



# SAVVY SEARCHING

## Google Scholar revisited

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### Abstract

**Purpose** – The purpose of this paper is to revisit Google Scholar.

**Design/methodology/approach** – This paper discusses the strengths and weaknesses of Google Scholar.

**Findings** – The Google Books project has given a massive and valuable boost to the already rich and diverse content of Google Scholar. The downside of the growth is that significant gaps remain for top ranking journals and serials, and the number of duplicate, triplicate and quadruplicate records for the same source documents (which Google Scholar cannot detect reliably) has increased.

**Originality/value** – This paper discusses the strengths and weaknesses of Google Scholar.

**Keywords** Data collection, Worldwide web, Document delivery

**Paper type** General review

Google Scholar had its debut in November 2004. Although it is still in beta version, it is worthwhile to revisit its pros and cons, as changes have taken place in the past three years both in the content and the software of Google Scholar – for better or worse.

Its content has grown significantly - courtesy of more academic publishers and database hosts opening their digital vaults to allow the crawlers of Google Scholar to collect data from and index the full-text of millions of articles from academic journal collections and scholarly repositories of preprints and reprints. The Google Books project also has given a massive and valuable boost to the already rich and diverse content of Google Scholar. The downside of the growth is that significant gaps remained for top ranking journals and serials, and the number of duplicate, triplicate and quadruplicate records for the same source documents (which Google Scholar cannot detect reliably) has increased.

While the regular Google service does an impressive job with mostly unstructured web pages, the software of Google Scholar keeps doing a very poor job with the highly structured and tagged scholarly documents. It still has serious deficiencies with basic search operations, does not have any sort options (beyond the questionable relevance ranking). It offers filtering features by data elements, which are present only in a very small fraction of the records (such as broad subject categories) and/or are often absent and incorrect in Google Scholar even if they are present correctly in the source items.

These include nonexistent author names, which turn out to be section names, subtitles, or any part of the text, including menu option text which has nothing to do with the document or its author. This makes “F. Password” not only the most productive, but also a very highly cited author. Page numbers, the first or second segment of an ISSN, or any other four-digit numbers are often interpreted by Google Scholar as publication years due to “artificial unintelligence”. As a consequence, Google Scholar has a disappointing performance in matching citing and cited items; its hit counts and citation counts remain highly inflated, defying the most basic



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plausibility concepts when reporting about documents from the 1990s citing papers to be published in 2008, 2009 or even later in the twenty-first century.

In spite of the deficiencies and shoddiness of its software the free Google Scholar service is of great help in the resource discovery process and can often lead users to the primary documents in their library in print or digital format and/or to open access versions of papers which otherwise would cost more than \$30-\$40 each through document delivery services. Google Scholar can act at the minimum as a free, huge and diverse multidisciplinary I/A database or a federated search engine with limited software capabilities, but with the superb bonus of searching incredibly rapidly the full-text of several million source documents. However, using it for bibliometric and scientometric evaluation, comparison and ranking purposes can produce very unscholarly measures and indicators of scholarly productivity and impact.

### **Background and literature**

On the third anniversary of Google Scholar I give a summary of the pros and cons of Google Scholar, focusing on the increasingly valuable content and on the decreasingly satisfactory software features which must befuddle searchers and ought to be addressed by the developers. I discuss here Google Scholar from the perspective of some of the traditional database evaluation criteria that have been used for decades (Jacsó, 1998). I complement this paper with an unusually long bibliography of some of the most relevant English-language articles by competent information professionals. For many of the citations I provide the URL of an open access preprint or reprint version, or of the original version published in an open access journal, to offer readers convenient access to the papers and understand the opinion of the authors. Re-reading these papers in preparation for this review was a great pleasure, even when my opinion did not agree with that of the reviewers. The balance of pro and con arguments and evidentiary materials presented by competent information professionals has been rewarding and has motivated my creation of this bibliography. It does not include references to papers which are dedicated to the citation counts of articles as presented by Google Scholar. These will be provided in follow-up papers which discuss the strengths and weaknesses of using Scopus, Web of Science and Google Scholar to determine the Hirsch-index and derivative indexes for measuring and comparing research output quantitatively.

After the launch of Google Scholar it received much attention, just as anything does that relates to Google, Inc. Within the first few months of its debut, there were a number of reviews in open access web columns (Price, 2004; Jacsó, 2004; Goodman, 2004; Gardner and Eng, 2005; Abram, 2005; Tenopir, 2005), and three web blogs were launched dedicated to Google Scholar (Sondemann, 2005; Giustini, 2005), or partially dedicated (Iselid, 2006).

These were followed by reviews in traditional publications (Jacsó, 2005a; Myhill, 2005; Notess, 2005, O'Leary, 2005, Giustini and Barsky, 2005; Noruzi, 2005; Adlington and Benda, 2006; Cathcart and Roberts, 2006) focussing on the content and software aspects of Google Scholar. These were well complemented by a number of essays, editorials and surveys pondering the acceptance, use, promotion and "domestication" of Google Scholar as one of the endorsed research tools for students and faculty in academic institutions (Kesselman and Watsen, 2005; Price, 2005; Anderson, 2006;

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Gorman, 2006; Mullen and Hartman, 2006; Friend, 2006; Hamaker and Spry, 2006; York, 2006; Helms-Park *et al.*, 2007; Schmidt, 2007; Taylor, 2007).

As Google Scholar became more intensively used, several research papers started to put it into context by comparing Google Scholar's performance with a single database (Schultz, 2007), federated search engines (Felter, 2005; Giustini and Barsky, 2005; Chen, 2006; Sadeh, 2006; Donlan and Cooke, 2006; Haya *et al.*, 2007; Herrera, 2007), citation-enhanced databases such as Web of Science and/or Scopus (Bauer and Bakkalbasi, 2005; Jacsó, 2005b; Jacsó, 2005c; Yang and Meho, 2006; Norris and Oppenheim, 2007), or with a mix of these and traditional scholarly indexing/abstracting databases (White, 2006).

There is increasing specialisation in researching Google Scholar, applying the traditional database evaluation criteria such as size, timeliness, source type and especially breadth of journal coverage (Jacsó, 1997) in a consistent manner in the context of a very non-traditional database which piggybacks on other sources rather than creating its own (Wleklinksy, 2005; Vine, 2005; Vine, 2006; Neuhaus *et al.*, 2006; Pomerantz, 2006; White, 2006; Mayr and Walter, 2007; Walters, 2007).

The recent incorporation of books in Google Scholar from Google Book Search (which after a poor debut with deficient software features, turned around and introduced within a month far more sophisticated software than Google Scholar in three years), spawned useful research (Hauer, 2006; Lackie, 2006; Goldman and Connolly, 2007), as did the only good new software feature of Google Scholar which led users to the full-text digital source document in the users' library through Open-URL resolvers (Grogg and Ferguson, 2005; O'Hara, 2007; Lagace and Chisman, 2007).

There is one additional research area where Google Scholar will play an important role: its use for bibliometric and scientometric evaluation of the performance of researchers, which is such a complex issue that it deserves to be discussed in a separate paper, with its own rich set of references.

### **The pros**

Most of the pros relate to the content part of Google Scholar, from different angles, including coverage, variety in source and journal base, size and currency.

#### *Journal coverage*

The source base of Google Scholar has been considerably enhanced since its debut, as every scholarly publisher wants to be a part of the Google universe. The source base also increased in quality through full-text indexing of thousands of additional academic journals of importance from the sites of the publishers, rather than just indexing bibliographic data and abstract from I/A databases. The two most important journal publishers that started to co-operate with Google Scholar are Elsevier and the American Chemical Society. Although only a tiny proportion of these publishers' digital collections (Elsevier's 7 million items and the ACS's 0.75 million items) have been indexed so far by Google Scholar, their shares are expected to increase rapidly once the Google Scholar spiders are sent to their routes.

#### *Book coverage*

It was an excellent idea to add book records to Google Scholar, primarily from the Google Books Project. It is a huge advantage, as books are barely present even as an

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indexing/abstracting record, let alone as a completely indexed, full-text item (for searching, not viewing) in most of the other multidisciplinary mega-databases (except for the also free and outstanding Amazon.com site). In preparing for a tutorial session in Vietnam, it was impressive to find 27 books in Google Scholar, each of which had numerous passages about or references to the so-called “scholar gentry class”. This is the type of casual digital book use that the late Frederick Kilgour, the founder of OCLC envisioned more than 20 years ago, when he was already in his early 70s.

### *Geographic and language coverage*

The geographic and language coverage of Google Scholar is also impressive and genuine. It is a typical limitation of even the subscription-based scholarly databases that they often almost exclusively cover only anglophone sources, predominantly published in the USA, UK, Australia and Canada (in which case francophone documents are also covered). I do not blame the commercial database publishers for this, as they were not created on the same principles as the UN or UNESCO. They have to spend their money on processing documents which are of interest to and understandable by the majority of scholars, their primary customers.

The Google Scholar service does not have the ever-increasing costs of subscription and human processing of the scholarly print publications. It has free access to practically any scholarly digital document collection it wants, and wisely has decided to index (by software) important Spanish, Portuguese, German, Japanese, Chinese, Korean and Russian language collections of academic works. While the latter four are of no help to me, the former three are and are worth the extra mental effort to read in the native language, as there are several sources in my areas of specialisation where researchers in Germany, Austria, the Iberian peninsula, Central and South America (especially Brazil), that publish only in German, Spanish and Portuguese.

I have avoided referring to the actual size of Google Scholar and its subsets, as it is impossible to determine a realistic number, or even estimate the number of records in the database, or in the Canadian subset or the language subsets.

### *Digital repositories*

The coverage of digital repositories – even if far from complete – is already a great asset, especially for physics, astrophysics, medicine, economics and computer and information sciences and technology. But the use of such full-text repositories still could be significantly improved. For example, only about a quarter of the open access PubMed Central (PMC) items are directly available in Google Scholar. True, there are records in Google Scholar – from other sources, such as cababstractsplus.org – for many more of the 620,000 full text documents deposited in PMC.

It would, however, be essential to index the source documents and give them priority in displaying the result list clearly, marking them as open access, instead of giving undeserved prominence to the British Library document delivery service (BL Direct), which is more than happy to charge for document delivery even when the open access paper is just a click away from the user. Just as quickly as Google Scholar can determine whether a journal is available for article delivery through the British Library, it could determine whether it is available free of charge from runs of open access issues of the journal. The same is true for the open access full-text subset of the National Transportation Library (which has, for example, more than 100 documents

about transport-related terrorism). In sharp contrast Google Scholar has only a dozen source documents indexed and made available from that site.

While praising the broad content coverage of Google Scholar, it must be noted that there are still huge gaps in the full-text indexing of the most important serial publications as mentioned in the original review (Jacsó, 2005a). For example, less than 17 per cent of the 430,500 documents at the nature.com web site were indexed by Google Scholar directly from that site (which includes not only *Nature* magazine but also many other journals of the Nature Publishing Group). True, many more than 17 per cent of them have a record in Google Scholar, but many of these are just citation records with minimal information.

#### *Indexing/abstracting records*

It is good that there are millions of records from good indexing/abstracting databases for documents for which digital full text is not yet available. However, Google Scholar should have used the unique privilege granted by thousands of scholarly publishers of gaining permission to crawl and index the full text of the primary documents, rather than just the ersatz records, often redundantly through several indexing/abstracting databases.

#### *Size*

I usually start the content review by determining the size of the database, and its distinct subsets. It is essential for researchers to know how many records are in Google Scholar in total, and/or in, say, English or Spanish, which journals are covered from what publishers for what time span, but its developers “take the Fifth” when asked about it or about any factual features of the database (such as the number of journals, publishers, foreign language materials, articles, conference papers, reports, books covered). My various “sizing up” queries do not work so it would be irresponsible to report them.

The only good new features in the software are the Library Links and Library Search options. These inform users whether their library offers access to the document in question. If your library signed up (and provided data about its digital journal holdings) to Google Scholar this would work automatically (if Google Scholar is invoked from the library or a computer with authenticated IP address, or remotely through the library, after the appropriate login process). The Library Search option for books works if the library is an OCLC member. It is to be noted that the [BOOK] label in the Google Scholar result lists often refers to a review of, or blurb about, the book rather than the book itself.

#### **The cons**

Practically all the major negative traits of Google Scholar are caused by or relate to software issues. As indicated above, it is impossible even to guess the size of the database because of elementary problems with the software.

#### *Innumeracy*

It speaks volumes about the limitations of the software that when using the query term < the > (the most commonly occurring English word), Google Scholar yields a hit count of over 1.5 billion records, whether you are using it with or without the + sign or

surround it by double quotation marks (as it is supposed to be a stop word without these signs, but apparently it is not). I do not believe this hit count to be true, but that is not the point here (see Figure 1).

If you add (out of curiosity) the letter “a” in an OR relationship, the result set should increase by picking up records for foreign language source documents which use the letter *a* as the definite article and/or a preposition. In the extreme case, if all anglophone records had the letter “a” as the indefinite article or part of terms such a “blood type A”, “personality A”, “grade A”, the number of hits would not increase.

But in Google Scholar the OR operator decreases the result set to less than 1 per cent of the original set. The regular Google search engine does not take part in this nonsense. Some may feel lucky that, although both search terms were purportedly excluded from the search (as the message shows), Google Scholar still could provide with nearly 14 million hits – without using the + sign or the double quotation mark. Actually, it shows only 1,000 hits at most for any query, so it can claim any number above 1,000 without the burden of proof (see Figure 2).

This has been a problem from the beginning. The enhancement of the content has not been matched by improvements in the software. The software does not reflect at all, for example, the specialties of the fully-indexed books. The template in the advanced mode still refers to articles written by, articles published in, articles published between, and articles in subject areas.

As for subject areas, they should not be used as filters. When entering the search for any documents with the word “Vietnam” in the title, and the radio button for all subject areas turned on, Google Scholar reports 135,000 hits, an impressively high number. When sending the query through the advanced template, Google Scholar inserts two spaces in front of the search term. If you change it to one, the result will go up to 137,000; if you eliminate both spaces the result set will revert to 135,000 items. This is not true for field-specific searches, such as author, title, journal name. This will be the



**Figure 1.**  
Hit count for the definite English article



**Figure 2.**  
Unorthodox Boolean OR which reduces the original set by 99 per cent

least enigmatic part of the search process, thanks to the logic of Google Scholar (see Figure 3).

Selecting one checkbox at a time for filtering by the first subject group, then the second, the third, etc. will produce cumulative subsets. After the last subject group the aggregate of the seven subject categories will produce a set of 20,500 records. This is less than 15 per cent of the original set, meaning that 85 per cent of the items for this topic are not assigned to any of the subject groups (see Figure 4).

Much more surprisingly, when the query is expanded by adding the word “Vietnamese” to the query without any filtering, the result will shrink to 46,100 items (34 per cent of the single-word query) (see Figure 5).

More oddly, restricting the search to the seven listed subject groups will increase the result set to 105,000. Activating the “Search in All Subject Areas” radio button will report a set size of 43,200 (not shown here because any logic breaks down here, and only the first 1,000 items will be listed by Google Scholar anyhow) (see Figure 6).

The image shows a screenshot of the Google Scholar Advanced Search interface. At the top, the Google Scholar logo is on the left, and 'Advanced Scholar Search' is on the right. Below the logo, there are several search filters: 'Find articles with all of the words' (selected), 'with the exact phrase', 'with at least one of the words', 'without the words', and 'where my words occur'. The search term 'vietnam' is entered in the first input field. Below these filters, there are sections for 'Author', 'Publication', and 'Date', each with an input field and an example. The 'Subject Areas' section has a radio button selected for 'Return articles in all subject areas'. At the bottom, there is a search bar with 'allintitle: vietnam' and a 'Search' button. Below the search bar, there are links for 'Advanced Scholar Search', 'Scholar Preferences', and 'Scholar Help'. The search results are displayed below, showing 'Scholar All articles - Recent articles Results 1 - 100 of about 135,000 for allintitle: vietnam'. The first result is '[BOOK] Trauma and the Vietnam War Generation: Report of Findings from National Vietnam Veterans ...' by R. Kulka, published in 1990 by Brunner/Mazel. There are also links for 'Cited by 693', 'Related Articles', 'Web Search', and 'Library Search'.

Figure 3.  
Search for Vietnam in the  
title in all subject areas

allintitle: vietnam Search

- Search only in:
  - Biology, Life Sciences, and Environmental Science
  - Business, Administration, Finance, and Economics
  - Chemistry and Materials Science
  - Engineering, Computer Science, and Mathematics
  - Medicine, Pharmacology, and Veterinary Science
  - Physics, Astronomy, and Planetary Science
  - Social Sciences, Arts, and Humanities
- Search in all subject areas.

Scholar All articles - Recent articles Results 1 - 100 of about 20,500 for allintitle: vietnam. (0)

All Results

[BOOK] Trauma and the Vietnam War Generation: Report of Findings from National Vietnam Veterans ...

Figure 4. Selecting each listed categories the set decreases by 85 percent

Find articles with all of the words

with the exact phrase

with at least one of the words → vietnam vietnamese

without the words

where my words occur → in the title of the article

Author Return articles written by

e.g., "PJ Hayes" or McCarthy

Publication Return articles published in

e.g., J Biol Chem or Nature

Date Return articles published between

e.g., 1996

Subject Areas  Return articles in all subject areas.

allintitle: vietnam OR vietnamese Search

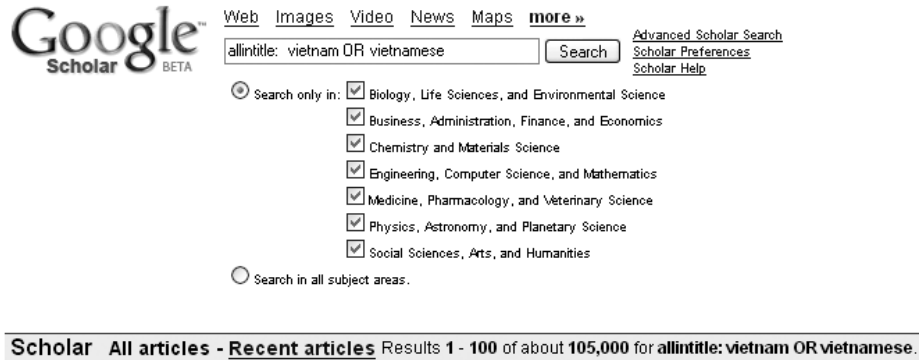
Scholar All articles - Recent articles Results 1 - 100 of about 46,100 for allintitle: vietnam OR vietnamese.

Figure 5. Expanding the query will drastically shrink the result set

The publication year limiters behave in an equally odd way. Limiting the initial set with "Vietnam" in the title to the publication year range 1435-2008, to accommodate the first possible English language transliteration of the Vietnamese word for the name of the country to publications which will be published the next year (I write this in mid-November, 2007) yields 20,200 hits. Limiting the search to 1960-2008, i.e. to a more than 500 years shorter time span, increases the set to 20,600 items. The fact that many



**Figure 6.**  
Restricting the query to predefined subject categories will more than double the set



records in any sample would not have the publication year data element, or Google Scholar would not recognise it, does not justify this logic. There is no word about this serious limitation in the help file (see Figure 7).

*Illiteracy*

These were problems of innumeracy, but there are many problems that can be classified as problems of illiteracy in the software. When the two come together in certain searches the result becomes serious. Google Scholar has deficiencies in distinguishing author names from other parts of the text using its parsing algorithm.

After seeing left and right author names like F. Password, V. Findings, N. Vietnam, S. Vietnam, it was surprising to notice one of the new software features of Google Scholar, the cluster of authors related to the user's query as explained in the help file. My test search shows the suggested authors from a set of purportedly 2,9110,000 records on the topic of risk factor evaluation with the following names: P Population, R Evaluation, M Data, R Findings and M Results (see Figure 8).

The extent of wrong author names is well above hundreds of thousands and often these results deprive the real authors from receiving credit for some of their paper (including highly cited papers) and thus prevent them from receiving a decent h-index.

The upcoming issues will look at the theory and the practice of determining the h-index in general, and in Google Scholar, Scopus and Web of Science in particular.



**Figure 7.**  
The shorter the time span the higher the hit count

Scholar All articles - Recent articles Results 1 - 100 of about 2,910,000 for risk factor evaluation.

All Results

P Population

R Evaluation

M Data

R Findings

M Results

[Pyrogenic Hepatic Abscess: Changing Trends Over 42 Years - Full-Text @ My Library - all 6 versions »](#)  
P Population, R Evaluation, M Data, R Findings, M ... - Annals of Surgery, 1996 - annalsofsurgery.com  
... al.21 from Taiwan found several of the same parameters to be **risk factors** as were  
...  
found that a high Acute Physiology and Chronic Health Evaluation (APACHE) II ...  
[Cited by 113](#) - [Related Articles](#) - [Web Search](#)

How do I search by category?

From the [Advanced Search page](#), you can search for scholarly literature within seven broad areas of research. Simply check the boxes for the subject areas you're interested in searching.

Why are there author names on the left hand side of my results page?

We automatically suggest authors related to your query – just click on an author's name and you'll see their papers. Finding authors who publish on the topics you're interested in is often a great way to get better acquainted with a field and discover related work you may not have found otherwise.

**Figure 8.**  
Odd list of recommended authors in the side bar, and a cheery help file

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