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LONG PAPER

Web popularity: an illusory perception of a qualitative order in information

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Abstract Using a psychotechnological perspective, this study discusses the current model of information ranking by search engines, based on quantitative Web Popularity (WP), which binds users to a cognitive adaptation to the rank-system restrictions. This phenomenon gives rise to a "*rich-get-richer*" effect on the Web. This paper claims that such an effect could be limited or reversed by the introduction of quality factors in ranking, and addresses the case of accessibility as a fundamental such factor. A study is reported which, through introducing an accessibility factor in a well-known popularity ranking algorithm, demonstrates that this transformation allows a qualitative rearrangement, without modifying or weighing on the properties of the rank. The overall approach is grounded on two development factors: the analysis of accessibility through specific tools and the employment of this analysis within all components used to build up the ranking. The results show that it is important to reconsider WP as including not only on the number of inbound and outbound links of a website, but also on its level of accessibility for all users, and on users' judgment of the website use as efficient, effective, and satisfactory.

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1 Introduction

The development of the Internet, even though the "digital divide" problems still must be resolved, is entering into a new phase centered on the relationship between users and technology. All kinds of technology can be described as an amplifier [1] which transports rules, restrictions and knowledge possibilities. But forces users to a cognitive and cultural adaptation.

Website Popularity (WP) appeared in the 1990s as a quantitative indicator in response to the need of order search engines' results by organizing web information into "classifications" able to answer to users' queries [2]. Such classifications express the WP in orders of value (rank). The term "popularity" has to be understood as "wide popular consent", calculated in number of websites visits.

At the beginning of web technology development, this formulation has been useful, but it has soon assumed an implied qualitative meaning, concerning the quality and accessibility of website of content. The rank order as an index of quality could be acceptable only if search engines contained in their algorithms factors connected to the structural quality of websites and their information, which however does not hold. Therefore, the consent on which WP is measured by search engines does not consider the users' judgement about website content and quality. However, WP rank implicitly indicates a quality level concerning the website, simply because, as on the market the most a good is sold, the better the good, in the case of the web, the most a website is clicked, the better the website.

Search engines order any query outputs in a top–down hierarchical sequence, starting from the greatest ranking level website to the lowest. So the highest website occurring in the rank is perceived by users as qualitatively better than others, i.e., as the best answer to the users' queries. In this way, it has become a common idea that search engines and ranking lists are structured to offer as fast as possible the best answer to the users' queries. A certain "cognitive consonance", according to which websites with best rank value have the best content quality (i.e., demand met supply), has produced a circular and vicious process: since popular websites are already better reachable in the virtual space (that meaning they will probabilistically get more clicks), they will always be more popular [3, 4]. Since they appear in the first rank positions, popular websites are more likely to be clicked, and this influences both users' choices and information use. In this way, quality becomes a mere technological product that informs and forms the users' reality, influencing their judgements and choices.

2 Overlap of web popularity and link popularity measures

Google™'s founders, Brin and Page [5], stress that Internet ranking is based on "link popularity" (LP), calculated on the base of "inbound" and "outbound" number of links. The more links leading to a certain website, the higher rank position in the search engines that website has. Though it is known that also other ranking factors are included in Google™'s algorithm, such as the "dumping" factor (i.e., the rank value of a single webpage) and the website traffic, it is undeniable that currently WP is primarily determined by LP, and it is commonly believed that websites' quality and popularity are directly related through the number of links [6]. In the most used search engines, Google.com, Yahoo.com and Msn.com [7], searching the keywords "link popularity" and "website popularity" (synonymous are: "web site popularity", "web popularity" and "popularity") will obtain a near coincidence of the first 10 results (see Table 1).

Popularity rank is certainly the main criterion used by search engines both to arrange web information and to reply to users' queries with effectiveness and efficiency [8]. Yet, this functional order criterion can be misunderstood when users assume that the highest websites in the rank offer better content quality than others.

The ranking algorithms should be elaborated considering the users' judgements on visited pages in order to introduce a quality factor in the WP index.

Thomson Scientific "Impact factor" (IF) index provides an example illustrating the difference between a quantitative and a qualitative rank (http://scientific.thomson.com/index.html). IF consists of a value assigned to each journal listed in the Citation index (a scientific journals and articles collection), which is calculated over a 3-years period. It consists in the ratio between the numbers of citations of the papers published in a specific journal within a year's period, and the total amount of papers published by the same journal in the last 2 years [9, 10]. Therefore, IF quantitatively expresses the impact of a journal in the scientific community, intended as quantity of readers and citations. In this particular case the quantitative value of scientific journals popularity could represent an index for scientific content quality (at least for the scientific community using *Citation Indexes* as a popularity index). Therefore, the "popularity" index (given by the IF) expresses how many times an article has been used by the users' community, and in this way it guarantees the information ranking system's external quality (*Thomson Scientific*).

The WP produced by search engines does not consider users' judgement about websites' content: it only computes the number of links and the website traffic quantity.

Both these kinds of rank (WP and IF) could suffer from a vicious cycle. Explaining success in scientific publication, Merton [11, 12] shows that popularity is a cumulative process; in fact well known scientists get disproportionately great credit for their contributions to science, while relatively unknown scientists tend to get disproportionately little credit for comparable contributions (Matthew Effect). IF, contrary to WP, is based on a participative and deliberate popularity. At the same time, as Merton shows, even popularity in the scientific community is linked to factors different from pure quality, but it should be considered that a scientific reader is more aware of this influenced ranking process than a web user, who is forced to a simple clicking automatism.

Table 1 Results using the queries "Link Popularity" and "Website Popularity" in three different search engines

Search engines	WP total results	LP total results	First Serp
Google.com	65.300.000	16.800.000	9/10 Relation between LP/WP
Yahoo.com	77.100.000	64.600.000	8/10 Relation between LP/WP
Msn.com	27.900.000	20.500.000	9/10 Relation between LP/WP

WP web popularity, *LP* link popularity, *SERP* search engines results page

The actual ranking algorithms used by search engines lead to the impossibility for not popular websites to emerge from the web. As Cho et al. [2] show, the "rich-get-richer" phenomenon is widespread through the web: the popularity of already popular web pages tends to increase, while the new or not popular pages have less possibilities to be clicked.

However, some empirical studies seem to reject the passive view of web users as subjects unaware of the "rich-get-richer" induced phenomenon.

Fortunato et al. [4] show that a users' adaptive behaviour exists that mitigates WP incidence as a ranking factor. In fact, expert users tend to extend their searches from most to less popular websites, thus producing a redistribution of the web traffic (Mitigation Effect). In addition, the same study shows that over a certain number of in-links, a website does not increase its WP and visibility in the rank (Saturation Effect). These two effects (Mitigation and Saturation Effect) depend on the users' interest for the searched subject: once users have visited the most popular websites concerning their interest, then they will move to less popular ones, thus redistributing Internet traffic. However, this redistribution depends mostly on users' expertise in finding information and extending their search to less popular websites, whereas less expert users are often stopped by online barriers and therefore they cannot contribute to Internet traffic redistribution. In this way, expert users' behaviour mitigate the quantitative WP. These users, having developed an adaptation to the limits of the *search engine results page* (SERP), can access peripheral and higher quality information. On the other hand, the rank and information distribution structured by quantitative popularity becomes a barrier for novice or not so expert users. The possibilities of web access remain unequal and tend to extend the *digital divide*. As all technologies, the world wide web forces all its users to an adaptation, but such a process could be simplified by modifying the ranking algorithms with a qualitative index that could expand the current WP formulation.

A quality index, inserted in the search engines' algorithms, could produce a more user-centered information availability process, which would still allow information ranking, and at the same time would guarantee accessibility to better quality information for all Internet users, independently from their technological skills.

A first qualitative aspect that should be imported in the WP is website accessibility, defined as: "The art of ensuring that, to as large an extent as possible, facilities are available to people whether or not they have impairments of one sort or another" [13]. Accessibility constitutes the first fundamental level of information access, even though it still does not guarantee content quality to users. A popularity index including this factor could constitute a significant step towards universal access, through reducing the users' cognitive workload in web navigation, and thus allowing a easier fruition of web contents. Adding the accessibility factor to the ranking process can represent a first step towards the solution of the WP and LP overlap.

2.1 How to overcome the WP and LP overlap

Several international studies on ranking show that:

1. Websites rank positions are stable over Internet history and development, suggesting that WP may be a universal Internet property [14].
2. Most popular websites tend to maintain their rank positions, increasing the discrepancy with less popular websites.

These studies, targeted to implementing or modifying ranking metrics, are based on different points of view on popularity:

- Cho et al. [3] proposes a view of WP as quality of a single page derived from a hypothetical user model, with the objective to overcome the "rich-get-richer" phenomenon. It is also proposed to integrate into the rank algorithm a new function, named "pagequality", introducing in the popularity rank computation a factor derived by the hypothetical user model. Even though this seems an interesting solution, it appears to be external to search engines' algorithms and too much dependent on the limits of a generic hypothetical user model. In fact, the actual necessity is to find an evaluation process that could be integrated in the ranking metrics used by search engines.
- Nie et al. [15] propose to integrate WP with the quality of links, instead of quantity of links. An "object ranking" model is proposed, named PopRank (popularity rank), that considers every link present on a webpage as an object having a specific weight. In this way, the PopRank model allows a diversification of popularity ranks, since every link has a different weight and therefore a different influence. This solution, though, cannot be considered as a universal quality index, since it is not able to overcome the vicious relationship between WP and LP.
- More recently, Yen [16] proposes to integrate WP with page design. From this point of view, WP is understood as the easiness degree with which a page is able to be found across other pages and links (findability). Such formulation is based on a point of view dependent on the quantitative popularity according to which the accessibility, here understood as findability, is strictly related with the number of links (i.e., more a website is linked by other websites more is findable in the search engines

and accessible). In this sense, findability can be defined as quantitative accessibility. This approach is useful to create calibrated web structures, where the pages with the most important content should have the highest in-links number from other websites; in this way, there should be a connection between popularity and pages with the most remarkable information. This model, though useful for building easily findable and calibrated web structures, does not succeed in overcoming the quantitative logic and it remains dependent on web design analysis, without considering web accessibility in its most shared meaning: "that people with disabilities can perceive, understand, navigate, and interact with the Web, and that they can contribute to the Web (http://www.w3.org/WAI/intro/accessibility.php).

- Signore [17] assumes that the quality of websites is often unsatisfactory, and designers ignore or scarcely consider basic web principles, such as interoperability and accessibility. In order to automatically evaluate a website, Signore proposes a quality model based on five dimensions: correctness, presentation, content, navigation, and interaction. This point of view is based on the standard quality characteristics of software [18] and is targeted to evaluate quality as an objective dimension. Therefore, in this model, the quality of websites is just calculated as a relation among those five qualitative dimensions without taking into account the user's judgment.
- Zeng and Parmanto [19] show that there is a correlation between WP and accessibility, the latter being understood as the possibility to guarantee information access to the largest extent of people, independently from any kind of disabilities [13]. For their analysis of accessibility, the authors propose an index, named Wabscore (*Web Accessibility Barrier Score*), that measures how many accessibility barriers are present in a website, calculating the Web Content Accessibility Guideline 1.0 (WCAG) violations for each web page of the site. See below the Wabscore Formula

$$\text{WabScore} = \frac{pv\left(\frac{nv}{Nv}\right)wv}{Np}$$

where p: Total pages of a website,
v: Total violations of a web page,
nv: Number of violations,
Nv: Number of potential violations,
Wv: Weight of violations in inverse proportion to WCAG prority,
Np: Total number of pages checked

Through the rank and accessibility analysis of a representative sample composed by 108 health information websites, Zeng shows a correlation between quality, accessibility and WP. These results indicate that a correlation does exist between WP and website accessibility, at least in some search engines' ranking results; therefore, the usefulness of introducing the accessibility factor in the search engines" algorithms is confirmed.

All these studies show the need, opportunity and possibility to overcome the current WP formulation maintaining its primary function of information organization, and at the same time introducing qualitative factor into the search engine report page (SERP) order. The WP could be rethought as an index that actually offers to users the possibility of receiving qualitative information about the content available on the web and useful to their searches; in order to obtain this result, guaranteeing website accessibility could be sufficient, i.e., guaranteeing the absence of web accessibility barriers.

According to the Webster's Dictionary, "popularity" has a threefold meaning that well matches the different meanings of WP emerged in the previous review of the international studies on ranking. Indeed, the first meaning concerns the features of what is stated to be popular: "the quality or state of being popular […] adapted to common people". In this "objective" sense, popular concerns with the accessibility structure of information—the intrinsically condition of an object per se—that is popular because it does not offer resistance (barriers) to users (i.e. his charm soon won him popularity). The second meaning of popularity refers to the attitudes or believes of people: "the state of being esteemed by people at large […] or pleasing to common people". In this "subjective" sense, popularity concerns people's perspective onto the features of objects (i.e. all children are deemed innocent). This is what can be traced back to "usability", namely, what is deemed popular on the web by the users because it is suitable, friendly, satisfactory. The last popularity meaning concerns the pursuing of an aim: "Something which obtains, or is intended to obtain, the favor of the vulgar […] The act of courting the favor of the people". In this sense, popularity is not just a feature of an object (accessibility) nor a (user) self-representation of an object (usability), rather it is the set goal reached (i.e. the fiction's success gave her popularity), namely the website wide-spreading, such as, for example, its "linkability".

Therefore, WP can be defined as a property that it is attributed to a website when it is well widespread on Internet by the means of inbound and outbound links (linkability/link-popularity), the information is accessible for all users (accessibility), and when users esteem its use as efficient, effective, and satisfactory (usability) [20].

Since WP is currently only ranked on the LP criteria, the following section will address the issue of what happens in a website rank order when accessibility is introduced as a factor of popularity measurement.

3 Introduction of an accessibility criterion in the World Universities' Rankings

A study has been conducted to empirically verify that the introduction of an accessibility index in the ranking formula changes the ranking position of a website, which currently is calculated only by quantitative factors. In this study, the Zeng and Parmanto [19] WabScore was applied to the *Webometrics Ranking* [WR] *of World Universities* (http://www.webometrics.info), created by Cybermetrics Lab, a research group belonging to the *Consejo Superior de Investigaciones Cientificas* (CSIC).

WR is obtained as an addition of four different ranks based on quantitative indexes. It was chosen to use the WR classification, in its 2007 version, for three main reasons: first, because it is based on shared search engines' criteria; second, for its implicit purpose to overcome search engines' ranking limits with the integration of different indexes for better representing the global quality of universities' websites and resources; and third, because the WR formula has been made public until the 2007 version, even though this formula is no longer available in its 2008 version. The conducted experiment was intended to verify if the WR criteria and subsequent rank positions of universities' websites were correlated to the accessibility level of those websites.

3.1 Metrics properties of WR

WR 2007 version is obtained as an addition of four different ranks (http://www.webometrics.info/methodology.html):

- *Size (S)*. Number of pages recovered from four engines: Google, Yahoo, Live Search and Exalead. For each engine, results are log-normalised to 1 for the highest value. Then for each domain, maximum and minimum results are excluded and every institution is assigned a rank according to the combined sum.
- *Visibility (V)*. The total number of unique external links received (in-links) by a site can be only confidently obtained from Yahoo Search, Live Search and Exalead. For each engine, results are log-normalised to 1 for the highest value and then combined to generate the rank.
- *Rich Files (R)*. After the evaluation of their relevance to academic and publication activities and considering the volume of the different file formats, the following were selected: Adobe Acrobat (.pdf), Adobe PostScript (.ps), Microsoft Word (.doc) and Microsoft Powerpoint (.ppt). These data were extracted using Google and merging the results for each filetype after log-normalising in the same way as described above.
- *Scholar (Sc)*. Google Scholar provides the number of papers and citations for each academic domain. These results from the Scholar database represent papers, reports and other academic items.

It should be considered that, according to the Cybermetrics Lab website, the WR 2008 indexes description is quite different from the 2007 version, but the weight analysis of each singular rank (Visibility, Size, Rich Files, Scholar) shows no differences with respect to the older version. The WR formula, that had been made public, has now disappeared from the Cybermetrics Lab website.

In the 2007 version, the WR formula was as follows:

$$\mathrm{WR} = (4 * \mathrm{V}) + (2 * \mathrm{S}) + \mathrm{R} + \mathrm{Sc}$$

V: Visibility rank, S: Size rank, R: Rich file rank, Sc: Google scholar rank.

The WR formula shows how the visibility rank (V), consisting in the number of external in-links, has a bigger impact on rank position than all the other three ranks. This happens in the 2008 version as well, even though the formula is not shown and the authors only provide the percentage related to each rank: *Rank V* has 50% of weight on WR (therefore has the biggest impact), *Rank S* 20%, *Rank R* and *Rank Sc* 15%.

In this way, WR aims to offer to users qualitative exhaustive information, trying to overcome the limits of a purely WP based ranking.

3.2 Methods and results

In the conducted analysis, the top 3000 Universities' websites according to WR were considered. They were classified, on the basis of their WR value, into 20 classes of 150 websites each. Then, as representative sample of each class, the following were used: the website with the average WR value, and the websites with the WR value one point over and one point under the class standard deviation. In conclusion, the final sample, representative of the top 3000 websites, was composed of sixty websites (see Appendix 1).

As Zeng and Parmanto [19] suggest, accessibility was calculated using Bobby© 5.0. Bobby identifies the WCAG 1.0 violations, similarly to A-Prompt, EvalAccess 2.0, Functional Accessibility Evaluator 1.0, and other validators. The data obtained were used in order to calculate the WabScore value for each website. WabScore values range from 0 (fully accessible website) to 1 (not accessible website), and the sample analysis showed that most of the websites were not fully accessible. The sample mean was 0.35 (stdv: 0.10), indicating a presence of 35 out of 100 barriers (real or potential).

The analysis did not show any correlation among WabScore, WR, and the four singular ranks, while it is clear that all the elements belonging to the four WR ranks are correlated to WR itself (see Table 2).

Table 2 Spearman correlations between webometrics factors and wabscore

	S	V	R	Sc	WR	Wabscore
S	1.000	.801*	.764*	.689*	.909*	.113
V	.801*	1.000	.674*	.621*	.927*	.135
R	.764*	.674*	1.000	.729*	.833*	.160
Sc	.689*	.621*	.729*	1.000	.803*	.060
WR	.909*	.927*	.833*	.803*	1.000	.107
Wabscore	.113	.135	.160	.060	.107	1.000

S size rank, *V* visibility rank, *R* rich file rank, *Sc* Google scholar rank, *WR* Webometric Rank

* Correlation is significant at the 0.01 level (2-tailed)

In conclusion, even though *Webometrics Ranking of World Universities* offers a rank based on more analysis factors than the ones used by search engines, still it does not consider the accessibility of websites. On the other hand, as already discussed in this paper, accessibility should be considered as a decisive factor in a ranking for websites promoting high level educational content, especially if they want to guarantee information access to all users.

Based on the above, it was assumed that it should be possible to modify a website rank position according to its accessibility, introducing an accessibility index in the WR. The WR lists lower values in higher positions, so that the less is the value of the 4 factors (Visibility, Size, Rich file, and Google scholar) the higher is the website position rank. In order to respect the WR properties, the WabScore value was transformed so that it could be inserted in the WR calculation as a new rank next to the other four. As Zeng and Parmanto [19] show, accessibility can be correlated with WP. In the WR calculation formula, WP is represented by the Visibility Rank (V).

This relation between V and accessibility gives the possibility to create an Accessibility Rank (AR) representing the number of positions that a website should lessen in the V Rank (i.e., increasing the value in WR decreasing the rank position) according to its accessibility problems, as shown in this formula:

$$V * \text{WabScore} = AR$$

$$V : \text{Visibility rank}$$

From this formula a new factor is obtained (the AR, see Appendix 2) that affects directly the V Rank and indirectly WR, as proposed in a modification of the WR formula, named Global Rank (GR) [21]:

$$GR = (4 * (V + AR)) + (2 * S) + R + Sc$$

GR: Global Rank, V: Visibility rank, AR Accessibility Rank, S: Size rank, R: Rich file rank, Sc: Google scholar rank.

If WabScore is 0, there will no changes in the website ranking, both in V Rank and WR, since the website is fully accessible. If WabScore is 1 (that corresponds to full inaccessibility), the website doubles its value while lessening the V Rank, and thus influencing the WR ranking.

Therefore, as far as accessibility is concerned, GR represents the WR order variation while keeping the correlations with the other ranks unaltered (see Table 3).

The accessibility factor introduced by AR in the GR has a significant correlation with WabScore and with all the other WR factors, thus respecting the WR order calculation properties (see Appendix 3). It is important to notice that WabScore does not correlate with GR, as well as it does not correlate with WR (see Wabscore Formula). In this way, considering accessibility through the AR factor, the GR does not distort the former WR order: it still correlates with the other WR factors, while deepening its websites analysis.

3.3 Suggestions for search engines developers

Based on the proposal presented in this paper, the following important issues arise regarding the development of search engines' ranking algorithms:

Table 3 Spearman correlations between webometrics factors, accessibility rank and global rank

	S	V	R	Sc	AR	Wabscore	GR
S	1.000	.801*	.764*	.689*	.756*	.113	.894*
V	.801*	1.000	.674*	.621*	.935*	.135	.946*
R	.764*	.674*	1.000	.729*	.654*	.160	.820*
Sc	.689*	.621*	.729*	1.000	.599*	.060	.787*
AR	.756*	.935*	.654*	.599*	1.000	.432*	.907*
Wabscore	.113	.135	.160	.060	.432*	1.000	.160
GR	.894*	.946*	.820*	.787*	.907*	.160	1.000

S size rank, *V* visibility rank, *R* rich file rank, *Sc* Google scholar rank, *AR* accessibility rank, *GR* WabScore and global rank

* Correlation is significant at the 0.01 level (2-tailed)

- The integration of some accessibility measurement formulas in search engines' algorithms, similar to GR. If search engines considered an accessibility factor in their ranking algorithms, website developers would be more motivated to adopt W3C-WAI accessibility guidelines in order to grant their own sites' visibility.
- Integrating accessibility in ranking algorithms would be a first step towards search engines capable of addressing web content quality too.
- Eventually, as a further step, web interface usability should be a main goal for future developments of search engines' algorithms, introducing user-technology interaction quality as a ranking factor.

4 Conclusion

The presented analysis about WP and quality relation on the Internet has shown how the present LP based search engines' algorithms do not suit Internet users' demands. Since Internet users are constantly adapting to the technology, there is a growing need of a qualitative popularity indexes. As Fortunato et al. show [4], users adapt their searching strategy to the technology limits, widening their searches even far from the most popular results, and thus redistributing web traffic. It is also interesting to consider how those limits compel users to evolve towards new adaptive behaviours in complex systems, thus reinforcing the model of technology as a human action amplifier. Nevertheless, users adapting to the Internet technology reproduce the rich-get-richer phenomenon. This situation can be addressed through the introduction of quality indexes.

As this paper has shown, the WabScore could be used to obtain such a quality index, thus allowing rank positioning reorganization. The modified *Webometrics Ranking of World Universities* demonstrates how integrating accessibility in the WP could reorganize rank orders without altering their properties and goals. In this way, the accessibility diffusion and promotion would be strictly related to linkability (i.e. like the most popular search-engines do) plus, at least, to a web quality index (e.g. like our AR does). Such a link could not only contribute to reduce the digital divide, but also to downsize the users' cognitive workload, thus making it simpler for users to find information.

Although the WabScore introduces accessibility in the popularity scoring of the rank, it does not compute the usability dimension that belongs to the popularity significance, as claimed in provided definition of popularity in accordance with the international literature review (see Sect. 2.1).

Therefore, future work will be targeted to obtain a WP rank that encompasses the whole complexity of "popularity", including website spread on Internet by the means of inbound and outbound links (linkability/LP), information accessibility for all users (accessibility), and the users' esteem of the website use as efficient, effective, and satisfactory (usability). Towards this objective, an index also is currently under development which will weight the usability of user computer interaction and integrate the obtained scores with linkability and accessibility.

Appendix

See Tables 4, 5, 6

Table 4 Sample of websites

Order of sample	Website	S	V	R	Sc	WR
1	http://www.msu.edu	64	28	26	98	364
2	http://www.buffalo.edu	71	71	128	222	776
3	http://www.usyd.edu.au	203	111	186	149	1185
4	http://www.maine.edu	235	151	74	561	1709
5	http://www.uni-ulm.de	132	305	339	269	2092
6	http://www.uab.es	265	383	300	118	2480
7	http://www.uit.no	258	359	569	519	3040
8	http://www.rdg.ac.uk	442	398	418	600	3494
9	http://www.utsa.edu	537	433	306	829	3941
10	http://www.mcw.edu	489	351	767	1311	4460
11	http://www.biu.ac.il	627	674	305	612	4867
12	http://www.fordham.edu	1215	159	924	1256	5246
13	http://www.iitb.ac.in	352	1092	403	337	5812

Table 4 continued

Order of sample	Website	S	V	R	Sc	WR
14	http://www.iisc.ernet.in	628	1036	570	229	6199
15	http://www.gvsu.edu	878	567	848	1741	6613
16	http://www.stevens.edu	1351	663	717	1087	7158
17	http://www.cwu.edu	892	855	713	1602	7519
18	http://www.weber.edu	1060	564	1428	2060	7864
19	http://www.nmu.edu	803	958	791	2183	8412
20	http://www.uniandes.edu.co	1211	1354	686	322	8846
21	http://www.iitk.ac.in	1293	1369	683	530	9275
22	http://www.uevora.pt	587	1619	1114	1083	9847
23	http://www.ttuhsc.edu	1627	830	1530	2087	10191
24	http://www.ulster.ac.uk	1086	1341	1439	1579	10554
25	http://www.niigata-u.ac.jp	1372	1266	2322	890	11020
26	http://www.sciences-po.fr	1951	1108	2238	766	11338
27	http://www.simmons.edu	1737	1002	1776	2340	11598
28	http://www.lcsc.edu	1376	1009	1682	3186	11656
29	http://www.artic.edu	1166	430	4950	3186	12188
30	http://www.bard.edu	2035	983	2753	2266	13021
31	http://www.uhb.fr	1725	1483	2100	2108	13590
32	http://www.uestc.edu.cn	1742	1494	2314	2141	13915
33	http://www.univ-lille2.fr	1803	1968	1533	1247	14258
34	http://www.bvu.edu	1218	1935	2374	2314	14864
35	http://www.bridgeport.edu	2036	1774	1492	2614	15274
36	http://www.ucs.br	1459	2398	1814	1356	15680
37	http://www.nsu.edu	2488	1697	1895	2679	16338
38	http://www.luiss.it	2296	2059	2289	1502	16619
39	http://www.ceu.es	2949	1808	2504	1274	16908
40	http://www.hamk.fi	1056	2468	1760	3701	17445
41	http://www.artcenter.edu	1448	1209	5738	4329	17799
42	http://www.ubu.ac.th	1877	2451	1611	2980	18149
43	http://www.edgewood.edu	2612	1589	2603	4511	18694
44	http://www.savonia-amk.fi	2648	1984	1674	4163	19069
45	http://www.uca.edu.ar	3007	2606	1982	1022	19442
46	http://www.njust.edu.cn	2182	2434	2174	3801	20075
47	http://www.mgimo.ru	2749	2508	2407	2507	20444
48	http://www.dusit.ac.th	2821	2339	1912	3902	20812
49	http://www.sciencespobordeaux.fr	3283	2599	2665	1673	21300
50	http://www.nmhu.edu	3828	2065	1916	3801	21633
51	http://www.xznu.edu.cn	3843	2360	2066	2792	21984
52	http://www.ujn.edu.cn	1581	3298	2646	3531	22531
53	http://www.jct.ac.il	2687	3103	1833	3335	22954
54	http://www.tokai.ac.jp	3075	2177	5189	3335	23382
55	http://www.miem.edu.ru	2181	2880	5095	2893	23870
56	http://www.spc.edu	3338	1779	5678	4707	24177
57	http://www.hebau.edu.cn	2308	3002	2437	5445	24506
58	http://www.rdc.ab.ca	3062	2822	3417	4163	24992
59	http://www.aubg.bg	4069	3203	1573	2824	25347

Table 4 continued

Order of sample	Website	S	V	R	Sc	WR
60	http://www.ensicaen.fr	2640	3897	2978	1824	25670

The rank order of the sample without any modification (Order of sample), Url (Website), Size rank (S), Visibility rank (V), Rich file rank (R), Google scholar rank (Sc), Webometric Rank (WR) [chached http://www.webometrics.info, June 2007]

Table 5 Accessibility rank index of websites

Website	V	Wabscore	AR
http://www.msu.edu	28	0.1412294	4
http://www.buffalo.edu	71	0.2889718	21
http://www.usyd.edu.au	111	0.2504605	28
http://www.maine.edu	151	0.298679	45
http://www.fordham.edu	159	0.4138173	66
http://www.uni-ulm.de	305	0.415074	127
http://www.mcw.edu	351	0.5132357	180
http://www.uit.no	359	0.4575269	164
http://www.uab.es	383	0.3624207	139
http://www.rdg.ac.uk	398	0.1242035	49
http://www.artic.edu	430	0.3547774	153
http://www.utsa.edu	433	0.2234849	97
http://www.weber.edu	564	0.3116937	176
http://www.gvsu.edu	567	0.3654671	207
http://www.stevens.edu	663	0.2385974	158
http://www.biu.ac.il	674	0.3625789	244
http://www.ttuhsc.edu	830	0.1409681	117
http://www.cwu.edu	855	0.0813753	70
http://www.nmu.edu	958	0.2952126	283
http://www.bard.edu	983	0.2852888	280
http://www.simmons.edu	1002	0.3676724	368
http://www.lcsc.edu	1009	0.6150826	621
http://www.iisc.ernet.in	1036	0.35242	365
http://www.iitb.ac.in	1092	0.3717004	406
http://www.sciences-po.fr	1108	0.3494034	387
http://www.artcenter.edu	1209	0.3516156	425
http://www.niigata-u.ac.jp	1266	0.4370188	553
http://www.ulster.ac.uk	1341	0.361158	484
http://www.uniandes.edu.co	1354	0.3098967	420
http://www.iitk.ac.in	1369	0.3455658	473
http://www.uhb.fr	1483	0.4025819	597
http://www.uestc.edu.cn	1494	0.3617934	541
http://www.edgewood.edu	1589	0.249702	397
http://www.uevora.pt	1619	0.3171626	513
http://www.nsu.edu	1697	0.3894097	661
http://www.bridgeport.edu	1774	0.4272401	758
http://www.spc.edu	1779	0.3135802	558
http://www.ceu.es	1808	0.3982475	720
http://www.bvu.edu	1935	0.5091097	985
http://www.univ-lille2.fr	1968	0.2203426	434

Table 5 continued

Website	V	Wabscore	AR
http://www.savonia-amk.fi	1984	0.33616	667
http://www.luiss.it	2059	0.133901705	276
http://www.nmhu.edu	2065	0.3071112	634
http://www.tokai.ac.jp	2177	0.3519752	766
http://www.dusit.ac.th	2339	0.2994149	700
http://www.xznu.edu.cn	2360	0.3895089	919
http://www.ucs.br	2398	0.5197499	1246
http://www.njust.edu.cn	2434	0.5785757	1408
http://www.ubu.ac.th	2451	0.3007108	737
http://www.hamk.fi	2468	0.2666667	658
http://www.mgimo.ru	2508	0.4081197	1024
http://www.sciencespobordeaux.fr	2599	0.4219648	1097
http://www.uca.edu.ar	2606	0.3890916	1014
http://www.rdc.ab.ca	2822	0.354155329	999
http://www.miem.edu.ru	2880	0.2838405	817
http://www.hebau.edu.cn	3002	0.2732174	820
http://www.jct.ac.il	3103	0.3516174	1091
http://www.aubg.bg	3203	0.3927393	1258
http://www.ujn.edu.cn	3298	0.4380698	1445
http://www.ensicaen.fr	3897	0.2564539	999

The URL (Website), Visibility rank (V), WabScore, Accessibility Rank (AR)

Table 6 Global rank

Old order	New order	WebSite	S	V	R	Sc	WR	GR
1	1	http://www.msu.edu	64	28	26	98	364	380
2	2	http://www.buffalo.edu	71	71	128	222	776	860
3	3	http://www.usyd.edu.au	203	111	186	149	1185	1297
4	4	http://www.maine.edu	235	151	74	561	1709	1889
5	5	http://www.uni-ulm.de	132	305	339	269	2092	2600
6	6	http://www.uab.es	265	383	300	118	2480	3036
7	**8**	http://www.rdg.ac.uk	**442**	**398**	**418**	**600**	**3494**	**3690**
8	**7**	http://www.uit.no	**258**	**359**	**569**	**519**	**3040**	**3696**
9	9	http://www.utsa.edu	537	433	306	829	3941	4329
10	10	http://www.mcw.edu	489	351	767	1311	4460	5180
11	**12**	http://www.fordham.edu	**1215**	**159**	**924**	**1256**	**5246**	**5510**
12	**11**	http://www.biu.ac.il	**627**	**674**	**305**	**612**	**4867**	**5843**
13	13	http://www.iitb.ac.in	352	1092	403	337	5812	7436
14	**15**	http://www.gvsu.edu	**878**	**567**	**848**	**1741**	**6613**	**7441**
15	**14**	http://www.iisc.ernet.in	**628**	**1036**	**570**	**229**	**6199**	**7659**
16	16	http://www.stevens.edu	1351	663	717	1087	7158	7790
17	17	http://www.cwu.edu	892	855	713	1602	7519	7799
18	18	http://www.weber.edu	1060	564	1428	2060	7864	8568
19	19	http://www.nmu.edu	803	958	791	2183	8412	9544
20	20	http://www.uniandes.edu.co	1211	1354	686	322	8846	10526

Table 6 continued

Old order	New order	WebSite	S	V	R	Sc	WR	GR
21	**23**	http://www.ttuhsc.edu	**1627**	**830**	**1530**	**2087**	**10191**	**10659**
22	**21**	http://www.iitk.ac.in	**1293**	**1369**	**683**	**530**	**9275**	**11167**
23	**22**	http://www.uevora.pt	**587**	**1619**	**1114**	**1083**	**9847**	**11899**
24	24	http://www.ulster.ac.uk	1086	1341	1439	1579	10554	12490
25	**29**	http://www.artic.edu	**1166**	**430**	**4950**	**3186**	**12188**	**12800**
26	**26**	http://www.sciences-po.fr	**1951**	**1108**	**2238**	**766**	**11338**	**12886**
27	27	http://www.simmons.edu	1737	1002	1776	2340	11598	13070
28	**25**	http://www.niigata-u.ac.jp	**1372**	**1266**	**2322**	**890**	**11020**	**13232**
29	**28**	http://www.lcsc.edu	**1376**	**1009**	**1682**	**3186**	**11656**	**14140**
30	30	http://www.bard.edu	2035	983	2753	2266	13021	14141
31	31	http://www.uhb.fr	1725	1483	2100	2108	13590	15978
32	**33**	http://www.univ-lille2.fr	**1803**	**1968**	**1533**	**1247**	**14258**	**15994**
33	**32**	http://www.uestc.edu.cn	**1742**	**1494**	**2314**	**2141**	**13915**	**16079**
34	**38**	http://www.luiss.it	**2296**	**2059**	**2289**	**1502**	**16619**	**17723**
35	35	http://www.bridgeport.edu	2036	1774	1492	2614	15274	18306
36	**34**	http://www.bvu.edu	**1218**	**1935**	**2374**	**2314**	**14864**	**18804**
37	37	http://www.nsu.edu	2488	1697	1895	2679	16338	18982
38	**41**	http://www.artcenter.edu	**1448**	**1209**	**5738**	**4329**	**17799**	**19499**
39	39	http://www.ceu.es	2949	1808	2504	1274	16908	19788
40	40	http://www.hamk.fi	1056	2468	1760	3701	17445	20077
41	**43**	http://www.edgewood.edu	**2612**	**1589**	**2603**	**4511**	**18694**	**20282**
42	**36**	http://www.ucs.br	**1459**	**2398**	**1814**	**1356**	**15680**	**20664**
43	**42**	http://www.ubu.ac.th	**1877**	**2451**	**1611**	**2980**	**18149**	**21097**
44	44	http://www.savonia-amk.fi	2648	1984	1674	4163	19069	21737
45	45	http://www.uca.edu.ar	3007	2606	1982	1022	19442	23498
46	**48**	http://www.dusit.ac.th	**2821**	**2339**	**1912**	**3902**	**20812**	**23612**
47	**50**	http://www.nmhu.edu	**3828**	**2065**	**1916**	**3801**	**21633**	**24169**
48	**47**	http://www.mgimo.ru	**2749**	**2508**	**2407**	**2507**	**20444**	**24540**
49	**51**	http://www.xznu.edu.cn	**3843**	**2360**	**2066**	**2792**	**21984**	**25660**
50	**49**	http://www.sciencespobordeaux.fr	**3283**	**2599**	**2665**	**1673**	**21300**	**25688**
51	**46**	http://www.njust.edu.cn	**2182**	**2434**	**2174**	**3801**	**20075**	**25707**
52	**56**	http://www.spc.edu	**3338**	**1779**	**5678**	**4707**	**24177**	**26409**
53	**54**	http://www.tokai.ac.jp	**3075**	**2177**	**5189**	**3335**	**23382**	**26446**
54	**55**	http://www.miem.edu.ru	**2181**	**2880**	**5095**	**2893**	**23870**	**27138**
55	**53**	http://www.jct.ac.il	**2687**	**3103**	**1833**	**3335**	**22954**	**27318**
56	**57**	http://www.hebau.edu.cn	**2308**	**3002**	**2437**	**5445**	**24506**	**27786**
57	**52**	http://www.ujn.edu.cn	**1581**	**3298**	**2646**	**3531**	**22531**	**28311**
58	58	http://www.rdc.ab.ca	3062	2822	3417	4163	24992	28988
59	**60**	http://www.ensicaen.fr	**2640**	**3897**	**2978**	**1824**	**25670**	**29666**
60	**59**	http://www.aubg.bg	**4069**	**3203**	**1573**	**2824**	**25347**	**30379**

The rank order of the sample without any modification (Old Order), the rank order of the sample with AR modification (New Order), the URL (Website), Size rank (S), Visibility rank (V), Rich file rank (R), Google scholar rank (Sc), Webometric Rank (WR), Global Rank (GR)

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