

Boolean vs. Semantic Search Interfaces: Which Work Better?

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Introduction

In 2004, the Center on Media and Child Health (CMCH) at Children's Hospital Boston created the first database dedicated to research on the health effects of media on child and adolescent health. Previously this literature was compartmentalized into the databases of each academic discipline performing media effects research, which includes the fields of medicine, psychology, communications, public health, education, gender studies, anthropology, sociology, criminal justice, and business. This made a search of multiple databases necessary for a comprehensive review of existing literature. Unaware that other disciplines were performing media effects research, many scientists read only the literature produced by their own discipline. This separation of literature rendered the study of media effects multidisciplinary, with researchers in each field operating in isolation.

With the advent of the CMCH Database of Research, freely available on the [CMCH website](#), researchers can access a comprehensive bibliography of media effects research compiled from all relevant disciplines. The aim of CMCH is to bring the field from a multidisciplinary state to a truly interdisciplinary one, where researchers read and all existing literature before embarking on new investigations, collaborate with other researchers doing similar work, regardless of academic field of study, and combine the best methodologies from all disciplines to form innovative research methods.

Because the research on media effects comes from so many distinct academic disciplines with their own terminology, there was no established controlled vocabulary to represent this field of knowledge. Thus, a controlled vocabulary was created by CMCH librarians, whereby concepts unique to the field of media effects were combined with terminology common to all related disciplines. Library science interns apply this controlled vocabulary through a value-added indexing process that includes not only major topics, but also study design, reference type, and participant age groups. Users can retrieve these citations through a traditional [advanced search](#) page with Boolean operators to combine all desired parameters.

However, as Kayo Denda describes in her article about information retrieval in women's studies, the "relevance and usefulness" of conventional controlled vocabularies and traditional methods of indexing and searching are insufficient for interdisciplinary fields. "Librarians need to create a mechanism that concatenates disparate terms and concepts from different disciplines and place[s] them in a specific context or structure of knowledge". This mechanism is an ontology – a representation of the concepts of a discipline, the relationships between these concepts, and all available names for these concepts.

CMCH librarians created an ontology describing the central concepts of the study of media effects, the relationships between these concepts, and all available names for these concepts represented in the literature of ten distinct academic disciplines. This ontology is now the back-end "map" for a [semantic search engine](#). The citations are parsed by a computer and indexed automatically with a list of concepts expressed in the text, regardless of the terminology used to describe these concepts. Users can access the citations by entering a query in natural language.

Both the Boolean and semantic search engines are available on the CMCH website, allowing users to make the choice based on which method best suits their searching style and/or their literature needs. But which search engine should be recommended for which purposes? Which engine returns the most relevant results? Is one engine more precise than the other? The following test of Boolean and semantic searches of the CMCH Database of Research is intended as a pilot study to determine whether one search method has a clear, or whether further study is warranted.

Methodology

SAMPLE

The author compiled an EndNote library of all citations available through both the Boolean search interface and the semantic search interface. This library included 892 citations. Search queries were chosen from the 2005-2006 log of reference questions answered by CMCH librarians. Queries were chosen based on known representation of the topic in the compiled EndNote library.

SEARCH PROCEDURE

First, the author compiled a list of ideal answers for each query, using traditional Boolean search techniques in EndNote, expert knowledge of the subject matter, and a thorough reading of each study's abstract. When possible, results were roughly rank-ordered according to relevance to the question. After compilation, each list was saved and closed until analysis.

Next, the author broke each query into elements for the Boolean Search engine, such as keyword groups and age groups. The author entered each query into the Boolean search interface, which returned results in alphabetical order by author's last name. The Boolean search

returns all matching citations, thus a different number of search results was returned for each query. The author saved the results list for each query and closed the lists until analysis.

Finally, the author entered each query into the semantic search engine as it was phrased in the CMCH reference log. The semantic search engine always returns 20 citations for each query, listed in order of relevance to the query. The author saved the results list for each query and closed the lists until analysis.

A bibliography of all results returned by any of the three search methods is compiled in Appendix B.

DATA ANALYSIS

In two similar papers measuring the success of search strategies or search engines, the authors used a relevancy weighting scale, where each citation in the search results list was assigned a value according to its ability to answer the question. This scale was adapted for this project:

| Designation | Value | Assignment Criteria |
|---------------------|-------|---|
| Fully Relevant | 1.00 | Assigned automatically to citations that appeared in the list of ideal answers, as well as citations that answered the question but were missed on the ideal list |
| Mostly Relevant | 0.75 | Assigned to citations that were relevant in some manner and could be used to supplement the ideal citations, but were not ideal in and of themselves |
| Marginally Relevant | 0.25 | Assigned to citations that were relevant in a small way, but would not be used to answer the question |
| Irrelevant | 0.00 | Assigned to citations that were completely off-topic |

Once all citations were assigned a value, the author determined precision scores by dividing the total relevancy score by the total number of search results returned. The precision for each search method was then compared for each query. Because the semantic search produced very low precision scores, the author examined the citations' relevancy scores for a pattern. After seeing that the last half of each results list contained almost no mostly or full relevant citations, the author recalculated the precision scores using only the first ten results, then again using only the first five results.

Results

QUERY 1

Semantic query: Does playing violent video games cause increased aggression?

Boolean query: Keyword Group = Violence (Media Content) AND Keyword Group = Video Games AND Keyword Group = Aggression

| Ideal Search Results | Boolean Search Results | Relevance Score | Semantic Search Results | Relevance Score |
|----------------------|------------------------|-----------------|-------------------------|-----------------|
|----------------------|------------------------|-----------------|-------------------------|-----------------|

| | | | | |
|-------------------|-------------------|------|-------------------|------|
| Weber 2006 | AAP 2001 | 0.75 | Anderson 2003a | 0.75 |
| Schutte 1998 | Anderson 1986 | 1.00 | Gentile 2004a* | 1.00 |
| Wiegman 1998 | Anderson 2000 | 1.00 | Uhlmann 2004 | 1.00 |
| Kronenberger 2005 | Anderson 2003a | 0.75 | Anderson 2000 | 1.00 |
| Fleming 2001 | Anderson 2003c | 1.00 | Anderson 2003b | 0.00 |
| Gentile 2004a | Bartholow 2002 | 1.00 | Bartholow 2002 | 1.00 |
| Krahe 2004 | Bensley 2001 | 1.00 | Ballard 1999 | 1.00 |
| Uhlmann 2004 | Browne 2005 | 0.75 | Williams 2002 | 0.25 |
| Anderson 2000 | Bushman 2002b | 1.00 | Krahe 2004 | 1.00 |
| Anderson 2003c | Cantor 2003b | 0.25 | Subrahmanyam 2001 | 0.00 |
| Bensley 2001 | Cooper 1986 | 1.00 | Weber 2006 | 1.00 |
| Bushman 2002b | Dominick 1984 | 1.00 | Kronenberger 2005 | 1.00 |
| Cooper 1986 | Fleming 2001 | 1.00 | Bushman 2002b | 1.00 |
| Dominick 1984 | Funk 2002 | 1.00 | Kirsh 2002 | 0.00 |
| Fling 1992 | Glaubke 2001 | 0.00 | Huesmann 2003 | 0.00 |
| Vastag 2004 | Krahe 2004 | 1.00 | Colwell 2003 | 0.75 |
| Anderson 1986 | Kronenberger 2005 | 1.00 | Coyne 2005 | 0.00 |
| Kirsh 1998 | Panee 2002 | 1.00 | Coyne 2004a | 0.00 |
| Bartholow 2002 | Scharrer 2004 | 0.00 | Coyne 2004b | 0.00 |
| Funk 2002 | Schmidt 2005 | 0.00 | | |
| Panee 2002 | Slater 2003a | 0.25 | | |
| | Slater 2004 | 0.75 | | |
| | Uhlmann 2004 | 1.00 | | |
| | Vastag 2004 | 1.00 | | |
| | Weber 2006 | 1.00 | | |
| | Wiegman 1998 | 1.00 | | |

Table 1: Search Results for query “Does playing violent video games increase aggression?”

* duplicate result given in list

For query 1, the list of ideal search results contained 21 citations, the Boolean search results list contained 26 citations, and the semantic search results list contained its consistent 20 citations. The Boolean search identified seventeen of the ideal citations, plus four mostly relevant citations, two marginally relevant citations, and three irrelevant citations. The semantic search identified eight of the ideal citations, plus one citation that was full relevant but missed in the ideal search, one marginally relevant citation, and seven irrelevant citations. As shown in Appendix A, the Boolean search results were 84.6% precise while the semantic search precision for this query was 38.8%.

QUERY 2

Semantic query: Does watching sex in the media influence teens to have sex?

Boolean query: Keyword Group = [Sexual Behavior (Media Content) AND (Sexual Behavior OR Sexual Attitudes)] AND Age Group = Adolescents

| Ideal | Boolean Search | Relevance | Semantic Search | Relevance |
|-------|----------------|-----------|-----------------|-----------|
|-------|----------------|-----------|-----------------|-----------|

| Search Results | Results | Score | Results | Score |
|---------------------|---------------------|-------|---------------------|-------|
| Collins 2004 | Ashby 2005 | 1.00 | Escobar-Chaves 2005 | 1.00 |
| Escobar-Chaves 2005 | Barongan 1995 | 0.75 | Collins 2004 | 1.00 |
| Wingood 2001 | Brown 2005 | 1.00 | Collins 2003 | 1.00 |
| Brown 2005 | Cantor 2003a | 0.75 | Rich 2005 | 1.00 |
| Mitchell 2003 | Collins 2003 | 1.00 | Cantor 2003b | 0.00 |
| Ward 2005 | Collins 2004 | 1.00 | Brown 2005 | 1.00 |
| Greeson 1986 | Escobar-Chaves 2005 | 1.00 | Ward 2005 | 1.00 |
| Ashby 2005 | Greeson 1986 | 1.00 | Clark 1995 | 0.25 |
| Collins 2003 | Hoberman 1990 | 0.25 | Polce-lynch 2001 | 0.25 |
| | Krenske 2000 | 0.25 | Knobloch 2005 | 0.00 |
| | Mitchell 2003 | 1.00 | Surette 2002 | 0.00 |
| | Ward 2005 | 1.00 | Anderson 2003a | 0.00 |
| | Wingood 2001 | 1.00 | Will 2005 | 0.25 |
| | | | Bushman 2003 | 0.25 |
| | | | Kronenberger 2005 | 0.00 |
| | | | Bushman 2002a | 0.25 |
| | | | Linz 1988* | 0.25 |
| | | | Subrahmanyam 2004 | 0.00 |
| | | | Golde 2000 | 0.25 |

Table 2: Search Results for query “Does watching sex in the media influence teens to have sex?”

For query 2, the list of ideal search results contained nine citations, the Boolean search results list contained 13 citations, and the semantic search results list contained its consistent 20 citations. The Boolean search identified nine of the ideal citations, plus two mostly relevant citations and two marginally relevant citations. The semantic search identified five of the ideal citations, plus one citation that was fully relevant but missed in the ideal search, seven marginally relevant citations, and six irrelevant citations. As shown in Appendix A, the Boolean search results were 78.8% precise while the semantic search precision for this query was 53.8%.

QUERY 3

Semantic query: How do music lyrics impact adolescents?

Boolean query: Keyword Group = Lyrics AND Age Group = Adolescents

| Ideal Search Results | Boolean Search Results | Relevance Score | Semantic Search Results | Relevance Score |
|----------------------|------------------------|-----------------|-------------------------|-----------------|
| AAP 1996 | AAP 1996 | 1.00 | Roberts 1998 | 0.75 |
| Greenfield 1987 | Anderson 2003a | 0.75 | AAP 1996 | 1.00 |
| Barongan 1995 | Arnett 1991a | 1.00 | Anderson 2003a | 0.75 |
| Arnett 1991a | Barongan 1995 | 1.00 | Anderson 2003b | 1.00 |
| Wass 1988 | Browne 2005 | 0.75 | Escobar-Chaves 2005 | 0.25 |
| Leming 1987 | Calvert 2001c | 0.75 | Subrahmanyam 2001 | 0.00 |
| Greeson 1986 | Greenfield 1987 | 1.00 | Rustad 2003 | 0.75 |
| | Greeson 1986 | 1.00 | Johnson 2000 | 0.75 |

| | | | | |
|--|----------------|------|-------------------|------|
| | Haninger 2004a | 0.25 | Lacourse 2001 | 1.00 |
| | Krenske 2000 | 0.75 | Borzekowski 2001b | 0.00 |
| | Leming 1987 | 1.00 | Flammer 2000 | 0.00 |
| | Wass 1988 | 1.00 | Ward 2005 | 0.25 |
| | | | Schwartz 2004 | 0.25 |
| | | | Distefan 1999 | 0.00 |
| | | | Kronenberger 2005 | 0.00 |
| | | | Henriksen 2006 | 0.00 |
| | | | Arnett 2001 | 0.00 |
| | | | Surette 2002 | 0.00 |
| | | | Subrahmanyam 2004 | 0.00 |

Table 3: Search Results for query “How do music lyrics impact adolescents?”

For query 3, the list of ideal search results contained seven citations, the Boolean search results list contained 12 citations, and the semantic search results list contained its consistent 20 citations. The Boolean search identified seven of the ideal citations, plus four mostly relevant citations, and one marginally relevant citation. The semantic search identified one of the ideal citations, plus two citations that were fully relevant but missed in the ideal search, four mostly relevant citations, three marginally relevant citations and ten irrelevant citations. As shown in Appendix A, the Boolean search results were 85.4% precise while the semantic search precision for this query was 33.8%.

QUERY 4

Semantic query: Are media ratings consistently applied?

Boolean query: Keyword Group = Content Ratings

| Ideal Search Results | Boolean Search Results | Relevance Score | Semantic Search Results | Relevance Score |
|----------------------|------------------------|-----------------|-------------------------|-----------------|
| Linz 1990 | Abelman 2001 | 0.25 | Bushman 2003 | 0.75 |
| Walsh 2001 | AAP 2001 | 0.25 | Cantor 2003b | 0.75 |
| Leone 2002 | AAP 1996 | 0.25 | Slater 2003b | 0.00 |
| Thompson 2004 | Bahk 1998 | 0.25 | Clark 1995 | 0.75 |
| Walsh 2002 | Beasley 2002 | 0.75 | Funk 1999b | 1.00 |
| Haninger 2004a | Borzekowski 2005 | 0.25 | Anderson 2003a | 0.00 |
| Jenkins 2005 | Browne 2005 | 0.25 | Surette 2002 | 0.00 |
| Funk 1999b | Bushman 2003 | 0.75 | Greene 2005 | 0.00 |
| Haninger 2004b | Bushman 1996 | 0.75 | Saylor 2003 | 0.00 |
| Thompson 2001 | Cantor 2003a | 0.25 | Botta 1999 | 0.00 |
| Yokota 2000 | Cantor 1997 | 0.25 | Hobbs 2003 | 0.00 |
| Smith 2003 | Cantor 2003b | 0.25 | Chen 2002 | 0.00 |
| Kunkel 2002 | Christenson 1992 | 0.75 | Schmidt 2005 | 0.00 |
| | Clark 1993 | 0.75 | Roberts 2000 | 0.00 |
| | Clark 1995 | 0.75 | Escobar-Chaves 2005 | 0.00 |
| | Dalton 2002 | 0.75 | Kronenberger 2005 | 0.00 |

| | | | | |
|--|----------------|------|---------------|------|
| | DiMaggio 2003 | 0.25 | Brown 2005 | 0.00 |
| | Fujioka 2002 | 0.25 | Gentile 2004b | 0.25 |
| | Funk 1999b | 1.00 | David 2002 | 0.00 |
| | Gerend 2000 | 0.25 | Posavac 1998 | 0.00 |
| | Glaubke 2001 | 0.25 | | |
| | Haninger 2004b | 1.00 | | |
| | Haninger 2004a | 1.00 | | |
| | Jacobsen 2001 | 0.25 | | |
| | Jenkins 2005 | 1.00 | | |
| | Krcmar 2000b | 0.25 | | |
| | Krcmar 1997 | 0.25 | | |
| | Kunkel 2002 | 1.00 | | |
| | Leone 2002 | 1.00 | | |
| | Linz 1990 | 1.00 | | |
| | Potter 1996 | 0.75 | | |
| | Sargent 2003 | 0.25 | | |
| | Sargent 2002 | 0.25 | | |
| | Smith 2003 | 1.00 | | |
| | Sneegas 1998 | 0.25 | | |
| | Thompson 2001 | 1.00 | | |
| | Thompson 2004 | 1.00 | | |
| | Vastag 2004 | 0.25 | | |
| | Walsh 2001 | 1.00 | | |
| | Walsh 2002 | 1.00 | | |
| | Yokota 2000 | 1.00 | | |

Table 4: Search Results for query “Are media ratings consistently applied?”

For query 4, the list of ideal search results contained 13 citations, the Boolean search results list contained 41 citations, and the semantic search results list contained its consistent 20 citations. The Boolean search identified all 13 of the ideal citations, plus eight mostly relevant citations, and 20 marginally relevant citations. The semantic search identified one of the ideal citations, plus three mostly relevant citations, one marginally relevant citation and 15 irrelevant citations. As shown in Appendix A, the Boolean search results were 58.5% precise while the semantic search precision for this query was 17.5%.

QUERY 5

Semantic query: Are there any experimental studies on body image?

Boolean query: Keyword Group = Body Image AND Study Design = Experimental

| Ideal Search Results | Boolean Search Results | Relevance Score | Semantic Search Results | Relevance Score |
|----------------------|------------------------|-----------------|-------------------------|-----------------|
| Turner 1997 | Agliata 2004 | 1.00 | Lavin 2001 | 1.00 |
| Wade 2003 | David 2002 | 1.00 | Polce-Lynch 2001 | 0.00 |
| McVey 2002 | Frisby 2004 | 1.00 | Hargreaves 2003c | 1.00 |

| | | | | |
|-----------------|-----------------|------|--------------------|------|
| Halliwell 2004 | Halliwell 2004 | 1.00 | Groesz 2002 | 1.00 |
| Posavac 1998 | Harrison 2003 | 1.00 | Hargreaves 2003a | 1.00 |
| Tiggermann 2004 | Lavin 2001 | 1.00 | Hargreaves 2003b | 1.00 |
| Leit 2002 | Leit 2002 | 1.00 | Murnen 2003 | 1.00 |
| Agliata 2004 | McVey 2002 | 1.00 | Calvert 2003c | 0.00 |
| David 2002 | Posavac 1998 | 1.00 | Botta 1999 | 0.00 |
| Frisby 2004 | Tiggermann 2004 | 1.00 | David 2002 | 1.00 |
| Lavin 2001 | Turner 1997 | 1.00 | Ricciardelli 2003* | 0.00 |
| Harrison 2003 | Wade 2003 | 1.00 | Wadsworth 1996 | 0.00 |
| Wade 2003 | | | Mares 1999 | 0.00 |
| | | | McVey 2002 | 1.00 |
| | | | Turner 1997 | 1.00 |
| | | | Spitzer 1999 | 0.00 |
| | | | Labre 2002 | 0.00 |
| | | | Cusumano 2001 | 0.00 |
| | | | Green 2003 | 0.00 |

Table 5: Search Results for query “Are there any experimental studies on body image?”

* duplicate result given in list

For query 5, the list of ideal search results contained 13 citations, the Boolean search results list contained 12 citations, and the semantic search results list contained its consistent 20 citations. The Boolean search identified 12 citations, all of which were on the ideal list. The semantic search identified four of the ideal citations, plus five citations that were fully relevant but missed in the ideal search, plus ten irrelevant citations. As shown in Appendix A, the Boolean search results were 100% precise while the semantic search precision for this query was 45%.

Discussion

PRECISION

Looking only at the precision scores for Boolean versus semantic searching (Appendix A), the Boolean search engine resulted in more precise results for all search queries. Four of the five queries resulted in a more than 40% difference in precision between the Boolean search and the semantic search. On average, the Boolean search method was 81.5% precise while the average semantic search averaged 40.5% precision; again a difference of over 40%. Additionally, the Boolean search produced significantly fewer irrelevant citations – only three of 104 total results – while the semantic search produced 43 irrelevant results of 100 total results. The results of these queries demonstrate that the Boolean search is more precise overall.

However, there are two outstanding advantages to the semantic search over the Boolean search: the relevancy ranking of results, and finding related information missed by human error in both cataloging and searching.

RELEVANCY RANKING

While the Boolean search results are always listed in alphabetical order by author, obscuring to the user the most relevant results, the semantic search results are listed in order of relevancy to the query.

While examining the relevancy scores of the citations, the author found that the last half of the semantic search results returned were always scored in the marginally relevant or irrelevant weights. In order to discover whether the precision scores of the semantic searches would be raised if the last half of the results were not returned, the author recalculated the precision of each semantic search query based only on the first ten results. This recalculation resulted in a significant increase in precision scores; this time the average precision was 62.5% compared to the average 20 result semantic search precision of 39.8% and the average Boolean precision of 81.5%.

In order to determine whether the first five results of the semantic searches would be even more precise than the first ten, the author recalculated precision scores based on only the first five results in each semantic search query. This examination resulted in a precision of 77% - much more comparable to the Boolean average of 81.5%, thus demonstrating that while the Boolean search method yielded more precise results overall, the semantic search method provided a similar level of precision in the first few results. The importance of the most relevant studies being listed first can not be underestimated in an age where 62% of users do not look past the first page of results .

COMPENSATING FOR HUMAN ERROR

In four of the five queries, the semantic search retrieved results that were missed in the list of ideal citations. Since the ideal citations list was formulated by the author using a combination of Boolean searching, recalled knowledge of the subject matter, and reading of the abstracts, the potential for human error is present in all three of these stages. Since the citations are indexed by humans, the potential for error exists there as well. In contrast, the semantic search engine interprets the query and indexes documents according to the same metrics each time, so the possibility for human error does not exist either in indexing or searching.

Query 1 asked whether aggression increased as a result of playing violent video games. Since the author used “aggression” as a search term in both the ideal search and the Boolean search, and the Ballard 1999 citation did not have the term “aggression” listed as a keyword, the citation was left out of both lists. However, the semantic search was able to identify this paper when the author’s search and the Boolean search failed to locate it. The citation describes an experiment measuring the level of punishment subjects administered to a confederate after playing violent video games. Since the semantic search engine understood that the concept of punishment was similar to the concept of aggression, so the citation was returned even though the term “aggression” does not appear in the record.

Query 2 asked whether watching sex in the media influenced teens to have sex. Since the author searched for citations containing “adolescents” as an age group and interns following

CMCH cataloging procedures do not insert an age group if a paper does not involve a subject group, the Rich 2005 commentary paper was missed on both the ideal list and the Boolean results list. The semantic search understood that the query was looking for information about adolescents and sexual content of the media, interpreting the word “teen” to mean “adolescents” and ignoring that the age group field did not contain the term. Thus, the semantic search compensated for human error, looking for the meaning behind the question rather than searching only for the terms entered.

Query 3 asked how music lyrics impacted adolescents. Since the author searched for citations containing the term “lyrics” and Lacourse 2001 was mistakenly cataloged without the term “lyrics”, this citation did not appear in either the ideal or Boolean list. Since the subjects in Anderson, the age group “young adults” was used. According to CMCH cataloging procedure, the term “young adults” is used as the age group for college students. Since the subjects in Anderson 2003b were college students, the ideal and Boolean searches did not bring up this citation. However, because the semantic search technology understands adolescents and college students to often overlap in age classification, Anderson 2003b was returned in the list of results. Here, the semantic technology made up for a cataloging oversight as well as a “gray area” in the classification of age groups.

Query 5 asked about experimental studies on body image. Since the author searched for citations containing the keyword group “body image” and neither Hargreaves 2000a nor Hargreaves 2000b contained the keyword group “body image”, neither citation was found by the ideal or Boolean searches. The author assumed (incorrectly) that all studies containing the keyword group “thin ideal” would also contain the keyword group “body image”, since the concepts are closely related. However, the indexers of these articles apparently did not insert the keyword “body image” (whether from oversight or from conscious decision is not known). Since the semantic search engine looked at records with terms that had an ontologically defined relationship with the concept of body image, it was able to call up these citations that the ideal and Boolean searches missed.

As happened in query 3 when a citation was cataloged without a critical keyword, the Hargreaves 2003c and Murnen 2003 citations were also miscataloged and thus, not found in the query 5 ideal and Boolean searches. Both of these studies were miscategorized as correlational studies when, in fact, they were experimental studies. The human error of the indexer prevented these studies from being found by the author in both the ideal and Boolean searches. Because the semantic search technology recognized that the study descriptions were of an experimental nature, even though they were not indexed as such, Hargreaves 2003c and Murnen 2003 were listed fifth and sixth in the semantic results list. Additionally, the semantic search located Groesz 2002, a meta-analysis, which can be most useful in a literature search, providing both a statistical overview of what other experiments found, along with a reference list of experimental studies the user can review.

Conclusion

This study has shown that both Boolean and semantic searches have important but different benefits to offer depending on the user. While the general public looking for answers to

specific questions will find the semantic search useful, scholars and researchers will need to use both Boolean and semantic searches to compile a comprehensive collection of research.

The primary strength of Boolean searches is the high level of precision. Since the search engine return as many results as match the query, and not a fixed number of results, there are fewer irrelevant citations presented to the user. However, Boolean searches rely on a process whereby the potential for human error exists in two different instances: during the indexing process and during the search process. If the indexer has deemed a citation to warrant a keyword from the controlled vocabulary, and the user employs that keyword in his or her search strategy, the resulting precision is high. However, the human error renders the potential for overlooked citations also high.

The primary strength of the semantic search is that human error is eliminated. Since the technology is based on underlying concepts and ideas, rather than matching the text that describes those concepts and ideas, citations are often returned that were overlooked by either the indexer or the user in a similar Boolean search. A secondary strength of the semantic search is that results are ranked according to relevancy, as opposed to the alphabetical listing of the Boolean search. When the most relevant citations are listed first, it is evident to the user the strength of the correlation between the question they asked and the citation they received in return. A third strength of the semantic search is the user interface. Instead of translating an information need into the controlled vocabulary necessary for a Boolean search, a user can enter the query in the terminology that best describes the underlying concept of the information need, relying on the technology to do the translating.

This study was an initial attempt at quantifying the precision of search results in Boolean and semantic searches. The results of this study indicate that Boolean searches have a higher degree of precision, but that semantic searches offer the possibility to compensate for human error. This topic warrants significant further study using a larger number of queries, a variety of both more and less complex queries, a larger sample of citations from which to pull results, and more rigorous statistical analysis.

Acknowledgements

The author would like to acknowledge the assistance of both Sharon Colvin and Stephen Palumbo, who offered significant editing suggestions for the description of this study.

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Appendix A

Precision Scores According to Search Method and Number of Results

| Type of Search Query | Boolean Number of Relevant Results | Boolean Total Number of Results | Boolean Precision Score |
|------------------------------|---|---------------------------------------|-------------------------------|
| Videogames and Aggression | 20.50 | 26 | 78.8% |
| Sex in the Media | 11.00 | 13 | 84.6% |
| Music Lyrics and Adolescents | 10.25 | 12 | 85.4% |
| Media Ratings | 24.00 | 41 | 58.5% |
| Body Image | 12.00 | 12 | 100.0% |

| Type of Search Query | Semantic Number of Relevant Results | Semantic Total Number of Results | Semantic Precision Score |
|------------------------------|--|--|--------------------------------|
| Videogames and Aggression | 10.75 | 20 | 53.8% |
| Sex in the Media | 7.75 | 20 | 38.8% |
| Music Lyrics and Adolescents | 6.75 | 20 | 33.8% |
| Media Ratings | 3.5 | 20 | 17.5% |
| Body Image | 11 | 20 | 55.0% |

| Type of Search Query | Semantic Number of Relevant Results | Semantic Total Number of Results | Semantic Precision Score |
|------------------------------|--|--|--------------------------------|
| Videogames and Aggression | 7 | 10 | 70.0% |
| Sex in the Media | 6.5 | 10 | 65.0% |
| Music Lyrics and Adolescents | 6.25 | 10 | 62.5% |
| Media Ratings | 3.25 | 10 | 32.5% |
| Body Image | 7.5 | 10 | 75.0% |

| Type of Search Query | Semantic Number of Relevant Results | Semantic Total Number of Results | Semantic Precision Score |
|-------------------------|--|--|--------------------------------|
|-------------------------|--|--|--------------------------------|

| | | | |
|------------------------------|------|---|-------|
| Videogames and Aggression | 3.75 | 5 | 75.0% |
| Sex in the Media | 4 | 5 | 80.0% |
| Music Lyrics and Adolescents | 3.75 | 5 | 75.0% |
| Media Ratings | 3.25 | 5 | 65.0% |
| Body Image | 4.25 | 5 | 85.0% |

Appendix B

Bibliography of Media Effects Literature Found Through Either Boolean or Semantic Search

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