Examining the Claims of Google Scholar as a Serious Information Source

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The Debate

Since its introduction in mid 2004 the Google Scholar search engine has been the subject of considerable interest within the library community and has been the subject of both excitement and criticism. While applauding its ambitious scope various writers have pointed out its shortcomings through unfavourable comparisons with the traditional scholarly databases. These include -

- the incompleteness of Google Scholar's coverage
- the inconsistent and unstructured nature of its records
- the lack of formal indexing
- the many inaccuracies that result from the application of an algorithmic approach to a large and varied body of documents and records
- the relative paucity of its search options
- the inability to accurately sort results by date.

By way of contrast, formally structured databases from commercial suppliers were seen to provide better coverage, were more up-to-date, had better search options, contained fewer errors and were more transparent. Their coverage was known and their users could reasonably expect that all relevant articles from the journals listed would be found by an appropriately structured search.

Google Scholar's most consistent critic has been Péter Jacsó who has subjected the results of searches to a rigorous analysis (Jacsó, 2005a, 2005b, 2006a, 2006b) and found a number of deficiencies -

- inflated results counts
- incomplete coverage of academic journal contents
- inaccurate identification and counting of citing and cited records
- inaccurate identification of authors' names
- the creation of bibliographic absurdities through poor handling of metadata
- the inclusion of material of dubious scholarly worth.

Jacsó sees Google Scholar as a wasted opportunity – having been granted access to a large body of academic content its creators have failed to apply sufficient rigour and have come up with a product that allows its users to "discover only a fragment of the scholarly literature" (Jacsó, 2005b). Other writers have echoed his criticisms; Roy Tennant (2005) described Google scholar as an "emperor without clothes" while Mary Ellen Bates (2005) suggested that library clients should be advised to approach it with "fear, uncertainty and doubt." In a thoughtful study of Google Scholar's usefulness in the social sciences Susan Gardner and Susanna Eng (2005) found much that was positive, especially in its relevance rankings, before concluding that "it cannot compete with the article index databases."

It is little wonder then that the uptake of Google Scholar by many within the academic community, students and faculty alike, has concerned those librarians who do not consider its functional deficiencies and incomplete coverage of the scholarly literature to be well-adapted to the task of accurate and comprehensive information retrieval. Of particular concern has been the tendency of users to see it as a scholarly one-stop-shop in the mould of Google itself. Describing 'the principle of least effort' Thomas Mann (1993, p. 97) has suggested that "given a choice between a system of access to information that is perceived as easy to use and one that is perceived as difficult most researchers will choose the easy path alone regardless of the fact that it may contain lower quality content." In the case of Google Scholar there is indeed reason to believe that students and researchers who find the complex structure of the electronic information domain uncongenial will follow this principle by treating it as a single unbounded source of information which by utilising a single search methodology releases them from the task of using a variety of sources each with its own set of protocols and its own limitations and boundaries (Brophy & Bawden, 2005; Markland, 2005). Such a desire would be only rational and even if there were some trade-off to be made in terms of coverage or accuracy this would probably be acceptable in many cases. It is important not to overstate the dangers inherent in this wish for simplicity; we should bear in mind that users of scholarly information are not passive consumers – they bring to the search process a body of existing knowledge and a reasonable expectation of what they should and will find. These critical users will not be easily satisfied by anything less than comprehensive and high quality information.

It is reasonable to wonder in fact whether the principle of least effort is as ironclad a rule as Mann suggests - after all below a certain point minimisation of effort becomes clearly dysfunctional. Rather than being simply minimalist, much information seeking behaviour may be governed by the principle known to biologists as "optimal foraging" (MacArthur & Pianka, 1966); researchers will gravitate towards those sources that give the greatest return for effort and will tend to avoid the energy cost of making their searching absolutely comprehensive when this is unlikely to produce a positive outcome. From that point footnote-chasing (Mann, 1993, p. 75) is likely to take over as the preferred method of acquiring new documents.

The fear that researchers would desert traditional information sources and tools has tended to place the early discussion of Google Scholar within an excessively binary frame which Kesselman and Watstein have cleverly characterised as a point/counterpoint dispute between 'handwringers' and the 'carpe diem camp' (Kesselman, 2005). Until relatively recently the desire to counter its use as a one-stop-shop and to criticise or defend it on this basis have tended to overshadow more pragmatic questions relating to its actual value and usefulness. It is only now that a more nuanced picture is emerging that the practising librarian may make real decisions on when to use it and how to position it alongside other information products. A report on the use of Google Scholar in University of California libraries (Meltzer, 2005) revealed an extensive pattern of activity despite misgivings on the part of librarians and concluded that its inclusion among the information products on the libraries' home page was the most sensible course of action. Indeed G.E. Gorman (2006) has suggested that Google Scholar was well on the way to replacing many traditional library functions and that libraries needed to reposition themselves into new niches. The provision of openURL links through the Library Links programme has lead many libraries to make use of Google Scholar in linking their clients to subscribed content; recognising the complex issues surrounding its use. M.I.T. Libraries (2005) have provided sound advice to their clients on its value and limitations and on the need to supplement the results of its searches from other sources and undoubtedly librarians everywhere are grappling with the issues it has raised.

If librarians in New Zealand are to make use of Google Scholar and recommend it to our clients there are a number of questions to be answered –

- are there purposes for which Google Scholar is poorly suited?
- are there occasions on which it will be the best source of information?
- what are the gaps in coverage that should be supplemented from other sources?
- does it provide access to a sufficient amount of quality material to sit alongside structured databases on library websites?

Examining the Evidence

Despite misgivings it is possible to identify areas in which Google Scholar has a distinct edge over rival products and that advocate its use as a serious information tool. Although a thorough comparison of the differing results returned by Google Scholar and traditional scholarly databases is beyond the scope of this article some examples can be used to identify two distinct areas in which it performs with considerable credit – keyword searching within the full-text of articles and the linking of articles to later works that cite them.

Like its parent product, and other general search engines, Google Scholar is based on an algorithmic spider that creates indexes to massive amounts of internet-based text, in this case consisting of works that might, through their provenance, be considered academically sound. These include traditional web pages from

research and academic institutions and material from university digital repositories including theses, working papers and other 'unpublished' material as well as authorised copies of published articles. More importantly the Google Scholar spider has been given access to the full text of a considerable number of academic journals through their publishers' websites. Google doesn't publish a list of these but it is easily possible to compile a fairly impressive inventory – Blackwell, Taylor & Francis, Springer, Cambridge, Wiley, Sage, Emerald, Nature Publishing, Association for Computing Machinery, IEEE, American Institute of Physics, Royal Society of Chemistry, BioMed Central, Public Library of Science and many more including the journals of the Royal Society of New Zealand. In addition to these publishers' sites the spider also accesses some substantial full text collections like Highwire (learned society journals), Bioone, Project Muse and JSTOR. All in all, this amounts to full text coverage of several thousand peer-reviewed journals and one is left looking for serious omissions. Elsevier's ScienceDirect is the obvious one – having created their own scholarly search engine in Scirus they may not wish to share their content with a perceived rival even though this exclusivity may begin to look rather more like self-imposed exclusion. As well as Elsevier, Google Scholar also misses out on many small publishers with one or two titles, learned societies that haven't found a place under the umbrella of Highwire and of course print-only titles. However as in addition to its full-text coverage Google Scholar also includes records from a number of open-access databases with searchable metadata and abstracts such as PubMed and ingentaconnect references to many articles from these excluded publishers are returned by its searches, albeit that the full-text is not being searched.

Providing search access to this amount of full text is a hugely ambitious undertaking and possibly beyond the capacity of those library-oriented federated search engines which still use metadata and abstracts as their search targets and simply link to full text rather than indexing it directly. While some databases provide full text searching, as do journal publishers' websites, to amalgamate all of this into a single searchable entity creates so many inconsistencies that Google Scholar will provide errors and omissions to keep its critics busy for years to come. The variety of different data structures over such a wide range of sources militates against the construction of a single accurate and discriminating search statement.

Comparisons between the capabilities of databases and search engines are notoriously difficult involving as they do judgements on both the volume and the relevance of the information found and this article cannot pretend to be a rigorous examination which would need to be based on end-user perceptions of relevance as well as on "hit-counts". However some simple examples will suggest areas in which Google Scholar's usefulness is most evident. To allow for a fair comparison I have counted only hits to articles in scholarly journals that are found towards the top of the Google Scholar list of hits – within the first sixty or so records.

Example 1 (17 May 2006):

Effect of dairying on groundwater aquifers in Southland

CAB Abstracts and Web of Science (both through Web of Knowledge)

(groundwater or aquifer*) and southland and zealand and dairy*

2 hits

Geobase

kw: dairy+ and (kw: aquifer+ or kw: groundwater) and kw: southland

2 hits

Google Scholar

groundwater OR aquifer southland zealand dairy

117 total hits which included 16 "apparently relevant" journal articles within the first 40 hits.

Among the records found by Google Scholar but not by the database search were -

Cameron, K. C., Di, H. J., Reijnen, B. P. A., Li, Z., Russell, J. M., & Barnett, J. W. (2002). Fate of nitrogen in dairy factory effluent irrigated onto land. *New Zealand Journal of Agricultural Research, 45*(3), 207-216.

McDowell, R. W., Monaghan, R. M., & Morton, J. (2003). Soil phosphorus concentrations to minimise potential P loss to surface waters in Southland. *New Zealand Journal of Agricultural Research, 46*(3), 239-253.

Monaghan, R. M., Paton, R. J., & Drewry, J. J. (2002). Nitrogen and phosphorus losses in mole and tile drainage from a cattle-grazed pasture in eastern Southland. *New Zealand Journal of Agricultural Research, 45*(3), 197-205.

These three articles were present in both the Web of Knowledge databases and in Geobase but were not returned because the titles and abstracts did not contain the search terms which Google Scholar located within the articles themselves. One could argue about the degree of relevance of these three articles and the others found or that the database search had been too narrow (although the ability to construct highly specific search statements is an advantage of electronic searching), but it hard to imagine that the researcher would not welcome knowledge of these additional articles and the other thirteen that were found as well.

The advantage of full-text searching is illustrated by the example below. The record from CAB Abstracts while containing a full abstract and thorough indexing does not contain either of the search terms "groundwater" or "aquifer" and so was not returned by the search. The first sentence of the article's introduction on the other hand gives a full match of all the ANDed search terms. Now it could be argued that the database record contains the term "water" throughout so that using

this as an ORed term would have produced this record as a hit, but to follow this logic means that the word "groundwater" cannot be searched for independently of finding all records containing the word "water".

ISI Web of Knowledge℠   [CAB Abstracts ▼] [GO]

Title: Nitrogen and **phosphorus losses** in mole and tile drainage from a cattle-grazed pasture in eastern Southland.

Author(s): Monaghan, R. M.; Paton, R. J.; Drewry, J. J.

Source: New Zealand Journal of Agricultural Research 45 (3) : 197-205 2002

Language: English

Abstract: An experimental system for monitoring drainage outflows from mole- and tile-drained plots is described, and nitrogen (N) and phosphorus (P) losses in drainage are reported for Year 1 of a 4-year study examining nutrient losses in drainage from a pasture in Southland. Twelve plots (0.09 ha), grazed by non-lactating dairy stock, were artificially drained by installing a mole and tile drainage network. A metering station was used to monitor drainage flow rate from six of these plots using a V-notch weir and a shaft encoder system. Drainage water samples were collected on a flow proportional basis using either an automated water sampler triggered by the flow monitoring system, or by manual collection during daylight hours. The amount of nitrate-N lost in drainage water in this first year of study was 25 kg N ha-1, resulting in a volume-averaged nitrate-N concentration of 6.9 mg N litre-1. Although this is a significant loss of potentially plant available N, the average nitrate-N concentration of the drainage water was below the 11.3 mg N litre-1 standard adopted by the New Zealand Ministry of Health for acceptable nitrate levels in drinking water. Mean dissolved reactive P and total P concentrations in drainage waters were 23 and 74 micro g P litre-1, respectively. Analysis of forms of P showed 61% of the total P lost in the drainage was in the form of particulate P, which may reflect the recent introduction of mole and tile drainage to this site.

Address: AgResearch, Invermay Agricultural Centre, Private Bag 50 034, Mosgiel, New Zealand.

Publisher: Royal Society of New Zealand; Wellington; New Zealand

ISSN: 0028-8233

CABICODES: JJ800 Soil Water Management (Irrigation and Drainage) (REVISED June 2002); PP200 Water Resources; PP350 Grasslands and Rangelands

CAS Registry No.: 7727-37-9; 7723-14-0

Descriptors: drainage water; mole drainage; nitrogen; pastures; phosphorus; tile drainage; water flow; water quality

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Nitrogen and phosphorus losses in mole and tile drainage from a cattle-grazed pasture in eastern Southland

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INTRODUCTION

The rapid expansion of dairy farming in Southland, New Zealand, throughout the late 1980s and 1990s has raised local concerns about the impact of this intensive land use on groundwater quality. The potential for leakage of nitrate into groundwater aquifers and the associated risks to human health has been of concern to rural communities within

Abstract An experimental system for monitoring drainage outflows from mole- and tile-drained plots is described, and nitrogen (N) and phosphorus (P)

Example 2 (17 May 2006):

Rushing attacks on ad hoc wireless networks

ACM Digital Library

+"rushing attack" +"ad hoc wireless network" (full text search)

8 hits

IEEE Xplore

rushing attack<and>ad hoc wireless network (full text search)

13 hits

Google Scholar

"rushing attack" OR "rushing attacks" "ad hoc wireless network" OR "ad hoc wireless networks"

68 hits

At least 28 journal articles and refereed conference papers were found – these included all of the ACM hits plus 11 out of the 13 IEEE records. To some extent this is an easy question for Google Scholar which covers both ACM and IEEE and there is cause for concern about the two IEEE records it did not find. On the other hand Google Scholar has found a sizeable body of information in sources that were not covered by either of these databases. The general purpose databases Web of Science and Business Source Premier produce no hits on such a specific topic even when the latter is searched full text.

This search demonstrates the need for care in searching Google Scholar. While Google's stemming technology was effective in returning variant endings in Example 1, here it failed to operate and only by ORing singular and plural was the search productive. Inconsistencies of this sort detract from Google Scholar's standing as a serious information source and underline the need for user awareness of its shortcomings and the need to try alternative strategies.

Example 3 (17 May 2006):

Gabriel Plattes (the seventeenth century utopian and scientific author)

Historical Abstracts

1 hit

Web of Science

2 hits

JSTOR (full text)

51 hits

Google Scholar

55 hits of which 38 were journal articles

Of the 38 journal articles 25 came from JSTOR which means that only about 50% of the potential hits from that source were found. As JSTOR sorts its results by relevance it is possible to find a correlation between the articles' rankings and the likelihood of being returned in a Google Scholar search. In this case 19 of the top 25 JSTOR articles were among those found by the Google Scholar search.

This example also highlights the power of searching full-text rather than metadata. In addition to the utopian tract *Macaria*, Plattes wrote about agriculture, geology, mining, chemistry, economics and social policy. The only published monograph about him is an obscure report by Charles Webster and he has been the primary subject of a handful of journal articles. Web of Science locates two reviews of the monograph and Historical Abstracts only the monograph itself. Records for many of the articles found by Google Scholar and JSTOR are present in Web of Science and Historical Abstracts but because they do not routinely index individuals named in the articles these were not found. An extreme example of the limitations imposed by this approach can be seen in the failure of Historical Abstracts and Web of Science to return the following article which established Plattes as the author of *Macaria* –

Webster, C. (1972). The authorship and significance of *Macaria*. *Past and Present, 56*, 34-48.

A controlled vocabulary entry for Plattes would have found this article but was not present in either database. Unless the databases were to index all named individuals in an article, as Chemical Abstracts (SciFinder Scholar) does for named substances, the full-text search approach still has a distinct edge in locating references to this individual. Even though full-text searching is not useful in all cases it is a valuable function in this and many other instances.

Example 4 (17 May 2006):

Works citing the article Matisoo-Smith, E., Roberts, R. M., Irwin, G. J., Allen, J. S., Penny, D., & Lambert, D. M. (1998). Patterns of prehistoric human mobility in Polynesia indicated by mtDNA from the Pacific rat. *Proceedings of the National Academy of Sciences of the United States of America, 95*(25), 15145-15150.

Web of Science

23 citing articles

Google Scholar

20 citing articles

Fourteen of the citing articles were common to both Web of Science and Google Scholar, meaning that the two sources had nine and six unique citing articles respectively. Four of the citing articles unique to Web of Science had full records on Google Scholar and should have been linked to the original cited article, another from the journal *Nature* should have appeared in Google Scholar but did not, while four articles were from journals issued by small publishers which were not covered. Of the six articles unique to Google Scholar four appeared in journals not indexed by Web of Science, including the *Graduate Journal of Asia-Pacific Studies* and the *Records of the Australian Museum.* The other two were not found by the Web of Science search because of erroneous citation of the Matisoo-Smith article. Links between cited and citing articles depend on a high degree of accuracy and consistency and this is clearly an issue for both sources.

Example 5 (17 May 2006):

Works citing the article Scheyvens, R. (1999). Ecotourism and the empowerment of local communities. *Tourism Management*, *20*(2), 245-249.

Web of Science

6 citing articles from the journals *Annals of Tourism Research* (4), *Development and Change* and *Tourism Management.*

Google Scholar

33 citing references of which 9 were from scholarly journals in English - *Development and Change*, *Tourism Management*, *Journal of Sustainable Tourism* (2), *International Journal of Sustainable Development*, *Journal of Ecotourism*, *Development Policy Review*, *Current Issues in Tourism*, *International Journal of Tourism Research.*

The citing articles from *Development and Change* and *Tourism Management* were common to both sets with the result that a total of thirteen articles were found that had cited the original article by Scheyvens. Only the four articles from *Annals of Tourism Research* (published by Elsevier and hence not accessible to the Google spider) were unique to Web of Science whereas the other seven articles were unique to Google Scholar. Tourism research is not well covered by Web of Science and citations from several of the major journals in this field were therefore not included.

Jacsó has rightly pointed out the dangers of taking Google Scholar's "cited by" counts at face value but this example makes very clear the limitation of Web of

Science citation counts; being confined to citings in WoS-indexed journals they represent only a fraction of the true number of citings a document may have received. Unless the scholarly community is to grant an absolute meaning to the inclusion of journals in WoS then these figures could be seen as arbitrary in nature, especially for those disciplines outside the pure sciences.

Example 6 (26 June 2006):

Articles on leptospirosis published since 1966 in *New Zealand Veterinary Journal*

OVID Medline With Map Term to Subject Heading

44 hits

OVID Medline with Non-indexed Citations

68 hits

Google Scholar

108 hits

SciQuest database (i.e. full-text search of the publisher's website)

136 hits

Because the "standard" version of Medline allows keywords entered to be mapped to the subject headings of articles it includes only articles from those journals that are fully indexed. Between 1982 and 2004 *NZVJ* fell outside this category with result that its articles are not from that period are not returned by searches. The result is that a search of Medline on "leptospirosis and Zealand" fails to locate a significant amount of the available information. By searching full-text Google Scholar outperforms both versions of Medline but the superior result obtained from SciQuest bears out Jacsó's contention that Google Scholar does not find all articles from the journal's "native" website.

O V I D° MEDLINE with Map Term to Subject Heading: Ovid MEDLINE(R) 1966 to Present with Daily Update ovid web gateway		
Change Database | Help | LOGOFF		
Personal Account (for Searches) | Saved Searches/Alerts		

#	Search History	Results	Display
1	new zealand veterinary journal.jn.	1266	DISPLAY
2	leptospirosis.mp. [mp=title, original title, abstract, name of substance word, subject heading word]	4159	DISPLAY
3	1 and 2	44	DISPLAY

Ovid MEDLINE(R) In-Process , Other Non-Indexed Citations , Ovid MEDLINE(R) Daily Update , Ovid MEDLINE(R) , Ovid OLDMEDLINE(R)

ovid web gateway

Change Database | Help | LOGOFF
Personal Account (for Searches) | Saved Searches/Alerts

#	Search History		Results	Display
1	leptospirosis.mp. [mp=ti, ot, ab, nm, hw]	Details	5524	DISPLAY
2	limit 1 to yr="1966 – 2006"	Details	4099	DISPLAY
3	new zealand veterinary journal.jn.	Details	2820	DISPLAY
4	2 and 3	Details	68	DISPLAY

Google Scholar BETA

leptospirosis | "new zealand veter | 1966 | – | 2006

Scholar   Results **1 - 10** of about **108** for **leptospirosis** [definition]. (**0.06** second

Discussion

These examples demonstrate the more obvious strengths of Google Scholar in locating journal articles -

- searching of full-text as opposed to document summaries
- more precise search definition and location of otherwise hidden documents
- breadth of coverage, particularly of major academic journal publishers
- appearance of highly relevant articles near the top of results lists
- supplementation of publisher content with material from digital repositories

No matter how good the metadata and how skilfully written the abstracts the searching of summary documents is no substitute for being able to search within the full document itself - bibliographic records cannot emulate the information-richness of actual documents. This has been apparent since full documents first became searchable but the contribution of Google Scholar has been to add scale to a massive degree. This has been possible because the full-text already exists on the publishers' websites and Google's contribution is in the provision of access rather than content. In the end size matters – quantity itself is a major component of quality when it comes to information sources. The ability to locate terms and references within whole documents from thousands of journals places Google Scholar in a class of its own and the evidence suggests that conventional sources are not able to match its performance.

Google Scholar uses an algorithm based on the appearance of search words in titles and on citation counts to pull highly relevant items to the top of results lists. This is not only highly convenient but creates an impression of efficacy that appeals strongly to users and that may account in some degree for the perception gap that exists between librarians and users. We might worry about the important references missed by relevance sorting, and its tendency to push uncited recent references down the list, but this could be seen as a functionally positive feature given users' preference for looking at only the first two or three pages of results (Markland, 2005). There might in fact be equal cause for concern about the highly relevant results missed by the researcher who looks only at the most recent two or three years' records in a date-sorted database.

There are some significant limitations to Google Scholar –

- the paucity of search functions, especially the lack of proximity operators
- the inconsistency and unpredictability of Google's stemming operators
- poor date sorting
- the lack of stable metadata that would make results more reliable and easier to interpret.

Because the effectiveness of the Boolean AND operator varies inversely with the size of the record being searched the lack of proximity search functionality is a real disadvantage. In terms of precision the AND operator is most effective when used to search standard bibliographic records consisting of title, keywords and abstract and in fact searching for terms within the title only will generally produce a set of hits of the highest relevance. As the size of the search target increases the number of inconsequential hits produced by an AND search increases accordingly and by the time full documents are being searched the number of false hits can become insupportable. Consequently Google Scholar works best for very tightly-defined searches, those for which conventional database searches produce few or no results.

Jacsó has catalogued the data problems of Google Scholar so thoroughly that there is little to be achieved either by repeating them here or attempting to deny them. Essentially they result from the application of a generalised spidering technology to an area where structure and precision have traditionally prevailed. At its worst Google Scholar tests its users' tolerance by listing the authors of an article as "EA Activation, A Info and S Guidelines", but by and large its quick and dirty approach gets things "right enough often enough" to make it more than acceptable; we are already used to the false hits in database searches that result from the homonyms of search terms. At other times it is the victim of its own size and the variety of its sources as the foibles of individual providers appear to pass straight through to Google Scholar. For example Cambridge Journals Online have a practice of bundling all of the articles in a single issue into one PDF and then returning a search hit for any one of these articles as a hit for each of them with the result that hit counts from Cambridge titles can be magnified by a factor of between five and ten.

It is important to be clear about what is *not* being said here or to see this brief study as a shot in some war being waged between Google and the library community. Google Scholar is not an adequate *replacement* for the existing bibliographic information structures and given the manner in which it is constructed it is doubtful that it ever could be. On the other hand it is a valuable supplement and provides both a reality check and a new approach to information searching that is reminiscent of the impact made by citation indexing in the 1960s. In the same way as many see internet news sources and practices as a threat to traditional journalism we are justified in feeling that the structures with which we are familiar may be threatened by these new technologies but this fear in no way absolves us of the responsibility of looking at them with a cold eye and judging them by their merits as well as their weaknesses.

This article has concentrated almost exclusively on the relationship between Google Scholar and the academic journal literature. This has been done in order to test its claims of being scholarly at its most critical point. Searching as it does not only the formally published literature of scholarship but numerous digital repositories, departmental, governmental and organisational websites and other 'grey' sources, it finds a wide array of documents that have been subjected to varying degrees of quality control – theses, working papers, student papers, opinion pieces, even course outlines. This is very commendable and would in itself be good cause for interest but without the presence of peer-reviewed material it would not justify use of the "Scholar" tag. By providing access to such an extensive body of published and quality-controlled literature Google Scholar merits our attention and deserves to be brought within the academic librarian's repertoire of effective search tools, not as a one-stop-shop but as an essential alternative to existing methods. That we are aware of its shortcomings and would wish to see the product improved is a measure of the success of its claims to serious consideration.

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