A Study of Information Richness and Downloading Time for Hotel Websites in Hong Kong

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Abstract

It is generally agreed that a hotel website is created for attracting business. Adding visual materials such as images and multimedia files can enrich the website's content and enable a visitor to better understand the hotel. However, the more visual materials that are put on the website, the longer the download time. This study analyzed 102 Hong Kong hotel websites' home pages. Empirical findings showed that economy hotels had fewer image files than their luxury counterparts but the total file size of the former group was much larger than the latter. Moreover, most luxury hotels used script programs to handle sophisticated web functions such as member login and room availability; whereas only half of the economy and mid-priced hotels used script. In general, the difference on average web page size between luxury hotels and economy hotels was only 100KBytes (371KB and 271KB). Luxury hotels, however, contained an average of 47 objects and economy class hotels only contained 18 objects. As a result, when download speed is considered, the number of objects is not the major factor, but file size needs to be measured carefully.

Keywords: Hong Kong, hotels, web page, download speed, website optimisation.

1 Introduction

Ever since its introduction to the commercial world, the Internet has become a useful tool for marketers and consumers both for communicating information and online purchasing (Dellaert & Kahn, 1999). To this end, the rapid growth in the number of online users is clearly evident in the importance of the Internet. According to the Internet World Stats (2007), the global population of Internet users has increased 225% between 2000 to 2007. Web users also now expect more functionality (content) and richer information from the Internet (Pons, 2006). In response to this increasing expectation, business managers have , and will continue to, provide more online information on their websites. Although the number of web users has largely increased in recent years, slow web page download speed continues to be a major problem that vexes users. A large volume of web page content requires a longer web page downloading time (Galletta et al., 2004; Nah, 2003), causing lower service satisfaction and making some leave (Hoxmeier & DiCeare, 2000; Galletta et al., 2004; Rose et al., 2001). As such, any attempts to reduce web page download time can help retain most, if not all, web visitors, leading to higher website service quality (King, 2003).

Hong Kong, being a popular travel destination in Asia, largely relies on tourism to support its local economy (Chan and Law, 2006). In 2006, there were 25 million visitor arrivals in Hong Kong. Average hotel occupancy rates were 87% (Tourism Commission, 2007). At present, consumers commonly use the Internet to check travel related information before they physically visit a destination. As such, travel websites enable travellers to get a first expression of Hong Kong. To better serve this need, website designers must enhance web page performance by considering web page download speed.

Most prior studies of response time of tourism websites concentrated on the affectation of website design such as customers' perceptions or attitude, and subjective website performance evaluations. Only a limited number of prior studies has attempted to examine the factors that can affect web page download speed in the context of tourism. The primary objective of this research is, thus, to evaluate the general download speed performance of hotel websites in Hong Kong using five factors, namely HTML, image, external CSS, external script, and multimedia. A commercially available online website optimization analyser program was used as in the research.

2 Literature Review

Several prior studies have indicated that response time is a key aspect of e-commerce quality (King, 2003, McKinney et al., 2002; Torkzadeh & Dhillon, 2002; Turban & Gehrke, 2000). When download time is out of users' expectations, they will leave and seek alternative sites (Ranganathan & Ganaphy, 2002). This, in turn, results in low service performance comments from users and may even result in their abandoning a site forever (Shneiderman, 1998). In order to attract visitors and increase a website's competitiveness, website developers are paying more attention to web page download speed. Prior studies that are related to this topic largely fall into two main areas: users' perception and web delay factors.

The existing literature comprises many studies that investigate customers' performance, attitudes, and behavioural intentions at different web page delay time. Galletta et al. (2004) examined the relationship between users' perceptions and web page delay times at intervals of 0 to 12 seconds. In addition, Hoxmeier and DiCesare (2000), Ramsay et al. (1998), and Weinberg (2000) conducted similar studies. Findings of these studies all indicated that slow website response time could have a significant impact on online service, leading to low customer satisfaction and poor productivity among users (Dellaert & Kahn, 1999; Galletta et al., 2004; Nielsen, 1999; Rose et al., 2001).

Although slow web page download speed can lead to various problems, only a small number of published articles have investigated the relationship between web page delay impact factors and website optimization. Usually, large sizes of web page content (text, graphs, multimedia and codes) are the main factors affecting download speed (Jacko et al., 2000; Pons, 2006). Pons (2006) comments though that under the same situations, some large content web pages can be downloaded faster than small

content web pages. Therefore, a study on website download speed and website's response time would provide useful insights on the factors which would have an impact on download speed, leading to website optimization (King, 2001; 2003).

3   Methodology

This research investigates the general performance of hotel websites in Hong Kong. Weinberg (2000) indicated that a website's home page was the most important page within a website. It should have abundant content (text, graphs and multimedia), and a short download time. In addition, the home page is the first opportunity to give visitors a first impression of a site. Web page download time is difficult to measure because many factors can affect download speed. Examples include client broadband performance, computer performance, and server location. In order to provide an objective view of web page download performance, this study compared the file size rather than timing the actual download speed. The web analyzing tool used in this study was a commercially available website optimization analyzer. The test examined five basic web page design dimensions: *HTML, Image, External Scripts, External CSS files and Multimedia files* (see Table 1). Test results also reflect the total page size, composition, and download time of a website. In this context, the web analyzer can provide improvement recommendations. The software can also be applied to different areas such as personal blogs (http://www.lemongtree.com and http://www.osxcn.com), and business IT websites (http://webdesign.about.com, http://www.genealogy-computer-tips.com and http://www.webaim.org).

In Hong Kong, a total of 112 hotels were members of the Hong Kong Hotels Association in mid-2007. This study examined 102 hotel websites. The other ten websites could not be analyzed because they were either created by Microsoft's .NET application (e.g. /default.aspx) or the websites needed additional parameters to retrieve information (e.g. /index.html?propertyID=1826).

Table 1. Five basic webpage design dimensions

Basic Dimensions	Definition	Benefit for webpage
HTML	A computer language used to mark up web pages and display web content.	It is basically the universal language of web design, and the size of HTML is a key factor for fast page display (King, 2003).
Image & Multimedia	*Image and Multimedia files* display visual and aural product images such as video, audio and graphics (Chan and Law, 2006).	Multimedia & images have been shown to motivate and attract visitors to use a website (Hong, Thong, and Tam, 2004). Too many or too large sized images can lead to download delay (Perdue, 2001).
External CSS (Cascading Style Sheets) files	*CSS file* is a new style sheet language, which can be applied to any web page and used by both website designers and users to create elements such as colours, layout, and headers (Wikipedia, 2007 and Webopedia, 2007a).	CSS style web elements can save 25 to 50 percent of the file size compared to old-style web elements (King, 2003).
External Script	Script in computer programming languages is commonly called script languages. These languages are typed directly from a keyboard. The script languages can be written as internal or external part of the webpage program (Wikipedia, 2007).	External script means the program is written out of the whole web program, making it easier to change the webpage.

No officially classified star rating lists of hotels exists in Hong Kong. . The study, therefore needed to develop a proxy system to rate hotels. Three local and international hotel reservation websites (www.hotel.hk, www.hotels.com, and www.hotelsinhk.net) were compared, to classify hotels. Hotels were divided into one of three groups : i) 'economy class' representing two and three-star hotels, ii) 'mid price' representing four-star hotels, and iii) 'luxury hotels' encompassing five-star hotels. Table 2 shows the summary of different hotel categories.

Table 2. A Summary of Different Hotel Classes

Hotel Class	Hotel Main Pages Analyzed	Total Website Available
Economy	42	42
Mid-priced	38	42
Luxury	22	23
Total	102	112

In this study, empirical findings of various types of web services were displayed using different colors, which in turn, revealed whether the web page download speed was good, satisfactory, or problematic. A score of 3, 2, or 1 was then assigned for the good, satisfactory, or problematic performance in each of the analyzed types of service. Results were then analyzed by SPSS to compare mean scores.

4   Findings and Discussions

Five dimensions, namely HTML, image, external script, external CSS, and multimedia were analyzed. The average score hotels in each class is shown in Table 3.

Table 3. Average Scores for Different Dimensions of the Selected Hotels

Overall Rating		Economy	Mid-priced	Luxury	All Hotels
HTML (n=102)	Total no. of files	2.98	2.97	3.00	2.98
	Total Files size	2.68	2.74	2.64	2.69
Image (n=97)	Total no. of files	1.54	1.53	1.32	1.46
	Total Files size	1.26	1.19	1.36	1.27
External Script (n=72)	Total no. of files	2.33	2.04	1.95	2.11
	Total Files size	1.50	1.43	1.30	1.41
External CSS (n=70)	Total no. of files	2.96	2.89	2.74	2.86
	Total Files size	2.52	2.00	1.37	1.96
Multimedia (n=32)	Total no. of files	2.75	2.71	2.83	2.77
	Total Files size	1.08	1.07	1.00	1.05
Overall (n=102)	Total no. of Objects	1.38	1.24	1.14	1.25
	Total Web page	1.45	1.16	1.23	1.28
	Average Score	2.04	1.91	1.82	1.92

*   *Scores ranged from 1 to 3, higher scores mean fewer files or smaller file size with shorter download time (Shaded colour shows the highest score in that row)*

The HTML dimension gets the highest score among all dimensions with an average of 2.98 points. Only two hotels had more than three HTML files and the size of HTML files was relatively small. Image files and multimedia files did not perform well because there were both large images and large numbers of images on luxury hotels' web pages (on average more than 47 images). Similarly, the average image file size for economy class was relatively large (more than 10KB each). In addition, using multimedia files was not as popular as images since only 31% the analyzed hotel web pages incorporated multimedia into their web pages. Inevitably, all hotel classes received very low scores (average = 1.05) and luxury hotels even scored 1.00, meaning that all luxury hotels' web pages had very large multimedia files. On the basis of the average scores, luxury hotels performed the worst (average score = 1.82); whereas economy hotels performed the best (average score = 2.04).

4.1   HTML

If a web page contains more than one HTML file, it means the web page has multiple frames. A search engine normally treats each HTML file as an independent web page. When customers retrieve hotel information from search engines, they may only get partial web information. As a result, many hotels have stopped using frames as their website templates. According to the findings of this study, eight economy and mid-priced hotels have multiple HTML files. Five of them had two HTML files, one had three HTML files, and two had five files. For the two that had five HTML files, their main pages were divided into four areas of top banner, top menu, content area, and footer. This way of arranging fragmented information could cause difficulties for visitors to retrieve the overall view of the website.

No significant difference were noted in hotels web page size among different hotel classes. The average HTML file size was about 14.2KB for economy hotels, and the corresponding numbers for mid-priced and luxury hotels were 14.1KB and 21.5 KB respectively (Table 4). However, great variation was noted in file size for hotels within each individual class. The size of HTML files for economy and mid-priced hotels ranged from 0.29KB to 68KB, and the range for luxury hotels was from 2.89KB to 57KB.

Table 4. An Analysis of Hotels' Main Page HTML Files

HTML		Number of Files	Total File Size (Bytes)	Average File Size (Bytes)
Economy (n=42)	Mean	1.22	17,321.07	14,203.28
	std	0.72		
Mid-priced (n=38)	Mean	1.16	16,320.16	14,094.68
	std	0.68		
Luxury (n=22)	Mean	1.00	21,520.18	21,520.18
	std	-		
All Class (n=102)	Mean	1.15	17,859.15	15,549.78
	std	0.60		

4.2   Image

Images are one of the most attractive and important items for web pages. As shown in Table 5, economy hotels' web pages had on average 15.41 images (ranging from one to 42 images), while luxury hotels had an average of 38.86 images (ranging from three to 111 images). When the total image file size was compared, economy hotels' image size was even larger than luxury hotels. As indicated in Table 5, the average file size of an image on economy class hotels' web page (10,688 bytes) was almost three times as big as the luxury hotels (3,317 bytes). Interestingly, five hotel web pages did not contain any images. Apparently, these hotels made use of multimedia files to replace all image files that made the web pages more interactive and attractive.

Table 5. An Analysis of Hotel Main Page Image Files

Image Files		Number of Files	Total File Size (Bytes)	Average File Size (Bytes)
Economy (n=39)	Mean	15.41$^{\Delta}$	164,699.62	10,687.66
	std	9.53		
Mid-priced (n=36)	Mean	18.75$^{\#}$	107,330.11	5,724.27
	std	16.59		
Luxury (n=22)	Mean	38.86$^{\Delta, \#}$	128,907.45	3,317.23
	std	37.13		
All Class (n=97)	Mean	21.97	135,290.03	6,158.20
	std	22.91		

$^{\Delta}$ *The mean difference for these two hotel classes is significant at the 0.05 level (p=0.000)*
$^{\#}$ *The mean difference for these two hotel classes is significant at the 0.05 level (p=0.002)*

4.3 External Script

To enhance the usability of web pages, many web designers make use of external script files to create special functions to cater for special needs. Among the 102 hotel web pages, 72 had external script files (70.59%). The number of external script files used for all classes of hotels web pages ranged from one to 15 files, with the average of about four to six files (Table 6). For luxury hotels, their main pages normally included many functions such as member login, availability search, newsletter subscription, and banner advertisement. The external script files sized in the range of 0.6KB to 250KB, except for two luxury hotels' external script files that were about 800KB.

Table 6. An Analysis of Hotel Main Pages' External Script Files

External Script Files		Number of Files	Total File Size (Bytes)	Average File Size (Bytes)
Economy (n=24)	Mean	3.54	39,363.04	11,114.27
	std	2.87		
Mid-priced (n=28)	Mean	4.96	46,722.18	9,411.66
	std	3.77		
Luxury (n=20)	Mean	5.70	127,879.05	22,434.92
	std	3.74		
All Class (n=72)	Mean	4.69	66,812.71	14,232.29
	std	3.55		

4.4 External CSS

On average, about 70% of the hotel web pages made use of external CSS files as web templates. More specifically, 26 hotels (18.20%) used multiple external CSS files for handling different needs. For web pages that had two or more external CSS files, one was used as the standard format and the remaining ones were used for special

occasions such as festivals and special function format like forms printing. As a whole, luxury hotels' main pages contained two external CSS files, while economy hotels only had 1.22 files (Table 7). Economy hotels' external CSS file size ranged from 0.52KB to 28.8KB, whereas the corresponding numbers for luxury hotels were 1.28KB and 73KB respectively. Thus the average size of external CSS files for luxury class hotel was more than three times of that for economy hotels. Seemingly, the size of external CSS files could affect the overall website performance because every time when a visitor clicks a new page, the relevant external CSS file would be loaded. If the file size gets large, the overall website loading time will be slowed down.

Table 7. An Analysis of Hotel Main Pages' External CSS Files

External CSS Files		Number of Files	Total File Size (Bytes)	Average File Size (Bytes)
Economy (n=23)	Mean	1.22^{Δ}	$5,478.70^{\#}$	4,500.36
	std	0.52		
Mid-priced (n=28)	Mean	1.54	11,776.25	7,668.26
	std	0.92		
Luxury (n=19)	Mean	2.00^{Δ}	$19,242.84^{\#}$	9,621.42
	std	0.88		
All Class (n=70)	Mean	1.56	11,733.70	7,535.40
	std	0.85		

$^{\Delta}$ *The mean difference for these two hotel classes is significant at the 0.05 level (p = 0.007)*
$^{\#}$ *The mean difference for these two hotel classes is significant at the 0.05 level (p = 0.009)*

4.5 Multimedia Files

Among the analyzed hotel web sites, only 32 home pages (31.37%) contained multimedia files (Table 8). Among the 22 luxury hotels, only six used no more than three multimedia files on their front pages. Files size ranged from 139KB to 0.58MB. Both economy class and mid-priced hotels' web pages had no more than three files with the size ranging from 12.3KB to 1.32MB and 4.8KB to 2.7MB, respectively. The opening time for the two hotels that had multimedia files larger than 1MB was obviously slower than those of other hotels.

Table 8. An Analysis of Hotel Main Pages' Multimedia Files

Multimedia Files		Number of Files	Total File Size (Bytes)	Average File Size (Bytes)
Economy (n=12)	Mean	1.67	370,364.33	222,218.60
	std	1.07		
Mid-priced (n=14)	Mean	1.86	441,372.50	237,297.04
	std	0.86		
Luxury (n=6)	Mean	1.33	355,976.33	267,651.38
	std	0.82		
All Class (n=32)	Mean	1.69	398,732.66	236,286.02
	std	0.93		

4.6   Overall Web Page Performance

A significant difference in average number of objects was noted between economy and luxury hotels. Within each of the hotel classes, members also exhibited wide differences in overall performance (Table 9). When the number of objects was considered, economy and mid-priced hotels ranged from one to 49 and 103 objects, and luxury hotels ranged from four to 128 objects, respectively. Total file size for economy and mid-priced hotels ranged from 0.29KB to 1.4MB and 2.7MB, whereas file size for luxury hotels ranged from 75KB to 1.36M. Apparently, the control of overall file size for luxury hotels was better than economy and mid-priced hotels in that luxury hotels were able to maintain a reasonable amount of information on the web page, while ensuring web pages were not oversized to slow download time.

Among the analyzed web pages, luxury hotels had 2.5 and 2.0 times more objects than economy and mid-priced hotel web pages respectively. Although the number of images on luxury hotels' websites was much larger, the total file size for economy hotels (278KB) was 26% smaller than luxury hotels (380KB) (Table 9). As a result, the average object size for economy and mid-priced hotel web pages was almost double the size of luxury hotels. When checking each hotel page size individually, the total file size ranged from 4 KB to 2.7MB.

Table 9. An Analysis of Hotel Main Pages' Overall Size and Number of Objects

Total Web Page		Number of Objects	Total File Size (Bytes)	Average Object Size (Bytes)
Economy (n=42)	Mean	18.67^Δ	278,485.52	14,918.87
	std	11.25		
Mid-priced (n=38)	Mean	$24.39^\#$	323,717.05	13,269.95
	std	17.98		
Luxury (n=22)	Mean	$47.32^{\Delta, \#}$	380,384.59	8,038.56
	std	39.00		
All Class (n=102)	Mean	26.98	317,314.72	11,760.94
	std	24.65		

Δ *The mean difference for these two hotel classes is significant at the 0.05 level (p =0.000)*
$\#$ *The mean difference for these two hotel classes is significant at the 0.05 level (p =0.001)*

5   Implications and Limitations

This study shows the presence of the recent practice of replacing image files with multimedia files, making sites more interactive and attractive for visitors. Moreover, with the increasing popularity of broadband Internet connections, download time for large files has become less of a concern for web designers. This study determined that the average image size for economy hotels was relatively high (10.4KB each). With advanced image compression technology, the image size can be largely reduced, making download time faster or enabling more images to be placed on a web page.

There are a few limitations in this study. First, this study has analyzed the first entry page of hotel websites but a few hotels only used the front page as a cover page that

did not show the actual layout of the websites. Additionally, the websites that were created by .NET applications were unable to be analyzed by the commercial software. Since .NET application is the latest technology, findings of this study could not reveal the latest web development. Finally, many chain hotels share the same web template irrespective of whether the hotel was an economy, mid-priced or luxury one. Therefore, the comparison of different hotel classes might not represent actual performance. Future research is thus recommended to investigate web performance for individual hotels versus chain hotels.

6   Conclusions

After the practical discovery that search engines treat individual HTML frames as an individual page, only a small number of hotels now use frames in their web design. As such, more than 90% of the hotels performed well in the HTML part of this study. Moreover, to make a website more interesting and attractive, five economy and mid-priced hotels purely used multimedia files on their main web home pages. Also, script programming plays an important role on luxury hotel websites as their file size was relatively larger than the others. Luxury hotels usually put the member login and room availability on the first page in order to create a convenient environment for visitors to make reservations.

In order to provide sufficient information on the website and not to affect the download time, web designers should compress images and multimedia files using image compression software to minimize the file size. The reduction of the size of their images and multimedia files while increasing number of images should be applicable not only to luxury hotel websites but also to all hotel websites. Since economy hotels' web page size was only 100KB smaller than luxury hotels, the downloading time for this 100KB would not have much effect on the opening speed of a web page if a broadband connection is used. For this reason, luxury hotels prefer to have larger page size to maintain information richness. Second, as the home page provided visitors the first impression of the hotel, to supply them with the necessary information, the home page should include the most attractive information of the hotel such as promotion and room availability.

The research findings show that the overall performance of downloading images and multimedia were not ideal. Luxury hotel websites have the largest sized multimedia files among all hotel websites. On one hand, it is good for hotels to promote their products and attract more visitors. On the other hand, users may leave a website if it takes too long to wait for the image to be displayed. As mentioned previously, the average image size for economy hotel was three times larger than luxury hotels. If the economy class hotels can further compress their image files, their downloading speed could be further improved.

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