2010-02-01

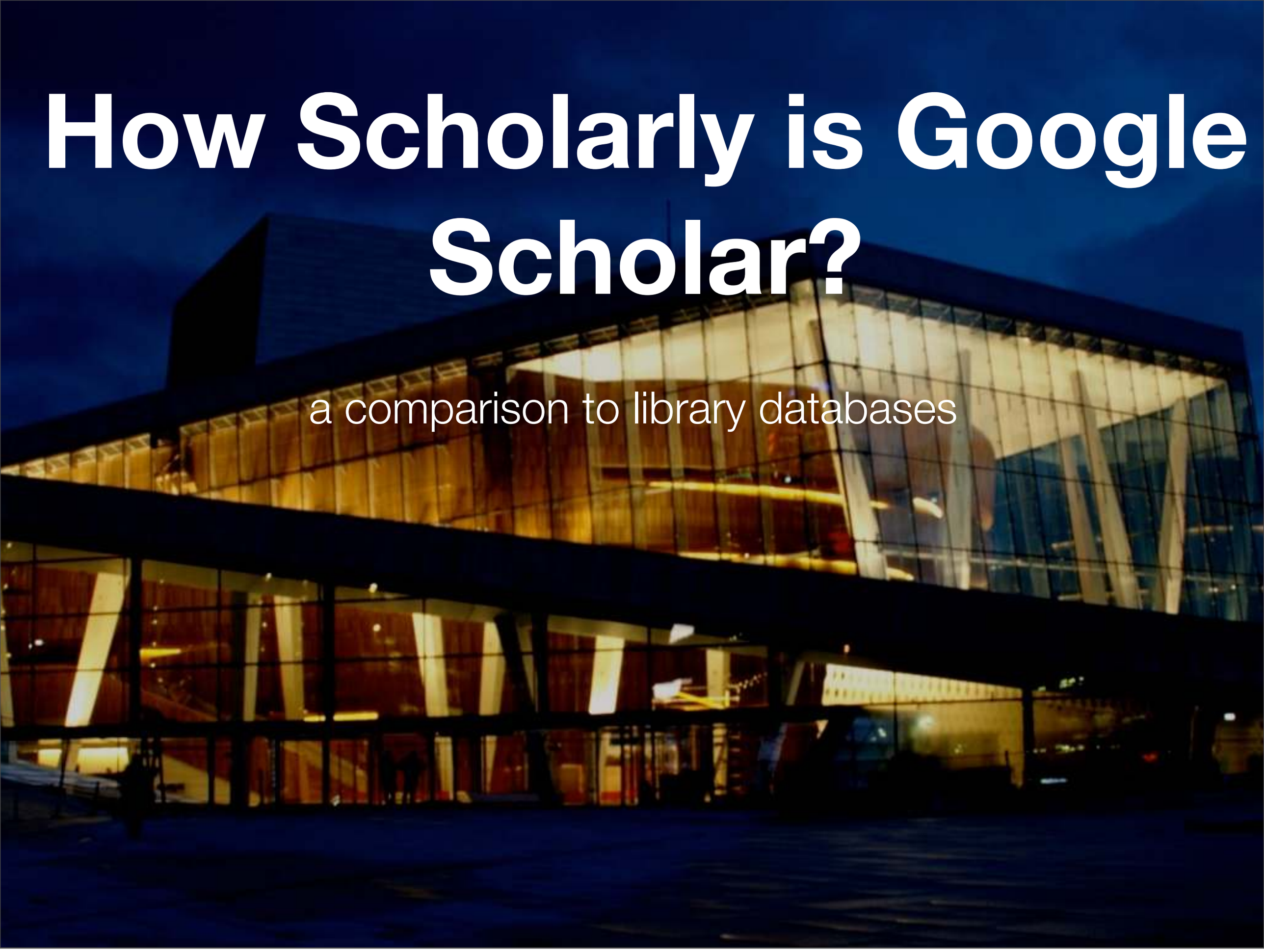
# How Scholarly is Google Scholar? A Comparison to Library Databases

Jared L. Howland
jared_howland@byu.edu



## Original Publication Citation

How Scholarly is Google Scholar? A Comparison to Library Databases, February 21, invited keynote speaker at the Norwegian National Library Conference in Oslo, Norway.



# How Scholarly is Google Scholar?

a comparison to library databases

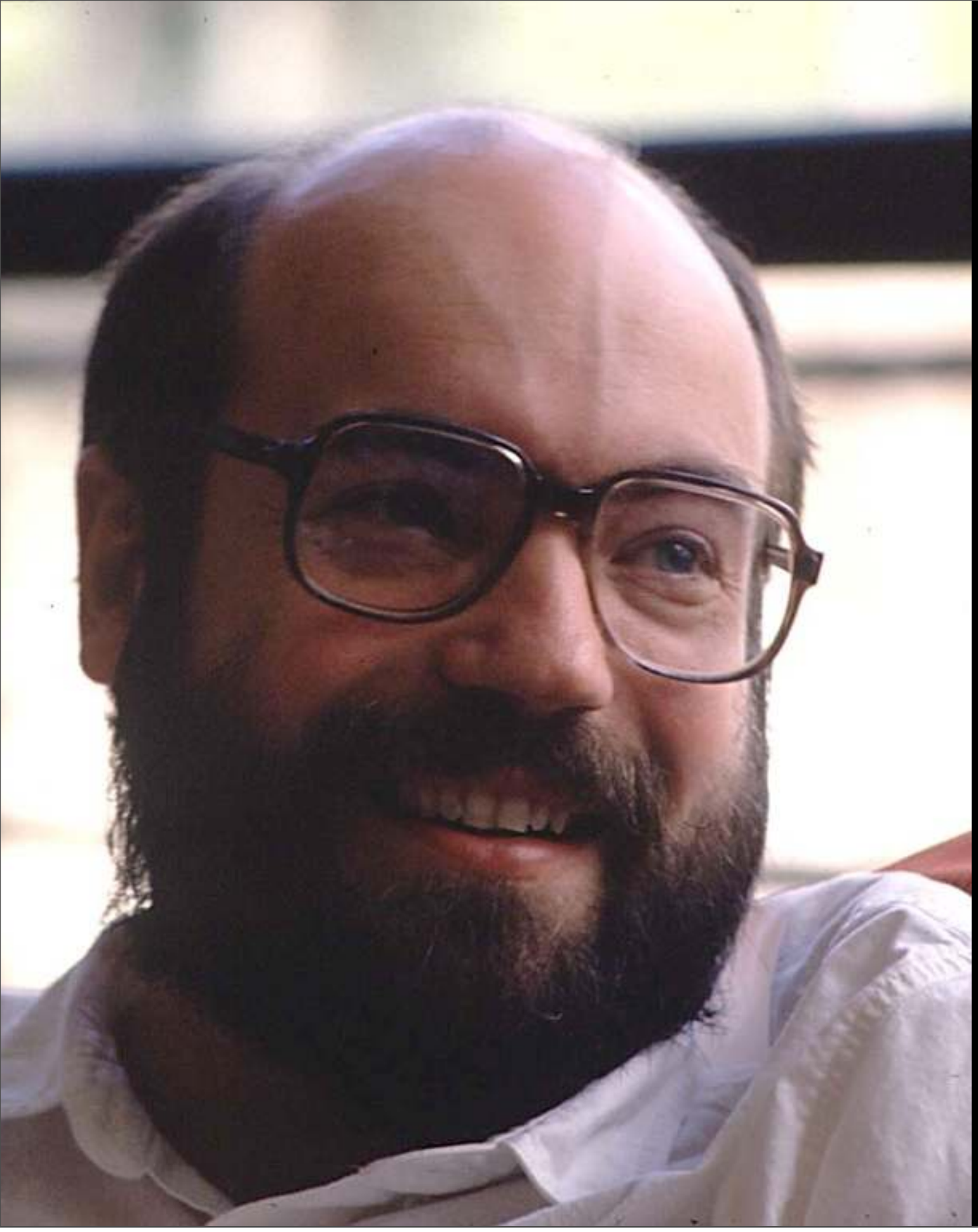
- I’d like to start this morning by sharing a story I heard a couple years ago on the NPR program “This American Life”
- You will be hearing from Alex Blumberg, the producer of the program:

"A Little Bit of Knowledge,"
Alex Blumberg,
**This American Life**,
National Public Radio,
Episode 293
22 July 2005

- This story illustrates the problems that are inherent in making assumptions
- Assumptions are the biggest challenge facing libraries today
- Alex's embarrassing experience was based on a set of faulty assumptions
- I'd like to spend the next couple of minutes summarizing a keynote address I heard in 2008 at the North American Serials Interest Group (NASIG) Annual Conference
- That keynote, given by Mike Kuniavsky, was, for me, the genesis of the project I will be discussing today
- This summary will be about three-fourths summary and one-fourth my interpretation of his presentation
- So, Mike Kuniavsky spoke at the NASIG 2008 annual conference about ubiquitous computing
- However, he started by analogizing the world of electric motors to the world of computing

- In 1910, "electric motors were expensive, so you bought one for the house and then you bought attachments for it. The motor was a general purpose tool that was adapted as needed."
- As motors got cheaper, you started having multiple motors in the home
- Instead of an attachment for a fan, you had a fan
- Instead of an attachment to wash clothes, you had a washing machine
- Eventually, we ended up with hyper-specialized electric motors (for example, there are now, on average, 20-30 motors per car)
- This led to many unintended consequences (vacuums -> wall-to-wall carpeting)

- We see the same thing happening with computers today as what happened with electric motors at the turn of the century
- We have entered the 3rd stage of computing (mainframe -> desktop -> ubiquitous computing)
- The phrase ubiquitous computing was phrased in 1988 by Mark Weiser
- He describes it as follows:



The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.

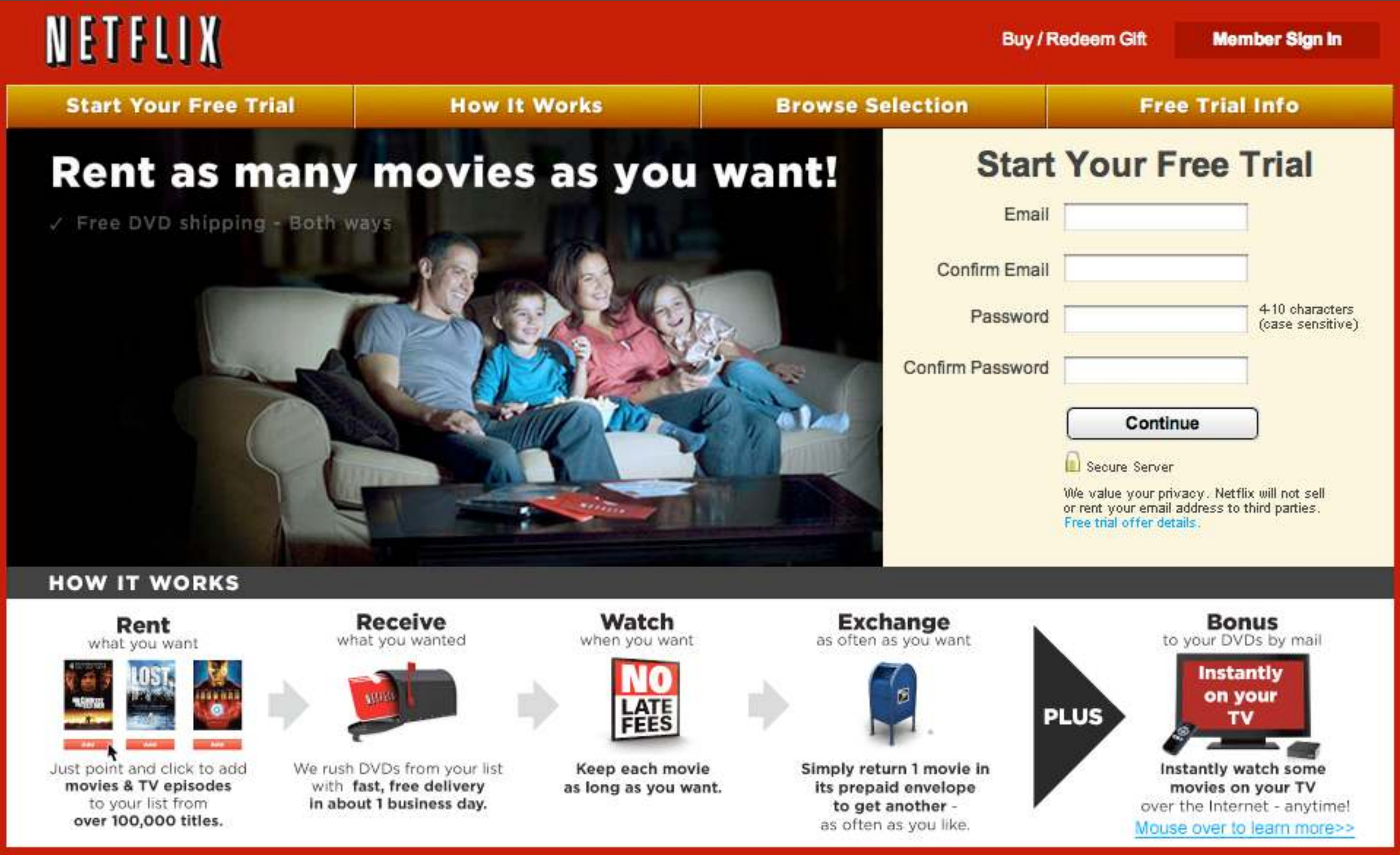
~Mark Weiser

• The most profound technologies are those that disappear. They weave themselves into the fabric of everyday life until they are indistinguishable from it.
• Just like hyper-specialization of the electric motor led to some interesting changes, so will ubiquitous computing
• Mike Kuniavsky continued by saying the following:

Ubiquitous computing gives us tools to track, trade and share objects much more efficiently than any previous technology.

~Mike Kuniavsky

- Ubiquitous computing gives us tools to track, trade and share objects much more efficiently than any previous technology.
- What does this mean in real terms?
- Here are just a few real world examples:



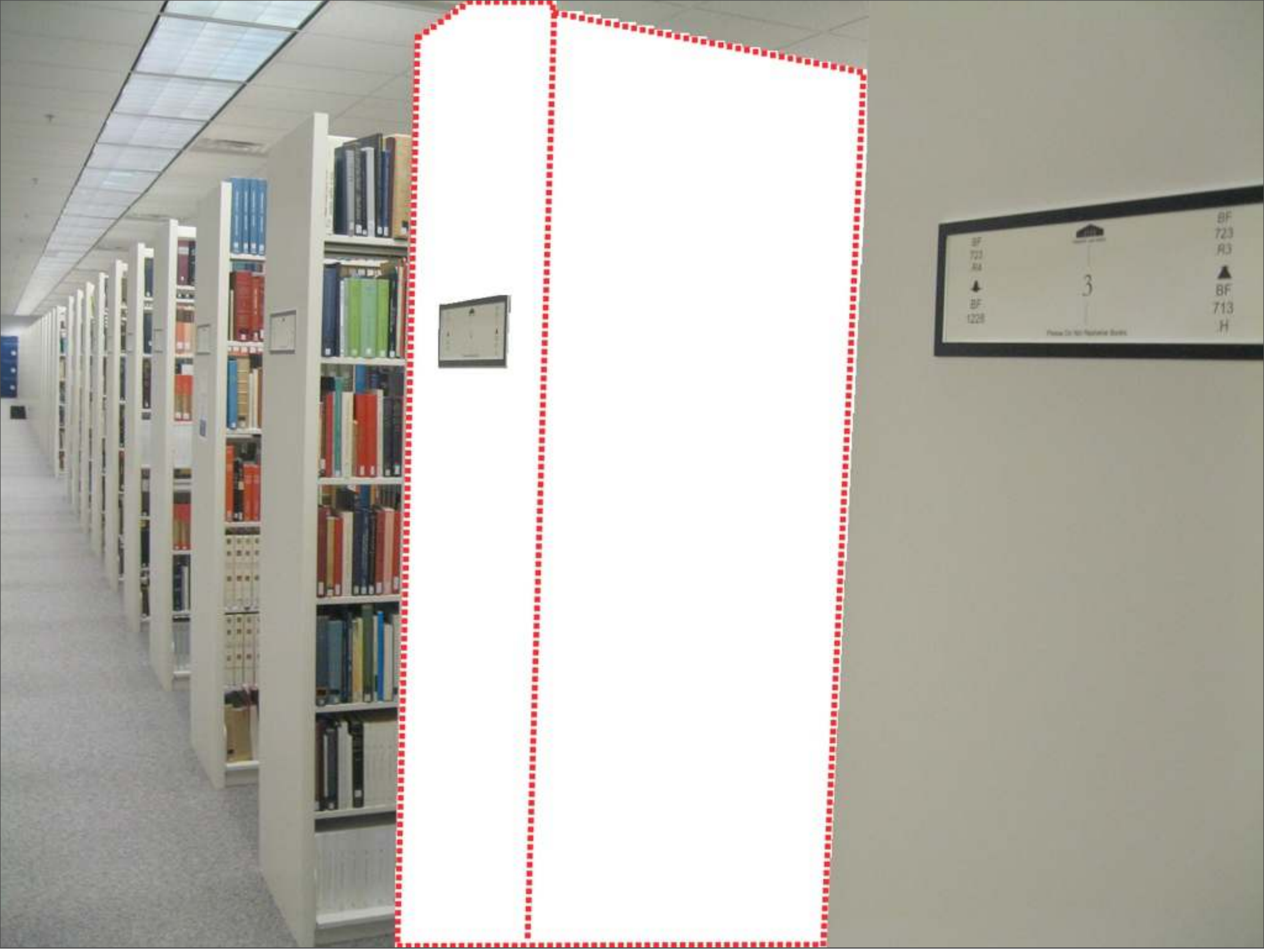

- You are all familiar with Netflix
- Ubiquitous computing has led to a tracking system that allows for cheap and easy movie rentals and, now, even movie streaming
- This model is challenging the way we think about ownership of movies
- Why would you need to own a movie when you can just stream a movie straight to your TV anytime you want to watch it (you don't even need to get out of our chair to put in the DVD)
- Here's another example:

- Another example is ZipCar – rent a car anytime you need one
- This is a very different idea of ownership than what we are used to
- Mike described it as living in a world where everything has dotted lines around it
- Instead of owning a car, you own the right to use a car

- The idea of subscribing to something instead of owning it is, of course, nothing new to librarians
- We have dealt with serials and aggregators for many years now
- However, with the advent of ubiquitous computing, the possibilities for what we can have access to without having ownership are almost endless
- It was not financially feasible to do this even just a few years ago, however, today we can get access to entire libraries


• In the past, the words access and ownership were synonymous in the library world – those two terms were inextricably intertwined
• There was no way for librarians to provide access without owning the material
• Interlibrary loan changed that to a certain extent
• However, it has only been since the advent of ubiquitous computing and the network that access and ownership have been truly decoupled
• Going back to Alex Blumberg and his assumptions about Nielsen families, the **biggest** assumption librarians are now questioning is that we must own content in order to provide research-quality resources
• Just how far will this idea go?

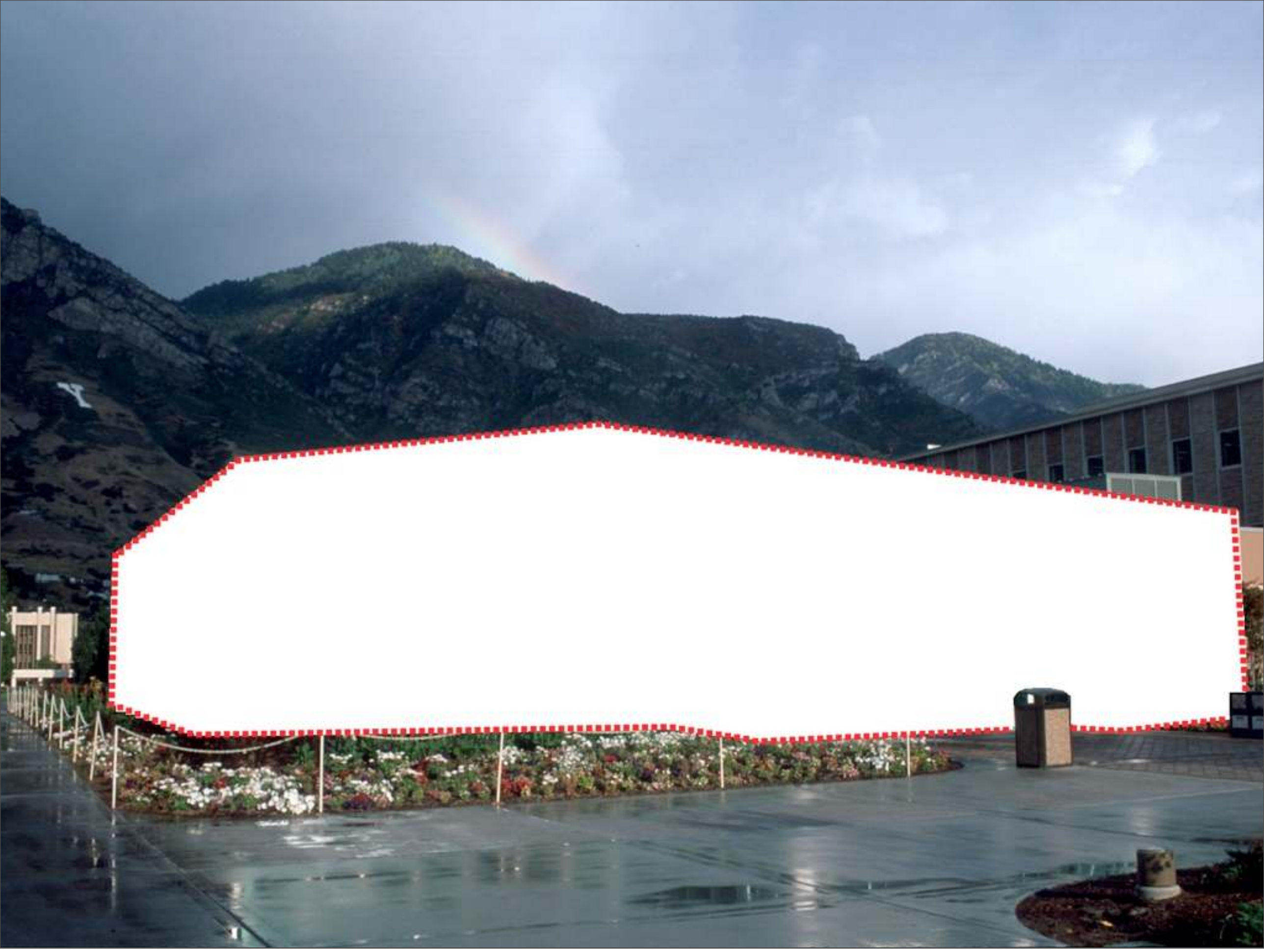
• How many resources are really so critical to a research library's mission that we **must** own them?




• And how many of our resources would it be okay for us to just have **access** to them?


- In other words, the big question is ownership

vs…



- access
- There is no one-size-fits-all answer
- However, access, rather than ownership, may be the best answer in many cases in the future
- Finding the optimal mix (the right answer) all depends on where we are willing to see dotted lines in our world
- But most of all, it depends on how willing we are to go back to the assumptions we made about Nielsen families as a kid and really start to question them

- I’ve dubbed this phenomenon:

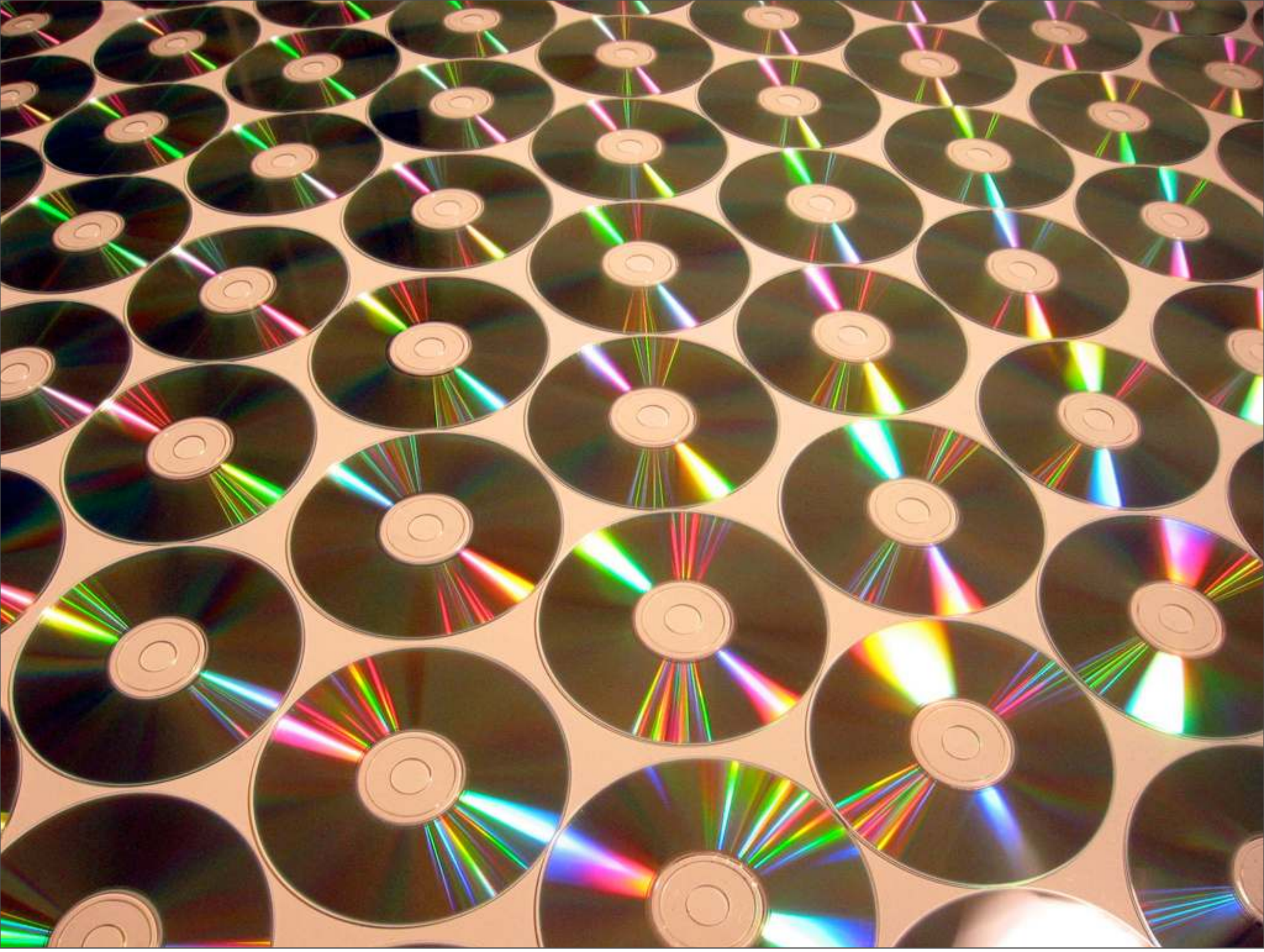
# Kuniavsky's Law:

Ubiquitous computing
decoupled
**access** and **ownership**

- Kuniavsky's law: Ubiquitous computing has permanently decoupled access and ownership

- The second principle I'd like to talk about today is access and discoverability
- The music industry serves as a great example of this
- Specifically, records

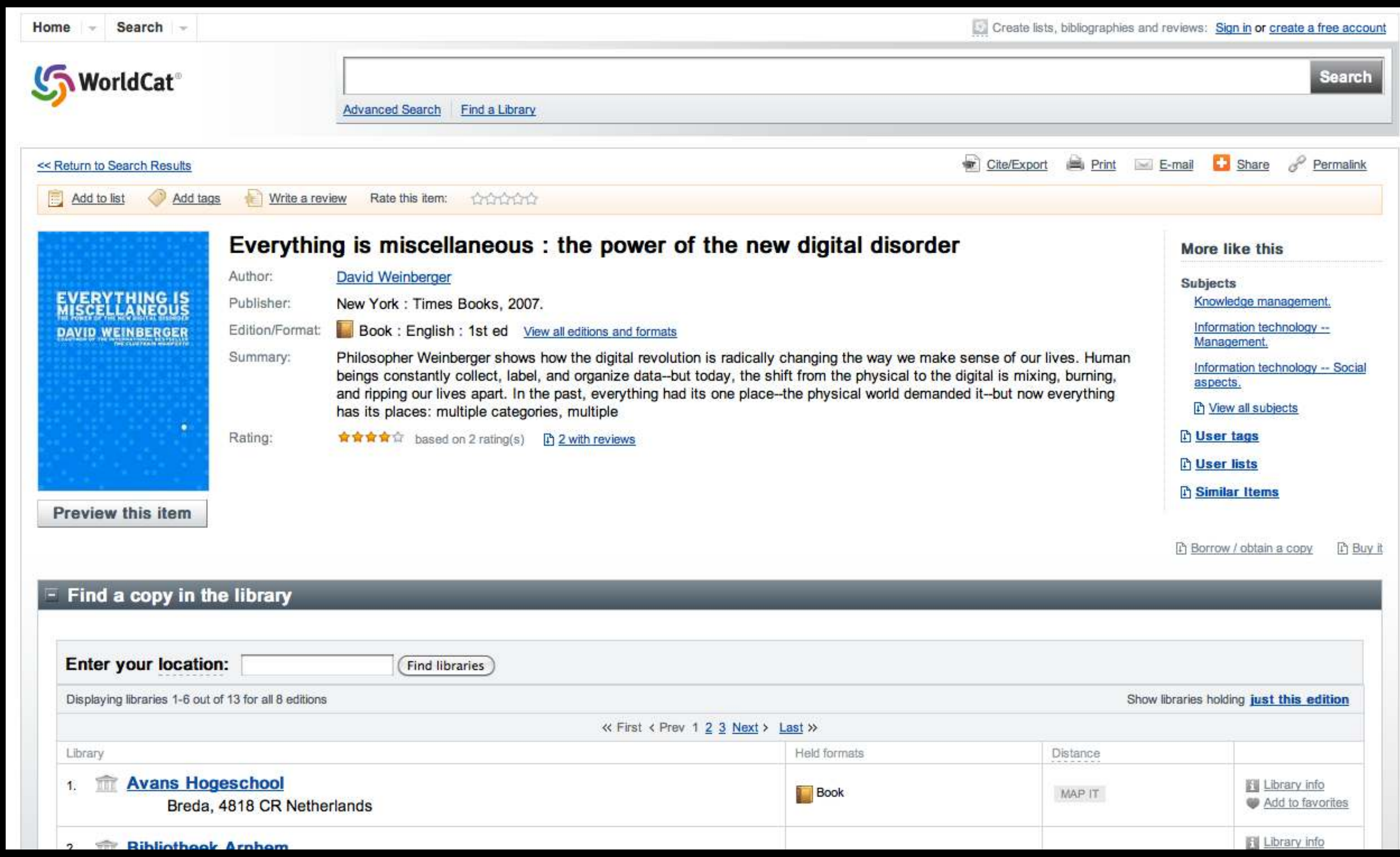
- We already discussed how electric motors gained popularity at the turn of the last century
- One of the hyper-specialized uses of the electric motor was the turntable
- The turntable allowed for playback of recorded music, speeches and other orally communicated content
- However, if you wanted a specific song on the record album, you had to know where to place the needle attached to the end of the record player's arm
- In other words, the content was accessible, but discovery was sub-optimal
- Other technologies came and went, but discovery was still not very good



- Then, the compact disc came along
- The discs were broken into tracks that allowed for quick access and quick discovery


- Discovery has increased significantly with the advent of services such as iTunes where you can search through hundreds of thousands of albums and find the exact song or other content that you were looking for
- iTunes and other similar services, such as Pandora (US only), last.fm or Jango, even provide recommendations based on your past music consumption which opens up whole new doors to discovering new-to-you music


- Libraries have followed a similar path as the music industry
- Before the advent of the network, and specifically the online library catalog, discovery was tedious
- To find anything, you had to scour the library card catalog
- At the risk of sounding like a very bad librarian, I will tell you that I was never very good at using the card catalog system
- It was hard!
- Fortunately, I came into librarianship several years after most libraries migrated to online catalogs




- Then the network came along which opened up many opportunities for improving discovery of library collections
- WorldCat was created and collocated many libraries' collections and made discovering the nearest location with access a breeze
- But WorldCat was the equivalent of the compact disc
- It revolutionized discovery, but it was still largely an analog tool
- Discovery was digital but access was still analog


- Google Scholar is to libraries, what iTunes was to the music industry
- It has streamlined both discovery and access to library collections
- It integrates with WorldCat so it knows what your print collections are and, if you use your link resolver to give Google your information, it will also know what your electronic collections are
- I call this Google Scholar's Law

# Google Scholar's Law:

Google Scholar decoupled **access** and **discovery**

• Kuniavsky's law states that ubiquitous computing decoupled access and ownership
• Google Scholar's law states that Google Scholar, a direct outgrowth of ubiquitous computing, has decoupled access and discovery

• So if computers are doing all of this, where does this leave libraries?
• My contention today, is that libraries are here to provide access to our patrons to the content that they need
• If discovery is best left to Google Scholar and the network at large, libraries should concentrate on building their own collections, which is our strength
• Leave the discovery to others that seem to have the advantage

• I want to talk today about some research that my colleagues and I have been working on
• The question we wanted to answer was, is Google Scholar a good discovery tool?
• Specifically, we wanted to know how the results returned in Google Scholar compared to results in library databases
• In other words, which is the better discovery tool?
• Library databases or Google Scholar

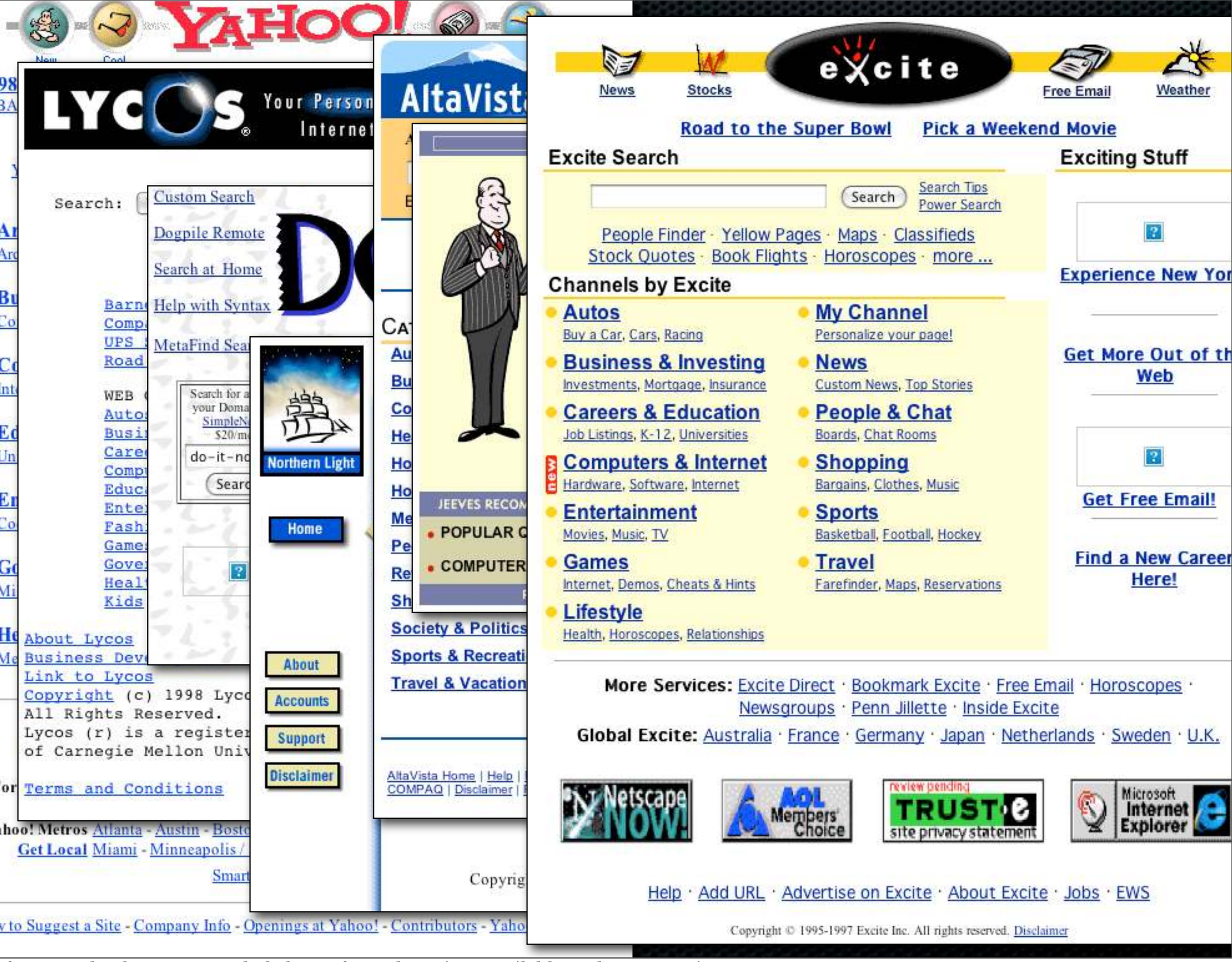
# Literature Review

- As you might imagine, there was a significant amount of skepticism in the library world when Google Scholar was introduced
- Many did not want to acknowledge that Google Scholar might have an important role to play in every librarian's toolbox
- It might be helpful to give a little bit of history:

• Before Google, there were a whole host of search engines available to the average internet user
• You may recognize some or all of these
• How many of you still use one or more of these search engines?
• How many of you use Google? (general public search engine use - 65% only use Google)
• Most of these search engines are now gone - they were eaten by the monster that Google became

• Here is what Google looked like when it was first released for public consumption in 1998
• There were over 25 million pages indexed! :)
• The last time they announced how big the index is was in 2005 - it had well over 25 billion pages indexed at that point

• So by the time that Google Scholar was introduced, at the end of 2004, Google had lots of search and, more importantly, **discovery** experience
• Despite all this skepticism, many librarians began placing Google Scholar on the homepages of their sites
• Many articles were published about Google Scholar
• Some of the better and more comprehensive studies were conducted by Peter Jasco, from the University of Hawaii
• He described Google Scholar's search results with such glowing terms as "shallowness" and, my personal favorite, "artificial unintelligence"
• Other studies tried to match citations "hit to hit"
• These studies were conducted by Neuhaus, Brophy and Bawden
• This means that they would gather a large data set from respected database vendors, such as ISI's Web of Science, and try to find all of the citations in that database to what was available in Google Scholar
• They found the obvious - Google Scholar's coverage was spotty and had lots of holes in it
• This is because Google Scholar indexes from reputable sources, such as publisher's websites (when they're given permission) but also gathers information from professor's personal websites, other pages in the .edu domain and from institutional repositories
• The nature of those sources is incomplete
• The nature of those sources also allows Google to more readily identify and index the seminal research in most disciplines
• Library databases typically have a much harder time identifying those types of papers
• This also allows Google to identify the prominent authors in each discipline
• After the initial onslaught of negative reviews, authors began looking at some of the value-added services that Google Scholar adds for researchers
• These value-added features include tracking open access content and other content found in institutional repositories
• This line of research was done by Kousha, Thelwall among others
• More recently Peter Jasco has re-evaluated Google Scholar and found the results to be much better than they were intially but still found many problems with the way it counts citations and other relatively minor quibbles about the service
• The research that we undertook was a very different approach from these other studies
• The studies by Neuhaus and others looked at all the content that was going into Google Scholar and found it lacking
• We wanted to look at the **outcomes** of Google Scholar searches
• Specifically, we wanted to know if the Google Scholar results were more or less scholarly than the results found in library databases
• We did this by directly comparing search results from Google Scholar to search results from library databases




- Before Google, there were a whole host of search engines available to the average internet user
- You may recognize some or all of these
- How many of you still use one or more of these search engines?
- How many of you use Google? (general public search engine use - 65% only use Google)
- Most of these search engines are now gone - they were eaten by the monster that Google became

- Here is what Google looked like when it was first released for public consumption in 1998
- There were over 25 million pages indexed! :)
- The last time they announced how big the index is was in 2005 - it had well over 25 billion pages indexed at that point

- So by the time that Google Scholar was introduced, at the end of 2004, Google had lots of search and, more importantly, **discovery** experience
- Despite all this skepticism, many librarians began placing Google Scholar on the homepages of their sites
- Many articles were published about Google Scholar
- Some of the better and more comprehensive studies were conducted by Peter Jasco, from the University of Hawaii
- He described Google Scholar's search results with such glowing terms as "shallowness" and, my personal favorite, "artificial unintelligence"
- Other studies tried to match citations "hit to hit"
- These studies were conducted by Neuhaus, Brophy and Bawden

- This means that they would gather a large data set from respected database vendors, such as ISI's Web of Science, and try to find all of the citations in that database to what was available in Google Scholar
- They found the obvious - Google Scholar's coverage was spotty and had lots of holes in it
- This is because Google Scholar indexes from reputable sources, such as publisher's websites (when they're given permission) but also gathers information from professor's personal websites, other pages in the .edu domain and from institutional repositories
- The nature of those sources is incomplete
- The nature of those sources also allows Google to more readily identify and index the seminal research in most disciplines
- Library databases typically have a much harder time identifying those types of papers
- This also allows Google to identify the prominent authors in each discipline
- After the initial onslaught of negative reviews, authors began looking at some of the value-added services that Google Scholar adds for researchers
- These value-added features include tracking open access content and other content found in institutional repositories
- This line of research was done by Kousha, Thelwall among others
- More recently Peter Jasco has re-evaluated Google Scholar and found the results to be much better than they were intially but still found many problems with the way it counts citations and other relatively minor quibbles about the service
- The research that we undertook was a very different approach from these other studies
- The studies by Neuhaus and others looked at all the content that was going into Google Scholar and found it lacking
- We wanted to look at the **outcomes** of Google Scholar searches
- Specifically, we wanted to know if the Google Scholar results were more or less scholarly than the results found in library databases
- We did this by directly comparing search results from Google Scholar to search results from library databases


• Before Google, there were a whole host of search engines available to the average internet user
• You may recognize some or all of these
• How many of you still use one or more of these search engines?
• How many of you use Google? (general public search engine use - 65% only use Google)
• Most of these search engines are now gone - they were eaten by the monster that Google became

• Here is what Google looked like when it was first released for public consumption in 1998
• There were over 25 million pages indexed! :)
• The last time they announced how big the index is was in 2005 - it had well over 25 billion pages indexed at that point

• So by the time that Google Scholar was introduced, at the end of 2004, Google had lots of search and, more importantly, **discovery** experience
• Despite all this skepticism, many librarians began placing Google Scholar on the homepages of their sites
• Many articles were published about Google Scholar
• Some of the better and more comprehensive studies were conducted by Peter Jasco, from the University of Hawaii
• He described Google Scholar's search results with such glowing terms as "shallowness" and, my personal favorite, "artificial unintelligence"
• Other studies tried to match citations "hit to hit"
• These studies were conducted by Neuhaus, Brophy and Bawden

• This means that they would gather a large data set from respected database vendors, such as ISI's Web of Science, and try to find all of the citations in that database to what was available in Google Scholar
• They found the obvious - Google Scholar's coverage was spotty and had lots of holes in it
• This is because Google Scholar indexes from reputable sources, such as publisher's websites (when they're given permission) but also gathers information from professor's personal websites, other pages in the .edu domain and from institutional repositories
• The nature of those sources is incomplete
• The nature of those sources also allows Google to more readily identify and index the seminal research in most disciplines
• Library databases typically have a much harder time identifying those types of papers
• This also allows Google to identify the prominent authors in each discipline
• After the initial onslaught of negative reviews, authors began looking at some of the value-added services that Google Scholar adds for researchers
• These value-added features include tracking open access content and other content found in institutional repositories
• This line of research was done by Kousha, Thelwall among others
• More recently Peter Jasco has re-evaluated Google Scholar and found the results to be much better than they were intially but still found many problems with the way it counts citations and other relatively minor quibbles about the service
• The research that we undertook was a very different approach from these other studies
• The studies by Neuhaus and others looked at all the content that was going into Google Scholar and found it lacking
• We wanted to look at the **outcomes** of Google Scholar searches
• Specifically, we wanted to know if the Google Scholar results were more or less scholarly than the results found in library databases
• We did this by directly comparing search results from Google Scholar to search results from library databases

# Methodology

## Subject Specialists

7 Subject specialists from 3 disciplines:
- 3 from sciences
- 2 from humanities
- 2 from social sciences

Blind to purpose of study

Asked them to give us 3 things...

How does the acquisition and use of a second language in children affect their general cognitive development?

A question they would typically receive from a student (humanities)

(**bilingual*** OR **L2**) AND

(**child*** OR **toddler**) AND

“**cognitive development**”

A structured query they would use to search a database

# Linguistic and Language Behavior Abstracts

The database they would use to search for that question

| Academic Discipline | Database Query | Library Database |
|---|---|---|
| Science | (ACL or “anterior cruciate ligament*”) and injur* and (athlet* or sport or sports) and (therap* or treat* or rehab*) | SportDiscus |
| Science | lung cancer and (etiol* or caus*) and (cigarette* or smok* or nicotine*) | Medline |
| Science | “dark matter” and evidence | Applied Science and Technology Abstracts |
| Social Science | (“fast food” or mcdonald’s or wendy’s or “burger king” or restaurant) and franchis* and (knowledge n3 transfer or “knowledge management” or train*) | Business Source Premier |
| Social Science | (“standardized test*” or “high stakes test*”) and (“learning disabilit*” or Dyslexia or “learning problem”) and accommodat* | PsycINFO |
| Humanities | (bilingual* or L2) and (child* or toddler) and “cognitive development” | Linguistics and Language Behavior Abstracts |
| Humanities | (memor* or remembrance or memoir*) and (holocaust) and (Spiegelman or Maus) | JSTOR |

This is what things looked like after we got all the information back from the librarians

# Methodology

Search using query

Then we took that information and used it in 2 ways.

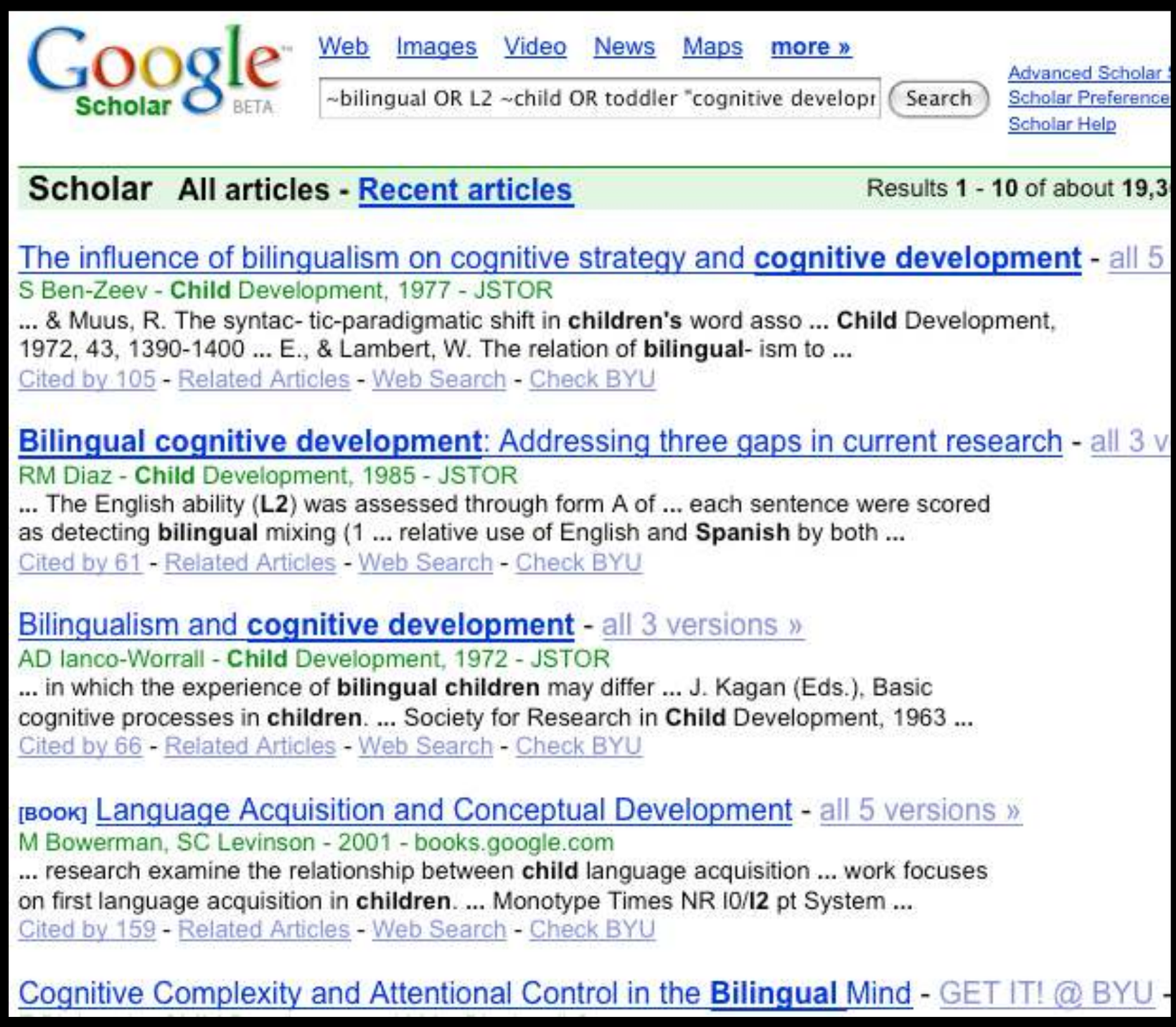

# Native database results

The first was to actually run the search query in the suggested database.

We put the first 30 citations into a bibliographic citation manager and saved all of the actual full text

We chose 30 because usability studies (Jakob Neilsen) tell us that less than 1% of all users ever go beyond the 3rd page of results and very few people ever change the defaults (ie, once they run a search they stick with it, success or failure).

Most of our DBs present 10 results per page so 30 results should represent a large enough sample to represent the actual set of results the majority of our users is ever going to see after performing a search.




# Google Scholar Results

We ran the same query in Google Scholar and saved the results again in a bibliographic Manager.

We used Zotero to quickly export all of the results.

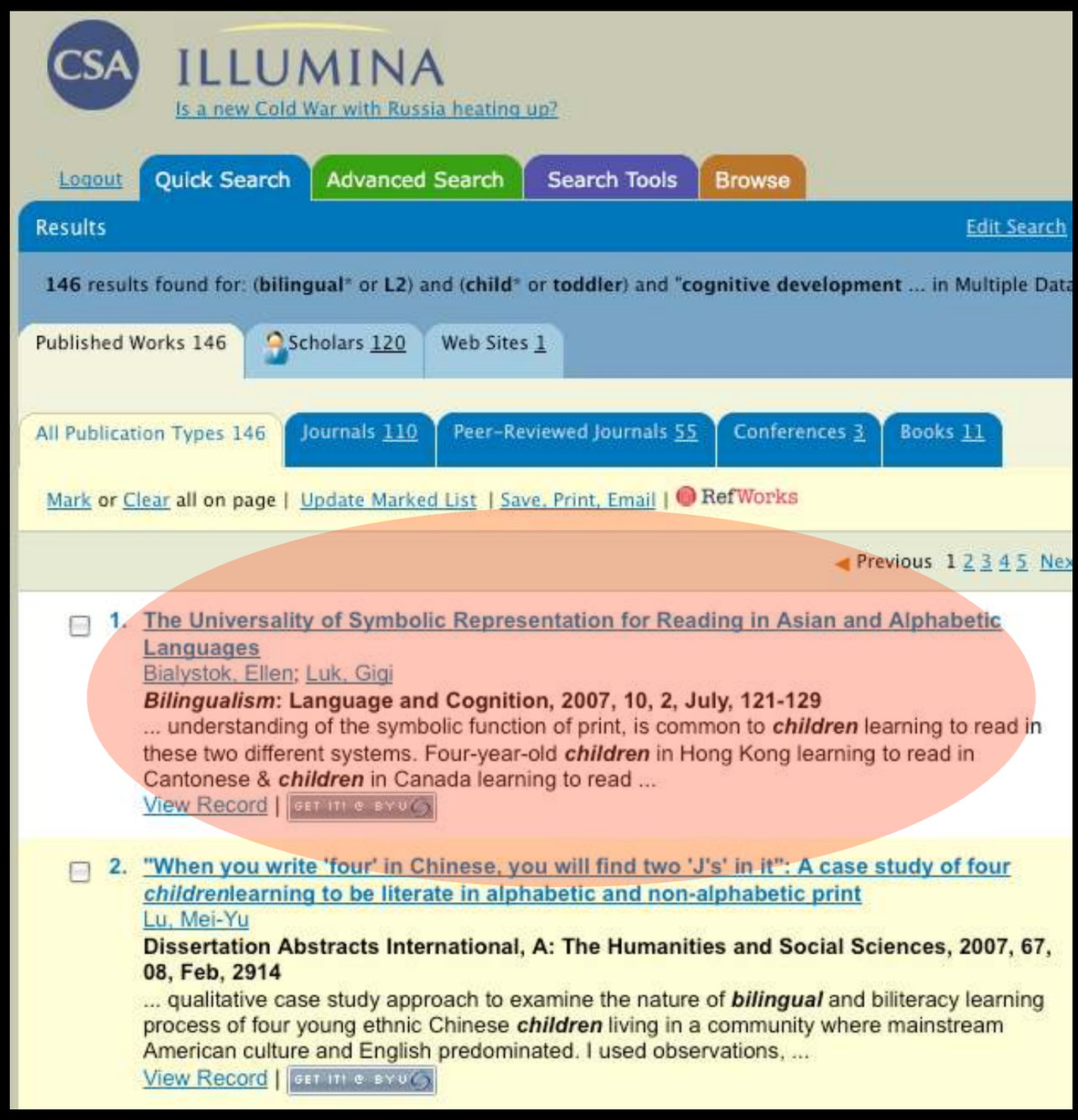
We also saved the full text of each citation for later use in our study.

# Methodology

## Search using citations

So, the first searches we ran using the native DBs and GS was for the query given to us by the librarian

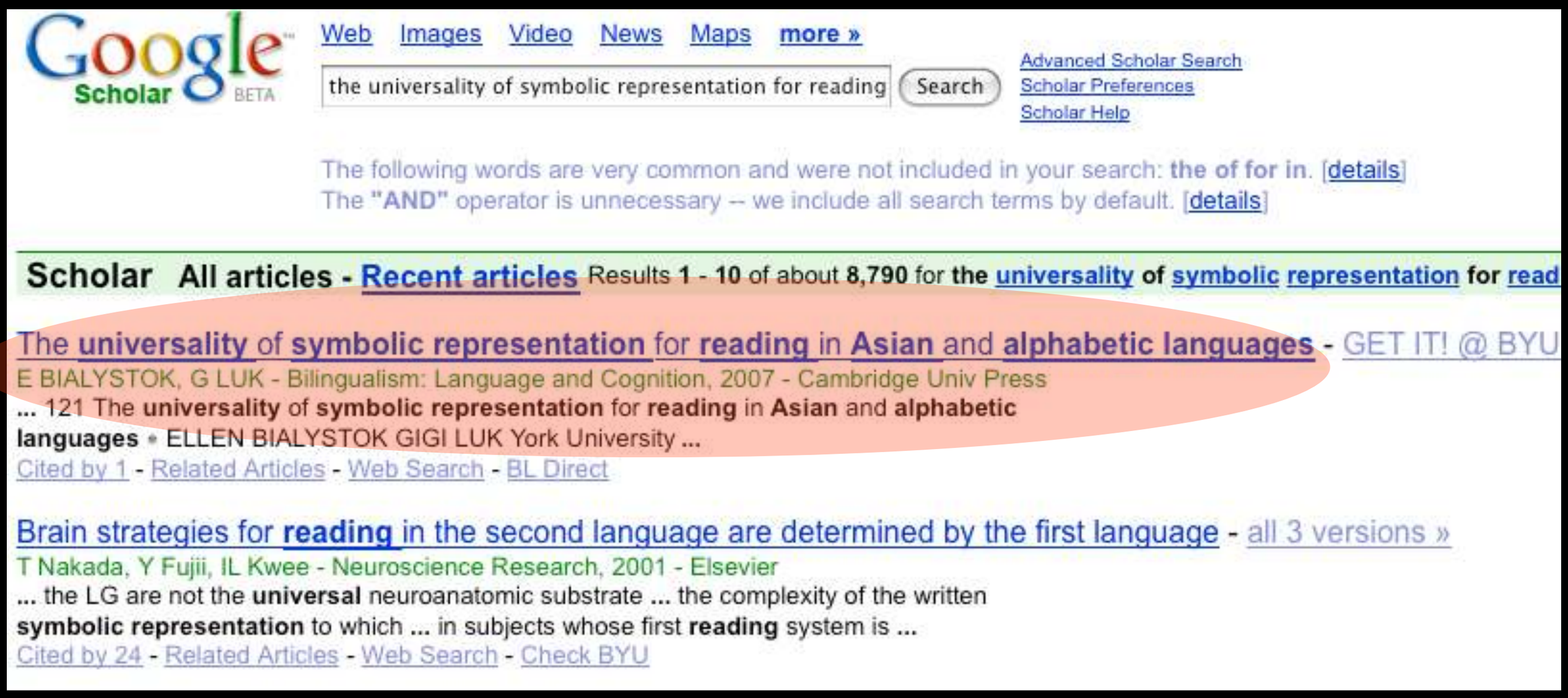
The second set of searches we ran was to see if the citations we found in the DB were available in GS and vice versa




# Is this citation available in Google Scholar?

Here is the same screenshot we saw just a minute ago.

We took the bibliographic information for each citation and searched for the citation within Google Scholar.




We then did the same thing in reverse.
We took the 30 results from GS and searched for each citation within the database


# Exclusivity

This allowed us to later calculate something we called “exclusivity”

We put the citations into 1 of 3 possible “exclusivity” categories

Shows proportion of citations within our study that overlap. As you can see, within our study we found that, on average, GS had a larger result set overall as well as more exclusively than the databases.

# Methodology

## Citation grading

So now that we have the citations from the database and the citations from Google Scholar. We used the bibliographic manager to generate a list of references that we input into an Excel spreadsheet. Then, using a random number table, we completely randomized the order of the citations for each subject specialist.

| Citation Number | References |
|---|---|
| 01 | Caporali, S. A., de Lacerda, C. B. F., & Marques, P. L. (2005). Teaching sign language to the families of the deaf: Focusing on the learning process. *PRO-FONO: Revista de Atualizacao Cientifica, 17*(1), 89-98. |
| 02 | Francis, N. (2002). Modular perspectives on bilingualism. *International Journal of Bilingual Education and Bilingualism, 5*(3), 141-161. |
| 03 | Chan, K. T. (2004). Chinese-English bilinguals' theory-of-mind development (Doctoral dissertation, University of Toronto, 2004). |
| 04 | Block, E. L. (1992). See how they read: Comprehension monitoring of L1 and L2 readers. *TESOL Quarterly, 26* (2), 319-343. |
| 05 | Auestad, N., Scott, D. T., Janowsky, J. S., Jacobsen, C., Carroll, R. E., Montalto, M. B., et al. (2003). Visual, cognitive, and language assessments at 39 months: A follow-up study of children fed formulas containing long-chain polyunsaturated fatty acids to 1 year of age. *Pediatrics, 112*(3), e177-e183. |
| 06 | Colson, E. R., & Dworkin, P. H. (1997). Toddler development. *Pediatrics in Review, 18*(8), 255-259. |
| 07 | Hendriks, H., Watorek, M., & Giuliano, P. (2004). The expression of localization and movement in descriptions and narratives in L1 and L2. *Langages, 155*(Sept), 106-126. |
| 08 | Andrews, D. B. (2004). The acquisition of Spanish gender by English-speaking children in a partial immersion setting (Doctoral dissertation, University of Washington, 2004). |
| 09 | Cable, C. (2004). 'I'm going to bring my sense of identity to this': The role and contribution of bilingual teaching assistants. *Westminster Studies in Education, 27*(2), 207-222. |
| 10 | Long, M. (2005). Problems with supposed counter-evidence to the critical period hypothesis. *Iral, 43*(4), 287-317. |

Finally, to deliver the content to the librarians in a way in which it would be easiest for them to evaluate, we saved the full-text of each citation according to its randomly assigned citation number. Then we used Excel to create hyperlinks to the full-text of each citation and delivered this list along with the full-text on a CD to the subject librarians. We asked them to evaluate each citation using a rubric which we provided in hard copy form. As you can see, the subject librarians were only able to see the citation number and the bibliographic information. By clicking on the hyperlinked citation number, the full-text of that citation would appear and the subject librarians could easily rate the citation on the rubric.

Have full text appear on this page after click to simulate linking from provided document.

| Citation Number | References |
|---|---|
| 01 | Caporali, S. A |
| 02 | Francis, N. (2( |
| 03 | Chan, K. T. (2 |
| 04 | Block, E. L. (1 |
| 05 | Auestad, N., S |
| 06 | Colson, E. R., |
| 07 | Hendriks, H., |
| 08 | Andrews, D. E |
| 09 | Cable, C. (20( |
| 10 | Long, M. (200 |

) the families of the deaf:
-98.

*al Education and*

issertation, University of

rs. *TESOL Quarterly, 26*

al. (2003). Visual,
ormulas containing long-

, 255-259.

vement in descriptions

in a partial immersion

ition of bilingual teaching

hesis. *Iral*, *43*(4), 287-

# Modular Perspectives on Bilingualism[1]

*Norbert Francis*
*Northern Arizona University, Education - Box 5774, Northern Arizona University, Flagstaff, Arizona 86011, USA*

**The following review of the research traces the current discussion on models of bilingualism to the contributions of L. Vygotsky and A.R. Luria. The attempt to differentiate among the different components of language ability in child development has from the beginning sparked sharp debate. Bilingualism, as an object of study, offers researchers a privileged viewpoint on the questions in dispute: the distinction between interpersonal conversational discourse and literacy-related academic discourse, the relationship between the development of linguistic knowledge of two languages and general cognitive development, and aspects of development that are universal and those aspects of child bilingual development that show wide variation. The article proposes that a modular approach to studying the different aspects of bilingual development promises to chart a course toward finding a broader common ground around research findings and interpretations that currently appear to be irreconcilable.**

## Introduction

In the study of bilingualism, research is drawn toward multidisciplinary approaches to a greater degree than in the linguistic and cognitive sciences in general. Tied closely as it has been to applied fields in bilingual education and second language learning, researchers borrow freely from theoretical and experimental work in a number of areas. Since bilingualism involves another layer of interactions among the different cognitive domains, it has been difficult to delimit the investigation to one or another. This of course both offers opportunities and opens up many traps to fall into. On balance, however, the interchange (mostly one-sided for now) between the applied-oriented and theoretically-oriented research programmes is probably a good thing, not just for the former. This discussion paper will explore one such application of a proposal from linguistics and cognitive science: how the concept of modularity, or cognitive models of the modular type, may help bring clarity to a number of vexing conceptual sticking points that have persisted in the research. In particular, the inquiry and debate that interests us here concerns the relationship between linguistic knowledge and the competencies that underlie what have variously been described as the higher-order discourse abilities and proficiencies related to literacy and academic language use, competencies that are associated with secondary discourses learned through schooling, and its extracurricular counterparts.

In accord with our multiple focus, we will consider what appear to be some historical antecedents to the modular approach (from outside its traditional sphere of investigation), apply it to a current leading model of bilingual proficiency (that of J. Cummins), and assess a recent critique of Cummins' model (MacSwan 2000), distinguished as it is from the more well trodden line of criti-

Finally, to deliver the content to the librarians in a way in which it would be easiest for them to evaluate, we saved the full-text of each citation according to its randomly assigned citation number. Then we used Excel to create hyperlinks to the full-text of each citation and delivered this list along with the full-text on a CD to the subject librarians. We asked them to evaluate each citation using a rubric which we provided in hard copy form. As you can see, the subject librarians were only able to see the citation number and the bibliographic information. By clicking on the hyperlinked citation number, the full-text of that citation would appear and the subject librarians could easily rate the citation on the rubric.

Have full text appear on this page after click to simulate linking from provided document.

**How does the acquisition and use of a second language in children affect their general cognitive development?**

1 = Below Average Quality  2 = Average Quality  3 = Above Average Quality

| Citation Number | References | Accuracy<br>* Reliability<br>* Fact checkers/editors/peer review | Authority<br>* Author's qualifications<br>* Reputable publisher | Objectivity<br>* Minimum bias<br>* Extent to which information is trying to persuade | Currency<br>* Information up to date<br>* Date of publication indicated | Coverage<br>* Depth of coverage | Relevancy<br>* Related to research topic |
|---|---|---|---|---|---|---|---|
| 01 | Caporali, S. A., de Lacerda, C. B. F., & Marques, P. L. (2005). Teaching sign language to the families of the deaf: Focusing on the learning process. *PRO-FONO: Revista de Atualizacao Cientifica, 17*(1), 89-98. | 1 2 3 | 1 2 3 | 1 2 3 | 1 2 3 | 1 2 3 | 1 2 3 |
| 02 | Francis, N. (2002). Modular perspectives on bilingualism. *International Journal of Bilingual Education and Bilingualism, 5*(3), 141-161. | 1 2 3 | 1 2 3 | 1 2 3 | 1 2 3 | 1 2 3 | 1 2 3 |

**Accuracy:** reliability, fact checkers/editors, peer review
**Authority:** author's qualifications, reputable publisher
**Objectivity:** minimum bias, extent to which persuasion is the goal
**Currency:** information up to date, date of publication indicated
**Coverage:** depth of coverage
**Relevancy:** related to research topic

This screen shows the rubric that we used. It is based on a rubric that has popularly been used to evaluate print resources (Alexander, 1999)

Alexander, J. E. (1999). Web wisdom: How to evaluate and create information quality on the Web.

We asked each subject librarian to assign a score of between 1 and 3 within 6 different categories to each of the citations (1 was below average, 2 was average and 3 was above average).

These six categories were:
Accuracy – which looks at
Authority – specifically the
Objectivity – looking for
Currency – is the information up to date?
How deep is the Coverage
And finally Relevancy – how well does the citation relate to the research question

This resulted in a total possible score of 18 for each citation – we called this a scholarliness score

# Methodology

total scholarliness score = $\mu + E_i + L_j + EL_{ij} + \varepsilon_{ijkl}$

where

$\mu$ = Average total score
E = Effect due to exclusivity (i = 1, 2, 3)
L = Effect due to librarian (j = 1, 2, ... 7)
EL = Interaction between exclusivity and librarian
$\varepsilon$ = Error term

We used this statistical model to evaluate the data. Essentially this formula says 2 important things about the way we used the data:

1. We controlled for the differences between the way librarians grade
2. We controlled for the differences in how exclusively the citation was available

This allowed us to pinpoint and measure any differences there may have been between disciplines in our data as well as any differences that can be attributed to the source of the citations

# Results

Google Scholar was
**17.6%** more scholarly

Citations found only in GS had, on average, a 17.6% higher scholarliness score than citations found only in the DB

# Results

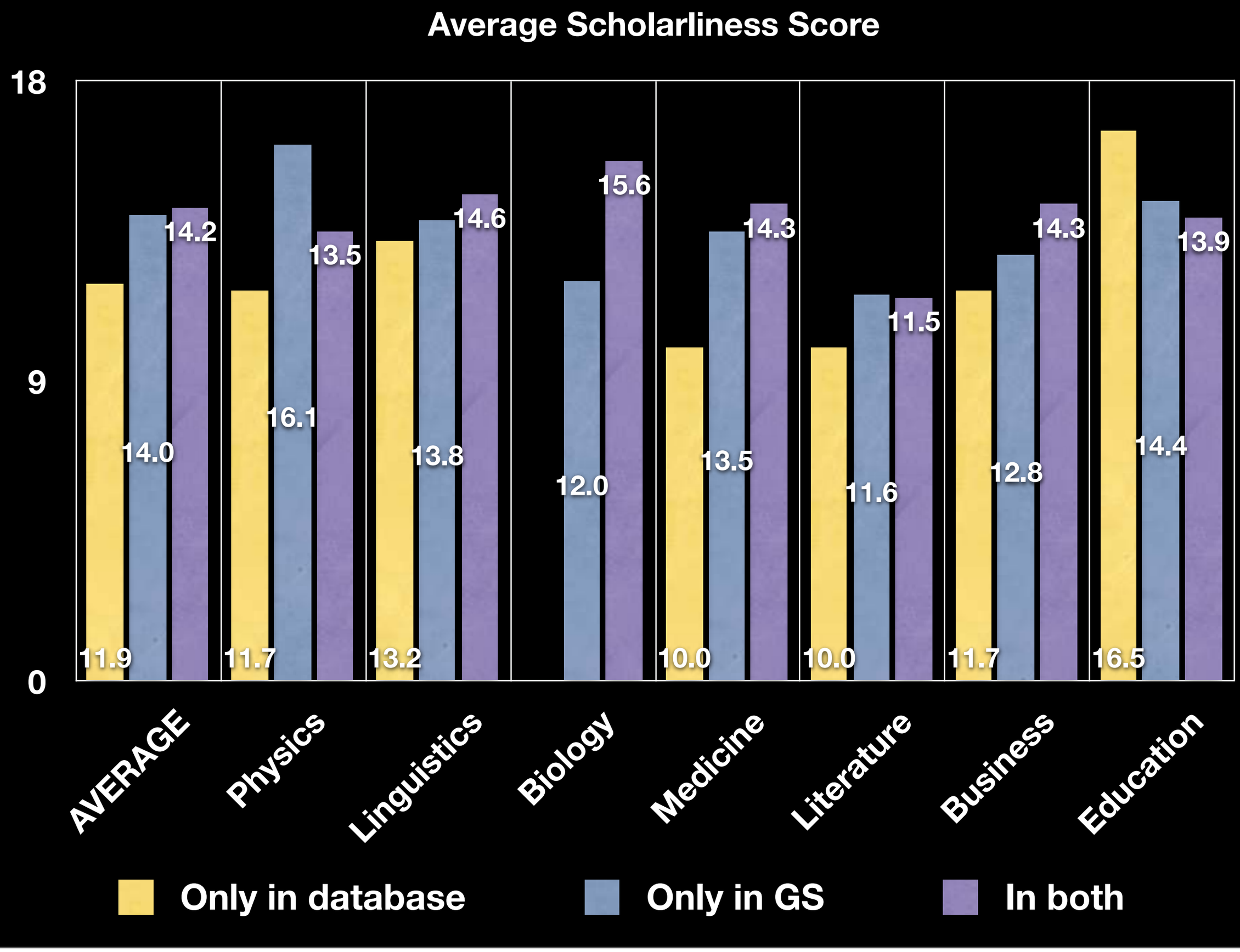
**Highest** scholarliness score when **found in both**

Citations found in both GS and the DB were even higher than citations found only in GS

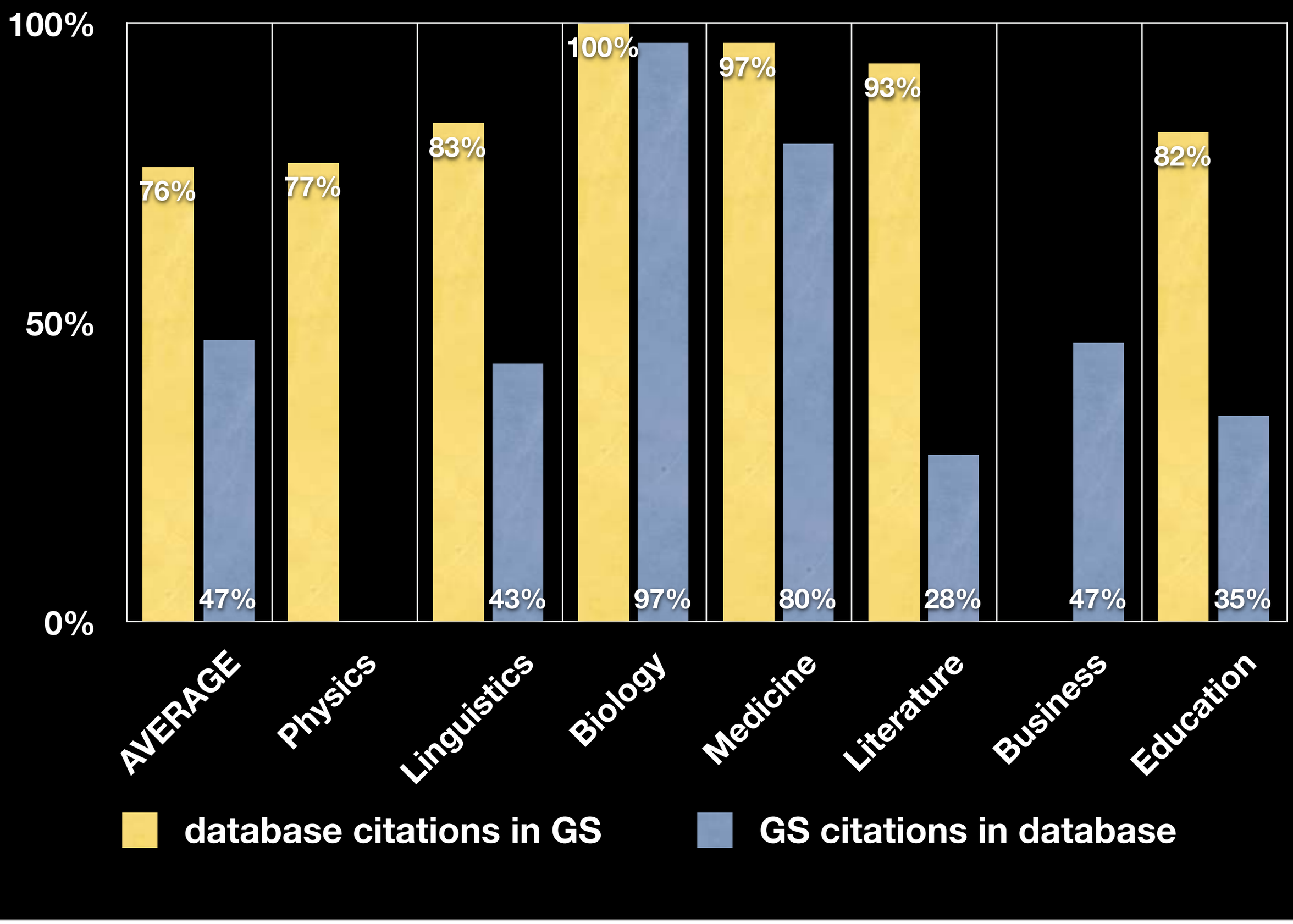
# Results

## **No difference** between disciplines

We found no statistically significant difference in the scholarliness scores between disciplines (ie, humanities citations in GS are just as scholarly as science citations found in GS)


Average Scholarliness Score
18
9
0
14.2
13.5
14.6
15.6
14.3
11.5
14.3
13.9
11.9
14.0
11.7
16.1
13.2
13.8
12.0
10.0
13.5
10.0
11.6
11.7
12.8
16.5
14.4
AVERAGE
Physics
Linguistics
Biology
Medicine
Literature
Business
Education
Only in database
Only in GS
In both

# Exclusivity of Citations



# Future Studies

## Generally applicable results

This study can only be extrapolated statistically to the specific topics and subject specialists used in this study

A more robust statistical methodology would need to be employed to make these results generally applicable

We are encouraged by the results we received and feel that they would probably hold up but cannot say so until another study is done

# Future Studies

## Improved rubric

If we had to do it over again, we would have increased the Likert scale on our rubric from 1-3 to 1-7 or 1-10

This would have allowed for a more nuanced statistical analysis and made it easier to spot significant differences, if any, between GS and databases

# Future Studies

## Scholarliness calculation

Our scholarliness calculation, ultimately, was based on the subjective opinions of librarians with subject expertise.

There are lots of ways to create a scholarliness score (citation counts, impact factors, etc). Which is best is still debatable

# Future Studies

## Comparison to federated searching

Our study compared GS to individual library databases. A more appropriate comparison may be GS to federated search tools.

# Questions?

jared_howland@byu.edu