the research of Kim *et al* (2001) it is stated that the length of the page should allow for a word count of "somewhere around 275-300."

2.2.4 Use of frames

Frames are an outdated method of partitioning screen space on web sites. Given that on mobile devices there is a lack of space to begin with, they are not recommended for use

on the mobile web. This led to the W3C HTML 4.0 Guidelines for Mobile Access (1999) stating that "frames should not be used."

2.2.5 Use of Hyperlinks, Images, Forms and Tables

Hyperlinks on mobile devices should be used “with a clear indication.” (Kärkkäinen *et al* 2002)

Pictures should be used within context, and images that are not relevant should be avoided (Kärkkäinen *et al* 2002). It should also be noted that not every mobile device supports the display of images (W3C HTML 4.0 Guidelines for Mobile Access, 1999) so suitable text should be used as well.

According to the W3C HTML 4.0 Guidelines for Mobile Access (1999), most mobile devices should support the use of “basic forms.” However those guidelines do state that developers wishing to utilise forms should take in the fact that mobile devices do not have keyboards thus text input will be difficult.

Uther (2002) states that mobile web sites should “avoid wide elements and tables” and that the width of tables used should fit the page to take screen scrolling into account.

2.2.6 Task Analysis (Purpose of Site)

Utilising task analysis and determining what web sites will be used for has been argued to be a major factor when it comes to producing mobile web sites. Shane Schick (2005) argued that “most mobile users use their devices for specific purposes” and this is backed up by the claim that “the primary goal of mobile Internet is not necessarily to browse, but to get easy access to specific information” (Uther 2002) and by Nielsen (2000) stating that mobile web sites should be “aimed at providing fast answers to specific problems.”

With those factors stated, task analysis appears to have major importance in the development of usable websites for the mobile web. In their research, Kärkkäinen *et al* (2002) state that the function of mobile websites should be researched instead of just making it as it would be used on a normal computer. Buchanan *et al* (2001) simply state that “developers that try to simply convert their conventional Web material to the phone platform will fail.”

Jones’ *et al* (1999) findings that actual content of the site should be “task focussed rather than verbose” with the important information being clear to see could be seen as an important factor with any website, but it’s especially important when on mobile websites due to the aforementioned characteristics of the mobile devices themselves.

2.2.7 Knowing how to navigate

When it comes to knowing how to navigate Kaikkonen *et al* (2003) suggest three main areas that are "knowing where you are," "finding your way forward," and "finding your way back." They go on to state that "unique page titles" should be utilised in order to inform the user of where they are.

For moving forwards within a mobile web site, Kaikkonen *et al* (2003) found that a search function "was surprisingly popular" when they carried out their studies, but also added that users easily used their "streamlined tree navigation."

When it comes to moving backwards in the page, it should be kept in mind that not all mobile devices have back buttons, so appropriate links should be used (Uther 2002). Kaikkonen *et al* (2003) again add that whilst the back button "is the most important way to go back" that mobile websites should provide adequate links to both the home page and other relevant pages.

2.2.8 Scrolling

Scrolling is a very normal occurrence on conventional websites as all of the content of a web page may not fit on one screen. Scrolling can come in two different forms: horizontal scrolling for going left and right, and vertical scrolling for going up and down websites. Horizontal scrolling will not be focused on in these guidelines as some mobile devices are not capable of horizontal scrolling (Uther 2002) and also because it has been stated that "users hate horizontal scrolling" (Nielsen 2005). It should also be taken into account that on certain mobile devices, there may not even be the presence of scroll bars to indicate that scrolling is possible or available.

It is evident that for a mobile device that scrolling should be reduced on mobile devices, as users may have to perform a lot of scrolling on a small screen display (Jones *et al* 2001). Scrolling is seen to have a disruptive influence when it comes to mobile devices as it has the potential to "interrupt a user's activities" (Uther 2002) as well as "interrupt their primary tasks" (Jones *et al* 2001) when using a website.

From this it can be seen that scrolling should be reduced when used on mobile websites. Jones *et al* (2001) states that extra navigation aids should be used in "fixed places" such as the side or top of the page. Kärkkäinen *et al* (2002) suggests that if scrolling is to be used, then visual aids such as markers should be used "guide the user's attention to the right place after a scrolling operation."

Guidelines regarding scrolling also have a knock on effect to the content of the page, as Buchanan *et al* (2001) notes that textual content of websites should be reduced or simplified with "action orientated keywords" being used instead of "wordy messages." Uther (2002) also adds that "interactive pages should not be too long" and adds the example that a user filling in an online form may not know if they have completed it all.

2.2.9 Navigation methods and reduction

An important factor with mobile websites is that a "consistent navigation method" should be used with every page containing links to the homepage of the site (Uther 2002).

Giving the user the ability to search through the website like a normal browser is recommended (Jones *et al* 1999) despite any aforementioned trouble with text input on mobile devices. However Kaikkonen *et al* (2003) state that it would be best to display information in lists that could then be used to obtain a "detailed view" of each piece of information as they found that "a compact list of items on one page was clearly preferred by the users." Buchanan *et al* (2001) support the "list selection" option as they recommend that the amount of interaction needed by the user should be reduced, and this includes scaling back on inputting text.

With mobile websites, it is imperative that navigation methods should be scaled down. In their work, Kärkkäinen *et al* (2002) reported that "constantly visible navigation bars require too much display space" and that different methods should be used. When it comes to providing reduced navigation methods, Jones *et al* (1999) recommend that "Focussed navigation" should be implemented for mobile websites. This is essentially structuring the navigation methods used on the website in order to aid the user in what they want to get out of the site. This is backed up from previous guidelines that outlined that the purpose of mobile web sites is "to get easy access to specific information" (Uther 2002). This is also supported by Kärkkäinen *et al* (2002) as they add that since mobile web users "do not tend to navigate deep into the site" then the key content and information of the site should be presented clearly. Buchanan *et al* (2001) also argue that navigation should be reduced as far as possible with "simple hierarchies" being implemented. From these guidelines it appears definite that navigation methods should be scaled back significantly, but with that said, it is stressed by Kaikkonen *et al* (2003) that any reduced navigation "should not increase the users' feeling of insecurity."

2.2.10 Conclusions

2.2.10.1 Use of style sheets

Style sheets should be used when producing usable websites for the Sony PSP as it will greatly aid in allowing page components to fit on the small screen. Since the Sony PSP is fully compatible with the Cascading Style Sheets standards (PSPVault 2005), there will be no problems in utilising this technology.

2.2.10.2 Text size

As the Sony PSP comes with only two available fonts and five different sizes (Web design for the Sony PSP, 2006), it has been concluded that the default sans-serif font be used with the default size (13px - 16px) due to research done by Kärkkäinen et al (2002) that states that mobile web sites should “use at least 14 pts font.”

2.2.10.3 Length of the web page

This research has concluded from the display characteristics of the Sony PSP, and the guideline of using "short pages and deep hierarchy" suggested by Kaikkonen et al (2003) that websites made with the Sony PSP in mind should try their best to stay within one screen worth (480*270). This conclusion will be addressed later in the "Scrolling" recommendation.

2.2.10.4 Use of frames

Frames will not be used as the W3C HTML 4.0 Guidelines for Mobile Access (1999) states that "frames should not be used.”

2.2.10.5 Use of Hyperlinks, Images, Forms and Tables

This research has concluded that hyperlinks should be well defined and should stand out from ordinary text. Due to the capabilities of the Sony PSP both to process image files and to display them with full colour, images can be used but only when they are required or serve a purpose. Forms should only be used when necessary (for example, to search the website or to enter usernames and/ or passwords) and tables should be avoided unless absolutely necessary, and in that context they should not be larger than one screen.

2.2.10.6 Task Analysis (Purpose of Site)

When making web sites for the Sony PSP, everything that does not serve a purpose should not be included. Any existing site to be produced with the Sony PSP in mind should stick to the idea of "providing fast answers to specific problems" (Nielsen 2000).

2.2.10.7 Knowing how to navigate

When it comes to knowing where you are, since the Sony PSP has a full screen browser, users will be unable to see any "unique page titles" unless they are present on the web page itself. From the research done, it has been recommended that every web page made for the Sony PSP in mind should provide a structured hierarchy near the top of each page that will include a link to the homepage, and any subsection.

This keeps in mind with the recommendation by Kaikkonen et al (2003) that mobile websites should provide adequate links to both the home page and other relevant pages. The Sony PSP includes specific buttons for moving back and forwards between visited pages, but the visual navigation options would aid the user.

2.2.10.8 Scrolling

As already stated in an above recommendation, a web page developed with the PSP in mind should ideally fit onto one screen. From the research done it is very clear that scrolling on websites designed mobile devices is both disruptive and because the Sony PSP's browser does not feature any scroll bars that would indicate if it were possible.

Instead of scrolling, the recommendation from this research is that web pages developed for the Sony PSP in mind should follow guidelines made by Buchanan et al (2001) when they stated that the textual content of websites should be reduced or simplified.

If scrolling is to be used in a web page developed for use with the Sony PSP then there should be a visual aid used to indicate that scrolling is possible.

2.2.10.9 Navigation methods and reduction

Web sites designed for the Sony PSP should maintain a “consistent navigation method” (Uther 2002). This recommendation also collaborates with earlier recommendations for Knowing how to navigate in that web pages should have visible and structured navigation methods present.

It is not clear whether or not a search function should be included with web sites developed for the Sony PSP. This is because that search functions should only be required if there is a lot of textual content on the site, and that would contradict this project's recommendation that textual content should be simplified. Instead of a proper search function where text would be inputted by the user, it is recommended that a "frequently asked questions" or similar section be used instead. This follows the research from Kaikkonen et al (2003) that stated that users liked a "“a compact list of items on one page" over a search function.

As for scaling down navigation methods, it is evident from the research done that the most important information on web sites made for the Sony PSP should be presented clearly on each screen and that a streamlined navigation method be used. The extent of the streamlining of the navigation methods would have be decided upon based on the exact purpose of the site after everything deemed irrelevant was removed.

3. Methods

This section contains all of development details for the test website and the user study.

The methods chosen for this project were:

- Identification of guidelines to be used
- Development of a test website
- User evaluation of test website

The test website would be an existing web site that has been analysed and converted into a Sony PSP optimised equivalent based on the guidelines derived from the aforementioned review of literature. A user study would then take place in order to determine if the website is usable, and to determine the validity of the hypothesis.

3.1 Identification of guidelines

As per the conclusions of the aforementioned literature review, the following is a summarised account of the following guidelines that will be used for the construction of the test website.

- Cascading Style sheets should be used in order to organise information on screen.
- Main body text should be the Sony PSP's default size.
- A "short page and deep hierarchy" format should be adopted. Websites made for the Sony PSP should fit onto one screen. Textual content should be simplified or spread out into multiple pages to meet this goal.
- Hyperlinks should stand out.
- Images should only be used when they serve a purpose.
- Forms should only be used when necessary due to their need for text entry.
- A structured hierarchy that provides links to previous sections and the homepage should be present near the top of the screen.
- Informational content should be clearly visible on the screen.

3.2 Construction of website - overview

In this section the existing website to be converted for use with the Sony PSP will be analysed and the features to be retained in accordance to the above guidelines.

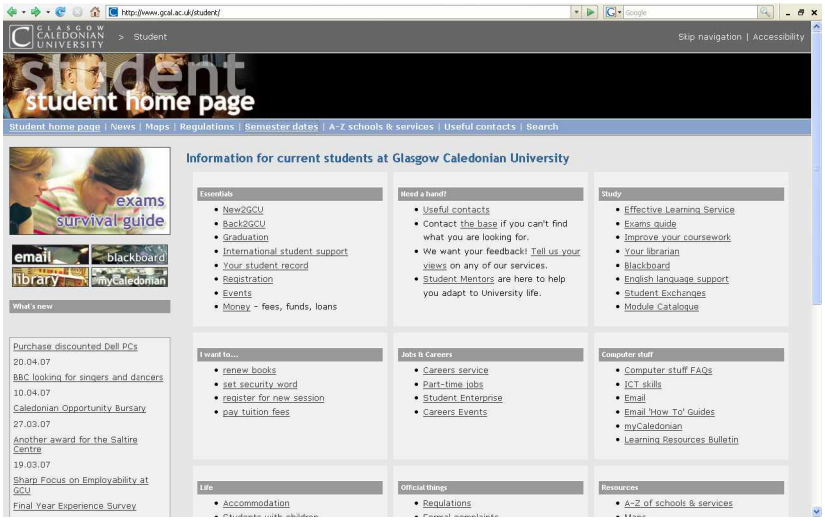
The website chosen for this study was Glasgow Caledonian University's Information for Students website (http://student.gcal.ac.uk). Another site that was considered was a Sony PSP-related news website, but the Information for Students website was decided on because there would be no complications in obtaining permission to use it.

3.2.1 Construction of website – features of website and what to keep and why

Before the Sony PSP compatible test website is created, the key features of the original website must be identified. This section will analyse the existing website and note which features will be retained or modified for use in the test website.

3.2.1.1 Index page

Figure 5, Information for Students website as seen through a normal internet browser on 30/4/2007. A large version is available for viewing in the appendices.



(Source: Glasgow Caledonian University's Information for Students web page)

The Information for Students website acts a central hub of information for all students at Glasgow Caledonian University. To that extent, it is the default home page of web browsers on every computer available to students at the university.

At the very top of the page is a grey strip that contains Glasgow Caledonian University's corporate logo as well as nested hierarchy for navigation. As the corporate logo image is small enough to not take a large amount of space on the PSP's screen, it will be used unedited in the same position (top left) on the Sony PSP website. The grey strip will remain as well to build some familiarity with the website. To this effect, the exact colour scheme of the website would be duplicated on the Sony PSP version. The nested hierarchy present has to remain on the website as a key part of the navigation methodology, but it will be moved to below the grey strip.

Below the grey strip is a large picture logo with the text "Student Home Page." This image will be removed completely in accordance to the reduction of images required for

mobile websites, and also due to the fact that the height of the image (100 pixels) is almost one third the size of the Sony PSP's vertical display (272 pixels.)

Directly below this image are featured links with a blue background. The links contained are to sections which would be expected to be the most popular choices on the website such as the News. It was decided that since this section stands out (due to its blue background) and because of it's location at the top of the screen that this section would contain the structured hierarchy that provides links to previous sections.

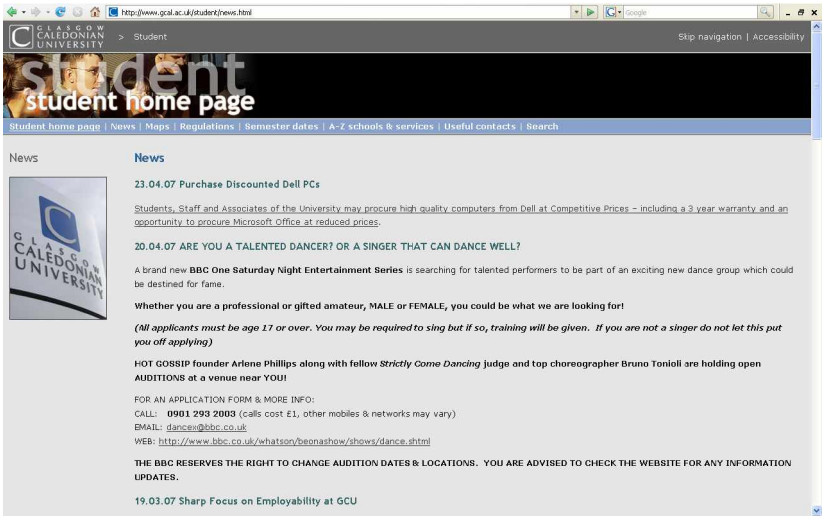
The information on the index page is clearly laid out and subsections are logically sorted into groups such as "Essentials," "Need a Hand," and "Study." At the side there are image links to sections such as Email and Blackboard as well as a brief list of updates or news stories. There are no large sections of text anywhere on the screen. The way in which subsections are sorted out would be retained for use on the Sony PSP test website but in a cut down fashion. Due to the screen constraints, only two or three at the most would probably fit onto one screen. The most prevalent categories would be displayed in them with links to relevant subsections. The images at the side will be removed, as will the entire side area due to it taking up a considerable amount of screen space.

It must also be noted that certain links on the Information for Students site are completely broken. For example, links to the Part-time Jobs section return an Internal Server Error. Without being able to access these pages, it is impossible to analyse them and to add them to the test website.

An extra feature that will be present on the Sony PSP website but is not present on the original website is a relevant link to an event that is happening “today.”

3.2.1.2 News page

- Figure 6, News website as seen through a normal internet browser on 30/4/2007. A large version is available for viewing in the appendices.



(Source: Glasgow Caledonian University's Information for Students News web page)

The news section is a single list of all the latest news stories relevant to the university students. As one of the guidelines expressly mentions that scrolling should be avoided, the news section's list of complete articles will be reduced to a list of news headlines. These headlines will contain links to web pages that contain individual news stories. In keeping with the "short page and deep hierarchy" format, long news stories would be broken up into multiple pages.

The news articles themselves may possess hyperlinks to pages outside of the Information for Students website (such as in the news story in which you can go to the SAAS website in order to apply for travelling expenses.) On the test website, it was deemed that external links should not be featured as they would disrupt the flow of the experience, may not go to a website that is usable with the Sony PSP or they may go to a website (as is with the aforementioned travel expenses page) in which the activity may be best suited for a full browser. In the case of the travelling expenses news story, if directions are made to a place were the user can obtain forms it would be better.

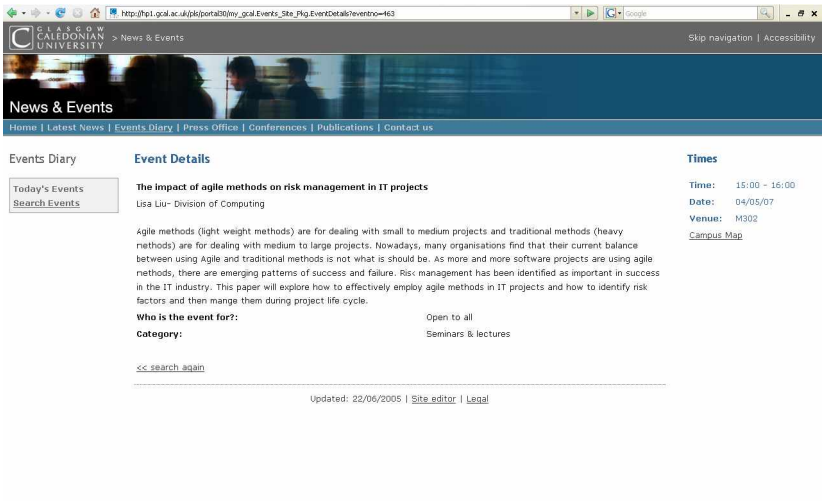
3.2.1.3 Events pages

- Figure 7, Events website as seen through a normal internet browser on 30/4/2007. A large version is available for viewing in the appendices.

(Source: Glasgow Caledonian University's Information for Students Events web page)

The events page is fairly barren as it allows the user to primarily search for upcoming events. As was discovered in the literature review, <person> suggested that on mobile devices users prefer to go through a list of items instead of searching for them. This will be the approach taken with the Sony PSP test website.

- Figure 8, Individual Event page as seen through a normal internet browser on 30/4/2007. A large version is available for viewing in the appendices.

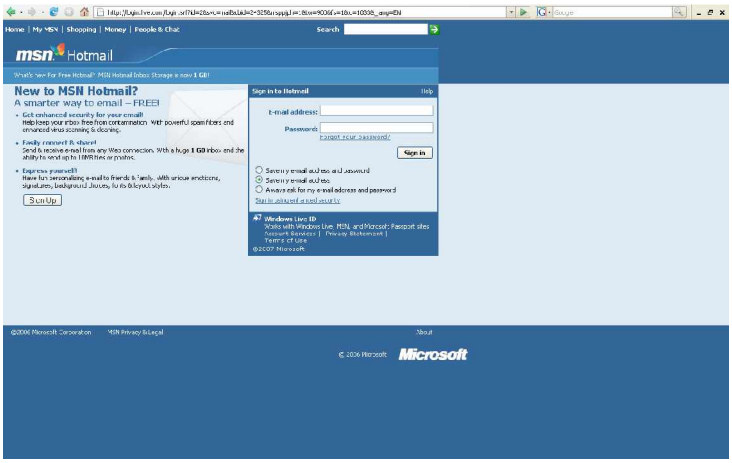


(Source: Glasgow Caledonian University's Information for Event Details web page)

Individual event pages (that the events page leads to) list the title of the event, an overview of the event, whom it is suited for, an event category, and at the side there is the time, date and venue of the event. On the Sony PSP version, those details would be kept. The overview would be simplified if required to fit on the page in accordance with the guidelines. Instead of being at the side, the time, date and venue details would be directly under the other details as it would make for better reading.

3.2.1.4 Mail page

- Figure 9, Email login page as seen through a normal internet browser on 30/4/2007. A large version is available for viewing in the appendices.

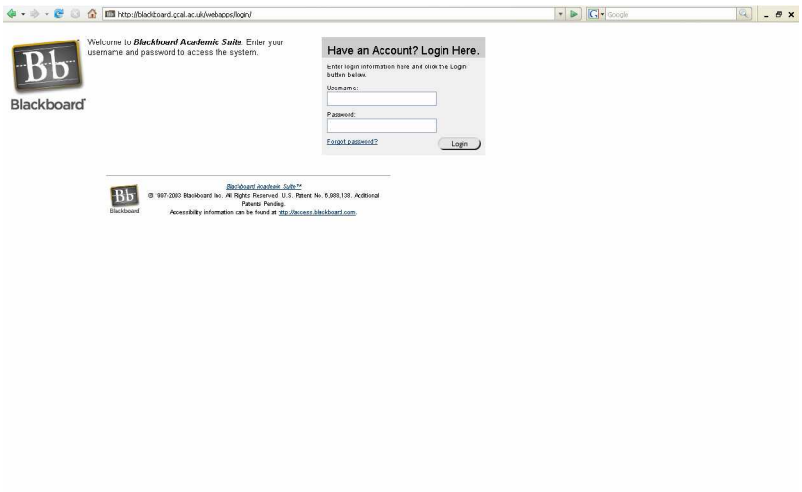


(Source: Microsoft Hotmail login web page)

The current mail page is completely disjointed from the rest of the website because of it being an external link. To that effect, an email login page is largely being included with the Sony PSP test website to test the validity of text entry on a mobile device.

3.2.1.5 Blackboard page

- *Figure 10, Blackboard login page as seen through a normal internet browser on 30/4/2007. A large version is available for viewing in the appendices.*

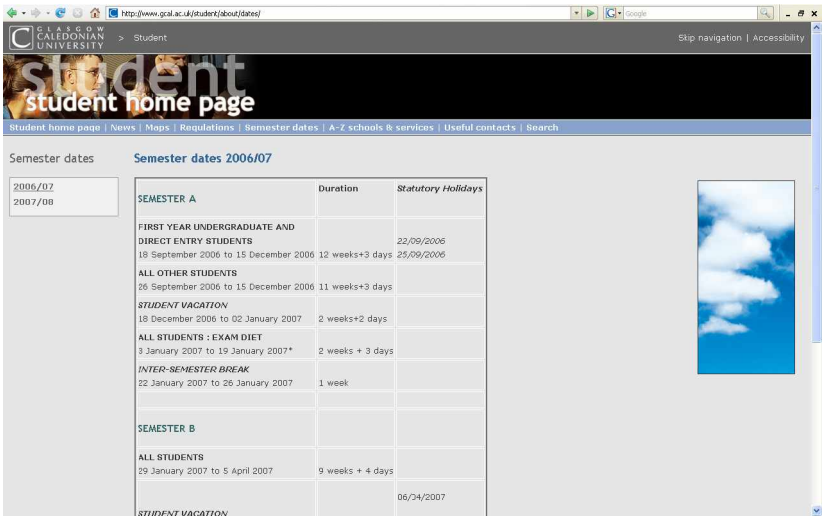


(Source: Blackboard login web page)

As with the Mail page, the Blackboard page is disjointed with the rest of the website. It too is being included to test the validity of text entry on a mobile device.

3.2.1.6 Semester Dates page

- *Figure 11, Semester Dates page as seen through a normal internet browser on 30/4/2007. A large version is available for viewing in the appendices.*

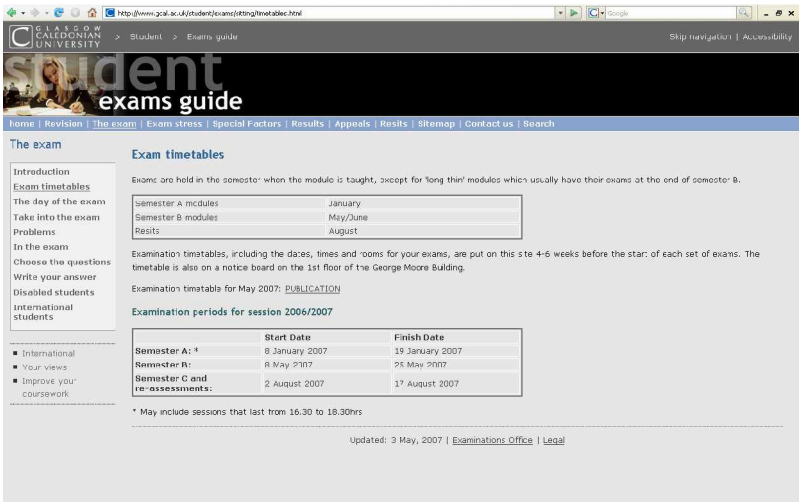


(Source: Semester dates web page)

The Semester dates are stored in a table with the headers Semester A/B, duration and Statutory Holidays and the relevant data is stored in each cell. Both semesters are featured and the table acts as one big list. For the Sony PSP test website, it was decided that each semester would have their individual page, as well as the statutory holidays having an individual page as well. This was done to follow the "short page and deep hierarchy" format.

3.2.1.7 Exam Timetables page

- Figure 12, Exam timetables page as seen through a normal internet browser on 30/4/2007. A large version is available for viewing in the appendices.

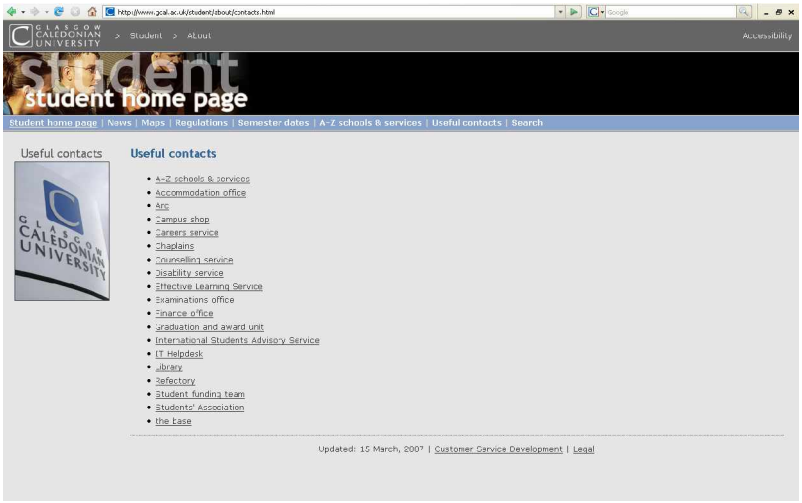


(Source: Exam timetables web page)

The exam timetables part of the website lists the examination periods and the exam timetables. It uses tables to list the information and also text to highlight the tables as well. As the Sony PSP website is just for the most relevant information possible **(REFERENCE - Nilsson)**, it will just list the examination periods. This is mainly due to the fact that the test website was developed before the publication of the examination timetables, they could not be included. It would have been preferential to have listed the exam timetables themselves and not the periods, as they are the aforementioned most relevant information.

3.2.1.8 Quick Contacts page

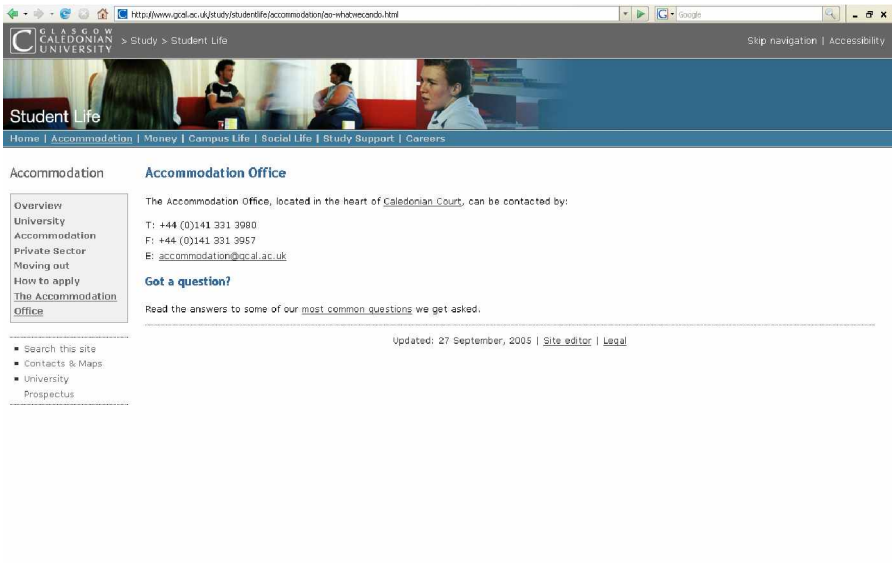
- Figure 13, Quick contacts page as seen through a normal internet browser on 30/4/2007. A large version is available for viewing in the appendices.



(Source: Useful contacts timetables web page)

The useful contacts part of the website is a simple list of different departments of the university. The listed departments contain links to web pages containing contact details for the relevant department. The list of departments can be transferred directly over to the Sony PSP test website, and so can the style of the individual pages.

- Figure 14, Quick contacts individual page as seen through a normal internet browser on 30/4/2007. A large version is available for viewing in the appendices.



(Source: Useful contacts individual web page)

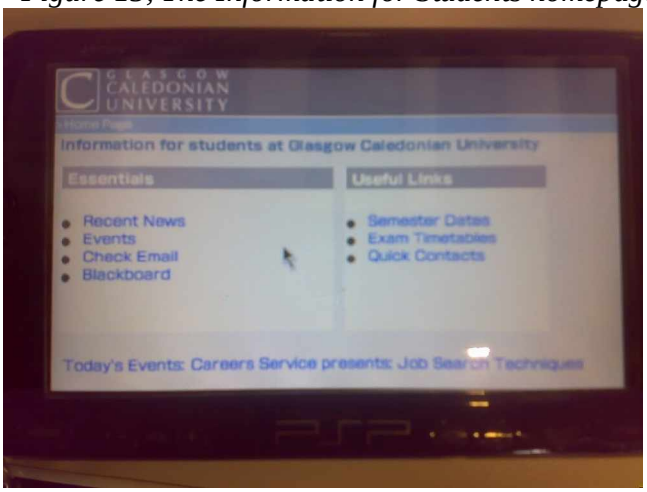
The individual pages contain relevant information to the department, such as telephone and fax numbers and email addresses. Since this is very little textual information, it can easily be recreated on the test website as it is.

3.2.2 Construction of website – actually constructing the thing

The Information for Students website is relatively primitive in it's usage of scripting. With no Javascript, ActiveX or other advanced technologies required to recreate the content. The only two technologies required for the creation of this website in a functional form are HTML and CSS. The software that will be used in creating the website is Textpad.

The finished website will be hosted on a private server for evaluation purposes. It can be found for viewing on a Sony PSP at the following URL - http://www.industrian.eu/gcu/.

- *Figure 15, The Information for Students homepage as it appears on the test website.*



(Source: Information for Students homepage on the Sony PSP)

3.3 Evaluation of website

The two methods of evaluation being used in this project are:

- User study
- Follow-up questionnaire

The user study was created with the primary aim of evaluating the user's hands-on performance when using the web site. The follow-up questionnaire was built with the intention of obtaining the opinions and thoughts of the users after they had finished using the system.

3.3.1 User study

The user study was built in a way that would make potential end users of the system carry out tasks that were typical of an information based website. These tasks include activities such as checking news stories, looking for specific dates if they are in university or on holiday. It also involved users writing down information from the website onto paper in order to judge their ability to read the on-screen text.

All of the users were currently enrolled students at Glasgow Caledonian University whom were familiar with the Information for Students website. The majority of which were computing students and only two of which had previous experience of using a Sony PSP to access web sites. Users that were unfamiliar with the Sony PSP were given a brief rundown of the controls of the device. These users were able to pick up the controls very easily with little or no help. When it came for the users to enter text into the console, then a little more help was given to them. They were able to grasp these controls with ease as well.

The user study was carried out fairly quickly with each user managing to complete the tasks in a succinct manner.

3.3.2 Follow-up Questionnaire

Directly after performing the user study, the users involved were given a questionnaire to complete. The questionnaire possessed eight questions that revolved around their opinions of the test website, and how easy it was for them to find their way around and to carry out tasks.

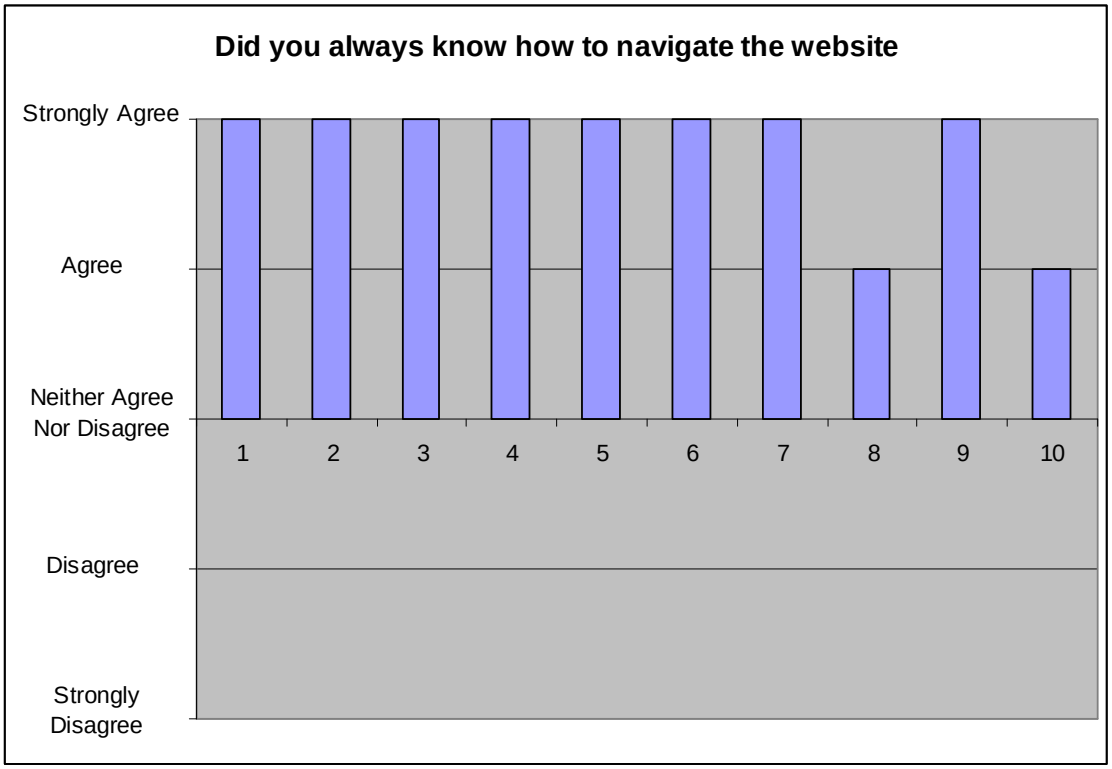
All quotations from the user comments are a reference to actual user feedback. All of the completed questionnaire forms can be found in the appendices.

3.3.2.1 First question

The first question was directly related to the first impression that the website had on the users. As first impressions of websites can be important, it was felt that a question of this nature should be included. As of such it asked for a comment only and not a rating. The feedback given was universally positive with comments stating it's familiarity with the existing Information for Students website as well as being "neatly laid out," "easy to read" and "simple and efective [*sic*]."

3.3.2.2 Second question

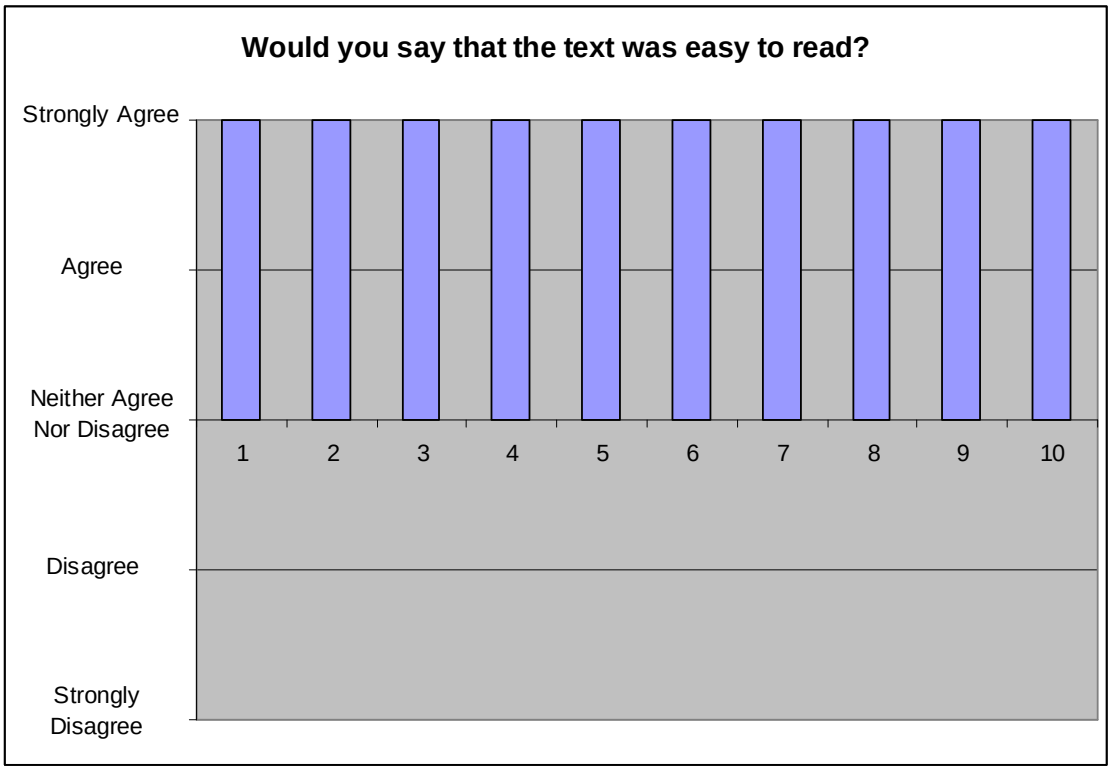
The second question allowed for users to provide feedback on what they felt of the navigational presence on the website. This question was directly related to the guideline that governs navigation methods. The user's reaction to this question would decide whether or not the choice in navigation was correct, proving that guideline to be relevant or not. This question was rated on a scale of "Strongly Agree" to "Strongly Disagree" with suitable gradients in between. There was also a space for users to elaborate on their rating with their own comments. The results were as follows.



The users overwhelmingly thought that there was a suitable navigational aids on the website for them to find their way between pages. There were only a few comments, and they directly referenced that the method of navigation was "well laid out."

3.3.2.3 Third question

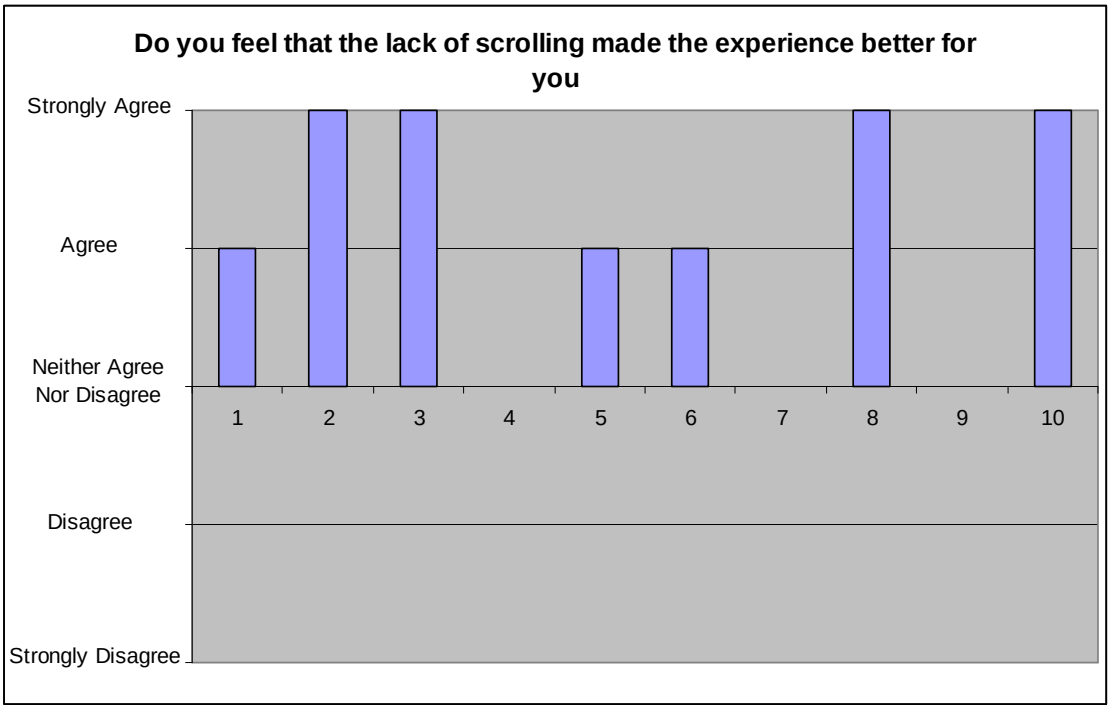
The third question directly related to the user's ease of comprehending the text on the screen. As with the second question, this question was chosen in order to test if a certain guideline was relevant or not. The guideline in question related to the size of the text on screen that recommended that main body text should be the same size as the Sony PSP's default text. As with the previous question, this was rated on a scale of "Strongly Agree" to "Strongly Disagree" with suitable gradients in between. Again, there was space for users to elaborate on their rating with their own comments. The results were as follows.



Every user whom took part had no problems with reading and understanding the text on the screen. This was noted in the user study in which they were able to write down contact details onto paper without any trouble. Extra comments made by the users directly reference their feelings of agreement. Users said that it was "easy to read" and the "text size was decent."

3.3.2.4 Fourth question

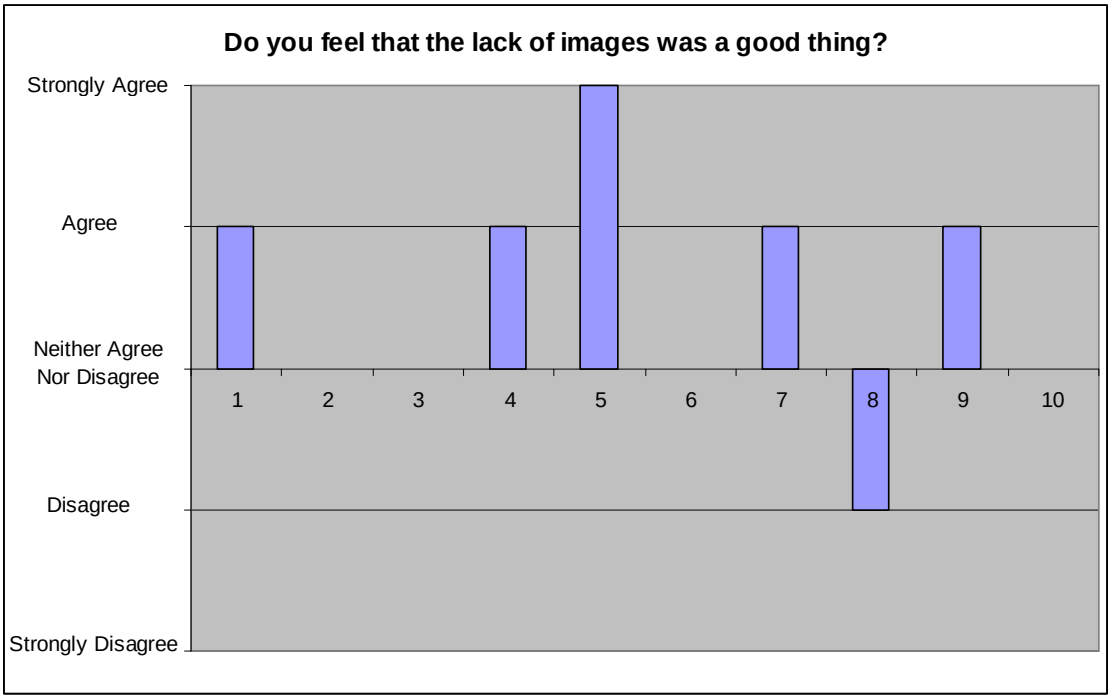
The fourth question asked in the questionnaire was included to gauge whether or not they noticed the lack of scrolling on the website, and if the lack of that function made the experience better. As scrolling of any kind was not recommended in the guidelines, this question would largely gather whether or not users agreed with that choice. As with the previous questions, this question was rated on a scale of "Strongly Agree" to "Strongly Disagree" with suitable gradients in between. Again, there was space for users to elaborate on their rating with their own comments. The results were as follows.



The majority of the users believed that the lack of scrolling made the web site better for them to use. Three users noted that they neither agreed nor disagreed. Comments made by the users tended to mention the fact that there was no need to scroll since the information was all designed to fit easily on one page. One user noted that since they were used to scrolling on websites, it made no difference to them.

3.3.2.5 Fifth question

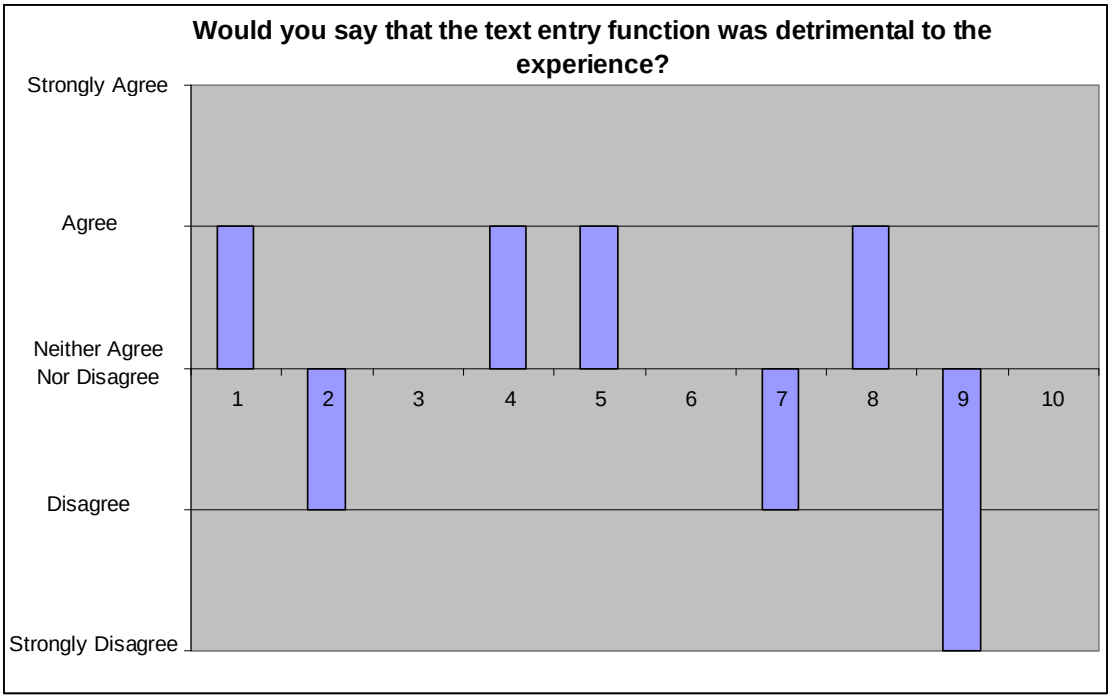
The fifth question was directly related to the guideline that images should not be used, and text should be used primarily. The question asked the users if they felt that the lack of images on the site was a good thing. Again, it was rated on a scale of "Strongly Agree" to "Strongly Disagree" with suitable gradients in between. Again, there was space for users to elaborate on their rating with their own comments. The results were as follows.



The users come to no certain conclusion. Four users agree that the lack of images made viewing the website easier, adding that "there was no [...] need for images" with another user strongly agreeing with the extra comment that it "helped me to concentrate on what I was doing." There were extra comments such as "images may have made it nicer" and the user that disagreed made the comment that the website was "quite bland without pictures."

3.3.2.6 Sixth question

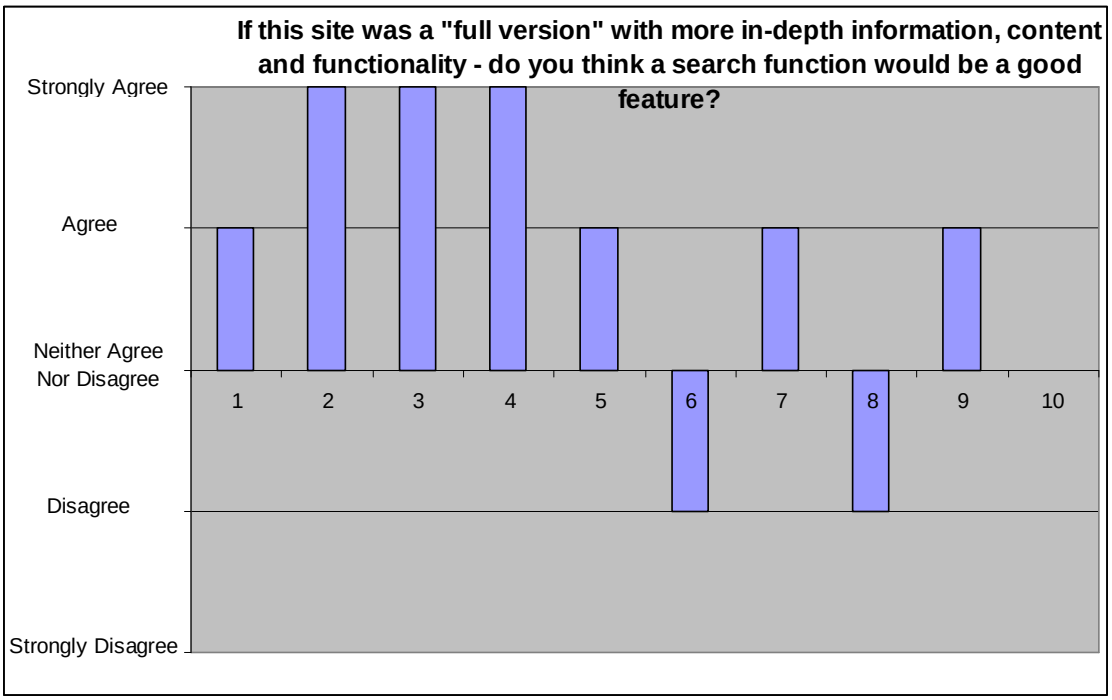
The sixth question related to the text entry function of the website. The guidelines make it clear that text should be only used where absolutely necessary as on mobile devices text entry is normally not recommended. The question asked the users if they felt that the inclusion of text entry was detrimental to the experience. Again, it was rated on a scale of "Strongly Agree" to "Strongly Disagree" with suitable gradients in between. Again, there was space for users to elaborate on their rating with their own comments. The results were as follows.



The result of this question was expected to be largely negative, but it balances out between agreement and disagreement. Some users believed that the text entry function of the Sony PSP was "easy to input text" even if it were "weak." Others compared it to the mobile phone keypad in which the Sony PSP's method of text entry is directly based on and noted that some mobile phones has "similar learning curves." Certain members just "didn't like the method of inputting text" whereas another said it was "slow."

3.3.2.7 Seventh question

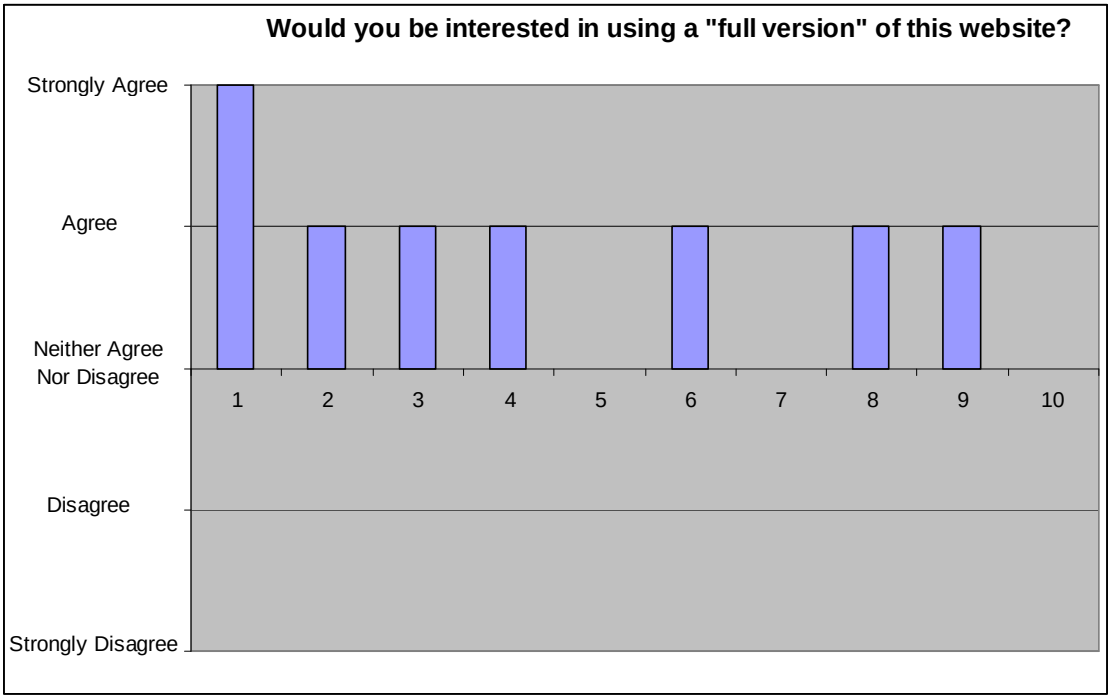
The seventh question was a form of follow-up to the previous question. During the development of the test website, the idea of a search function was considered if the contained information were to get quite excessive. The idea of a search function goes back to Jones *et al's* (1999) findings that users should be able to search if they want to, so this question was included to see if the users within this study would agree, keeping in mind what they thought about the text entry functions of the Sony PSP. This question was once again rated on a scale of "Strongly Agree" to "Strongly Disagree" with suitable gradients in between. Again, there was space for users to elaborate on their rating with their own comments. The results were as follows.



From these results it is quite clear that even though a lot of users disagreed with the Sony PSP's method of text entry, they would still largely like to have a search function if the site were to contain a lot of detailed information and more advanced functionality (such as working email/blackboard.) Some users had differing views, with one user stating that the existing menus are good enough and a search function may hinder the website but with another user adding that a search function would allow users to work "faster by not having to go through multiple menus."

3.3.2.8 Eighth question

The final question in the questionnaire is more related to possible future work on the project rather than directly proving the validity of the project's hypothesis. At the same time it does directly reference how much the user enjoys the website, so it is still valid in gauging whether or not the usability guidelines were a success. The question asked of the users was if they would be interested in using a "full version" of this website. As with the previous questions, this question was once again rated on a scale of "Strongly Agree" to "Strongly Disagree" with suitable gradients in between. Again, there was space for users to elaborate on their rating with their own comments. The results were as follows.



The reception to potentially using a "full version" of the test web site has garnered quite a positive response. Three users neither were interested nor uninterested, whilst the rest were interested, with one user strongly interested.

4. Conclusion

This project was to determine if existing mobile guidelines could be successfully adapted for utilisation on the Sony PSP. It first consisted of research into existing mobile guidelines and a study of existing mobile devices, their characteristics and how they influenced the creation of the mobile guidelines. The second step was to create a test website that was used to test the findings of the aforementioned research. The third step was to carry out a user evaluation in which potential end users of the completed mobile website would carry out a short user study before letting their opinion known on a questionnaire.

The findings of the user study and questionnaire were positive and it has been concluded that the hypothesis was proven correct, as the findings in the previous section all indicate that the users has little or no trouble in using the website developed for the Sony PSP that utilised the guidelines derived from the literature review.

With the aforesaid methods utilised in this project, the creation of the test website and the user evaluation, a lot of information was learned. However, a lot of details were missed out due to a lack of time with the project and because of certain faults out with the control of the project. As noted in the previous section, a lot of information on the Information for Students websites could not be accessed due to technical problems and time constraints. If this project were to be carried out again, it is also the recommendation that more user-based studying would have been utilised before the test website was developed in order to ensure that the web site was totally user friendly.

In developing this project, a lot of information was uncovered and skills improved. As well as the ability to research diligently, scripting skills in HTML and CSS were sharpened and enhanced, especially in respect to the latter technology. The benefits of involving end users in evaluating a system was also displayed, and aided in not just proving a hypothesis, but also getting across the message that developers alone must not be in charge of devising new systems meant for mass usage.

If the project were to be taken further, as it relates to the last question asked in the questionnaire, a “full version” of the Glasgow Caledonian University Information for Students website would be created. This would include the details that were left out due to technical problems (part time job listings) and time constraints (exam timetables) as well as possibly implementing working email and blackboard functionality.

Overall this study was a success. Existing mobile web usability guidelines can (and have) be utilised in the creation of websites for the Sony PSP.

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5.2 Figures

Figure 1: Perception of Narrow Web Pages on a Mobile Phone, 2003

Figure 2: Brighthand Reviews the Tapwave Zodiac (2004) [online]. Available from: http://www.brighthand.com/default.asp?newsID=10800 [Accessed 16th February 2007]

Figure 3: “Nix” (2005) IGN - Hands-On: PSP Web Browser [online]. Available from: http://uk.psp.ign.com/articles/637/637308p2.html [Accessed 16th February 2007]

Figure 4: “Nix” (2005) IGN - Hands-On: PSP Web Browser [online]. Available from: http://uk.psp.ign.com/articles/637/637308p2.html [Accessed 16th February 2007]