

2010

Are Bibliographic Management Software Search Interfaces Reliable?: A Comparison between Search Results Obtained Using Database Interfaces and the EndNote Online Search Function

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Citation of this paper:

Fitzgibbons, Megan and Meert, Deborah, "Are Bibliographic Management Software Search Interfaces Reliable?: A Comparison between Search Results Obtained Using Database Interfaces and the EndNote Online Search Function" (2010). *Western Libraries Publications*. Paper 25.

<http://ir.lib.uwo.ca/wlpub/25>



Are Bibliographic Management Software Search Interfaces Reliable?: A Comparison between Search Results Obtained Using Database Interfaces and the EndNote Online Search Function

by Megan Fitzgibbons and Deborah Meert

The use of bibliographic management software and its internal search interfaces is now pervasive among researchers. This study compares the results between searches conducted in academic databases' search interfaces versus the EndNote search interface. The results show mixed search reliability, depending on the database and type of search performed.

INTRODUCTION

The use of bibliographic management software packages, such as EndNote, RefWorks, BibTeX, and Zotero, is now firmly established among researchers and students as a time saving tool for writing academic papers. EndNote, in particular, is sold in most university bookstores in North America, as well as through independent distributors worldwide. As an illustrative sample, twelve of the top twenty-five universities in the United States¹ and four of the top fifteen Canadian universities² provide EndNote site licenses to their clients as a standard part of their services, and eight of these universities' library Web sites offer EndNote for purchase, while supporting other bibliographic management programs. This widespread access at major academic institutions and adoption by sophisticated users lends tacit approval to the effectiveness of the software as a bibliography management tool.

Citations management programs are continuously increasing in sophistication and have begun to add and promote new features like remote search capability. EndNote version X2 has recently emphasized its online search interface by moving it to the main page of the users' "library," apparently to increase its importance among the features available to the user.

Some librarians are uncomfortable with unvalidated engines for searching databases such as that of EndNote, particularly when used by graduate level students and faculty, and tend to promote caution. Despite such warnings, the proximity and apparent ease-of-use of such search features are proving to be very provocative to both researchers and students. EndNote is increasingly being cited as the only search tool used for conducting literature searches including for systematic reviews.

"...EndNote is increasingly being cited as the only search tool used for conducting literature searches including for systematic reviews."

The EndNote discussion forums³ provided by Thomson Reuters provide many examples of academic users attempting to employ the online search function of EndNote and encountering difficulty with their searches. It should be noted that this source is not representative in itself

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Table 1

Number of Hits Retrieved for Question 1 in Web of Science

| Search string | Web of Science topic field | EndNote Web of Science title/keywords/abstract field |
|--------------------------|----------------------------|--|
| Zinc | >100000 | >100000 |
| Type 2 Diabetes | 50,537 | 50,537 |
| Zinc AND Type 2 Diabetes | 182 | 182 |

Table 3

Number of Hits Retrieved for Question 3 in Web of Science

| Search string | Web of Science topic field | EndNote Web of Science title/keywords/abstract field |
|---------------------------------------|----------------------------|--|
| Copyright Law | 2870 | 2870 |
| International Trade | 11,588 | 11,588 |
| Copyright Law AND International Trade | 12 | 12 |

as a metric of EndNote's effectiveness, as few if any would post about successfully retrieving a desired result. Of those who experienced difficulty, an illustrative example is found in a message posted on September 23, 2008 with the subject line "Search failure: multi-word terms on PubMed."⁴ The user, through EndNote search, received a message saying that no hits were retrieved for the two-word phrase "adaptation index" in the title field using the PubMed connection file, even though the PubMed search interface hosted by the National Library of Medicine retrieved several items for the same search string. In this case, EndNote does not support the exact phrase searching technique (i.e., using quotation marks) that the database itself employs.⁵

In another sample message,⁶ an EndNote user described difficulties searching for a compound Library of Congress subject heading in a remote search of the Library of Congress catalog. One knowledgeable forum participant responded with instructions for modifying the connection file to retrieve the desired results.

Other messages illustrate that users often do not understand mechanics of Endnote's online search function. Some exhibit confusion when they are prompted for a password before connecting to an online search, not realizing that indirectly through EndNote they are attempting to search proprietary subscription-based databases.⁷ Other users understand this, but still experience problems connecting because their institutions' subscriptions to the databases are not configured to permit authentication through EndNote.⁸

LITERATURE REVIEW

EndNote is often praised for the convenience of its online search function.⁹ The common retrieval interface is attractive to researchers

because it conflates the steps of searching for materials and documenting citations in a single program. Moreover, it ostensibly eliminates the need for searchers to learn to use disparate databases, as many different resources can be searched from the EndNote interface.¹⁰

Indeed, some discussions of bibliographic software promote using remote search functions for literature searches. For example, Eapen's¹¹ review of EndNote 7.0, aimed at medical researchers, uncritically suggests that EndNote is a useful tool for both bibliography management and online literature searching, using PubMed as an example. He does not evaluate the effectiveness of the EndNote search interface, nor does he compare it to search results retrieved directly through PubMed.

Gall and Brahmī¹² undertook a methodological evaluation of EndNote's remote searching capabilities using version 7.0 of the software. Results were compared for searches conducted directly in Ovid Medline and PubMed versus searches using EndNote's connection files. The authors found some discrepancies across the platforms in the numbers of results retrieved by identical search strings. They often needed to experiment with the appropriate combination of fields searched via EndNote to achieve results that matched those of the native database interfaces. In their assessment, shortcomings of the EndNote interface included a lack of capabilities to limit and refine results, a confusing results display, a slow retrieval time, and potential confusion regarding the selection of a connection file. The EndNote software is now in version X3, but beyond Gall and Brahmī's paper, few comparative studies exist that evaluate the performance of interfaces within bibliographic software for searching databases in comparison to directly accessing the relevant databases.

Table 2

Number of Hits Retrieved for Question 2 in Web of Science

| Search string | Web of Science topic field | EndNote Web of Science title/keywords/abstract field |
|---|----------------------------|--|
| Socioeconomic Status | 18,492 | 18,492 |
| Physical Health | 48,156 | 48,156 |
| Children | >100000 | >100000 |
| Socioeconomic Status AND Physical Health AND Children | 418 | 418 |

Table 4

Number of Hits Retrieved for Question 4 in Web of Science

| Search string | Web of Science topic field | EndNote Web of Science title/keywords/abstract field |
|---|----------------------------|--|
| Stress Management | 13,660 | 13,660 |
| Employee Productivity | 968 | 968 |
| Stress Management AND Employee Productivity | 24 | 24 |

t5.1

Table 5

t5.2

Number of Hits Retrieved for Question 1 in Academic Search Premier

| Search string | Academic Search Premier <i>Subject Terms</i> field | EndNote Academic Search Premier <i>keyword</i> field | Academic Search Premier <i>any field plus full text</i> | EndNote Academic Search Premier <i>any field</i> |
|--------------------------|--|--|---|--|
| Zinc | 17,280 | 17,280 | 74,821 | 74,821 |
| Type 2 Diabetes | No hits | No hits | 32,579 | 32,579 |
| Zinc AND Type 2 Diabetes | No hits | No hits | 867 | 867 |

The EndNote search function uses the Z39.50 protocol, widely implemented in library retrieval systems, to enable remote searching of online databases. Each [databases](#) fields are configured differently, and in effect, the quality of a remote database search via EndNote is determined by the connection file's configuration in relation to the database's Z39.50 settings. Much has been written in library and information studies literature about the technology, theory, and importance of Z39.50, but less attention has been paid to non-library applications. One exception is East's¹³ examination of limitations and problems found in the configuration of EndNote's connection files for various products' Z39.50 protocols. These limitations are due to (1) inadequate documentation of the protocols, (2) incomplete implementation of connection files, (3) database indexing problems, and (4) poorly configured search interfaces. Although he confirms that Z39.50 searching is widespread and potentially useful in personal bibliographic software, he does illustrate the pitfalls that end-users encounter with remote searching through EndNote. He states that there is room to modify connection files and improve their effectiveness, but that this requires a certain amount of technical expertise, a suggestion supported by Dell'Orso.¹⁴

PURPOSE

The purpose of this study is to assess the accuracy, reliability, and efficiency of EndNote's in-software search interface versus directly accessing the search interfaces of databases themselves. A sample of core databases used at North American academic institutions was selected for comparison, to be searched both from within the database's own search interface and with the EndNote online search interface using the appropriate connection files (i.e., the customized files that map EndNote's search fields to those of a specific bibliographic database). High-use resources in multiple subject areas were chosen to provide a representative view of typical search conditions in universities. Database selection was also determined by the availability of functional connection files. Direct comparison of the results obtained using EndNote's search function with the primary database will highlight the relative effectiveness of the EndNote search interface.

t6.1

Table 6

t6.2

Number of Hits Retrieved for Question 2 in Academic Search Premier

| Search string | Academic Search Premier <i>Subject Terms</i> field | EndNote Academic Search Premier <i>keyword</i> field | Academic Search Premier <i>any field plus full text</i> | EndNote Academic Search Premier <i>any field</i> |
|---|--|--|---|--|
| Socioeconomic Status | No hits | No hits | 32,971 | 32,971 |
| Physical Health | No hits | No hits | 20,937 | 20,937 |
| Children | 297,801 | 297,801 | 1,661,120 | 1,661,120 |
| Socioeconomic Status AND Physical Health AND Children | No hits | No hits | 1543 | 1543 |

METHODOLOGY

The bibliographic management software EndNote, version X2.0.1 for Windows was used for all searches in this study except for searches in the database Academic Search Premier. For this particular search, EndNote version X1 was used due to software availability issues.

Four test questions were created and used to test the interfaces of EndNote and each database:

1. Does *zinc* help to prevent *type 2 diabetes*?
2. What is the impact of *low economic status* on *physical health* in *children*?
3. How are recent developments in *copyright law* affecting *international trade*?
4. Does *stress management* training increase *employee productivity*?

Each database search interface was tested with one or more of the questions, depending on subject relevance, and the corresponding EndNote interface was tested with the same search terms. The major concepts (in italics) in the questions were identified and used to search the databases as keywords or used to locate standardized subject headings, where allowed. The number of hits retrieved through each interface was compared.

RESULTS

Web of Science

All four test questions were used to assess the Web of Science (ISI) connection file provided by EndNote (updated to November 2008). Search terms were entered in the "title/keywords/abstract" field, using the AND operator from the drop-down list. In the Web of Science database, the "topic" field was searched, again with the AND operator from the drop-down list to combine terms. The two interfaces demonstrated the same phrase searching behavior; double quotation marks were required to retrieve an exact phrase in both. The Science Citation Index Expanded, Social Sciences Citation Index, and Arts & Humanities Citation Index were all searched in both interfaces, and identical results were retrieved. The numbers of hits are detailed in [Tables 1-4](#).

Table 7

Number of Hits Retrieved for Question 3 in Academic Search Premier

| Search string | Academic Search Premier <i>Subject Terms</i> field | EndNote Academic Search Premier <i>keyword</i> field | Academic Search Premier <i>any field plus full text</i> | EndNote Academic Search Premier <i>any field</i> |
|---------------------------------------|--|--|---|--|
| Copyright Law | 93 | 93 | 12,190 | 12,190 |
| International Trade | 17,444 | 17,444 | 57,782 | 57,782 |
| Copyright Law AND International Trade | 1 | 1 | 294 | 294 |

Academic Search Premier

The connection file supplied with EndNote X1 (updated to July 2008) was used to search Academic Search Premier (EBSCO). All four test questions were used to search this multidisciplinary database. Academic Search Premier records are indexed with controlled vocabulary terms that can be searched in the "Subject Terms" field. This was found to correspond to the "keyword" field in the EndNote connection file. The number of hits retrieved for the search strings is shown in Tables 5–8. When the correct correspondence of field names in the two databases was identified, the number of results was identical.

PsychInfo

Two questions were tested in the PsychInfo (Ovid SP) database interface and compared with the EndNote online search function for PsychInfo (Ovid SP connection file).

The first question was, "What is the impact of low economic status on physical health in children?" The question was searched in the PsychInfo database in the Ovid SP interface (1806 to 2008) using both Subject Headings (autoexploded) and keywords separately. There was no option to search PsychInfo (Ovid SP) in the EndNote online search function using "subject headings," so searches were done using the "any field" and "keywords" options in EndNote. The questions were broken down into concepts, and the concepts were searched both separately and together. The number of hits retrieved for the first question can be seen in Table 9. All searches in both interfaces produced relevant results except for the EndNote keyword search; however, the results in the OVID SP "keyword" search were the most successful at producing relevant hits, even though it was necessary to sort through more hits in total to find them.

The second test question used for PsychInfo was, "Does stress management training increase employee productivity?" Again, this question was searched in the PsychInfo Ovid SP interface using both Subject Headings (autoexploded) and keywords, and in the PsychInfo (Ovid SP) EndNote online search function using the "any field" and "keywords" options. The questions were again broken down into concepts, and the concepts were searched separately and together.

The number of hits retrieved for the second question can be seen in Table 10.

Again, the Ovid SP keyword search gave the most relevant hits, picking up one relevant citation that the Subject Heading search did not retrieve. In this case, however, the EndNote search interface for PsychInfo did not retrieve any hits at all.

Medline

One question was tested in the Medline Database using both the Ovid interface and the PubMed interface: "Does zinc help to prevent type 2 diabetes?" The same question was then tested with the EndNote online search for Medline with both the Ovid and PubMed connection files. In the Ovid interface, only a keyword search was performed because searching the Medline Ovid file through the EndNote search interface did not provide Medical Subject Headings (MeSH) as a search field, so they could not be compared. Both a "keyword" and "any field" search were performed in the Medline Ovid EndNote interface, with disparate results. In PubMed, however, both MeSH and keyword searches were performed, as the EndNote Medline PubMed file allowed for MeSH, keyword, and "any field" searching. The question was broken down into concepts, and the concepts were searched separately and together. The number of hits retrieved for the first question comparatively in the Ovid and EndNote interfaces can be seen in Table 11, and for the PubMed and EndNote interfaces in Table 12.

The EndNote search interface in the keyword field was ineffective when searching Medline Ovid SP. There were no matches found for Type 2 Diabetes, even variations of the term were tested. The search in the EndNote interface for Ovid SP using the "any field" option, however, gave nearly identical results to the Ovid keyword search.

The keyword searches in the PubMed and EndNote PubMed interfaces did not produce hits that were even remotely close in number, with the PubMed interface producing the same citations as the EndNote PubMed interface, plus many others. This is likely accounted for by the fact that a keyword search in the PubMed interface automatically includes a MeSH search as well, by default. The results for the "any field" search in the EndNote PubMed interface produced many more hits, most of which were not relevant. This, however, could be compensated for by adding another search term to

Table 8

Number of Hits Retrieved for Question 4 in Academic Search Premier

| Search string | Academic Search Premier <i>Subject Terms</i> field | EndNote Academic Search Premier <i>keyword</i> field | Academic Search Premier <i>any field plus full text</i> | EndNote Academic Search Premier <i>any field</i> |
|---|--|--|---|--|
| Stress Management | 2255 | 2255 | 9971 | 9971 |
| Employee Productivity | No hits | No hits | 1388 | 1388 |
| Stress Management AND Employee Productivity | No hits | No hits | 30 | 30 |

t9.1

Table 9

t9.2

Number of Hits Retrieved for Question 2 in PsychInfo

| t9.3 Search string | Ovid SP PsychInfo Subject Headings | Ovid SP PsychInfo Keywords | EndNote PsychInfo (Ovid SP) Keywords | EndNote PsychInfo (Ovid SP) Any Field |
|--|------------------------------------|----------------------------|--------------------------------------|---------------------------------------|
| t9.4 Socioeconomic Status | 25,779 | 20,452 | 451 | 746 |
| t9.5 Physical Health | 812 | 7083 | 169 | 466 |
| t9.6 Children | Limit used | 289,698 | 22 | 9978 |
| t9.7 Socioeconomic Status AND Physical Health AND Children | 4 (3 relevant) | 33 (16 relevant) | No hits | 1 (1 relevant) |

t10.1

Table 10

t10.2

Number of Hits Retrieved for Question 4 in PsychInfo

| t10.3 Search string | Ovid SP PsychInfo Subject Headings | Ovid SP PsychInfo Keywords | EndNote PsychInfo (Ovid SP) Keywords | EndNote PsychInfo (Ovid SP) Any Field |
|---|------------------------------------|----------------------------|--------------------------------------|---------------------------------------|
| t10.4 Stress Management | 3101 | 4530 | 96 | 144 |
| t10.5 Employee Productivity | 1994 | 2037 | 44 | 49 |
| t10.6 Stress Management AND Employee Productivity | 5 (4 relevant) | 6 (5 relevant) | No hits | No hits |

t11.1

Table 11

t11.2

Number of Hits Retrieved for Question 1 in Ovid SP Medline

| t11.3 Search string | Ovid SP Medline Keywords | EndNote Ovid SP Medline Keywords | EndNote Ovid SP Medline Any Field |
|--------------------------------|--------------------------|----------------------------------|-----------------------------------|
| t11.4 Zinc | 74,462 | 53,020 | 751,436 |
| t11.5 Type 2 Diabetes | 28,605 | No hits (used various synonyms) | 28,605 |
| t11.6 Zinc AND Type 2 Diabetes | 98 | N/A | 97 |

t12.1

Table 12

t12.2

Number of Hits Retrieved for Question 1 in PubMed Medline

| t12.3 Search string | PubMed NLM Keywords | EndNote PubMed NLM Keywords | EndNote PubMed NLM Any Field | PubMed NLM MeSH Major Topic | EndNote PubMed NLM MeSH Major Topic |
|--------------------------------|---------------------|-----------------------------|------------------------------|-----------------------------|-------------------------------------|
| t12.4 Zinc | 77,060 | 39,026 | 77,060 | 22,160 | 21,856 |
| t12.5 Type 2 Diabetes | 59,955 | 50,625 | 318,459 | 39,887 | 38,562 |
| t12.6 Zinc AND Type 2 Diabetes | 187 | 96 | 1278 | 56 | 56 |

299 narrow the results. The results from the MeSH searches in both the
303 PubMed and EndNote PubMed interfaces produced the same number
304 of hits.

305 **Index to Legal Periodicals**

306 Two questions were tested in the Index to Legal Periodicals
307 (Wilson) database and compared with the EndNote online search of
308 the database: "How are recent developments in copyright law
309 affecting international trade?" and "Does stress management training
310 increase employee productivity?"

311 For both questions, the results from searching the Wilson Database
312 directly and from the EndNote interface were identical. The "all fields"
313 search option was available, and therefore used, in both interfaces,
314 and identical results were retrieved (see Tables 13 and 14).

315 **DISCUSSION**

316 Generally, the EndNote search interface did an excellent job searching
317 databases that use keyword searching. There are, however, a variety of
318 ways in which databases use the words "text search," "keyword
319 search," "smart search," "all fields," etc., interchangeably. Under-
320 standing of which search term is being used by EndNote, and how that
321 search term equates to the original database, will directly affect the
322 results.

324 **"Generally, the EndNote search interface did an
325 excellent job searching databases that use
keyword searching."**

326
327 The database PsychInfo is a good example of this. In the Ovid
328 interface for the database PsychInfo, it is possible to search by
329 keyword or subject heading. If the keyword option is chosen, the
330 interface actually searches the keyword or phrase in all of the fields
331 that appear in the database record in Ovid, including abstract, article
332 title, author, institution, and many others. It does not search the full
333 text of the article. When PsychInfo is searched with the EndNote
334 interface, there is also a keyword search available, but it is not the
335 same kind of search as the keyword search in Ovid. To get the
336 equivalent search in EndNote as the keyword search in Ovid, the "all
337 fields" option must be selected in the EndNote interface.

338 Similarly, EndNote's online search function was capable of
339 retrieving results that were identical to those retrieved in the EBSCO
340 interface, but it was not immediately apparent how to obtain these
341 results. The "any field" search via EndNote does indeed search all the
342 fields in the database, including the full text of documents. However,
343 in the EBSCO interface, an "any field" search does not search full text
344 by default. Instead, it is necessary to click on the option to include the

t13.1 **Table 13**

t13.2 **Number of Hits Retrieved for Question 3 in Index to
Legal Periodicals**

| Search string | Index to Legal Periodicals all fields | EndNote Index to Legal Periodicals all fields |
|---------------------------------------|---------------------------------------|---|
| Copyright Law | 3917 | 3917 |
| International Trade | 8581 | 8581 |
| Copyright Law AND International Trade | 70 | 70 |

Table 14

**Number of Hits Retrieved for Question 4 in Index to
Legal Periodicals**

| Search string | Index to Legal Periodicals all fields | EndNote Index to Legal Periodicals all fields |
|---|---------------------------------------|---|
| Stress Management | 42 | 42 |
| Employee Productivity | 31 | 31 |
| Stress Management AND Employee Productivity | 1 | 1 |

360 full text of documents in the search. When this option was selected,
361 the results were identical to the EndNote search. In other words, a
362 search of "any field" or the "keywords" field via the connection file
363 produced the same results as an EBSCO search for any field plus full-
364 text. EndNote's "keywords" field corresponds directly to EBSCO's
365 "subject terms" field.

366 It is not surprising that results retrieved via the Web of Science
367 connection file exactly replicated results from the database's own
368 interface, given that both products are created by Thomson Scientific.
369 However, the terminology given to the searchable fields does not
370 directly correspond; the EndNote connection file searches "title/
371 keywords/abstract," while the database's general search interface
372 uses the term "topic."

ASSESSMENT AND FUTURE PLANS

373 The users' manual that is distributed with an EndNote X2.0.1
374 installation (a PDF file) provides instructions for conducting Z39.50
375 command-line syntax searches. This method allows users to "enter a
376 Z39.50 search which EndNote passes directly to the [database's]
377 server without any translation,"¹⁵ which obviously requires knowl-
378 edge of the database's Z39.50 attributes. This method of searching is
379 useful for librarians and advanced EndNote users, particularly creators
380 of connection files, but for the purpose of conducting searches for
381 materials in a database, it is simply too complicated to be practical.
382 Indeed, although this option is available, the fact remains that most
383 users use the provided connection files to conduct simple searches.

384 It should be noted that some of EndNote's connection files are
385 based on HTTP rather than Z39.50, notably PubMed and Web of
386 Science. Thus, Z39.50 command-line syntax searches cannot be
387 conducted in these databases. However, the HTTP-based connection
388 files can be edited, and the set up of the connection is rather more
389 transparent than with Z39.50 protocols. These files also demonstrate
390 that EndNote's capability for remote searching extends beyond the
391 somewhat esoteric world of Z39.50.

392 This study examined only five bibliographic databases, but the
393 results showed that the effectiveness of EndNote's connection files
394 varies even within the sample. It is expected that a similar variation
395 would be found if more databases' connection files were tested in
396 EndNote.

397 Moreover, subsequent comparison of connection files and data-
398 base's own retrieval systems would result in different variations over
399 time because new connection files are constantly modified and
400 created anew to match the changing configurations of bibliographic
401 databases. This constant change is simultaneously an asset and a
402 frustration for users of the EndNote program. Searches conducted at
403 different times on the same engine could potentially yield different
404 results.

405 Educating users about these variations when using the EndNote
406 search interface can be carried out during training sessions.
407 Librarians should continue to monitor the changes within the

417 EndNote program, primarily with regard to users' most commonly
418 searched databases, and share this information with their commu-
419 nities via online help pages and Frequently Asked Question lists, e-
420 mail assistance, and individual consultations. It is important that
421 students writing academic papers, especially those with a desire to
422 publish or produce a thesis, are made aware of potential variations in
423 search results and how this could affect their literature reviews. This
424 is a situation that requires librarians and academic institutions to be
425 as diligent as possible when encouraging students and researchers to
426 use bibliographic management software. Educating users on how to
427 properly use the software to make searching and citation faster and
428 easier, while still retaining the integrity of a comprehensive
429 academic paper, is paramount.

430

431 **“...the results retrieved via EndNote versus**
432 **direct searching of a database vary depending**
433 **on both the database searched and the**
434 **technique used to**
435 **search it.”**

436 **CONCLUSION**

437 The EndNote program, with its own search interface for querying
438 bibliographic databases, has widespread use among librarians and
439 researchers. But as this study illustrates, the results retrieved via
440 EndNote versus direct searching of a database vary depending on both
441 the database searched and the technique used to search it. Librarians
442 and others who promote and provide technical support for citation
443 management programs should be aware of the strengths and
444 potential problems that users will face in using the program's search
445 interface. It is clear that in spite of the capabilities of connection files
446 to mirror native database searches, user education is needed to fully
447 exploit and properly use this tool.

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