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Digital Visibility and Its Impact upon Online Usage: Case Study of a Health Web Site

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Digital visibility, a term coined by the Ciber research team at UCL, argues that use/consumption in the digital environment is not simply a function of need; it is also a function of visibility or prominence. It is a concept that describes and explains the impact of menu and topic prominence on transaction log (usage) statistics. This study repeats Ciber's digital visibility study, which was concerned with a Digital Interactive Television (DiTV) health information service, but this time the subject is a UK consumer health Web site, MedicDirect, a site attracting around a thousand users and 10,000 page views a day. Specifically the paper examines the change in use that results from increasing the prominence of two health pages – the cancer menu and cardiopulmonary resuscitation page on the Web site. The study was conducted over a three-month period when the links to the two health topics were placed on the home page and then moved and changed three times. Transactional log analysis was used to monitor the changes that occurred, the key metrics employed being number of users, number of page views, number of pages viewed in a session and number of visits made. It was found that, as predicted on the basis of our earlier results, use did indeed increase as a result of improving topic visibility. The results add further support to the findings of the initial digital visibility study.

Introduction

All Web sites have 'navigational signposts' through which content can be identified and accessed. By 'navigational signposts' we mean any recognisable digital "hotspot" linked to content. A navigational signpost is what makes a piece of content accessible or 'visible' via a predetermined link. The hotspot link can be activated either by a mouse button click, a touch screen or an alphabetical or numerical pad press. The hotspot itself must be recognisable and as such may contain, or be shown with, text. We do not include search engines in our definition of navigational signposts. A menu then is an organised, directed group of hotspot links, and has a very important role to play in navigating users to what they want, fast.

Digital visibility describes how visible or accessible content is as a result of navigational signposting, menu and hotspot prominence and argues that usage of a site and its contents will depend to a marked extent on its visibility. The Internet is an information environment that is becoming more and more like the Tower of Babel but, which at the same time, is becoming indispensable as a result of Government and Industry moving more and more life-critical or fundamental services to the platform. Consumers can only take advantage of these services and benefit from the huge choice offered if they can find what they want. Given the fact that virtually everything that is available is out of immediate sight and that we know that users have typically short attention spans, then digital visibility or prominence becomes a very important issue. Thus it has been estimated that the maximum time limit to keep users' attention is about 10 seconds (Nielson 2000); any longer than this and users tend to

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give up. This appears to correspond quite well with our own research, which has identified average page view time at about 10 to 12 seconds (Nicholas et al. 2004). What may in fact be happening is that if a user can spot a relevant topic on the home page (or the search engine results screen) and get there quickly (within 10 seconds) then they will use it. We have also found evidence elsewhere (Nicholas et al. 2004) that older users and users new to digital information systems (just the kind of people who are likely to use a consumer health site) will tend to terminate their session after just viewing one or two menu screens. It is thought that the strength of information need will also impact here, with those with a greater information need being more willing to spend time pursuing the search. Though, if the user does not have a good reason to believe that the site can deliver the information – an indication of which should be available from the home page, then why should they investigate submenus or even sub-sub menus. Once a topic or a service is buried within a long or complicated menu structure then many users will have little reason to expect the site or information system to deliver an answer to their query (in time).

Aims, objectives and scope of the study

The prime aim of this paper is to further our knowledge about the part that digital visibility plays in determining digital usage. We have seen its impact in a previous study (Nicholas et al. 2000), but only *after* the changes had been made, which the researchers were not aware of at the time of change. It was only discovered when sharp falls in the usage logs were spotted. This time an experiment was set up, which involved making changes to a site's navigational signposting, and then measuring the impact that it had on usage. Specifically, we wished to make some content more accessible by increasing its prominence by placing a link to it on the home page, when there was not one there before. Two items were given increased prominence through home page links. Transactional log analysis was used to monitor the changes that occurred, the key metrics employed being number of users, number of page views, number of pages viewed in a session and number of visits made.

Literature review

Studies have been carried out into how users negotiate electronic pages, usually by requiring them to retrieve information from them. Good examples are those undertaken by Hennig (1998) of the Bose Corporation Intranet site, and by Internet Guru Jacob Nielsen (2002). These studies examined online searching and browsing behaviour but did not attempt to utilise computer transaction log data to examine site organisation or navigation. In attempting to understand the success of a Web-based system, typically the studies looked at, navigation (how easy finding information is for the user within the resources of the site), information design (issues include the ease with which users can read from the interface, how understandable the system is, as well as aesthetics), and access. These are identified as key usability factors (Preece 2000).

Haigh and Megarity (1998) of the National Library of Canada recognised some six years ago that intimate knowledge of the structure of a Web site is crucial to produce accurate log analysis reports. Van der Geest (2002b) points out, in this regard, that information about the point of arrival can be used to redesign site structure. For instance, if many visitors arrive on a page that is hidden three layers deep in the site, it is time to reconsider the ordering of the information. Rozic-Hristovski et al. (1999) studied the phenomenon of site access when they used logs to evaluate a developing medical library Web site in Slovenia. The authors analysed and explored the Web server log files and suggested some possibilities for future development of the Web site based on page view generation data. Other studies (e.g. D'Alessandro et al. 1998) have used log data to examine the origin of users (by IP address) and their information behaviour. Results were used improve provision for their needs.

Nicholas et al. (2002) in a study of NHS Direct Digital, a UK Government supported consumer health information service broadcasted to subscribers of a digital interactive television service in Hull, England produced by Kingston Interactive Television (KIT), found that the service visibility on the KIT main menu was reduced over time and that this impacted on the take-up of the service. The study found that both access to and 'use' (as measured by users returning to the site, and

Figure 1: MedicDirect Home page

use and user statistics) of NHS Direct digital declined significantly over the survey period and these declines matched almost exactly changes in the positioning (resulting in a reduction in visibility) of the service in the KIT menus. As the service became more difficult to access as its sign posting became ever more removed from the television service's opening menu, the proportion of new visitors, as a percentage of all users, declined. New users were not coming through because of the increasing difficulty of finding the service. The authors argued that the reduced digital visibility of the service impacted on overall use metrics.

Background

MedicDirect (http://www.medicdirect.co.uk) is a commercial health information Web site and is unusual in that it is run and organised by doctors. MedicDirect aims to provide a complete health information resource for both consumers and medical practitioners. The site is hosted by 26 leading NHS specialists in the field of medicine in the United Kingdom; these consultants also comprise the majority shareholders in the privately-owned company. The medical information is written in plain, simple English and provides comprehensive and authoritative information online.

The MedicDirect home page is divided into three sections longitudinally down the page (Figure 1). On the left-hand side are the login features for registered and new users; there are also general links to information about the site, a site guide and press releases. A guide to the main sources of information contained on the site is located in the middle of the page, and is sub-divided itself into a 'Contents' and 'Features' section; these two areas provide copious links to the full repository of information on the site. The right hand side of the

page contains a shortened navigational menu with a series of links to news topics, videos, contacting a specialist, a medical A–Z, other resources, feedback facility, and the opportunity to join the mailing list of the site. Immediately below this is the 'Health Focus' area dedicated to raising the awareness of specific health themes.

The home page is spread over two screens, so only the contents section, part of the features section and the right hand menu options, are immediately visible prior to any scrolling down. The layout of the home page is designed to focus a user's attention on the contents and features section.

Table 1: Navigation on MedicDirect

	Contents Section*		
Menu Item	Three Screens Two Clicks	Four Screens Three Clicks	Five Screens Four Clicks
Clinics		√	
Disorders		√	
Operations		√	
Tests		√	
Virtual Body Tour		√	
Fitness and well being	√		
Complimentary medicine		√	
Travel Advice	√	√	
First Aid	√	√	
Self Assessment	√	√	
Student Health	√	√	√
Medicine cabinet		√	
Health Services guide	√		
Dental Health	√		
Diet and Nutrition	√		

* The table details the minimum number of clicks required to access a piece of information. In some instances the same piece of information can be accessed via more than one way from the home page and therefore the number of clicks required to navigate to the information varies.

Contents section

This area contains the main menu options, which allow users to access all the information content provided. The following menu items and links are provided:

- Clinics: a categorisation of all the common medical ailments and conditions.
- Disorders: allows users to search for their problems in an alphabetically arranged manner.
- Operations: types of anaesthetic used for various procedures, the length of time for certain operations as well as the recuperation period for them.
- Tests: offers information on various medical tests that someone can be offered.
- Virtual Body Tour: tour of the human body exploring the various parts of the human anatomy.
- Fitness and wellbeing: general information on fitness for various age ranges including eating, exercise and risks facing each group.
- Complimentary medicine: information on alternative medicines and availability of evidence to support their effectiveness.
- Travel Advice: provides region information and health issues associated with that area such as inoculations that will be required as well as various ailments that are prevalent there.
- First Aid: advice on how to deal with various first aid emergencies.
- Self-Assessment: examination techniques and tips on searching for cancerous moles, breast and testicular examinations.
- Student Health: information on typical problems faced by students covering issues such as alcohol, sex and drugs.
- Medicine cabinet: a guide to all over-the-counter and prescription medicines.
- Health Services guide: offers information on various aspects of the NHS and private health care.
- Dental Health: covers all aspects of dental problems including phobias, wisdom teeth and dental implants.
- Diet and Nutrition: explains various diets (high or low fibre) and how this can impact on your life, recommending suitable foods for each.

Features section

This is a distilled / highlight version of information contained on the site. The menu options are as follows; each option is presented next to a clickable radio button:

- Latest News: links to health topics currently in the news
- Popular clinics: a short selection of clinics on offer
- Health Highlights: specific issues of health are highlighted in this section
- Videos: all the videos showing various operations and general patient information. (There are a total of 30 videos.)

Reaching content

The number of menu screens a user has to navigate, from the contents section of MedicDirect, and hence the number of links they have to click on in order to reach content, varies, as detailed in Table 1. [1] The number of clicks required to get to the content is counted from the home page. The number of clicks required to reach a screen of information is always one less than the number of menu screens. For instance if three clicks are made to reach a piece of information then the user has been required to navigate four menu screens; if it takes two clicks to reach a piece of information then a user has navigated three menu screens and so on. Of importance to note is that real content (as opposed to navigational content) is a minimum of two clicks away from the home page, with the exception of the asthma link in the features section.

Methodology

MedicDirect agreed to firstly increase the prominence of two items by placing links to them on the home page and secondly to moving those links around on the home page – three different positions on the home page were tried. The links to the two topics included in the study were:

1. http://www.medicdirect.co.uk/clinics/default.ihtml?step=2&id=80 (Cancer link)
2. http://www.medicdirect.co.uk/minor_ailments/default.ihtml?step=4&pid=555 (Cardiopulmonary resuscitation link)

The first provided access to a cancer menu page and the second to a cardiopulmonary resuscitation (CPR) information page. Each page was uniquely identified via a query string affixed to the end of the URL because when a user clicks a link the system is designed to query the backend database to return the information requested. The cancer link transports the user to a generic information page, which presents further links to explore more specific cancer topics, such as "bladder cancer". In contrast the CPR link goes directly to a page that contains information on how to perform CPR on an infant, child and adult as well as what to check for if an individual in unconscious.

Table 2: Number of clicks and routes to the cancer menu page prior to menu changes

Menu	Two Clicks (three screen views)	Three Clicks (Four screen views)
Contents Section	Clinics – Cancer	Disorders – C letter – Cancer
Features Section	Popular Clinics – Cancer	(Not possible to access with this no. of clicks)

Table 3: Number of clicks and routes to the Cardiopulmonary Resuscitation Page prior to menu changes

Menu	Two Clicks (three screen views)	Three Clicks (four screen views)
Contents Section	First aid – CPR	Clinics – First Aid and Emergencies – CPR
Features Section	(Not possible to access with this no. of clicks)	Popular Clinics – First aid and emergencies – CPR

It is important to note that these two information topics were chosen deliberately to test the visibility hypothesis with health issues that offered scope to be popular and significant to users ('hot topics') as well as less immediately important and sensitive ones ('warm/cold topics').

Before the link was placed on the home page users could access the cancer menu page by viewing three screens or making two clicks with the mouse button from the home page. Table 2 illustrates the routes users had to take prior to the changes. A cancer topic could therefore, be approached either via the contents or features sections. It should be pointed out that cancer was not explicitly mentioned on the home page before the menu position change, in fact in our terms it had very low visibility.

Users could access the cancer menu page either by clicking on clinics under the contents section and then clicking on cancer (two clicks and three screen views from the home page). Alternatively, users could click on popular clinics under the features section and then click on cancer (two clicks and three screen views from the home page); lastly, users could access the page by clicking on the disorders option under the contents section then clicking on the letter "C" then clicking on cancer (three clicks and four screen views from the home page).

Table 3 provides a representation of possible routes the user could have taken to access cardiopulmonary resuscitation (CPR) information pages before its link on home page. Again CPR

Figure 2a: Period 2 positioning of links under Health Highlights on right hand side of Home page

Figure 2b: Period 3 positioning of links under Health Focus on central right hand side of Home page

was not explicitly mentioned on the home page prior to changes being made.

In the first instance users (row 2) could go via the contents section by clicking on first aid and then to the CPR page (2 clicks or three screen views including the home page). Alternatively the user could access the CPR page again from the contents section on the home page via Clinics then to First aid and emergencies and then to the CPR page (three clicks and four screen views including the home page). A third access route was provided via the features section by clicking through to Popular clinics then to First aid and emergencies and then to the CPR page.

The survey can be broken down into four time periods:

Period One – 1st October to 2nd November 2003 (the 'before' period). During this month the cancer menu page and the cardiopulmonary resuscitation (CPR) page were in their original position.

Period Two – 3rd November to 16th November 2003 (first period of change). For a period of two weeks links to the two items were placed on the right hand side of the home page screen under the features sub heading "health highlights". The link appears to the right and in the lower half of the screen. Health highlights appears in green and as a sub-title under the features section of the home page. Users could click on the radio button links. The wording is given in Figure 2a. Health highlights are a regular feature of the features section and during the research period users could also click on a link to MedicDirect's sister site on sports health and arrive there. MedicDirect also runs a site looking specifically at sports health.

Period Three – 17th November to 1st December 2003 (second period of change). For this two-week period the links to the two items were moved within the home page and placed under the sectioned information box headed "health focus". This is a boxed area and appears in a menu column on the central right hand side of the screen. Health focus is a regular feature of the Web site. Users could click on the underlined hypertext links. The wording is given in Figure 2b. Health focus is a regular feature of the home page and these two links were the only featured links under this section during the research period.

Period Four – 2nd December to 31st December 2003 (third period of change). The links were now moved to the right hand side of the Home page but this time just above the Health focus box. That is the items appeared in a list of links.

The most prominent positioning of the links was during period three when the links appeared in a box under the heading Health focus. This box was isolated from the other sections and did not contain any other information. The point size of the text in the Health focus box was also larger than was the case with the other two positions and the reader would not have had to have spent much time finding the items. For both positions, 2 and 4, there was quite a lot of additional menu information contained in both these sections that may have caused the user to miss the topics or choose something else. Comparing periods 2 and 3, the former offered marginally more visibility, as the fonts used on the menu on the right hand bar (Position 3) were smaller than those used in the features section.

All menu changes were monitored in real-time using the service transaction logs and these logs were analysed by Ciber researchers. Log files are

Figure 3: MedicDirect – daily number of pages viewed (October –December 2003)

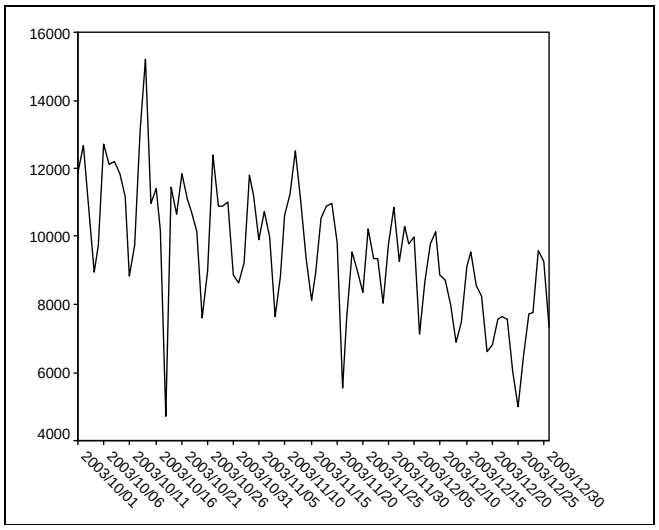
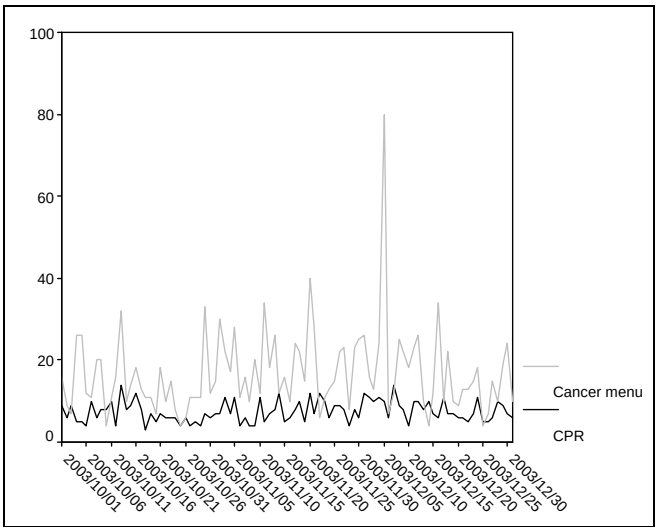


Figure 4: MedicDirect – daily page views to cancer menu page and Cardiopulmonary Resuscitation (CPR)



machine-generated records of user activity. A detailed explanation of how the data is analysed can be found in a number of articles published by the authors (Nicholas et al. 2001, Huntington et al. 2002). However, in general, Web sites are visited by users that make use of site content by viewing pages, though many users will visit a site and leave without viewing content. Users on the Internet are by and large difficult to track, the reason for this is that users are identified solely by an IP (Internet Protocol) address, and that there is not a complete or good mapping of IP number to user. IP addresses are allocated to computers rather than individual users and there may well be a number of people using the same computer; hence, IP address usage will not accurately represent user numbers. Furthermore, computers maybe allocated a temporary or floating IP address and hence we cannot be sure that a returning IP address identifies the same user. And, lastly, users may connect to the Internet via a proxy IP address and in this case a number or organisation of computers will access the Internet using the same IP Number. Pages are counted by looking at the complete download of a page from the server to the users' or clients' computer. However, the server will not necessarily count all pages viewed by the user. This occurs because the client's computer will cache recently viewed Internet pages to the hard drive and subsequent views to these pages will be accessed from the hard disk rather than requested from the server. Given these difficulties a page count is still estimated and for the present study caching is not thought to have an effect. There is no evidence that the rate of caching changed over the period of the study.

Results

Figure 3 shows the daily number of pages viewed for the three-month study period. Daily use varied from about 8000–9000 page views to 12,000 to 13,000 views. The pattern in the data reflects usage patterns by day of week; the amount of use dropped by about a third on Sundays compared to weekday use and by a quarter on Saturdays. There are, in addition, occasional peaks and troughs in use which are most notable on the 13 October (peak), the 17 October (trough) and the 20 October (trough). No reason can be given for these. A decline in daily use figures can be seen from the end of November and this decline is typical of Internet use, which tends to dip over the seasonal period. In looking at the whole period a decline can be observed; however, long-term cyclical patterns in use are not untypical of Web usage.

The daily page views for each page are given in Figure 4. In both cases they are quite low. Over the survey period, the average daily views to the cancer menu page varied between 5 and 20 pages while daily views to the cardiopulmonary resuscitation (CPR) page varied between 2 and 13 pages.

Table 4: MedicDirect- average daily page views for all pages, cancer menu page and Cardiopulmonary Resuscitation (CPR) page for each period.

	Days N	Average daily views	% change	Average daily views Cancer	% change	Average daily views CPR	% change
Period 1: 1st Oct to 2nd Nov	33	10,685		14.5		6.8	
Period 2: 3rd Nov to 16th Nov	14	10,129	-5.2%	18.0	+24.1%	7.2	+5.9%
Period 3: 17th Nov to 1st Dec	15	9,320	-8.0%	20.1	+11.7%	8.4	+16.7%
Period 4: 2nd Dec to 31st Dec	30	8,196	-12.1%	17.5	-12.9%	8.1	-3.6%
Over the 3 Months	92	9565		16.9		7.5	

One point that can be observed (Figure 4) is that there is no pattern of general decline as noted previously with the general figures. As said earlier, views to pages are expected to decline during the winter seasonal break 23-31 December. This appears to have occurred to overall views but not to views of the two pages that were moved to the home page. That is, use of these pages appears to have bucked the declining trend. There was a peak in use of the cancer menu page on 6 December when use of this page reached 80 views; we found no explanation as to why this peak occurred.

Table 4 gives the period for each position, the number of days in position and a record of average daily page views for all views, daily views to the cancer menu page and to the cardiopulmonary resuscitation (CPR) page.

Over the four survey periods average daily page views to the MedicDirect site declined from 10,685 in period one to an average of 8,196 daily views in period 4. In terms of percentages there was a 5.2% decline between periods one and two, an 8.0% decline between periods two and three, and a fall of 12.1% between periods three and four. These declines were not matched in the case of views to the cancer menu and cardiopulmonary resuscitation (CPR) pages. In fact there was an increase in views between period one, the original position, and period two when the links were placed on the home page. In the case of views to the cancer page this proved to be substantial: a 24.1% increase. For CPR the increase was 5.9%. Both pages also recorded increased use between periods two and three of 11.7% and 16.7%, respectively. However, the use of both topics declined between periods three and four, by 12.9% in the case of the cancer menu page and 3.6% for CPR.

It should be noted that the views to each case study topic, as a percentage of total views, was small – about 0.14% in period 1 for the cancer menu and 0.064% in the case of cardiopulmonary resuscitation. Therefore the increases in the average number of pages viewed for the cancer menu and cardiopulmonary resuscitation were small. The increase in views to the cancer page increased on average by about four and to the CPR page by one, between periods one and two. Statistically, the variation between the original position in period one and the home page positions (periods two to four) was no different in the case of views to the cancer menu page from the day-to-day variation of the average daily pages viewed, though the difference was found to be statistically significant, 7.9 pages viewed per day (period 2 through to 4) as opposed to 6.8 in the case of views to CPR pages. [2] Clearly there was an absolute increase in views to this page, albeit only an increase of on average 1.1 views per day, as a result of a link being put onto the home page.

The above analysis, however, ignores the underlying decline in overall views as a result of the seasonal break. To allow for this, it was decided to use proportions derived by dividing the views to the cancer page and cardiopulmonary resuscitation page by total views. The proportion is the share of views of each page in the total of views. Page views to the cancer menu as a proportion (times 100) of total pages viewed increased from 0.14 in period 1 to 0.18 in period 2, to 0.22 for period three and for the last change declined to 0.21. These differences are statistically significant. [3] In percentage terms this represents a 31% increase from period 1 to period 2 and a 60% increase

Figure 5: MedicDirect – distribution to views to cancer menu, Cardiopulmonary Resuscitation (CPR) and other pages by requests in a session.

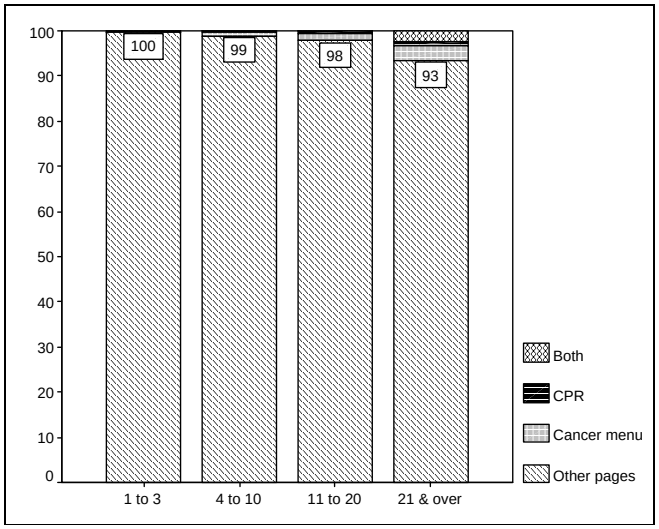
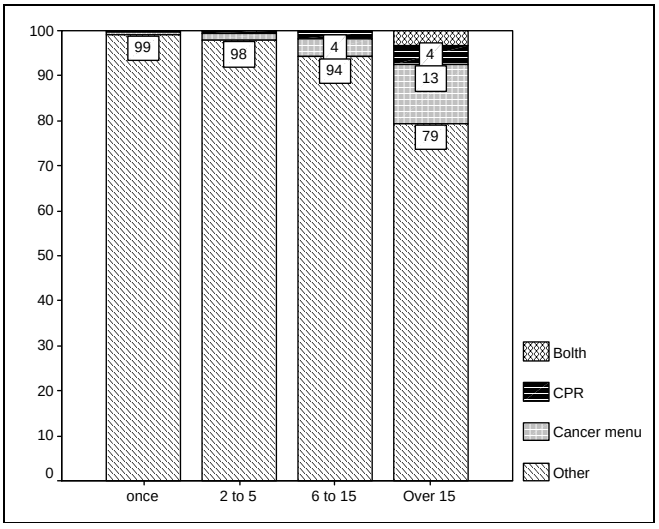


Figure 6: MedicDirect – views to cancer menu page, Cardiopulmonary Resuscitation (CPR) and other pages by number of visits.



from period 1 to period 3. The proportion of views to CPR were considerably smaller but again an increase could be observed from 0.064 in period one to 0.071 in period two, 0.090 for period 3 and .098 in period 4. Here there was no decline in period 4. Furthermore, these differences are statistically significant. [4] In percentage terms this represents a 12% increase from period one to period two and a 41% increase from period one to period three. In both cases, once the underlining decline was taken into consideration, there was sufficient evidence to say that there was an impact on use as a result of increasing the prominence.

The most significant increase in views occurred between periods 1 to 2. This was the period that saw the biggest enhancement in visibility, both items moved from relative obscurity (two to three clicks away) to the home page fame. Furthermore, there was a significant increase in usage of the cancer menu page and CPR page as a result of the move that occurred between periods 2 to 3. Out of the three home page positions period 3 saw probably the two topics being given their most prominent position. This link appeared in a box under the heading Health focus, furthermore the box was isolated from the other sections and did not contain, unlike the links in period 2 and 4, lots of other information. The change in usage patterns from period 3 to period 4 declined in real terms though a slight increase was found once the underlying decline pattern of overall usage was taken into consideration. The link in period 4 was not as visible as the link in period 3 and this perhaps accounted for the relative downturn in use during period 4.

Site penetration

Figure 5 examines the number of pages viewed in a session, a form of analysis we call 'site penetration'. Looking at the use of the cancer menu page and cardiopulmonary resuscitation page it can be seen that those people conducting longer sessions were more likely to visit these pages. This was true for 7% of those viewing 21 or more pages in a session compared to 2% viewing 11 to 20.

Return visits

Looking at use of the cancer menu and CPR pages by frequency of visits (Figure 6) it can be seen that those visiting the site more often were more likely to visit these pages. Approximately 21% of users who had visited over 15 times had viewed one or both of these pages this compares to 6% of users visiting between six to 15 times and 2% visiting two to five times.

Clearly there maybe two effects at work here: new users coming into the site may be more willing to visit the more prominent menu items and, secondly, that those returning to the site notice that there has been a menu change and are more willing to view the item.

Conclusion

This paper has demonstrated the use of transactional logs in monitoring changes in a site's navigational links. It is concluded that there was an impact as a result of making topics more visible by placing links to them on the home page. The menu prominence of two pages (the cardiopulmonary resuscitation page compared to the cancer menu page) was changed over a three-month survey period. Increased menu prominence resulted in greater use. The most significant increase in views occurred as a result of the move from a relatively obscure position, two to three clicks away from the home page, to the home page; this resulted in an increase in page use of the cancer menu page of a tenth and an increase of the CPR page by a third. Out of the three home page positions considered, the one providing the most prominence was the presentation of the links in a relatively uncluttered position on the home page – highlighted in a box and away from the other sections. The links did not contain, unlike the other positions, additional information. The impact seems to have been greater in the case of the cardiopulmonary resuscitation page compared to the cancer menu page.

The sample size of the study was not unduly small – the number of days sampled exceeded a hundred and page views averaged 10,000 over this period; the results proved to be statistically significant. This result does support the digital visibility hypothesis developed by the authors (Nicholas et al. 2002) on the back of a study of a Digital Interactive Television (DiTV) health service, which argues that changing the positioning of a menu item will impact on the number of hits that that item attracts and that visibility is a key usage driver.

Notes

1. For this paper content is defined as information specifically pertaining to a medical ailment, disease or condition.
2. T=2.1 90df p=.042
3. F=2.853 df 3,88 p=0.042
   Chi=10.5 df=3 p=.015 (Kruskal Wallis test)
4. F=10.608 df 3,88 p=0.000
   Chi=25.8 df=3 p=.000 (Kruskal Wallis test)

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