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The research as described in this document was done by the first author as noted below. He was a BTech student at the Cape Peninsula University of Technology (CPUT) in 2014 - the topic was given as a student project at Honours level. This working paper has not been peer reviewed, but has been edited for basic grammar and accuracy. References have been standardized as far as possible according to the Harvard system. Consider this document as a working paper, to be used for basic referencing but not as seminal source for research work. It could be useful for research in the fields of Website Visibility, Information Retrieval, Website Usability, Interface Design and Search Engines.

The effect of search engine
interface design on user perception

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Submitted October 2014   Edited, published December 2014

Field: Information Science
Topic: Search Engines

<u>Harvard Reference</u>:

Bougaardt, R. & Weideman, M. 2014. The effect of search engine interface design on user perception. *Working Paper*, Cape Peninsula University of Technology, Cape Town. Available online: http://www.web-visibility.co.za/website-visibility-abstracts-seo.htm

Abstract

Search engines are programs which enable users to retrieve information from the Web. Interface design is one aspect to consider when designing a search engine. This research paper focuses on how search engine interface design affects the user's perception of these programs. The objective of this study is to determine which of the three well know search engines is the most popular (based on its interface), as well as to find a link between the search engines' interface design and the user's choices. This study utilized a quantitative research method. A questionnaire was used to collect the data which involved 20 participants. Based on interface preference, Google used the preferred search engine interface for most participants, followed by Yahoo! and then Bing. This differs in the last two positions when compared to the figures for core searches done in the USA.

Keywords

1.   Introduction

There are many search engines provided by organizations on the Internet today. The most popular search engines (based on usage in the USA) are Google, Yahoo! and Bing. The interface provided by the search engine should be suitable for all users. The interface design of a search engine is important when considering the large number of users accessing it daily. Most users tend to choose a particular search engine that helps them achieve their intended goals. This study focused on the top three most popular search engines on the Web currently, namely Google, Yahoo! and Bing. The study has employed a quantitative research methodology whereby the researcher aimed to gather and rework data from users. The data was collected by means of a questionnaire. The data of the questionnaire has been collected and documented and presented in this paper. The output of this research is intended for anyone involved with search engine interface design. The main purpose of this study was to determine how the effect of search engine interface design affects the users' perception and search engine choice.

2.   Background to Research Problem

2.1   Search Engines

According to Edosomwan *et al* (2010), at the time of writing, there were more than one trillion webpages available on the Internet, and it was projected that this number would continue to grow indefinitely. More and more new webpages are added to this pool every hour. All this new information must be made accessible to all users who have access to the Internet. This is essential for most webpages (especially those with commercial intent) to accomplish its key goals. For retrieval of this new information, many companies and organizations have developed search tools, to overcome the problems of information retrieval (Edosomwan *et al* 2010). The primary goal of a search engine is to find, retrieve and present information from the Web, an intranet or a database. A search engine matches search queries provided by a user to an index that the search engine create and maintains. Most of the users of search engines have one goal in mind: to obtain relevant information based on their search query quickly from the Web.

The most well-known search engines in the U.S. are Google, Yahoo! and Bing. When viewed globally, two other search engines make up the top five (China's Baidu and Russia's Yandex). The three main search engines compete with each other in terms of producing better results as well as improving the functionality of the search engine. Table 1 indicates which search engines are used the most based on the number of search queries performed. The top three combined contributed around 96% of core searches done per month in the U.S.A – the reason why they have been chosen for this study.

Table 1: Number of core search queries in the U.S. for the related search entity for August 2014 (Lella, 2014)

comScore Explicit Core Search Query Report August 2014 vs. July 2014 Total U.S. – Home & Work Locations Source: comScore qSearch			
Core Search Entity	**Explicit Core Search Queries (MM)**		
	Jul-14	**Aug-14**	**Percent Change**
Total Explicit Core Search	*17,987*	*17,957*	*0%*
Google Sites	12,120	12,081	0%
Microsoft Sites	3,470	3,484	0%
Yahoo Sites	1,804	1,801	0%
Ask Network	362	360	0%
AOL, Inc.	232	231	0%

According to Wilson *et al* (2010), the more relevant the search results produced by the search engine, the more users will accept them as being accurate. Although each of the top three search engines offers functionality and relevance, many users will still choose one search engine over another. The reasons for this choice are not always clear. This research attempts to determine what role the interface plays in choice of search engine.

2.2 Interfaces

Text-based interface depends basically on the user interacting with the keyboard. The main advantages are that it is easier to customize options and they are usually more capable of performing powerful tasks. One disadvantage is that navigation of the interface could be more difficult than that of another search engine. A graphical user interface (GUI) refers to an interface that allows users to use the mouse to click and drag objects. The GUI depends much more on the mouse and it is more common in modern computing. The main advantage is that it is more user friendly and easier to navigate with. The main disadvantages are that it's less powerful, lacks options and is not very customizable. However, the GUI is the most widely used interface in modern search engine computing. In today's world, most interface designs are usually a combination of the two. For example, web-based interfaces are a form of GUI but they still require the user to use a keyboard to type in information.

3.   Research Problem

The interface of the search engine must enable the user to achieve the tasks of searching in accordance with the information system that users will interact with. In order for a search engine to generate the most relevant information based on the user's query, the necessary options and controls should be included within the interface design to allow users to perform more refined searches. Searching for data in an information system with an appropriate search engine should be powerful but still easy to use. The user interface for searching needs to be suitable for the users as well.

The research problem is the fact that not much is known about the way search engine interface design affects the users' perception when choosing a suitable Web search engine to work with.

4.   Research Objectives

The intention of this study was to determine the effect of the design of the search engine interface on the users' perception of search engine choice. A sub-objective was to determine the level of popularity of the search engines selected amongst participants. This information was used to find a link between the search engine's interface design and why the user chose that search engine.

5.   Research Question

This study is based on the following research question:

• How does the interface design of a Web search engine influence the users' choice of search engine?

In order to investigate this question, the researcher has collected data from users using a quantitative research methodology. Collection of the data was done through a questionnaire.

6.   Literature Review

This literature review highlights some topics on the main issues of this research paper. These topics help the reader get a good understanding on the background that this research is built on.

6.1   Search Engines

In the modern world of information being present in many forms around the human user every day, the search engine plays an essential role in information retrieval. Large amounts of information are transferred from the search engine index for every query that the end user provides (Ranganathan *et al* 2010).

The major function of a search engine is the crawling and building of an index. Secondly, it should provide relevant answers by calculating the degree of commonality between its results and the original search query. The search engine crawlers collect many documents, news clips, files, videos and media elements from the Web. This is done in an attempt to provide relevant answers to user queries by way of the familiar search engine result pages. One way to ensure that relevant answers are produced, from the website designer's side, is to perform either search engine optimisation on the website, or engage in a paid placement scheme (Visser *et al* 2014).

Search engines allow users to retrieve information they need through interaction with the interface. All a user needs to do is to type a few keywords into the search box and the search engine will provide an informative result list that is ranked, so that the most relevant results according to the algorithm appear first in the list (Wilson *et al* 2010). The market share of a search engine might be negatively affected should it find itself unable to fulfil the information needs of the user (Hu *et al* 2011).

The searching capabilities of an efficient search engine should have the most important functions that users are accustomed to. The capabilities of the search engine should include phrase searching, Boolean logic, truncation as well as options to limit the search topic. A lack of these most essential functions can most likely prove to be a disadvantage to the search engine.

Yahoo! existed before Google and Bing and still today these three well known search engines continue to compete with one another. According to one author, Google bypassed Yahoo! In terms of acceptance and use since Yahoo! became a victim of black hat SEO, spamdexing and metatag abusers (Si 2010). Google developed a more intelligent algorithm to overcome the problems that Yahoo! was facing. As a result, Google seemed to have based their success on the benefits of their algorithm's results (Si 2010). According to Notess, search engines like to keep their users guessing. This is evidenced by numerous tests run by Google and Bing. The more users get accustomed to changes to interfaces, new designs of the Web as well as websites that have updated, the more they will ignore any irregularities and accept newer interfaces as well as not paying as much attention to the slight changes (Notess 2013).

6.2   Interface Design

According to Wellhausen (2006), it is not correct to assume that every user knows the basics of information retrieval as well as recognise all the capabilities and limitations of back-end search facilities. When it comes to search engine user interface design, there are two factors that must be considered.
Accessibility and usability are of importance to users who use technology to help them navigate the Web to search for relevant information. Therefore it is necessary that search engines are easily accessible and relatively easy to use.

According to Buzzi *et al* (2012) an interface must be appealing in terms of the graphics and visuals, and should be simplistic as well as logical. Significant positive outcomes such as user satisfaction and enhanced productivity can be achieved with interfaces that are simple to understand as well as easy to navigate.

According to Katz, matters of visual appeal have become an integral part of designing collaborative systems. The visual design of an interface might contribute to the approach of users towards computer applications as well as information technology. Visual appeal can affect user approval, as well as to sway users' decisions on whether or not to buy or accept a new system (Katz 2010).

6.3   Technology Acceptance Model (TAM)

The Technology Acceptance Model is a model that was developed after studying the acceptance of technology by a user taking into consideration the perception of the user on whether the technology is easy to use, as well as the usefulness of the technology. Davis was responsible for proposing the model in 1989. The TAM is based on two vital beliefs i.e. the perceived utilities and the perceived ease of application. These two beliefs are what will determine how the users will react to the new technology and if they are willing to adopt it. It is an important element in understanding and modelling the behaviour of users. Utilizing the TAM enables the researcher to evaluate groups of data, providing researchers with information about how users would react to new interfaces or changes within a system. It also recommends ideas for enhancement or upgrading (Thomas *et al* 2014).

6.4   Summary

In summary, this literature review focused on some key topics related to this study. The research defines a search engine as a very important tool in the world of information management. A capable search engine should be able to perform the basic functions that a user requires to carry out effective Web searches. Google, Yahoo! and Bing are currently the most used search engines worldwide. The interface design of a search engine is also a very important aspect when considering what the capabilities of the search engine are intended to be. The two most important factors to consider about the interface design of a search engine is accessibility and usability. It is essential that everyone can access the search engine as well as be able to navigate through the Web without any major problems. The TAM's main role was to be able to determine how users would react to new technologies. The TAM measures the users' perceptions on how easy the technology is to use as well as how useful the user experiences the technology.

7.   Research Methodology

7.1   Quantitative Approach

Quantitative research methodology is a tool for the explanation of occurrences by collecting numerical data. This data is reworked and analysed using mathematically based methods, particularly statistics. The purpose of quantitative research includes the testing of hypotheses, considering of cause and effect, and predictions. In order to make use of quantitative research methods one must first consider the research questions that are being asked. Most quantitative research methods can be used when trying to answer questions that are essentially about collecting numerical data to explain a particular phenomenon.

7.2   Qualitative Approach

Qualitative research methodology makes use of non-numerical data as opposed to quantitative research methods. Qualitative research is the use of methods which result in a textual narrative – often a descriptive account of general practice or specific settings. This could include participant observation or case studies.

The purpose of qualitative research is to understand and interpret social interactions. Qualitative research methods involves collecting meaningful data in the form of audio, text or video that allows the researcher to analyse and interpret the data in order to provide some answers to their research questions.

7.3   Chosen Approach

The researcher's approach is based on a quantitative research method. Data collection has focused on which search engines users prefer and why, based on the design of the search engines' interface. The researcher chose to gather data by making use of a questionnaire. This was a relatively small study so the number of participants involved in this study was 20 people. Therefore collecting numerical data from users for example in the form of statistics and percentages assisted the researcher in building up conclusive evidence to answer the research questions.

8.   Findings

The findings of this study are based on the data that was gathered using the questionnaire. The questionnaire contained 22 closed-ended questions that related to the topic of the study. Question one was about whether or not the participant was familiar with Google, Yahoo! and Bing. Out of the 20 participants, 14 said that they were familiar with all three search engines and only six participants were only familiar with two out of three search engines.

Questions two, four and six were about the level of familiarity with the search engine - if the participant stated in question one that he/she was not familiar with the search engine then they should skip any question relating to the search engine that they are not familiar with. Findings show that Google is very popular amongst the all participants as it seems that they are all very familiar with it. Eight out the 20 said that they are very familiar with Yahoo! and 11 said they are fairly familiar with Yahoo. Fourteen out of the 20 said they are fairly familiar and six said that they are not familiar with Bing.

Questions three, five and seven focused on how much the participant use a specific search engine. Google seems to the most utilized search engine as all the participants said they use it at least once per day. At least one participant said that they use Yahoo! less that once a month, seven participants said they use Yahoo! once a month, eight said they use it once per week and four said at least once per day. For Bing, eight participants use it less than once a month, eleven said they use it once a month, one said once week. Refer to Figure 1.
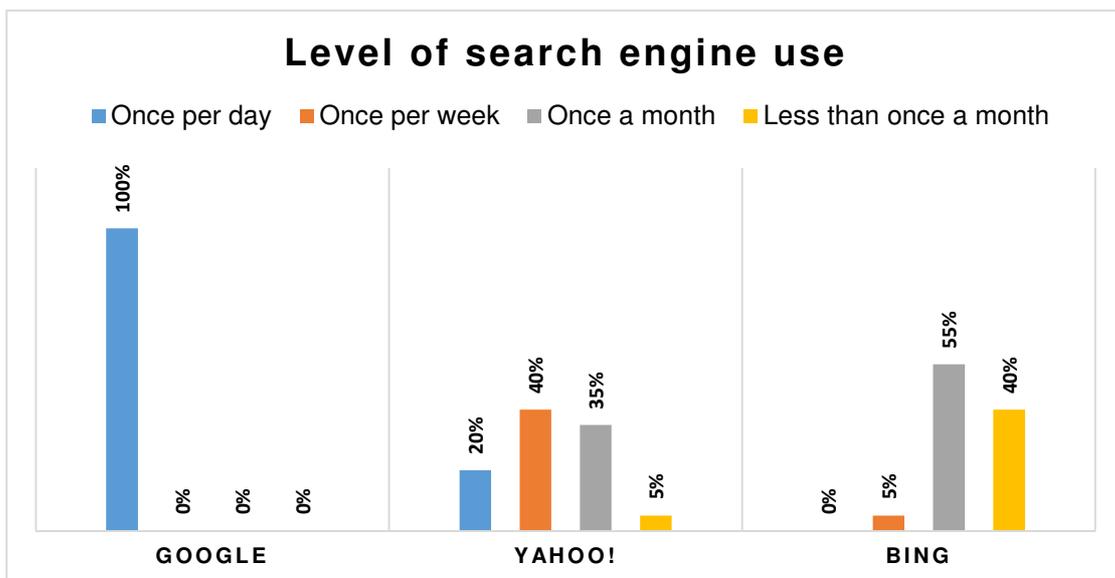

Figure 1: Level of search engine use

Question eight, nine and ten were about how the participants rated the search engines interface design in terms of how difficult or easy it is to use on a scale from one to five, one being difficult and five easy. Google's search engine interface design was rated by seven participants as three and the other 13 rated it as four. Yahoo!'s interface design was rated by fourteen users as three, ten others rated it as four and only one rated it as five. Bing's interface design was rated by nine participants as two, eleven rated it as three. Refer to Figure 2.
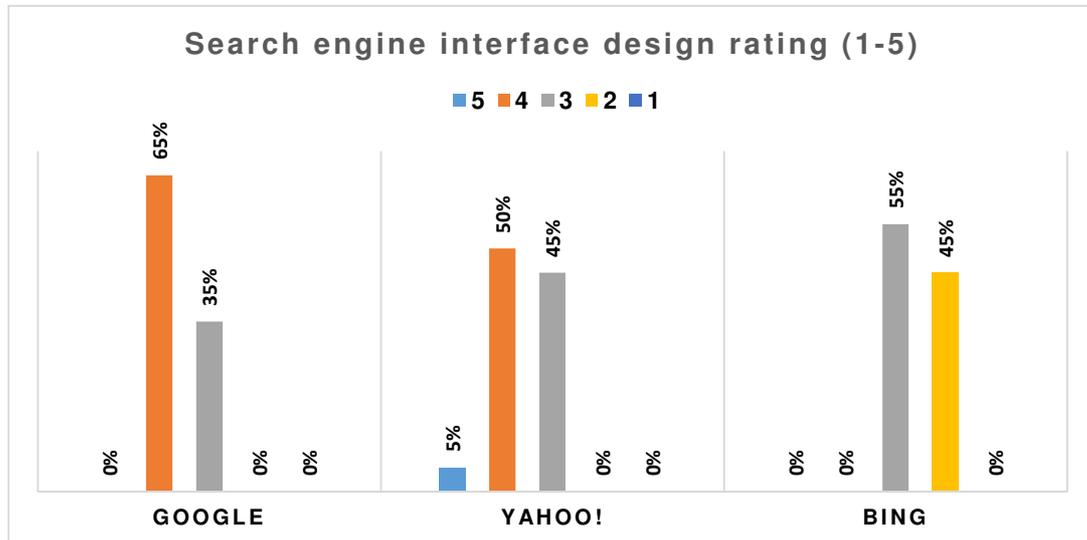
Figure 2: Search engine interface design rating (1-5)

Question 11 was used to obtain the participant's opinion on whether they prefer a simple, clean interface design or if they prefer an interface design with more features and clutter. Twelve of the participants said that they prefer a simple interface design that is not overcrowded and eight participants said they prefer an interface with more clutter. Refer to Figure 3.
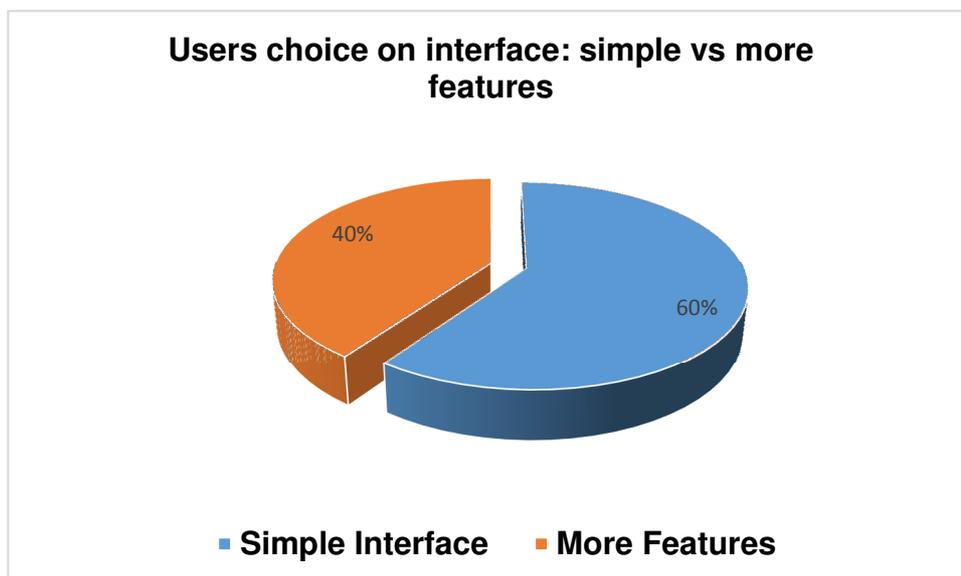
Figure 3: Users choice on interface: simple vs. more features

Questions 12, 13 and 14 were used to extract the participant's opinion on whether or not the search engine provides them with enough options to improve the scope of their searches. All the participants stated that Google and Yahoo! provide them with enough options to improve the search scope. For Bing, nine participants felt that Bing provides satisfactory options and 11 said no.

Question 15, 16 and 17 were aimed at determining whether or not users felt that the search engines provided them with relevant results based on the amount of options available. The answers were similar to questions 12, 13 and 14. Participants claimed that Google and Yahoo! provide relevant search results based on the amount of options available. Bing showed that nine participants felt that Bing provides them with relevant results based on the amount of options available and 11 said no.

Question 18, 19 and 20 focused on comparing each of the top three search engines with each other. Comparing Google to Yahoo! - 12 participants chose Google over eight others who chose Yahoo! Comparing Yahoo! to Bing showed that 14 participants chose Yahoo! over six others that chose Bing. Comparing Bing to Google showed that 15 participants chose Google and the other 5 chose Bing.

Question 21 and 22 focused on determining which search engine the participant preferred to use the most. Users were asked to select a suitable reason as to why they prefer that search engine the most. Nine participants selected Google, seven selected Yahoo! and four selected Bing. The reason for Google and Bing selection was that they like the interface that is simple and easy to use and Yahoo! because it provides more features. Refer to Figure 4.
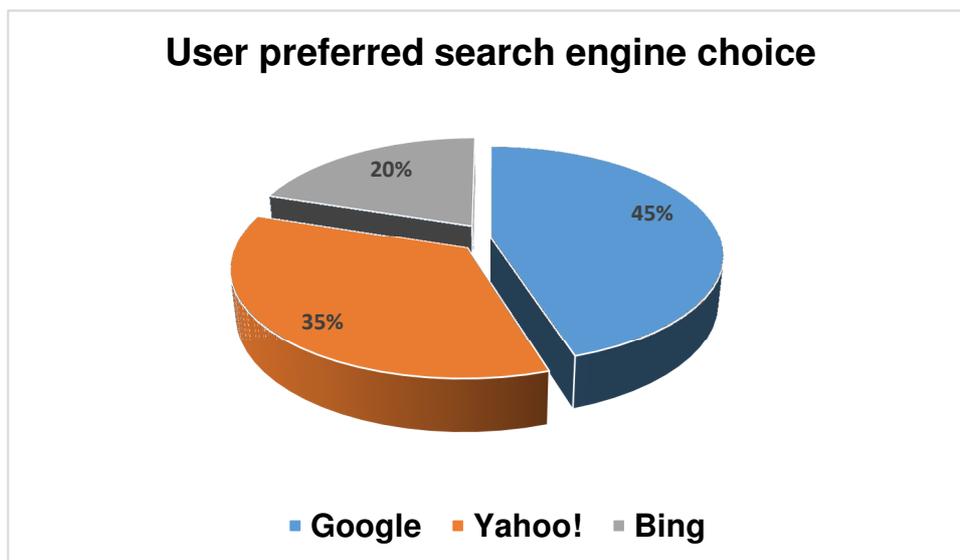

Figure 4: User Preferred Search Engine Choice

9.   Discussion of results

9.1   Google

Google ranks first amongst the participants of this study in terms of preference based on interface design. Results from the finding on Google show that every participant was familiar with this search engine. Most of the participants were very familiar with it as they used the search engine on a daily basis. The search engine interface design was rated as three and four, noting that users find that this search engine is very easy to use. Google has a simple interface design that most of the participants liked. The search engine is capable of performing more advanced searching to allow users to focus the scope of their topic and as a result users felt that Google provides them with relevant search results. When comparing Google to Yahoo! and Bing, it was shown that users prefer to Google for its simplicity and ease of use.

9.2   Yahoo!

Yahoo! ranks second in this study based on interface preference. Results for Yahoo! show that all the participants are familiar with it. Users like to use Yahoo! less occasionally than Google but Yahoo! still has some frequent users. Yahoo!'s interface design was rated between three and five showing that some users prefer an interface with more features. Users felt that Yahoo! provides some useful advanced searching options that helps improve the relevance and scope of search results.

9.3 Bing

Bing search engine ranks in third place based on the findings of this study. It was shown that not all the participants are familiar with Bing. Bing's interface design was rated between two and three showing that not all the users like Bing's interface design. Only a small number of users said that Bing provides them with enough useful options to focus their search and receive relevant results, which could indicate that most users in this study do not really find Bing that reliable.

10. Limitations of the study

Since this is a relatively small study, it has some limitations. These include: the number of search engines chosen for this study, the number of participants involved in the study as well as the questions that were asked in the questionnaire.

The study was based on three well known search engines. These search engines are currently the top three ranked search engines in the U.S.A. By not allowing more search engines to participate in the study the researcher could not gather more data on the users' choice of other search engines based on the design of the search engine interface. The low number of participants limited the amount of data that could have been collected if more participants were involved. By using closed ended questioning the researcher aimed at keeping the participants focused on the topic of the study.

To overcome these limitations for future studies, researchers should take into consideration the possibility of other search engines in order to gather more data. Increasing the number of the participants in the study can enable the researcher to gather more data on the research topic. The style of questions in future questionnaires could be altered by allowing the participants more freedom of opinion, and the inclusion of open-ended questions.

11. Conclusion

The findings of this study show that Google is the most preferred and frequently used Web search engine closely followed by Yahoo! and then Bing. This sheds some light on the research problem. Most users would prefer a search engine interface design that is simple and easy to use while some prefer an interface design like Yahoo! that has more features therefore the interface design of the search engine influences the user. Bing was considered as an alternative search engine to Google and Yahoo!, as only a few participants made use of Bing. The research objectives of this study have been met. The researcher identified which search engines are utilized the most as well as the reasons based on the design of the search engine interfaces.

Hu *et al* (2011) stated that search engines which are unable to provide enough useful capabilities might find that it negatively affects their market share. This study clarified that some of the users preferred to use one search engine over another as that search engine had something that the other one did not. According to Katz (2010), the element of visual appeal plays a role in whether or not technologies are accepted. Yahoo! is boasts a fair amount of visuals with regard to its interface design and some users liked – some did not. Buzzi *et al* (2012) also state that an interface should be visually appealing but also very simplistic and logical. The search engine should look good yet provides a simple and easy to use interface.

As final conclusion, it was clear that pattern of user search engine preference as indicated by figures from the USA (Lella 2014) did not correlate with those of the small sample of South African users in this study. The reason could be that the SA sample is too small. Or, since all three search engines originated in the USA, those users have other factors governing their choices.

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Acknowledgements

Definition of terms

Black hat SEO: Techniques used to increase online visibility and search engine rankings by making use of unprincipled strategies that break search engine guidelines and principles.

Spamdexing: A form of including information in a Web page that causes search engines to index it in some way that produces results that satisfy the spamdexer but usually tries to fool the search engine providers and users.

Meta tag abusing: HTML tags in Web pages that were once used to specify to search engine spiders about what the Web page contained.

Boolean logic: Searching that allows the user to combine words and phrases using AND, OR, NOT and NEAR to focus the search.

Truncation: A search technique that refers to the search engines ability to only to perform searches on a portion of a word.